EEHC DISTRIBUTION MATERIALS SPECIFICATION	EDMS 20-304-2
	Date: 17-08-2021

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TECHNICAL SPECIFICATION

FOR

THREE PHASE DIRECT SMART METER

Issue: AUG−2021 / Rev− 2

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1. General Requirements

1.1. Scope

Many important business processes conducted by the DISCOs require re-engineering to increase effectiveness and efficiency. An important enabler for this re-engineering is an Advanced Metering Infrastructure (AMI). The functionality of the AMI can contribute to a large extent of the business needs identified by EEHC, Smart meters is the key role in AMI.
Smart meters shall communicate using FAN telecommunications technologies such as PLC, PLC/RF, mobile wireless service 2G/3G / 4G Technology, and RS 485. The choice of FAN telecommunication technologies shall optimize system design and architecture, interoperability, total cost of ownership while meeting Specifications.

1.2. Service Conditions

The meters to be supplied according to this specification shall be suitable for satisfactory continuous operation under the following environmental conditions:

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Table (1)

NO	Condition	Specification
1	Maximum ambient temperature (^{O}C)	70
2	Minimum ambient temperature (^{O}C)	-5
3	Maximum daily average temperature (^{O}C)	35
4	Maximum annual average temperature (^{O}C)	30

1.3. Environmental Requirements

The meters shall conform to the environmental requirements as defined in IEC 62052-11, 62053-21 and 62053-23. In addition to those requirements, the following minimum requirements shall be met:

1. The meter shall be protected against malfunction due to the ingress of vermin, dust, or excess humidity by conformal coating of the printed circuit boards in the meter.
2. Any openings shall be as small as practically possible to prevent the ingress of dirt and vermin and to limit the potential for vandalism or tamper following Meter case.

2. Standards and codes of practice

2.1. All material and equipment supplied and all works carried out shall comply in every respect with the technical codes of the International Organization for Standardization (ISO) and with the recommendations of the International Electro Technical Commission (IEC) and the European Standards (EN), which apply to the electrical equipment.

2.2. The following documents shall be read in conjunction with this specification. In case of conflict, however, this document shall take precedence. Nothing in this specification shall lessen the bidders' obligations detailed in any other documents forming part of the contract

Table (2)

Identifier	Description
IEC 62052-11:2003	*Electricity metering equipment (a.c.) – General requirements, tests and test conditions – Part 11: Metering equipment*
BS EN50470-1	*Electricity metering equipment (a.c.) – General requirements, tests and test conditions – Part 1: Metering equipment*
IEC 62055	*Part 21: Framework for standardization* *Part 31: Particular requirements- Static payment meters for active energy (classes 1).*
BS EN50470-3	*Electricity metering equipment (a.c.) - Part 3: Particular requirements – Static meters for active energy (class indexes A, B and C)*
BS EN 61268	*Alternating Current Static Var-Hour Meters for Reactive Energy (Classes 2 and 3)*
IEC 62053-21:2003	*Electricity metering equipment (a.c) static watt hour meter for active energy meters class 1 & 2*
IEC62053-22:2003	*Electricity metering equipment (a.c.) – Particular requirements – Part 22: Static meters for active energy (classes 0,2 S and 0,5 S)*
IEC 62053-23	*Electricity metering equipment (a.c) static watt hour meter for reactive energy meters class 2 & 3*
IEC 60060	*HV test technique*
IEC 60068	*Shock and vibration withstand*
IEC 60387	*Marking symbols standard*
IEC 60529	*Degree of protection*
IEC 62054	*Real Time Clock (RTC)*
IEC 62056- 21:2002	*Electricity metering data exchange for meter reading tariff and load control : Direct local data exchange*
IEC 62056-51:1998	*Electricity metering data exchange for meter reading tariff and load control : Application layer protocols*
IEC62056-61	*Electricity metering – Data exchange for meter reading, tariff and load control –Part 61: Object identification system (OBIS)*

3. General Electrical Requirements

The meters shall comply with the following electrical requirements:

Table (3)

No	Description	Specification
	Rated Voltage	Low Voltage LV Operated Network Three Phase Meters: 3x220/380V
2	Variation in voltage	+30% to -40%;
3	Continuous over voltage	Low voltage meters shall withstand 400 volts (Phase to neutral) for 48 hours without being damaged or causing changes of more than 0.01 kWh in its credit registers (excluding the possible decrement of credit due to power being consumed).
4	Rated frequency	50 Hz
5	Variation in frequency	± 5%
6	Power factor	lag – unity – lead
7	Power consumption in the voltage circuit	10VA (2W) for voltage circuit. 4VA for phase current circuit for direct connected meters. Note: the above value for power consumption is for meter without communication modem.
8	RTC	Built-in real time clock with 10 years of operation battery backup
9	Display	LCD; Visibility shall be sufficient to read the meter mounted at height of 0.5 to 2.0 m. Pin type; trans-reflective HTN or STN type industrial grade; temperature range – 20°C to +70°C Meter LCD Messages shall be available in Arabic language.
10	Digits	W x H: 4 mm x 8 mm (minimum) with backlight.
11	Maximum viewing angle	160 degrees
12	Memory	Nonvolatile memory (EEPROM) that retains information up to 20 years without being damaged or corrupted during the meter operation.
13	Lightning Protection	In accordance to IEC 1036:1990

4. General Mechanical Requirements

The meters shall comply with the following mechanical requirements:

Table (4)

No	Description	Specification
1	Meter Case	The meter body shall be a nonflammable and high impact, strong material. The meter base, body, and frame including terminal block shall be of heat resistive; Shock proof and rust proof good quality hard material (Compatible with IEC 695-2-1). The meter base will be provided with 3 (three) screw mounting holes, 1 (one) slotted meter support bracket at the top and 1 (one) round hole on each side in the bottom half of the base for securely mounting the meter to the meter board. The meter cover shall be made of polycarbonate material. The meter cover shall be provided with a window of polycarbonate or toughened glass. The meter shall be effectively sealed to prevent entrance of moisture, rain and dust into its internal part
2	Connections diagrams and terminal marking	Every meter shall be indelibly marked (engraved on the terminal cover surface) with a connection diagram. The meter terminals shall be marked and indicated on this diagram
3	Protection against penetration of dust and water	Conform to the degree of protection IP54 for outdoor placement.
4	Pulse output	Flashing LED visible from the front along with Auxiliary 2-wire terminal for : - Active and Reactive energy consumption rate
5	Temperature range	Limit range of operation: -5°C to 70°C Limit range of storage and transport: -5°C to 70°C
6	Name plate	Every meter shall have clearly visible, indelibly and distinctly marked name plate containing the following information: i. Manufacturer's name ii. Meter type iii. Number of phases and number of wire iv. Meter serial number v. year of manufacture vi. Rated voltage of the system vii. Basic current and maximum current viii. Reference frequency in hertz ix. Meter constant in imp/kWh x. Meter Constant in imp/kVARh xi. Class index of the meter xii. DISCO logo xiii. Contract No. xiv. Reference Standards

5. General Functional Requirements

5.1. Meter Sealing

1. Provision shall be for sealing the meter with at least two Ferrule stainless steel seals
2. The stainless steel seals shall be applied in such a way that it will not be possible to undo/loosen the mounting screws used to secure the meter without breaking these seals.
3. The stainless steel seals shall be applied in such a way that they will be easily visible when viewing an installed meter from the front.
4. The terminals shall also be having Ferrule/TT sealing arrangement.

5.2. Meter Local Communication Interface

5.2.1. The meter shall have an IEC 62056-21 compliant optical communication port. This shall be place to allow the Utility to access via the front of the meter for a variety of interactions via a hand held unit (HHU).

5.2.2. The meter shall have an additional 2-wire serial communication port, RS485 compatible with IEC 62056 communication protocol for:

a. Local connected network of maximum 30 meters with one wide area network (WAN) Gateway.

b. Local connection with nearest data concentrator in the field of installation.

5.3. Meter Remote Communication Interface

5.3.1. The meter shall have remote communication PLC, PLC/RF, mobile wireless service 2G/3G / 4G Technology and communication option which will be able to interface with RS-485, RJ-45 port for data communication with the central server from meters via one of the different communication media

5.3.2. In case of cellular Communication modem shall use at least 4G mobile network communications.

5.3.3. The communication modules works as a plug-and-play model (modular), without the need to modify/change the meter firmware.

5.3.4. The communication protocol shall be compatible with the IEC 62056 Dynamic DLMS/COSEM Application Layer Protocol.

5.3.5. The bidder shall submit the range(s) of frequencies that he can support with his RF based metering system. The bidder shall also submit his RF related specifications, including Access Points and Bridges, Antennas, Maximum Output Power, Transmit and Receive Intervals, Mean Root-Square Emission Levels, etc.

5.3.6. The DLMS/COSEM profile(s) will be defined, programmed, and tested during pilot deployments. These definitions, programming, and testing shall be at no additional cost to the Utility.

6. Firmware upgrade

Mandatory - The Utility shall be able to update / change the meter firmware locally via the optical port or other ports installed on the meter.

The firmware upgrade mechanism shall be designed so as not to alter in any way the metering characteristics (metrology) or the meter data stored in the meter:

1. Meter data
2. Meter status
3. Configuration parameters or operational parameters

All of these data must remain unchanged even after firmware upgrades.

New firmware will be submitted to the meter with date and time parameter of executing new firmware operation (the meter will upload the new updated firmware but will only execute it when the defined date and time parameter achieved).

The meter will record the date and time of receipt of new firmware in the event log, as well as the date and time of the firmware upgrade process execution.

The meter will perform self-check process after the execution of the new firmware update, and the result of self-check process will be stored on the meter event log, and shall be retrievable locally or remotely.

The meter shall have non-volatile memory equal to or greater than ten times the size of the operational/running firmware image.

The meter shall support two concurrent firmware images: current operational/running and pending upgrade.

7. Security

7.1 The meters shall use a method for encryption/decryption of data exchanged in all meter interfaces.
According to cyber security department penetration test.

7.2 Mandatory - A method employing minimally AES128-CBC/GCM shall be used in all information exchanges in private network, between meter and data concentrator (Field Area Network, or FAN interface), and between the meter and hand held unit (HHU) via the optical interface. Enough reserve capacity in the components of the system (e.g., main processor, memory) shall exist to support AES256-CBC/GCM during the service life of the equipment.

7.3 The meter shall support encryption and decryption of two meter firmware images: current operational/running, pending upgrade>

7.4 The meter should be capable of supporting AES256-CBC/GCM during its operational lifetime without a hardware change.

7.5 A method employing at least ECC 256 shall be used in all information exchanges on public network, as well as between meter and central system directly.

7.6 The Bidder shall describe the security mechanism, including encryption/decryption methods, for the exchange of secure tokens or credits while the meter is in prepayment mode.

7.7 The security methods and hardware shall be described in details by bidder.

7.8 The bidder shall prove following items:

a) Security of method
b) Client ability to change security key remotely

c) Confidentiality of remote key changing
d) If client changes the security key there is no way for meter manufacturers to retrieve new key (New key is not accessible for meter hardware, firmware, and external software)
e) All input and output information decrypted and encrypted

8. Meter Operational Modes

The meter shall be required to support at least two modes of operation: Normal Mode and Test Mode.

8.1 *Meter Test Mode*

The meter shall support a Test Mode that is activated by using the optical port.

In Test Mode, there shall be an automated test sequence available that includes:

1. Full diagnostic test, that testing of the all the active and inactive functionality
2. Metering accuracy test (enabled to allow for accuracy testing to be performed without affecting the recorded customer registration for energy)
3. Connection validation tests (three-phase sequence connection).

The Test Mode shall also have the following displayed information (scrolled sequence):

1. Meter firmware version
2. Meter firmware update date and time stamp
3. Meter tampering events
4. Meter status
5. Current limit (this feature will not be implemented on transformer meters only)
6. Connect/Disconnect switch/Latching Relay open and close count times (this feature will not be implemented on transformer-operated meters)

9. Load Profile

9.1. At least four programmable channels for:

a. Active interval energy (import and export)
b. Reactive interval energy (import and export) *
c. Active cumulative energy (import and export)
d. Reactive cumulative energy (import and export) *

Adjustable time interval from 1 to 60 minutes.

Meter shall store these parameters for at least 30 days.

9.2. At least four programmable channels for voltage and current as well as active and reactive power. Measurement type for each channel can be chosen as follows:

a. average

b. minimum

c. maximum

Adjustable time interval from 1 to 60 minutes.

Meter shall store these parameters for at least 30 days.

9.3. Time & date shall be included in load profile.

9.4. Load profile shall be readable in complete form and in defined blocks (based on start and end time and channels) locally and remotely.

9.5. *Historic Consumption*

For this option, there are twelve energy registers that store the total energy consumed for the previous twelve months. These registers are cycled at during the month-end process, with the oldest data being deleted.

9.6. Date and time management

9.6.1 The meter shall be equipped with a real time clock supporting the date and time. Pseudo-clock using mains crossing detection is not acceptable. The maximum drift of the clock shall be less than 30 seconds per month. The battery shall operate maintenance-free for a period of at least 10 years.

9.6.2 The meter shall be equipped with a battery monitoring system that monitors the battery's condition and sends a "Change Battery Alarm" message to the HES when the battery approaches the end of its operating life

9.6.3 When first commissioned into the AMI System the meter shall synchronize its time & date with that of the HES. Meter time & date synchronization shall also be done on a periodic basis through the HES, with a programmable periodicity, and done automatically during meter installation stage.

10. Power quality

For low voltage meters (400V or less):

10.1. Meter shall record under voltage, overvoltage, and power cut.

10.2. Events related to under voltage and overvoltage shall be recorded in the meter. Threshold of under voltage is

from 210 to 130 by 5V decrements and for overvoltage is from 230 to 285 by 5V increments

10.3. The voltage events will not be recorded unless they continue for a time equal to or greater than the programmable time set for under voltage and overvoltage threshold. This time shall be adjustable / programmable between 1 to 60 seconds, in 1-second increments.

10.4. For each under voltage, minimum voltage occurred during the adjustable / Programmable (1 to 60) Second period, the meter shall be detected and recorded as such; date and time of last occurrence and the cumulative number of the occurrences.

10.5. For each overvoltage, max. Voltage occurred and during the adjustable / Programmable (1 to 60) Second period the meter shall be detected and recorded as such; date and time of last occurrence and the cumulative number of the occurrences.

10.6. Parameters related to threshold and duration of under voltage and overvoltage shall be adjustable locally and remotely.

10.7. Events related to power cut shall be recorded in the meter as follows:

a. For long duration power cuts (more than 3 min.), duration time and date shall be recorded.

b. For short duration power cuts, number of power cuts shall be recorded.

11. Meter Display

11.1. Meter display shall display all measured quantities or desired quantity automatically or scrolling via button on the meter as follows:

a. Active energy in each tariff
b. Reactive energy in each tariff
c. Current tariff
d. Max. Demand in each tariff, and the highest Max. Demand with exact time & date
e. Time and date
f. Serial number
g. Battery failure
h. The number of voltage cut offs and number of reverse energy events
i. Contactor's status (this feature will not be implemented in Transformer meters)
j. All parts of item 3 (including instantaneous quantities, cumulative energy values, and maximum demand in all tariffs with time & date indication).

11.2. . Meter shall have capability of display and record of current & pervious Max. Demand with ability of configuration of Max. Demand time interval calculation. Max. Demand shall be measured at least in three integer and two decimal digits.

11.3. LCD shall display measured items in OBIS codes.

11.4. Meter Display shall support Arabic language Interface).

12. Fault & Status Display

The meter shall provide a visible indication of the status of the incoming supply.

12.1. Status/Alarm/Event Displays

In addition to the displays required above, the meter must display the following minimum information in an intuitive way such that an inexperienced user can understand and interpret the information intelligibly (laminated instruction cards are to be provided for each unit):

1. Meter ID
2. Out of Credit message (for prepayment meters only)
3. Meter tamper state
4. Meter failure and/or fault code

The bidder must submit a detailed specification of the way in which the displays are structured and laid out

13. Smart Meters – Residential, Commercial, and Industrial Applications (Low Voltage)

Detailed Electrical Requirement

The meters supplied shall meet the following electrical requirements.

1. Table (5)

No	Description	Three Phase Direct Connected
1	Meter Type	3-phase, 4-wire, direct connected meter , active & reactive energy , four quadrant measurements
2	Number of element	Four measuring elements
3	Base current, I_b	5A
4	Maximum continuous current, I_{max}	100A
5	Starting current	0.4% I_b
6	Class index	Class 0.5, Active Energy Class 2, Reactive Energy
7	Number of display digits	8

8	Display parameters	i. kWh for the current billing period ii. kVARh for the current billing period iii. Cumulative Total kWh used since installation iv. Cumulative Total kVARh used since installation v. Current electricity rate (used Tariff) vi. Last month consumption. viii. Date and time ix. Instantaneous voltage for each phase x. Instantaneous current for each phase xi. Instantaneous PF for each phase xii. Maximum Demand kW xiii. Load Limit XV. credit
9	Load limiting	Meter shall disconnect the load when a pre- programmed threshold current is reached. The threshold shall be programmable/ configurable.
10	Limit of Current	Shall be programmable within the range of 0.04A $\geq$ 100 A
11	Load disconnection	Latching relay
12	Audible alarm	Built in buzzer

14. Meter Terminal Block Specifications

The Meter Terminal Block shall be made from fire-resistant material (polycarbonate grade 500R or equivalent Bakelite) materials.

The meter Terminal Block cover shall be made from fire resistance material (polycarbonate), and shall be extended type.

The meter terminals shall have two flat-head screws for wiring connection, these screws shall be made of brass. Furthermore, the meters shall meet the following terminal requirements

Table (6)

No	Description	Three Phase Direct Connected
1	Terminals Materials	brass or copper current terminals
2	Terminal bore Diameter	10 mm

15. Latching Relay

Manufacturers name & address to be mentioned in the Bidder technical Specifications latching relay specification for three-phase direct connected meters:

Table (7)

No	Description	Three-phase direct connected
1	No. of Poles	3 (Three)
2	Contact Material	Silver alloy
3	Min Switching Power	25000 VA
4	Min. switching voltage	400 V
5	Maximum Switching Current (RMS)	120A
6	Contact resistance	not more than 500 μΩ
7	Mechanical Cycle (without load)	$1x10^5$
8	Electrical Cycle (with load)	$1x10^4$
9	Switching time	≤ 20ms
10	Insulation resistance	≥ 1000 MΩ
11	Dielectric Strength between contacts	≥ 2000 VAC
12	Dielectric Strength between contact and coil (50 Hz)	≥ 3000 VAC
13	Dielectric Strength between contacts assembly	≥ 4000 VAC
14	Operating humidity	40 to 90%
15	Temperature rise at rated current (assuming 30°C room temp.)	70°C
16	Short circuit characteristic	according to IEC 62055-31 (UC3)
17	Switching Time	≤20 msec

The bidder must present a test certificate for the latching relay mounted inside the meter that confirms the upper mentioned specifications

16. Tamper detection

The meter shall classify and record the following commonly-occurring tamper events with a date and time stamp. The tampering event log shall record any combination of the following possible tamper conditions:

Table (8)

Tamper Case	Three phase, direct- connected
Current Reverse	Phase current reverse (L1, L2, L3) in separate or combination.
Current imbalance	$I_1 + I_2 + I_3 \neq I_n$
	Neutral current =0
Voltage Missing	For any phase (L1, L2, L3).
External magnetic field influence	√
Opening meter cover	√
Opening terminal cover	√

Tamper shall be detected with and without mains power connections. When the meter detects a tamper condition, it shall be capable of configuring the latching relay/contactor to perform an action or not on the connected loads with an appropriate message.

16.1. *There shall be a mechanism by which the consumer can be disconnected immediately when a verifiable tamper event occurs.*

16.2. *The tamper status shall be reset by using the meter optical port.*

16.3. *The meter shall send a push message to the Data Concentrator or even to the central system with every Tamper Event, stamped with date and time.*

16.4. *The meter shall provide tamper log data with the last occurred tamper date and time stamp and it can be easily readable remotely or locally.*

17. Meter Metrology

1. The meter shall have the ability of measuring and recording import/export active energy (The values to be recorded for import and export are actual values).
2. The meter should have the ability of measuring and recording import/export reactive Energy (the values to be recorded for import and export are actual values).

3. The measuring quantity for energy shall have following resolutions:
   a. for Active Energy (Min 0.01 kWh resolution).
   b. for Reactive Energy (Min 0.01 kVARh resolution)
4. It shall be possible to locally and remotely select or configure exported energy whether to be registered or not.(according to standard, when the energy flows from network to the consumer it is registered as IMPORT and when the energy flows from consumer to the network it is registered as EXPORT.)
5. The meter is configured in such way not to register the consumed energy as Export (except Distributed Generations) and whenever it is occurred, the system shall record this event.
6. The meter shall measure import/export energy as well as Absolute value of active energy and it shall be possible to activate this capability.
7. The meter shall measure phase current (True RMS)
8. The meter shall measure phase voltage (True RMS)
9. The meter shall measure Power Factor.
10. The measuring and recording maximum demand of active power shall be based on configurable time intervals and subintervals (sliding mode).
    a. It shall be possible to reset maximum demand remotely
    b. It shall be possible to reset maximum demand locally via sealed push button on front of the meter.
    c. It shall be possible automatically Maximum demand to be reset at specific billing Period.

Above capability shall be activated (or not) and all parameter shall be adjustable remotely and locally.

11. The meter shall measure the energy from both phase and neutral (which one is larger) by same accuracy.
12. Voltage sampling shall be done before input of the contactor/ latching relay.
13. Detailed OBIS code for the supplied meter should be offered .

18. Payment Mode

18.1. Most benefits of prepayment mode is that credit is transferred to the meter from online vending method, and the amount credit in local currency provided/ stored inside the meter, the meter will provide supply energy to the consumer when he have a enough credit. The credit register is decremented against energy consumption with the countdown total being displayed on the meter display.

18.2. When the consumer has consumed their credit amount, the meter shall shut off the supplied energy to the consumer until the meter has been recharged with more credit. This shutting off process will not be activated during holidays, weekends, or defined “Friendly Hours” (utility non-working hours).

18.3. There shall be a mechanism to trigger Friendly Hours to block customer disconnection when AMI communication is lost for a definable period (in hours) but electric service is maintained so that the customer

will not lose service due to lack of credit.

18.4. For post-payment mode, the meter will calculate the consumed energy according to the tariff management system, and transfer into money payable value, which shall then be displayed on the meter display in a local currency value.

18.5. Under normal circumstances, the consumer will pay their bill within the defined grace period as indicated on the bill (or by some other mechanism). Notifications about payment due shall be via SMS message, paper bills, or Utility personnel, among others. In the case of non-payment over the period as determined by the Utility for their collections process and programmed into the meter (number of day of grace period), the meter will shut off the supplied energy to the consumer. Optionally, there shall be a two-stage demand limiting function whereby the Utility can configure two lower demand limits to be managed by the meter and switch to encourage the customer to manage their consumption and ultimately pay for it.

18.6. Mandatory - The meter shall be capable to be switched from prepayment to post-payment mode remotely from the Master Information Center / Central System and locally via the optical port

19. Credit register (prepayment mode only)

The credit register is the “operating account” of the meter being decremented by the metering process. The specific requirements of this register are:

19.1. This register must be decremented for the equivalent of every credit unit consumed.

19.2. When the credit reaches a pre-determined point, the customer shall be informed about the remaining balance and advised to purchase more credit. Optionally, a soft demand limit is enacted, permitting them to maintain service at a lower level to stretch the remaining credit until more is purchased. There shall be two programmable points to enable this process at two different load levels.

19.3. When the available credit has been consumed, the meter must open the contactor and isolate supply from the customer (unless the Friendly hours are invoked).

19.4. The balance of this register shall be collected by the HES

20. Friendly Hours, Weekend & Holiday Features

Meter shall accommodate the "Friendly hours", "Weekend", and "Holidays" features. These are periods during which the meter shall not cut-off power to consumer if the credit becomes negative. The Friendly Hour mechanism shall also be configurable to be triggered due to loss of AMI communications for a defined length of time.

Details of the features are described in the following table:

Table (9)

No.	Requirement	Description
1	Friendly Hours	There shall be provision to define 'Friendly hours' in the meter. The utility shall be able to define the 'Friendly hours' and shall be communicated to the meter through token.
2	Weekend	There shall be provision to define 'Weekend' in the meter. The utility shall be able to define the weekend and shall be communicated to the meter through token.
3	Holidays	There shall be provision to define 'Holidays' in the meter. At the end of a year, the utility shall be able to define new holiday dates and these shall be communicated to meter through

21. Tariff

21.1. All tariff calculation and credit calculation shall be processed inside the meter.

21.2. The meter shall support stepped tariffs structures as well as time-of-use and maximum demand.

21.3. The tariff structure consists of the following records:

a) Each tariff must be uniquely identified using the tariff code
b) Each tariff shall have an activation date, being the date on which the tariff becomes effective.
c) Each tariff has up to ten steps / time slot (in kWh) for different levels of energy pricing.
d) Each tariff has up to ten steps / time slot (in kVARh) for different levels of energy pricing
e) The rate describes the cost per kWh for energy consumption in that step.
f) The rate describes the cost per kVARh for energy consumption in that step.

22. Tariff switchover

When the meter detects that a new tariff is applicable (using the tariff activation date), the meter shall execute the following steps:

a) The meter shall begin the billing against the new tariff.
b) The current tariff code shall be updated to reflect the new tariff code.
c) The old (expired) tariff should be deleted.
d) New tariffs will only be activated at 00:00 on the first day of a month.

23. Billing

Billing operates on a "monthly" basis (a period of days definable by the Utility). The energy consumption charge is deducted within the meter for at least every 1 kWh. All other charges including service charge, minimum charge, VAT, and other taxes are deducted at the POS.

24. Load Disconnection

24.1. The load shall be disconnected by a latching relay/contactor under the following conditions:

a) The credit in the meter has expired and grace facilities have also expired
b) The load power threshold has been exceeded
c) The meter is in a tampered state

24.2. The meter shall indicate whether the load is connected or not and shall display the reason for disconnection.

24.3. Shall have the option to switch the contactor manually. Under over – current (reaching the load limit) conditions by pushing a button in front of the meter, and also the mechanism shall permit automatic load reconnection and shall ensure that the number of switching cycles is limited. The meter shall attempt to reconnect the load up to programmable trail times with programmable time period intervals. If the over-current condition still exits the meter shall wait a programmable period of time before attempting to reconnect the load , and after the limited times of switching cycles Expiration the meter will not restore back the energy unless it done remotely from the HES or even locally by the Optical port.

25. Load Control

Meters shall have the options to control loads that shall be remotely activated or deactivated with the following features:

Table (10)

No.	Requirement	Description
1	Allowed loads for given time periods	There should be provision in the meter to define the allowable loads for given time periods within a day
2	Demand Limit	A levels of load current amount in order to disconnect the latching relay/contactor for warning the consumer to recharge his meter (prepaid mode) or even to pay the electricity bill (postpaid mode), which will be applied according to the remaining credit value
2	Load Limit step	Load limit value shall be defined in step of 500 W.

26. Smart Meters - Testing and Approval

26.1. Routine Acceptance Tests

1. Routine / Acceptance tests shall be carried out on all offered meters, and shall be carried out by Manufacturer / Contractor, with providing a Factory acceptance test certificate for the manufactured meters.

2. The tests shall be carried out in accordance with IEC 62053-21, IEC 62053-22, IEC 62052-11, BS EN50470-1 , BS EN 50470 – 3, BS EN 61268, and Tender Requirements.

3. Number of Samples Selection Criteria Done in accordance to the IEC 514 Standard. (**)

Table (11)

No.	Test Name			As per Standard
1	Test of Meter Constant			As per IEC 62052-11 , BS EN50470-1 and BS EN 50470 – 3 for active , BS EN 61268 for reactive
2	Limits of error due to variation of the Current			As per IEC 62052-11 , BS EN50470-1 and BS EN 50470 – 3 for active , BS EN 61268 for reactive
3	Test of no-load condition			As per IEC 62052-11, BS EN50470-1 and BS EN 50470 – 3 for active , BS EN 61268 for reactive
4	Test of starting condition			As per IEC 62052-11, BS EN50470-1 and BS EN 50470 – 3 for active , BS EN 61268 for reactive
5	Voltage Variation			As per IEC 62052-11 , BS EN50470-1 and BS EN 50470 – 3 for active , BS EN 61268 for reactive
6	Frequency Variation			As per IEC 62052-11 , BS EN50470-1 and BS EN 50470 – 3 for active , BS EN 61268 for reactive
7	Test of power consumption			As per IEC 62052-11 , BS EN50470-1 and BS EN 50470 – 3 for active , BS EN 61268 for reactive
8	Influence of Self-Heating Test(*)			BS EN 50470 – 3 for active , BS EN 61268 for reactive
9	Influence of Ambient Temperature			BS EN 50470 – 3 for active , BS EN 61268 for reactive
10	Resistance to heat and fire test(*)			BS EN 50470 – 3 for active , BS EN 61268 for reactive
11	Visual Inspection			
	1	Meter Display		As per RFP Specification
	2	Meter Casing		As per RFP Specification
	3	Meter Sealing		As per RFP Specification
	4	Meter name plate Marking		As per RFP Specification
	5	Connection Diagram and terminal Marking		As per RFP Specification
	6	Packing		As per RFP Specification
12	Tamper Test			
	Three Phase Tests	1	Phase (I1 , I2 , I3)Current and or Neutral	As per RFP Specification
		2	Current imbalance (I1+ I2 + I3 ≠ In	
		3	Neutral Current = 0	
		4	Missing phase Voltage	
		5	External Magnetic influence	
		6	Open Meter Cover and or Terminal cover	
13	Functional tests			
	1	Meter Mode		As per RFP Specification
	2	Maximum Demand		
	3	Load Profile		
	4	Meter Local Communication (Optical , RS485)		
	5	Meter Remote Communication		
	6	Load Limit		
	7	Tariff		
	8	Tariff Switchover		
	9	Friendly Hours , Weekend ,		
	10	Load Control		

(*) The first random sample will be collected from the first delivered batch, and the other random sample will be collected from the rest of the delivered meters.

In case of Sample test failure the delivered meter batch will be rejected, then collect other random sample from each later delivered batches in order to apply these tests , and the order will completely canceled in case of the failure of applying these tests three times.

(**) Number of Samples Selection Criteria according to IEC514

Table (12)

No. of Meters per batch (N)		First Sample			Second Sample	No of Meters for both 2 samples (n1+n2)
		No of meters per sample (n1)	No of Rejected meters (d1)	No of allowed rejected meters (c1)	No of meters per sample (n2)	Total No of allowed rejected meters(C2)
1st Case	101-500	30	2	0	30	1
2nd Case	501-1000	40	2	0	40	2

26.2. Meter Type test

The meter shall have a type test certificate that include details of test results according to IEC62052-11, IEC62053-21, IEC62053-22, IEC 62053-23 , BS EN 50470 – 3 , and BS EN 61268 from international accredited Laboratory (KEMA, NMI Holland, CESI Italy, or any worldwide recognized lab).

Mandatory - The bidder shall provide a type test report issued within the last 5 years. (Submission is Mandatory before the Pilot)

The type test must include all tests that applicable that particular type in the standards. Minimally expected tests are:

Table (13)

NO	Test Name	As per Standard
1	**Test of insulation properties**	
1.1	Impulse voltage tests	IEC62052-11 ,EN50470-1
1.2	AC Voltage tests	IEC62052-11,EN50470-1
2	**Tests of accuracy requirements**	
2.1	Test of meter Constant	BS EN 50470 – 3 for active , BS EN 61268 for reactive
2.2	Test of Starting Condition	BS EN 50470 – 3 for active , BS EN 61268 for reactive
2.3	Test of No-Load condition	BS EN 50470 – 3 for active , BS EN 61268 for reactive
2.4	Test of influence quantities	BS EN 50470 – 3 for active , BS EN 61268 for reactive
3	**Test of Electrical Requirements**	
3.1	Test of power consumption	BS EN 50470 – 3
3.2	Test of influence of supply voltage	IEC62052-11 , EN50470-1
3.3	Test of influence of short-time overcurrent	BS EN 50470 – 3
3.4	Test of influence of self-heating	BS EN 50470 – 3
3.5	Test of influence of heating	IEC62052-11 , EN50470-1
3.6	Test of immunity to earth fault	IEC62052-11 , EN50470-1
3.7	Test of accuracy in the presence of harmonics	EN 50470-3
4	**Test for Electromagnetic Compatibility (EMC)**	
4.1	Test of immunity to electrostatic discharges	IEC62052-11 , EN50470-1
4.2	Test of immunity to electromagnetic RF fields	IEC62052-11 , EN50470-1
4.3	Fast transient burst test	IEC62052-11 , EN50470-1
4.4	Test of immunity to conducted disturbances, induced by radio frequency	IEC62052-11 ,EN50470-1
4.5	Surge immunity test	IEC62052-11 ,EN50470-1
4.6	Damped oscillatory waves immunity test	IEC62052-11 , EN50470-1
4.7	Radio interference suppression	IEC62052-11 ,EN50470-1
5	**Test of effect of the climate environments**	
5.1	Dry Heat test	IEC62052-11 , EN50470-1
5.2	Cold test	IEC62052-11 ,EN50470-1
5.3	Damp heat cyclic test	IEC62052-11 ,EN50470-1
5.4	Solar radiation test	IEC62052-11 ,EN50470-1
6	**Mechanical Test**	
6.1	Vibration test	IEC62052-11 ,EN50470-1
6.2	Shock test	IEC62052-11 ,EN50470-1
6.3	Spring hummer test	IEC62052-11 ,EN50470-1
6.4	Tests of protection against penetration of dust and water	IEC62052-11 ,EN50470-1
6.5	Test of resistance to heat and fire	IEC62052-11 , EN50470-1

27. DLMS Compliance Certificate (mandatory)

Mandatory - The meter shall have a certificate for IEC62056 DLMS/COSEM, for the following: (Submission is mandatory upon submission of proposals)

1. Mandatory - Optical port Communication (Submission is mandatory upon submission of proposals)
2. Mandatory - 2 -wire Serial R S 4 8 5 Communication port (Submission is mandatory upon submission of proposals)
3. Mandatory - WAN / FAN Communication Modem (Submission is mandatory upon submission of proposals)

Failure to submit any one of the theses Certificates will be considered as the Bidder failing to submit the whole item (DLMS Compliance Certificate).

28. Communication Modem Certificate

Mandatory - Communication modem should have certificate for industrial equipment from an international accredited laboratory (Submission is mandatory before the Proof of Concept)

29. Meter Life Time Test Certificate

Mandatory - The meter must be certified for 15 years life of operation, according to the accelerated Life Time (ALT) IEC testing Procedures found in IEC62059-41, IEC62059-31-1, and IEC62059-32-1 (Submission is mandatory before the Proof of Concept).