

**TECHNICAL SPECIFICATION  
OF  
Supply of Watch Dog Device for fixing the same on  
DISCOM's Distribution Transformer laying in the  
DISCOM's agency workshop and testing of the Watch  
Dog Transformer.**

**TENDER No. UGVCL/Project/Tender /WDD/71**

## 1. SCOPE OF SUPPLY & WORK

- 1.1 The scope of this contract includes but not limited to development, design, engineering, manufacturing, assembling, inspection & testing at manufacturer's works, supply, and delivery of Watch Dog Device (WDD) for Watch Dog Transformer (WTD) and WDD for service line supplying power to agriculture consumers, and successful commissioning with necessary software with complete Remote Monitoring and Control System as mentioned hereunder.
- 1.2 **Watch dog Device for Distribution Transformers:** The Watch Dog Device (WDD) shall be an integral part of the Distribution Transformer. The WDD shall be fixed in a metal housing and whole unit with metal housing shall be fixed on LV bushing side via metallic adaptor so that there shall not be a direct access of LV bushing of DT (Distribution Transformer) to consumers. There shall be direct access to WDT LT bushing only. The WDD shall comprising of major components like, AC-3 type Power contactors, 3 phase audit energy meter, three numbers of tape wound ring type current transformers of required capacity (i.e 100/5 Amp and 200/5 Amp, 0.5 Class), adequate self-intelligent IoT base gateway which has at least four serial RS485 communication ports. It shall also facilitate to communicate remotely with Central server through GPRS/3G/LTE communication using necessary communication protocol.
- 1.3 **Watch dog Device for agriculture consumers:** The Watch Dog Device (WDD) consisting components stated in clause no 1.2 shall be mounted in an SMC box with IP55 without glass window. The SMC shall have appropriate size of two nos of cable entry holes and shall have a sealing arrangement and to be installed on PSC pole, where service cable is taped for connection. The SMC box shall be fixed on PSC pole with hot dip galvanized clamp, nut-bolts and required accessories.
- 1.4 DISCOM will provide Distribution transformer to local distribution transformer repairing agency. The WDD supply agency shall visit the repairing agency and take required measurement to prepare adopter and housing for WDD as per transformer design and its rating considering safety aspects within 7 days on receipt of the information from respective DISCOM after providing transformers at repairing agency. The WDD supply Agency will design, manufacture and supply adopter as well as WDD housing as per reference drawing No-1 of this specifications. The adaptor shall be supplied to the repairing agency for welding on respective DT. The welding of adopter on DT shall not be in the scope of the WDD supplier. After welding of metallic adaptor with distribution transformer, WDD devices shall be fixed with relevant all components and wiring as per defined specifications in presence of WDD supplier. Providing of LT bushing with terminal metallic part on WDD device is not in the scope of WDD manufacturer (it is in the scope of Transformer repairing agency-which is not part of this tender).
- 1.5 The controller shall be turn ON/OFF each phase contactors based on operation logics as per point No.10 of this specifications.

- 1.6 The whole unit may be retro fitted with the existing distribution transformer of various ratings available in the DISCOM i.e.10-16-25-63-100-200 KVA. In future, it may also be proposed to design and manufacture the distribution transformers with the concept of watch dog unit.
- 1.7 Supply of all such accessories/parts which are useful and necessary for its electrical, electronic and mechanical safe operation deemed to be within the scope of this order, whether specifically mentioned or not.
- 1.8 SIM cards including its subscription shall be supplied by DISCOM. Installation and commissioning of required white listed SIM card in each controller unit for required data shall be in the scope of bidder. SIM Card service provider shall be selected by the bidder with due approval of respective DISCOM considering the network strength so as to ensure proper communication.
- 1.9 High gain antenna to be considered to ensure better GPRS signal strength when it is found that the GPRS signal strength is insufficient at the locations of WDT.

## **2. General Technical and operational requirements:**

- 2.1 **The** equipment shall be fixed on the LV bushing of a Distribution Transformer (DT) having various capacity like 5, 10, 16, 25, 63 or 100 kVA.
- 2.2 3 pole/ 4 Pole Contactors shall be preferable. Minimum rating of each pole shall be as per Table-B.
- 2.3 The equipment shall be installed outdoor in a metal housing. It shall be suitable for all weather conditions.
- 2.4 The equipment shall be tamper-proof and opening shall be by authorized person only. The provision Limit switch shall be provided for monitoring unauthorised opening of top metal cover of WDD. The instance of opening shall be recorded in the monitoring devices and shall also reported to Remote Stations.
- 2.5 The communication shall be GPRS/3G/LTE based and all the parameters need to be reported to the remote centre as well as commands like time-settings, opening and closing, single phase and three phase, etc. shall be possible from remote as well as local programmable time based as well as voltage based. The threshold value of voltage for 1ph/3ph operation and threshold current to turn ON/OFF contactors can be remotely programmable.
- 2.6 All outdoor Metal housing, including bushing insulators, Gaskets with their mountings, shall be designed in such a way that no water shall be ingress.
- 2.7 Remote centres shall have online data for the group of the feeders and also dash boards for availability, locations, and consumptions and ON/OFF operations, etc.

### 3. SERVICE CONDITIONS:-

#### 3.1 SYSTEM PARTICULARS/DISTRIBUTION NETWORK PARAMETERS:-

The normal system parameters of the distribution network are as below.

<b>Network</b>	3Phase-3wire
<b>System Voltage (LT) (incoming to WDD)</b>	170 to 275 V (Phase to neutral)
<b>Transformer Voltage ratio</b>	11/0.433 KV
<b>No of phases</b>	Three
<b>System Frequency</b>	50 Hz±3%
<b>Neutral Earthing</b>	Solidly Earthed
<b>Method of Earthing</b>	Effectively earthed

#### 3.2 ATMOSPHERIC PARTICULARS:-

The atmospheric conditions under which the Distribution transformer with Watch Dog Device should perform continuously and successfully are mentioned as below.

Maximum Ambient Air Temperature	50° C
Minimum Ambient Air Temperature	5° C
Maximum daily average ambient air temperature	40°C
Maximum humidity	95%
Altitude above M.S.L. (maximum)	1000Mtr
Average annual rainfall (mm)	925
Max. wind pressure(Kg/sqm)	200
Seismic level (Horizontal accn.)	0.3 g
Iso-ceraunic level(Days per Year)	50
Average thunder storm days per annum	50
Wind pressure	200 KG/M <sup>2</sup>
Note: The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitable design to work	

satisfactorily under the System conditions.

#### 4. APPLICABLE STANDARDS:

Unless otherwise specified elsewhere in this Specification, Power contactor, LT PVC insulated flexible copper cable, IoT gateway, Energy Meter, control wires and other associated accessories shall conform to the latest revisions and amendments thereof to the following standards.

Sr No	Applicable IEC/IS	Description
1	IEC 60947-4-1	Low-voltage switchgear and controlgear :Contactors and motor-starters - Electromechanical contactors and motor-starters
2	IEC 60947-5-1	Low-voltage switchgear and controlgear : Control circuit devices and switching elements - Electromechanical control circuit devices
3	IS 694:2010	Polyvinyl chloride (PVC) insulated unsheathed and sheathed cables/cords with rigid and flexible conductor
4	IS: 8130	Conductors for insulated electric cables and flexible cords
5	IEC 61000-4-2	Electromagnetic compatibility: Testing and measurement techniques - Electrostatic discharge immunity test
6	IEC 61000-4-4	Electromagnetic compatibility (EMC):Testing and measurement techniques - Electrical fast transient/burst immunity test
7	IEC 61000-4-5	Electromagnetic compatibility (EMC):Testing and measurement techniques - Surge immunity test
8	IEC 61000-4-6	Electromagnetic compatibility (EMC):Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
9	IEC 61000-4-8	Electromagnetic compatibility (EMC)-Testing and Measurement Techniques - Power Frequency Magnetic Field Immunity Test
10	IEC 61000-4-11	Electromagnetic compatibility (EMC): Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests
11	IS – 7421/IS - 3347	Specification for Low Voltage bushings/ outdoor Low Voltage bushings
12	IS - 4257	Dimensions for clamping arrangements

		for bushings
13	IS 13410	Glass reinforced polyester sheet moulding compounds (SMC)
14	IS 14772	General Requirements for Enclosures for Accessories for Household and Similar Fixed Electrical Installations
All Indian Electricity Rules/ Bills amended up to date applicable for clearances, safety and operation of the equipment		

Equipment meeting with the requirements of any other authorities standards, which ensures equal or better quality than the standard mentioned above as well as latest standard shall also be acceptable. If the equipments, offered by the Bidder conform to other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. In case of any difference between provisions of tSysteme standards and provisions of this specification, the provisions contained in this specification shall prevail. One hard copy of such standards with authentic English Translations shall be furnished along with the offer.

## 5. Power Cable:

5.1 The power cable used for connection between Transformer LT bushing to WDD Enclosure Outer bushing through Power contactor and Energy meter (in case of whole current meter) shall be flexible flame retardant (FR) PVC Insulated single core unsheathed industrial multi-strand plain annealed electrolytic grade bare copper conductors having 99.97% purity for voltage grade up to 1100 V confirming to IS 694:2010.

5.2 Cable construction:

Conductor: Plain annealed electrolytic grade copper conductor as per IS: 8130

Insulation: Primary - PVC (Type C) with FR property as per IS 5831

Colour- R Phase-Red, Y Phase-Yellow, B Phase- Blue

5.3 All the cables quoted / supplied shall bear ISI mark. The PVC Cable shall conform in all respects to high System standards of engineering, design, workmanship, this specification and the latest revisions of relevant standards at the time of offer.

5.4 The cables shall be suitable for being installed in outdoor metallic enclosure which is in contact with top of Transformer Tank. The insulation shall withstand mechanical and thermal stress under steady state and transient operating conditions.

## 6. Power contactors:

The Contractors shall confirm to the latest IS specification IS/IEC 60947-4-1. The contractor shall be suitable for motor duty for 690 V ac with impulse withstand capacity of 6 kV. The contractor shall have no derating up to 55°C service temperatures. In case the contractors need derating, manufacturer shall declare the derated current carrying capacity at 55°C service temperatures. The contractors shall be suitable operation duty AC3. For each phase 3P/4P Contactor shall have to be provided by successful bidder. The Contactor selected should have a coil of low VA burden.

**Table-A**

General Required GTP of Power Contactors		
SR No	Particulars	Values
1	Applicable standard	IEC 60947-4-1
2	Utilization category	AC-3
3	Rated Operational Voltage	433 V/50 HZ
3	Rated Insulation voltage	690 V
4	Rated Impulse withstand voltage	8 KV
5	Ambient temperature	-5 °C to 55 °C
6	Control circuit type	AC, 50 HZ
7	Rated Breaking capacity	Shall be confirming to IEC 60947-4-1
8	Rated Making capacity	Shall be confirming to IEC 60947-4-1
9	Rated short time withstand current	Shall be confirming to IEC 60947-4-1
10	Mechanical Durability	10 Million cycles
11	Electrical Durability	1 Million cycles
12	Limit of operation	
A.	Pick- up (% of coil voltage)	85-110 %
B.	Drop-off (% of coil voltage)	30-60 %
13	<b>Auxiliary contacts</b>	
A.	Contacts confirming to standard	IEC 60947-5-1
B.	Nos of Built in/Add on Aux Contacts	1 NO/1 NC
C.	Short circuit protection	Shall be Confirming to IEC 60947-5-1
D.	Rated making capacity	Shall be Confirming to IEC 60947-5-1

**Table-B**

Sr No	Transformer Rating (KVA)	3-Pole Contactor/Phase		4-Pole Contactor/Phase	
		Contactor operational current rating (AC-3)	Flexible PVC Insulated Copper cable (mm <sup>2</sup> )	Contactor operational current rating (AC-3)	Flexible PVC Insulated Copper cable(mm <sup>2</sup> )
1	10	9 A per Pole	2.5	6 A per Pole	2.5
2	16	16 A per Pole	2.5	12 A per Pole	2.5
3	25	25 A per Pole	4	18 A per Pole	4
4	63	50 A per Pole	10	40 A per Pole	6

5	100	80 A per Pole	25	65 A per Pole	16
6	200	130 A per Pole	50	95 A per Pole	35

## 7. IoT Gateway:

### 7.1 Processor & Clock:

- a. 32-Bit ARM Processor
- b. More than 100 MHz clock
- c. Hibernate Power Mode in case of power supply failure
- d. Built In RTC with 10 Years Battery Back Up
- e. RTC Synchronization provision for
  - I. GSM Sync
  - II. Manual Sync

### 7.2 Power Supply:

- a. Primary Supply Voltage: up to 36 VDC
- b. Isolation: Up to 1500 Vrms Three Way Isolation
  - I. Input Supply to Micro Controller Supply Isolation
  - II. Input Supply to Communication Isolation
  - III. Microcontroller to Communication Isolation
- c. Battery Supply Voltage: up to 5 VDC

### 7.3 Communication Connectivity:

- a. Serial Connectivity: 02 (1 Master for Energy Meter, 1 Slave)
  - I. 02 MODBUS ports freely configurable as Master/slave
  - II. 2 Wire, EIA - RS485
  - III. Baud rate: 9600, 19200, 38400, 57600, 115200
  - IV. Protection: Up to 2000 Vrms Isolation from Input Power Supply, Field IO and Controller
  - V. Communication Protocol: MODBUS RTU Master
- b. Ethernet Connectivity: 01
  - I. For local configuration and data connectivity
  - II. LAN: 10/100 BASE Ethernet Connectivity
  - III. Protection: Up to 1500 Vrms Magnetic Isolation (IEEE 802.3 Compliant)
  - IV. Communication Protocol: (User Selectable)
    - IV.1. MODBUS TCP
    - IV.2. MODBUS over HTTP
- c. Remote Connectivity: server connectivity using IIoT Communication protocol
  - I. Dual SIM Connectivity
  - II. Quad Band GSM/GPRS Connectivity
  - III. GPRS Multi slot Class 12
  - IV. Extended Temperature -40 to 85-degree C



- V. Communication Protocol: MQTT / CoAP / XMPP over GPRS
- VI. Antenna : 7dBi Gain
- d. **Secure WiFi:** The DCU shall have the capability of being connected locally through its own secure WiFi. Access to this WiFi shall be through a hand-held device such a mobile phone with both read & write access. The Contractor shall provide an appropriate mobile application (the “Mobile App” or “App”) to connect with this WiFi in a secure password-protected manner in order to connect to the DCU. Both meter reading & writing shall be allowed over WiFi; i.e. the capability of programming the DCU over WiFi shall be enabled.
- e. **Mobile Application:**  
All necessary helps for development of mobile app shall be provided by the contractor.

#### **7.4. Functionality for local meter reading:**

- (i) It is assumed that the RJ45 connectivity will only be used occasionally at the time of commissioning of the Metering Console, and later whenever there is any replacement of meters.
- (ii) On the other hand, WiFi may be used more often especially in areas with poor mobile data connectivity. In such cases, the DisCom’s meter reader will have to physically go to the Metering Console to fetch the meter data.
- (iii) Whether through RJ45 or WiFi, there shall be a double layer of security between the DCU and the reader. The first layer of security shall entail a password which shall be dynamic based on the Metering Console’s identification number and the respective date of that instance. The second layer of security shall be at the local user’s interface to log in to the required portal and attempt the intended operation.
- (iv) Once the DisCom’s meter reader (or the DisCom/ Client/ Contractor via the RJ45/wi-fi port) locally transfers the DCU’s data into its mobile device, the Mobile App shall be capable of transferring and synchronizing this data with the cloud server and its database in order to ensure a seamless database.

#### **7.4 Field Interface:**

- a. Digital Inputs: 04 (3 Contactor Feedback, 1 Door Status)
  - I. Isolation: Upto 2000 Vrms
  - II. Sensor Type: Dry / Potential Free Contact
  - III. Built in Interrogation voltage: 24 VDC
- b. There shall be inbuilt temperature sensor inside IoT device for inside temperature measurement of WDD Enclosure.
- c. Relay Outputs: 03 (3 contactor operations)
  - I. Contact Type: Form A (NO)

- II. Voltage: 230VAC / 30VDC
- III. Current: 5 A
- IV. Isolation: Upto 4000 VAC
- V. Electrical Endurance: Up to 100000 Operations
- VI. Mechanical Endurance: Up to 1000000 Operations
- VII. Status Hold Feature

- d. Analog Inputs: 04 (Transformer Health Monitoring: OTI, WTI, Level etc.)
  - I. Input Range: 0-10 VDC / 0-20 mA
  - II. Accuracy: 0.1% FSR @ 25 deg C
  - III. ADC: 24-bit Sigma-Delta ADC
  - IV. Software Configurable Analog Inputs: 0-10VDC / 0-20mA / 4-20mA
  - V. Multiple Display: Raw Count / Electrical Value/Engineering Value

### 7.5 EMI/EMC Compliance:

- i. Electrostatic Discharge (**IEC 61000-4-2**)
  - a. Contact Discharge : +/- 4 kV, Criteria B
- ii. Fast Transient (**IEC 61000-4-4**)
  - a. Power : +/- 2 kV, 100 kHz , Criteria A
- iii. Surge (**IEC 61000-4-5**)
  - a. Power : +/- 1kV, Criteria B
- iv. Conducted Immunity (**IEC 61000-4-6**)
  - a. Power : 10 Vrms, 0.15 – 80 MHz, Criteria A

### Embedded Features:

- a. Web Server: To configure device using web browser

Communication Protocol: MODBUS over HTTP

- b. Event/Alarm Processing:
  - 1. To configure and process events against any measured parameter (Load/ Power Factor /KVAR etc.)
  - 2. In case of event
    - Event Status update on Local SCADA as well as Web Page connectivity
    - Alarm server will push message to remote server with snapshot of all meter parameters in that group

- c. Storage

- I. SD card storage to store Up to 50 parameters periodically at interval of 15 minutes
- II. To store event data with local time stamp Up to 10000 events
- III. In case of GPRS connectivity failure device should store the time stamped data in SD card and upon reconnection it should back fill all missing data to server software

d. Remote Diagnostics

- I. GPRS Diagnostics: RSSI (Signal Strength), Network Status, GPRS Status, Connectivity Status
- II. Local RS485 Master Communication Diagnostics: No of requests failed per port, No of Errors per Port, Meter level communication failure indications.

**8. Three Phase Redundant SMPS:**

- a. Isolation Voltage: 3000 VAC
- b. Input Voltage Range:
  1. R Phase – Neutral : 85 – 280 VAC
  2. Y Phase – Neutral : 85 – 280 VAC
  3. B Phase – Neutral : 85 – 280 VAC
- c. Phase wise DC Output Voltage (DC1, DC2, DC3): 24 VDC
- d. Phase wise Output Power: 5 W each
- e. Common DC Output Voltage (DC4): 24 VDC
- f. Short Circuit Protection: Continuous with Self Recovery
- g. Operating Temperature: -40 to 85 deg C
- h. EMI/EMC Compliance:
  - I. CISPR22 Class A
  - II. Fast Transient (**IEC 61000-4-4**)
    - a. Power : +/- 2 kV, 100 kHz , Criteria A
  - III. Surge (**IEC 61000-4-5**)
    - a. Power : +/- 1kV, Criteria B
  - IV. Conducted Immunity (**IEC 61000-4-6**)
    - a. Power : 10 Vrms, 0.15 – 80 MHz, Criteria A
  - V. Voltage Dips (**IEC61000-4-11**)
    - a. Power : 0-70%, Criteria B

**9. Energy Meter:**

- a. Meter Type: Three Phase Electronic Energy Meter

- b. Current Rating: 10-60( Up to 25 KVA Transformer, -/5 63 KVA and above Transformer)
- c. Accuracy: Class 1.0 or Higher
- d. Size :Compact
- e. Communication Port: RS 485 Modbus Compliance
- f. Rated impulse withstand voltage:6 KV
- g. Climate Conditions: The meter should function satisfactorily with temperature ranging from 5-60<sup>0</sup>C and humidity up to 95%
- h. Ref. Voltage: 240V
- i. Working voltage : -30% to 20% of Vref
- j. Frequency: 50 Hz  $\pm$  5%
- k. Measurement Parameters:
  - I. 3 - Phase Voltage
  - II. 3 Phase Current
  - III. 3 Phase Power
  - IV. 3 Phase Power Factor
  - V. All Energy
  - VI. Frequency
  - VII. Active, Reactive, Apparent and Real Power
  - VIII. Temper data with date and time
  - IX. Maximum Demand KW, KVA

**10. Operational Logic Controller: (It may be changed as and when required during the CMC period)**

1. Operation Logic Controller can be an integral part of IoT Gateway or a separate unit other than IoT Gateway
2. Objective of controller is to perform operation as well as protection logics even in case of remote connectivity failure based on local programmed controller.
3. Feeder Status Detection & Operations
  - a. Controller should detect the status of feeder in terms of three phase or single phase Mode.
  - b. If LT Side of Distribution transformer, Phase to Phase Voltage difference of all phase is less than 10 % then it shall be taken as 3Phase Mode of feeder, and if not then consider as 1 Phase Mode.
  - c. Feeder status to be determined only if condition persists for remotely configurable “hold time”.

- d. In case of single phase operation with Three Phase feeder status, controller should switch on only the phase which was available during last single phase operation cycle.
- e. Remotely Configurable Registers
  - i. Voltage Thresholds
  - ii. Hold Time for Single Phase Power On
  - iii. Hold Time for Three Phase Power On

#### 4. Running Hours Calculations

- a. Controller should do running hours calculations to be updated in non-volatile memory at every 10 minute interval of the following:
  - i. Day Running Hour – Three Phase Feeder
  - ii. Day Running Hours – Three Phase Output
  - iii. Day Running Hours - Pump

#### 5. Operation Modes

- a. Device should operate in remotely selectable Operation Modes
  - i. **Mode-1 : Solarisation Mode** without Compensation of Extra 3 Phase Hours to consumer.
    - 1. In this mode, Controller should switch on all three contactors on detecting three phase status of feeder after waiting for “Delay Time for Three Phase Duration”
    - 2. Controller should switch contactors to Single Phase mode when  $\text{Current time} - \text{Three phase start time} > \text{“Three phase Limit Hours”}$
  - ii. **Mode-2 : Solarisation Mode with Compensation**
    - 1. This mode is similar to Mode-1.
    - 2. But in this mode, controller should switch contactors to single phase only if  $\text{“Day Running 3ph Hours”} > \text{“Three phase Limit Hours”}$
  - iii. **Mode-3 : Non Solarisation Mode**

1. In this mode, controller should work in sync with the feeder status as per the defined logic.

- iv. **Mode-4** : Remote Manually ON/OFF

1. User shall have facility to make ON/OFF Contactors remotely or 1 phasing power supply with various security level.

- b. Remotely Configurable Registers for

- i. Three phase Hours (in Minutes)
- ii. Operation Mode Selection
- iii. Delay Time for Three Phase Operation
- iv. Delay Time for Single Phase Operation

6. Over Current Protection

- a. Over Load Protection Logic

- i. If load increases more than “over current limit”, controller should switch off the contactors for remotely configurable “Wait Time Duration”. Device should repeat the same action for configured “Repeat count”
- ii. If “Over Current” condition persist even after repeat count, it should trip permanently
- iii. On request of consumer, it should be possible to remove permanent trip status remotely

- b. Remotely Configurable Limits:

- i. Rated Current
- ii. Over Current Limit in % of rated Current
- iii. Wait Time Duration
- iv. Repeat Count

7. Contactor Chattering Protection

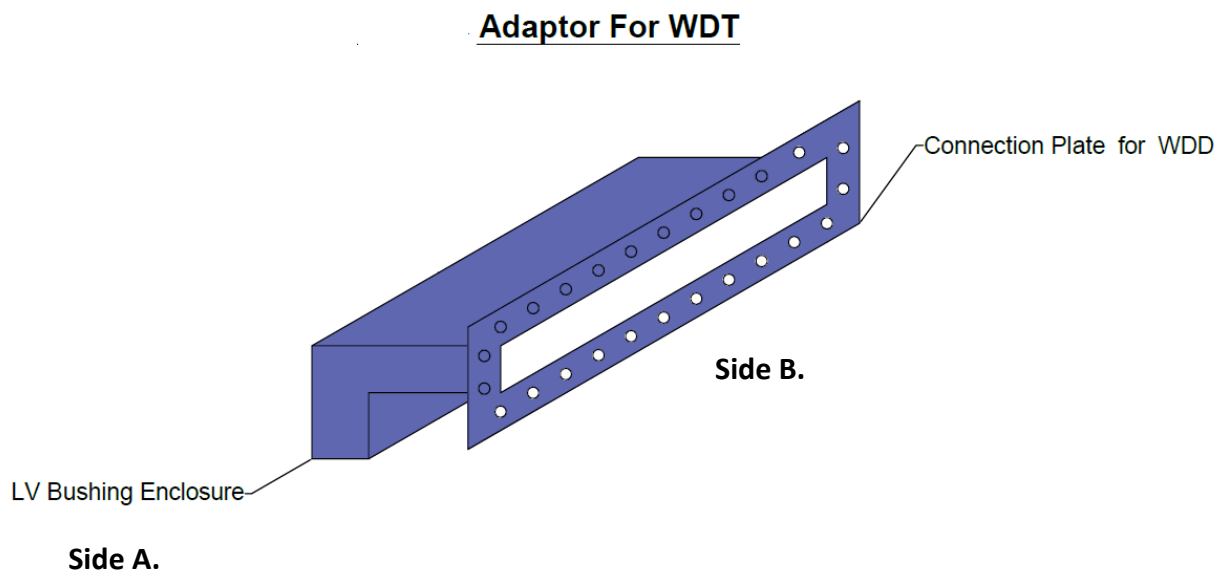
- a. Controller should provide remotely configurable “dead band of voltage” for contactor operation to avoid chattering of contactors in case of low voltages

## **11. Adaptor & WDD Enclosure for WDT:**

## 11.1 Adaptor :

11.1.1 **Adaptor** is a metallic housing for LV Bushing of distribution transformer. The adaptor shall be manufactured with MS Plate having minimum thickness of 3.15 mm. Following drawing shall be taken as a reference for designing Adaptor, the dimensions may vary for different rating of transformers rating and its tank design. Side "A" of adaptor shall be welded such that LV bushing remain Enclosed in adaptor and access for wiring/repair/replacement of LV bushing of distribution transformer shall have from side "B". The welding shall be carried out as per as per the relevant ASME standards.

11.1.2 The internal clearance of adaptor shall be such that, it shall facilitate access for wiring/repair/replacement of LV bushing of distribution transformer and per latest safety standard.



## 11.2 WDD Enclosure :

11.3 WDD Metal Enclosure shall have enough space such that it shall comprise major components and easy to lay the power and control wiring within the enclosure. The components are AC 3 type Power contactor, SMPS, 3 phase audit energy meter, three numbers of tape wound ring type current transformers of required capacity (i.e 100/5 Amp and 200/5 Amp, 0.5 Class), adequate self-intelligent IoT base gateway which has RS485 communication ports, at least four serial ports to communicate locally with energy meter.

11.4 The WDD Enclosure shall be manufactured with MS Plate having minimum thickness of 3.15 mm.

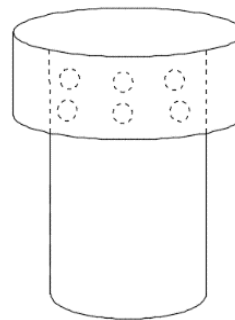
11.5 There shall be provision of DIN rail mounting at sufficient height inside WDD Enclosure for easy assembly of Devices.

11.6 There shall be provision of Exhaust pipe of MS on top cover of the WDD enclosure. The Exhaust pipe shall have a proper provision on top to avoid water ingress and External access to the internal parts of WDD. The External coating and paint of Top pipe shall be same as of WDD Enclosure.

**Dimensions of Exhaust Pipe.**

- a. Length: 150 mm (minimum)
- b. Diameter: 75 mm
- c. Thickness: 3 mm
- d. Hole Diameter : 1.5 mm

**Reference Drawing of Pipe:**



11.7 A vertical MS pipe with 8 nos of 2mm size holes on the surface of the pipe for essential GPRS signal strength connectivity. The pipe shall be closed bottom end having following size shall be welded at bottom side of WDD enclosure. This shall work as a housing of internal signal antenna of WDT. This is to avoid unauthorised external access as well as to ensure better signal strength. The WDD shall have hole of 10 mm diameter at the bottom where the MS pipe is connected to house the antenna.

**Dimensions of Tube:**

- Length: 120 mm
- Diameter: 24 mm
- Thickness: 3 mm

11.8 The Fixing of LV Bushing with standard marking (phase identification) on a metal plate of WDD Enclosure shall be as per Drawing NO-2 of this specifications.

11.9 Bushing shall be of porcelain/epoxy material. The LV bushings shall conform to the relevant standards specified and shall be of 1.1 KV class outdoor type.

11.10 Dimensions of the bushings of the voltage class shall conform to the Standards specified and dimension of clamping arrangement shall be as per IS 4257.

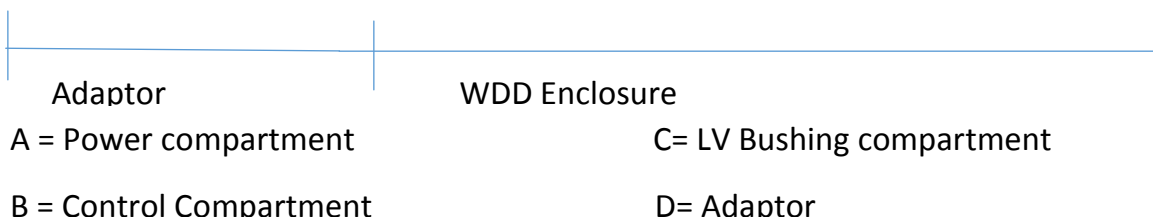
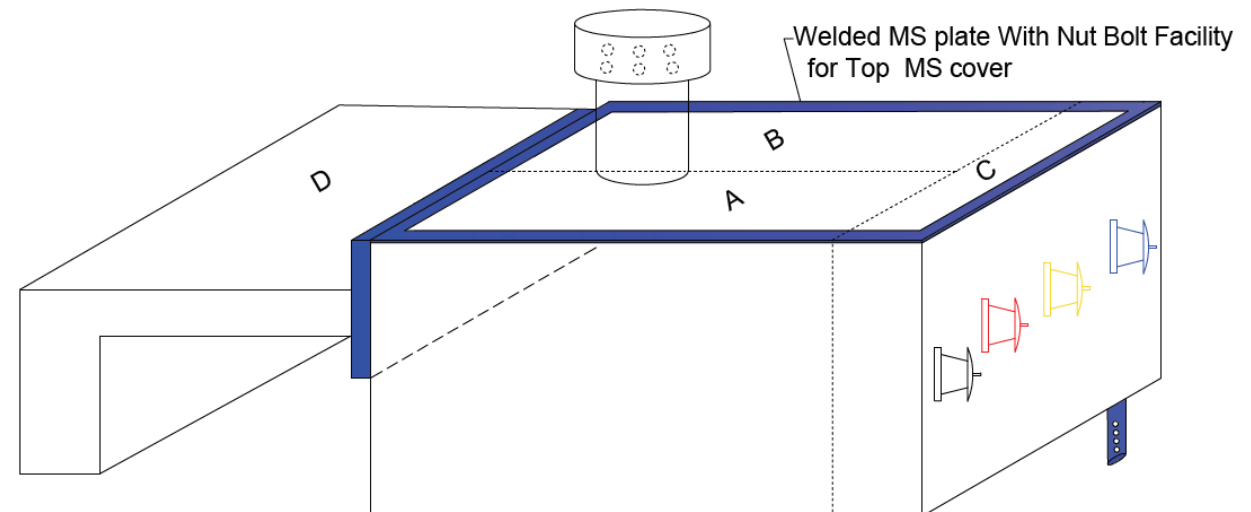
11.11 Minimum external phase to phase and phase to earth clearances of bushing terminals shall be as follows:

Voltage	Clearance



	Phase to Phase	Phase to Earth
LV , 0.433 KV (L-L)	75 mm	40 mm

- 11.12 The LT bushing rods and nuts shall be made of brass material and not less than 12 mm diameter. (This supply shall not be in the scope of supplier)
- 11.13 The bushings shall be of reputed make supplied by those manufacturers who are having manufacturing and testing facilities for insulators. (This supply shall not be in the scope of supplier).
- 11.14 The live part of LV bushing, power contactors and power PVC cable shall be separated by insulation barrier of partition(minimum 2 mm thickness) from Electronics Devices used inside WDD Enclosure to limit electromagnetic interference as per drawing no-2.( Dimensions may vary)



**Drawing No: 2**

- 11.15 All other bolts, nuts and plain washers used for tightening purpose including connectors should be of M.S. hot dip galvanized. Bolts, nuts washers also shall be hot dip galvanized.
- Pitch of Holes = 80 mm  $\pm$  10%
- Nut Bolt dimension= 3/8" x 3/2"

- 11.16 Top cover fixing bolts adequately spaced and 6 mm Neoprene bonded cork gaskets conforming to IS 4253 part-II shall be placed between WDD Enclosure and top MS cover. The bolts outside Enclosure shall have 2 flat washers & one spring washer. Also 6mm Neoprene bonded cork gasket confirming IS 4253 part-II shall be placed between Adaptor and WDD Enclosure connection.
- 11.17 The exterior of the Adaptor, WDD Enclosure and other ferrous fitting shall be thoroughly cleaned, scraped /sand blasted and given of thermo setting powder paint or one coat of epoxy primer followed by two coats of synthetic enamel/polyurethane. These paints can be either air drying or stoving.
- 11.18 The colour of the exterior finishing coats shall be of Pantone 321 C (Colour name-SIMENS Patrol).
- 11.19 The interior of the Adaptor, WDD Enclosure and other ferrous fitting shall be thoroughly cleaned, scraped /sand blasted and given of thermo setting powder paint or one coat of epoxy primer followed by two coats of synthetic enamel/polyurethane. These paints can be either air drying or stoving.
- 11.20 The colour of the interior finishing coats shall be of Light orange as per IS 5-2007 (ISC code-557).

## **12. SMC Box:**

- 12.1 The WDD to be installed on Individual agriculture consumer shall be fixed in SMC box.
- 12.2 SMC box shall be anti-corrosive, dust proof, rust proof, shock proof, self-extinguishing property, resistant to heat, vermin & water proof, Ultra Violet Stabilized and pilfer resistant Meter Box made from Glass Reinforced Polyester Sheet Moulding Compound (SMC) confirming to IS: 13410 (1992) and IS 14772:2000.
- 12.3 SMC Box shall be moulded in a single piece forming the body of SMC the box with a cover fitted with base by minimum three nos. concealed stainless steel hinges. The lid/cover shall rest on the collar of the SMC box base in such a way that any access from outside of the WDD is not possible. The stainless steel hinges shall be fitted with the SMC Box body base and covers rigidly, thereby making the SMC M Box pilfer resistant.
- 12.4 The door in closed position should be overlapped in such a manner that no direct entry or access is possible. The SMC meter Box shall be closed by S.S. 'U' Clamp of minimum 0.8 mm (+/- 0.1 mm).thickness for holding and locking of the door with body base. The "U" Clamp shall have 4 mm diameter hole through which it is possible to seal the box for sealing purpose.
- 12.5 The top surface of SMC meter Box shall have little tapering shape towards both Sides of the SMC meter Box for easy flow of rainwater.
- 12.6 The box should have a window with glass. The SMC box door shall open at 90 degree.

- 12.7 Hardware used for fixing window glass, hinges and particle board shall be concealed and non-removable from outside.
- 12.8 Cable entry and exit shall be from both sides of box, however there shall not be any hole on the box. Holes will be drilled by the user at the time of installation of the box.
- 12.9 Wooden Particle board should be provided to facilitate easy & faster mounting of components of WDD.
- 12.10 Earth bolt of 6mm diameter x 20mm length with 2 nos nuts and 2 nos washers shall be provided. The earthing arrangement shall be of M.S. with Zinc Passivated.
- 12.11 All corners of the meter box should be round & not pointed ones. All metal parts shall be zinc passivated.

### **13. Wiring:**

- 13.1 In all types of wiring due consideration shall be given for neatness, good appearance and safety.
- 13.2 All the circuit wires shall be properly crimped with lugs and connected to terminals. Power cable shall be properly terminated with tinned copper lugs and cables Identification tags soldered with lugs as directed.
- 13.3 Material of Power cable Lug: ETP Grade Copper IS 1857.

### **14. Current Transformer :**

The detail Ring Type Current Transformer specifications for 100/5 Amp and 200/5 Amp is separately enclosed as Annexure-1 of this tender.

#### **1. Name Plate :**

The aluminium metal name plate fixed on the C shaped base of MS sheet (2 mm Thick) welded on WDD Enclosure toward Neutral side of Distribution Transformer. It shall be Non detachable type, with legible and indelible marking.

#### **Title: Watch Dog Transformer**

Name of Manufacturer

A /T No. with date

Serial Number: Unique Id

Max Transformer Capacity (KVA)

Contacting current capacity

CT ratio

Energy Meter capacity

Property of \_\_\_\_\_

Patent pending-Concept by GPRD CELL, GUVNL

Sr. No. of the WDD will be its unique Id no. DISCOM will maintain the unique id so as to avoid duplication.

DGVCL : 1XXXXXXXX (with bar code)

MGVCL: 2XXXXXXXX (with bar code)

UGVCL: 3XXXXXXXX (with bar code)

MGVCL: 4XXXXXXXX (with bar code)

## **15. Approval before mass manufacture**

The successful tenderer shall manufacture one proto type and offer proto inspection and testing at their works.

Mass production can be taken up only after approval of proto sample.

## **16. Drawing and documentation :**

- 16.1 The tenderer shall have to submit detailed constructional and dimensional, control drawing of WDD enclosure along with adaptor with details of Contactors, SMPS, Energy Meter, IoT gateway incoming and outgoing circuit details, LT bushing arrangement, and clearance details along with the offer. And any other relevant drawing required by purchaser.
- 16.2 Drawings, diagrams, instructions and reports shall be identified by descriptive titles indicating their applications to the equipment offered.
- 16.3 All dimensions shall be in metric system.
- 16.4 All the drawings of individual equipment shall be marked with all Technical details, Guaranteed Technical Particulars, details of manufacturer etc.
- 16.5 On approval of all drawings one set of drawings shall be sent to each sub-division where WDT to be installed & one set each to the concerned Division & Circle office shall also be provided. All Approved drawings in Auto CAD format shall be submitted to the Project Implementation Cell.
- 16.6 All drawing shall conform to International standards organization (ISO), „A“ series of drawing sheets/Indian Standards specification IS:656. All dimensions shall be in SI units.

## **17. Inspection and Testing:**

The manufacturer shall supply all type test certificates for Contactors, SMPS, Energy meter, IoT gateway, PVC cables, and LT Insulators, SMC Box. All the Type Tests shall be carried out from Laboratories which are accredited by the National Board of Testing and Calibration Laboratories (NABL) or Govt. approved.

The inspection shall be carried out by the purchaser at two stages of manufacture i.e inspection during manufacturing and final inspection and testing. The supplier shall keep the purchaser informed in advance of the manufacturing programmer so that the arrangement can be made for inspection.

The tenderer must clearly indicate what testing facilities are available in the works of manufacturer (WDD manufacturer) and whether the facilities are adequate to carry out

all Routine, and Acceptance Tests. TSysteme facilities should be available to DISCOM's Engineers, if deputed to carry out or witness the tests in the manufacturers to carry out the acceptance tests on the Box. All testing equipment shall be duly calibrated in Govt. / NABL approved laboratory.

Following Minimum testing facility shall be available at Manufacturer work place:

1. Variable 3 phase AC Source (0 to 270 V)
2. Variable 3 phase current source ( up to 200 A
3. Voltage, current, & KW Measurement panel.
4. 3 Phase Load of Minimum 5 KW.
5. Megger (Min 500 V) & Clamp ON meter.

## **18. ACCEPTANCE AND ROUTINE TESTS:-**

All acceptance and routine tests as stipulated in the relevant standards for individual components of the WDD shall be carried out by the supplier in presence of DISCOM's engineer in charge. Immediately after manufacturing of WDD, the supplier shall give fifteen days advance intimation in writing to concern DISCOM to enable him to depute his representative for witnessing the tests. The following are the acceptance test for the confirmation of WDD( but not limited to tSysteme tests, purchaser shall have right to add or delete the tests for acceptance after more detail engineering during the scope of project execution)

- 18.1 Insulation resistance Test
- 18.2 Meter accuracy test
- 18.3 Logic test
- 18.4 Communication test
- 18.5 Over load protection and logic test

## **19. GUARANTEE:**

The tenderer quoting complete WDD Device with all components supplied shall be guaranteed for a period of 7 years from the date of dispatch. The Stores / materials as above found defective or not meeting requirement of specifications within above guarantee period shall be replaced / repaired duly tested by the supplier free of cost within 10 days of receipt of intimation. The contractor shall have to incorporate all changes required in controller logics and web Dashboard as per DISCOM requirements free of cost during guaranty period.

## **20. QUALITY ASSURANCE PLAN:**

The bidder shall have ISO-9001/9002 or any latest, certification". The bidder shall invariably furnish the following information along with his bid part-I falling which his bid shall be liable for rejection should be given be individual type of material offered.

- 20.1 Statement giving list of important raw materials, name of suppliers for raw material, list of standards according to which the raw materials are tested and list of tests

normally carried out on raw materials in presence of bidder's representative, copies of tests certificates,

- 20.2 Information and copies of test certificates as in(1) above in respect of bought out items,
- 20.3 List of manufacturing facilities available
- 20.4 Level of automation and list of areas where manual processing exists.
- 20.5 List of areas in manufacturing process where stage inspections are normally carried out for quality control and details of such test.
- 20.6 List of testing equipment available with the bidder for stag and final testing Of equipment offered and test plant limitations if any, vis-à-vis the type test, special acceptance and routine tests specified in the relevant standards. TSysteme limitations shall be vary clearly brought out in the relevant schedule of deviation as deviations from specified tests requirements.

## **21. PACKING & FORWARDING:**

- 21.1 The equipment shall be packed in creates suitable or vertical, horizontal transport as the case may be and suitable to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully. The WDD manufacturer shall have to supply WDD unit with adaptor and other relevant accessories at transformer repairing agency site/DISCOM store as per the Dispatch instruction.
- 21.2 Packed and marked with the appropriate caution symbol. Wherever necessary proper arrangement for lifting such as fitting hooks shall be provided. Any material found short within the packing case(s) shall be supplied immediately by the supplier without any extra cost to purchaser.
- 21.3 Each consignment shall be accompanied with a detailed pacing list containing the following information and shall be marked " PROPERTY OF DISCOM"
  - 1. Name of the consignee
  - 2. Details of consignment
  - 3. Destination
  - 4. Total Weight
  - 5. Handing and packing instruments.
  - 6. Bills of material indicating contents of each package.
- 21.4 In addition to the above the marking on each package shall per relevant standards.
- 21.5 The packing shall be done as per manufactures standards practice ensuring that no material is damage during transit by Rail/Road.

## **22. Requirement of Hardware and Software for the system :**

- 22.1 The hardware and software should be based on robust architecture model, frame work that is suitable as per the project including routine operations and

maintenance of distribution Company considering 15% annual growth. Initially, the hardware and software to be supplied should be suitable of handling up to 10,000 WDD Devices and 1000 End user.

- 22.2 The system shall be developed on open platform based on distributed architecture for scalability without degradation of the performance using additional hardware. system shall support storage of raw meter data, alarms and alerts for minimum 3 days. Adequate data base and security features for storage of data at SYSTEM need to be ensured.
- 22.3 The successful bidder shall have import and integrate data on Existing server and Solar Energy data Management (SEDM) software to be developed separately. Extensive watch Dog Module shall be developed and hosted on the GUVNL server.
- 22.4 The extent and modalities of integration with the existing system has to be worked out by the bidder.
- 22.5 SYSTEM shall have Following functions:
- I. Real-time data acquisition and contactor status monitoring
  - II. Acquisition of meter data on demand & at user selectable periodicity
  - III. Two way communication with meter IoT gateway
  - IV. Signals for connect & disconnect of switch System present in end points like meter
  - V. Audit trail and Event & Alarm Logging
  - VI. Encryption of data for secure communication
  - VII. Maintain time sync with IoT gateway
  - VIII. Store raw data for defined duration
  - IX. Handling of Control signals / event messages on priority
  - X. Setting of configurable parameters
  - XI. Communication device status and history
  - XII. Critical and non-critical reporting functionality. The suggestive critical events may be alarms and event log for meter events like tamper/power failures, contactor ON/OFF, overload etc., if data is not received from IoT gateway, if relay does not operate for connect / disconnect or there is communication link failure with lot gateway or network failure while non-critical events may be retry attempts on communication failure, periodic reading missing and failure to connect etc.

### **23. Integration :**

SYSTEM shall preferably interface with exiting SEDM on standard interfaces and the data exchange models and interfaces shall comply with CIM / XML / IEC 61968 or any other open standard. The solution shall be Service Oriented Architecture (SOA) enabled.

### **24. Network Security**

1. The Network shall have adequate cyber security measures not limited to the measures as described below. The network security would be extended to all the interfaces also.
2. Secure Access Controls: The system shall include mechanisms for defining and controlling user access to the operating system environment and applications. Best practices from enterprise security including password strength, password aging, password history, reuse prevention etc. must be followed for access control.
3. Authorization Controls: A least-privilege concept such that users are only allowed to use or access functions for which they have been given authorization shall be available.
4. Logging: Logs must be maintained for all attempts to log on (both successful and unsuccessful), any privilege change requests (both successful and unsuccessful), user actions affecting security (such as password changes), attempts to perform actions not authorized by the authorization controls, all configuration changes etc. Additionally, the access to such logs must be controlled in accordance to the least-privilege concept mentioned above, so that entries may not be deleted, accidentally or maliciously.
5. Hardening: All unnecessary packages must be removed and/or disabled from the system. Additionally, all unused operating system services and unused networking ports must be disabled or blocked. Only secure maintenance access shall be permitted and all known insecure protocols shall be disabled.
6. Malicious Software Prevention: Implementation of anti-virus software and other malicious software prevention tools shall be supported for all applications, servers, data bases etc.
7. Network Security: The network architecture of the SYSTEM (Head end system) must be secure with support for firewalls and encryption. The system shall also allow host-based firewalls to be configured, as an additional layer of security if the network firewall were to fail.

## **25. Dashboards, Analysis and Reports:**

The application software shall have drilldown dashboards for depicting the real time status of the contactors along with the details of the energy flow statistics with time stamping. Further, the vendor should provide for changes, updating, modifications, new dash boards and reports during the entire project implementation as per the requirement of the Owner as and when required. The reports shall be generated and published periodically on the web server and shall be readily available for download and consumption. Further all the reports generated shall have option of exporting into xls, pdf etc. The separate Watch Dog Module shall be designed and hosted on GUVNL server.



Some of the reports that needs to be generated at desired periodicity are:

1. Energy audit( overall, 1ph, 3ph)
2. Periodic loading
3. Voltage Profile
4. Power Factor
5. Outage Report
6. Daily 3 Phase availability duration
7. Nos of contactor operations
8. Seasonal Demand Curve
9. Abnormal loading with duration and time stamping
8. Any other reports which can be generated from the available data.
9. Viewing Historical data in Graphical format
10. Present Geo location (latitude, longitude) of WDT

The above reports are indicative and further reports along with details and formats of the dashboards and reports to be generated online shall be finalized with the vendor during the implementation.

Web dashboard shall be responsive web design (RWD) for mobile viewing facility.

## Annexure –A (IoT) gateway device)

(To be furnished by the Manufacturer)

IoT based DCU GTP		
Sr no	Details	Bidders Response
		Compliance
1	3 Phase Power Supply with Isolation	
2	RS485 Communication Ports: 02 Nos.	
3	Ethernet Communication Port: 01 Nos.	
4	Dual SIM GPRS	
5	RTC with Battery Back Up and GSM Sync provision	
6	04 Digital Inputs	
7	03 Relay Outputs, 5 A, 230VAC/30VDC	
8	04 Analog Inputs, 0.1% FSR, 24-Bit ADC	
9	EMI/EMC Compliance	
	a. IEC61000-4-2	
	b. IEC61000-4-4	
	c. IEC61000-4-5	
	d. IEC61000-4-6	
	e. IEC61000-4-8	
	f. IEC61000-4-11	
10	IoT Communication Protocol	
11	JSON Message Format	
12	SD Card Storage	
13	History Back Fill	
14	Periodic Push Data	
15	On Demand Read and Write (Pull)	
16	Events and Notifications	
17	Remote Configuration	
18	TLS based encrypted communication	
19	Battery backup provision for reporting Power loss	
20	Local Calculations capability for Solar performance	
21	Built in Temperature sensor	

**Annexure – B (Power contactor, Energy meter & Enclosure)**

(To be furnished by the Manufacturer)

Sr No	Particulars	
1	Make & Contactor application	
2	Utilisation category	
3	Poles description	
4	Rated operational voltage	
5	rated operational current	
6	Control circuit type and voltage	
7	Auxiliary contact composition	
8	Rated impulse withstand voltage	
9	Irms rated making capacity	
10	Rated breaking capacity	
11	Rated short-time withstand current	
12	Average impedance	
13	Electrical durability	
14	Mechanical durability	
15	Ambient temperature	
16	Product certifications	
17	Operating time	
18	Operating rate	
19	Coil technology	
20	Hold-in power consumption in VA	
21	Heat dissipation	
22	Minimum switching voltage	
23	IP degree of protection	
24	Pick- up (% of coil voltage)	
25	Drop-off (% of coil voltage)	
<b>Energy - Meter</b>		
1	Meter make, rating	
2	Accuracy class	
3	Communication port	
4	Operating voltage range	
5	Auxiliary supply voltage	
6	Size (Dimensions)	

Metal Enclosure		
1	Dimensions of Adaptor and WDD enclosure	
2	Type of coating and paint	
3	Type of LT bushing and voltage rating	

## Annexure –D

### GUARANTEED TECHNICAL PARTICULARS FOR SMC BOX

	Particulars	Detailed Particulars	To be Offered by Bidder
1	Maker's name	To be intimated by the supplier	
2	Material	Glass reinforced polyester sheet moulding compound	
3	Grade of Material	SMC confirming to IS: 13410-1992 Grade S 1	
4	PROPERTIES OF MATERIAL OF CONSTRUCTION OF METER BOX		
	Flame Retardant test	As per IS – 11731 (Min.FVO)	
	Glow wire test at 650 C	As per IS – 11000 Part-2/sec-1	
	Degree of protection	IS-42 as per IS-12063 / 87	
	Fire Retardency	Self-Extinguishing as per IS:4249	
	Heat Distortion temp	180° C (min) as per IS: 13411	
	Dielectric Strength at 90 °C in oil	9 KV / mm (min) as per IS:6262-1971	
	Tensile Strength	50 Mpa (Min) as per Annex-F of IS-8543 (P-4/Sec-1) 1984	
	Flexural strength	155 Mpa (Min) as per Annex-F of IS-13411-1992	
	Izod Impact strength (Notched)	45 KJ/M2 (Min) as per Annex-E of IS-13410-1992	
5	Window having Triplex Glass (Mention Dimention)	Window with Triplex glass.	
6	Fixing of Glass	Fitted from inside in such a way that it cannot be replaced without opening door (with metal frame all around)	
7	Locking arrangement	For holding & locking of door with base "U" shaped clamps to be provided with arrangement for sealing of box	
8	Manufacturer short name shall be embossed on the front side of the box	To be provided on the front side of the box	
9	Cable entry holes with Diameter	Cable entry holes of 50 mm dia with polymeric gland on both	

		sides.	
10	Colour of box	Off White	
11	Box weight: (in grams)		
	a. Weight of SMC material	Give weight of thermosetting plastic.	
	b. Total weight of offered SMC Box	Give total weight including thermosetting plastic, glass, metal parts etc.	