Draft of:

Technical Standard for Prepayment Meters

Authority for Public Services Regulation

December 2020

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1. Introduction

1.1 Purpose

The purpose of this Technical Standard is to establish the additional requirements for prepayment metering equipment which may be installed at LV customer connections between networks of all licenced distribution companies and all network users.

1.2 Scope

This Technical Standard applies to Prepayment Metering Equipment owned by the Network User and/or the Distribution Company for the provision of an electricity connection at the premises of a Network User and the financial settlement for electricity transferred. This Technical Standard applies to prepayment metering equipment and is in addition to all metrological requirements specified for the transfer of electricity from the networks of Licensed Distribution Companies to network users in the Sultanate of Oman.

1.3 Interpretation

In addition to special meanings contained in the Definitions that follow, within this document:

- References to the masculine shall include the feminine and references in the singular shall include references in the plural and vice versa,
- Except where explicitly stated otherwise all references to section shall be a reference to a section in this document,
- All clock times or other references to time, shall refer to the standard time in the Sultanate of Oman, which is four hours in advance of Universal Time Co-ordinated (UTC),
- Any reference to a law or regulation shall be a reference to that law or regulation applicable in the Sultanate of Oman or, following the replacement of that law or regulation the new law or regulation from the date it comes into force,
- Any general reference to a standard shall be a reference to the current version of that standard from its date of implementation. A reference to a particular requirement in a standard shall be a specific reference to that requirement in the referenced version of the standard unless a later version of the standard has an equivalent requirement in which case it shall be a reference to that equivalent requirement in the current version of the standard.

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1.4 Definitions

For the purpose of these Regulations, the following definitions which, where appropriate have been taken from the International Electrotechnical Vocabulary as defined in IEC 60050 the following definitions which, where appropriate, have been taken from the International Electrotechnical Vocabulary as defined in IEC 60050 apply unless an alternative definition has been used in the IEC Standards specified in section 2.1.1.2. In that case, the definition used in that IEC Standard shall also apply to the relevant section of this Technical Standard:

Sector Law - means Royal Decree 78/2004 as amended by Royal Decree 59/2009, Royal Decree 47/2013 and 78/2020.

MoCIIP - means the Ministry of Commerce, Industry and Investment Promotion

APSR – means the Authority for Public Services Regulation

Case - (of an energy meter) means the set that comprises the base and the cover. [IEV 314-07-17]

Cover - (of an energy meter) means the enclosure on the front of the meter, made either wholly of transparent material or of opaque material provided with window(s) through which the operation indicator (if fitted) and the display can be read. [IEV 314-07-16]

Current Transformer - means an instrument transformer in which the secondary current, in normal conditions of use, is substantially proportional to the primary current and differs in phase from it by an angle which is approximately zero for an appropriate direction of the connections [IEV 321-02-01].

Customer – means any person, corporate body, or company who has a connection or supply agreement with a Distribution Company for the provision of electricity.

Display - (for static meters) means a device which displays the content(s) of (a) memory(ies). [IEV 314-07-11]

Distribution Company – means an entity holding a licence to distribute and/or supply electricity issued pursuant to the Sector Law.

Maximum Current – means the highest value of current at which a meter meets the specified accuracy requirements. [IEV 314-07-03]

Meter Type – means a particular design of meter, manufactured by one manufacturer, having:

a) similar metrological properties;

b) the same uniform construction of parts determining these properties;

c) the same ratio of the maximum current to the reference current

Note 1 – The type may have several values of reference current and reference voltage.

Note 2 – Meters are designated by the manufacturer by one or more groups of letters or numbers, or a combination of letters and numbers. Each type has one designation only.

Note 3 – The type is represented by the sample meter(s) intended for the type tests and whose characteristics (reference current and reference voltage) are chosen from the values given in the tables proposed by the manufacturer. [IEV 314-07-07]

Memory - (for static meters) means the element which stores the digital information representing the measured energy. [IEV 314-07-10]

Network User – is a generic term that includes customers, generators and other network operators using a network of a licenced network operator

Operation Indicator - means a device which gives a visible signal of the operation of the meter. [IEV 314-07-13]

Rated Current – means value of current in accordance with which the relevant performance of a transformer operated meter is fixed. [IEV 314-07-02]

Register - means an electromechanical or electronic device which stores and displays the information representing the measured energy

Note 1 – In static meters, the register comprises both memory and display.

Note 2 – A single display may be used with multiple electronic memories to form multiple registers. [IEV 314-07-09]

Terminal Block – means the support made of insulating material on which all or some of the terminals of the meter are grouped together. [IEV 314-07-18]

Terminal Cover – means the cover which protects the meter terminals and, generally, the ends of the external wires or cables connected to the terminals [IEV 314-07-19]

Year – means a calendar year according to the Gregorian calendar.

2. Metrological Requirements

2.1 Requirement to Use Approved Meters

2.1.1.1 Only meters and, where appropriate, metering equipment that has been approved by MoCIIP for use in Oman shall be installed at any network connection point in Oman. It is not permitted to install meters and, where appropriate, metering equipment which otherwise meets the requirements of this or other technical standards but has not been approved by MoCIIP.

2.1.1.2 Meters and metering equipment shall, where appropriate, meet the requirements of the following international standards except where varied by this technical standard:

a) IEC 62052-11 – Electricity metering equipment (AC) – General requirements, tests and test conditions - Part 11: Metering equipment;
b) IEC 62053-21 - Electricity metering equipment (AC) - Particular requirements - Part 21: Static meters for active energy (classes 1 and 2);
c) IEC 62053-23 - Electricity metering equipment (AC) - Particular requirements - Part 23: Static meters for reactive energy (classes 2 and 3);
d) IEC 62052-31 - Electricity metering equipment (AC) - General requirements, tests and test conditions - Part 31: Product safety requirements and tests;
e) IEC 62055-31 – Electricity metering – Payment systems – Part 31: Particular requirements – Static payment meters for active energy (classes 1 and 2)
f) IEC 61869-1 - Instrument transformers - Part 1: General requirements;
g) IEC 61869-2 - Instrument transformers - Part 2: Additional requirements for current transformers;
h) IEC 61869-3 - Instrument transformers - Part 3: Additional requirements for inductive voltage transformers
i) IEC 61869-4 - Instrument transformers - Part 4: Additional requirements for combined transformers; and
j) IEC 61869-5 - Instrument transformers - Part 5: Additional requirements for capacitor voltage transformers.

2.1.1.3 All metering equipment shall be suitable for operation in the electrical system and environmental conditions specified in OES 11: General Specification for Electrical Materials and Equipment, except as modified by this or any other relevant technical standard.

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2.1.1.4 The manufacturer of all meters connected to the network of a licenced network operator shall hold a valid accreditation under ISO 9001 throughout the manufacturing period.

2.1.1.5 In addition to meeting the requirements of this technical standard, meters shall also comply fully with the requirements of the Technical Standard for Metering Systems and be installed, operated and maintained in accordance with the requirements of the Regulation for Installation and Maintenance of Metering Systems.

3. Compliance with Regulatory Requirements

3.1.1.1 All prepayment meters shall be capable of installation, operation maintenance and replacement in accordance with the Supplier's or Distribution Network Operator's Late Payment Code of Practice (as appropriate).

3.1.1.2 All prepayment meters shall be capable of meeting the requirements of the permitted tariff (as defined by the Sector Law) that is applied at the premise at which the meter is installed.

4. Ownership of Prepayment Meters

4.1.1.1 Prepayment meters installed on consumers' premises in Oman shall be provided by the licenced distribution network operator. Where an installed prepayment meter is not already the responsibility of the relevant network operator, responsibility for its ongoing maintenance as a metrological device and as a payment mechanism shall be assumed by the relevant network operator.

5. Interface with Prepayment Financial System

5.1 General Requirements

5.1.1.1 Prepayment meters installed on consumers' premises must be compatible with the financial transaction system established by the licensed distribution network operator who will specify the type of token that the meter must be able to accept in a Code of Practice describing its pre-payment meter services, made available to all users of pre-payment meters and approved by the Authority for Electricity Regulation, Oman. In this context, a token includes the provision by any means of a code to be entered using a keypad associated with the prepayment meter and also an electronic signal sent to the prepayment meter by a remote device.

5.1.1.2 Where a virtual token is sent directly from the financial transaction system to the meter via a communications channel, the meter must be capable of informing the

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financial transaction system that the purchase of another token will soon be required.

5.1.1.3 Where a virtual token is sent directly from the financial transaction system to the meter via a communications channel to a meter whose load switch is in the open position, the contactor shall not close until a local action is taken – either by pressing a physical pushbutton on the meter or by sending a close signal from a local control unit.

5.1.1.4 Prepayment meters shall be compatible with the Standard Transfer Specification and capable of operating in the STS consumption (kWh) and STS monetary currency unit modes as set by the licenced distribution network operator and implemented in such a manner that the security of the system at least matches the requirements for the use of a cryptographic algorithm using a 128-bit DecoderKey outlined for the use of the Standard Transfer Specification supported by IEC 62055-41:2018. When operating in monetary currency mode, the currency shown shall be Omani Rials and Baisas.

5.1.1.5 When operating in either consumption or monetary currency mode, the meter shall be capable of operating a monthly based step (or block) tariff.

5.1.1.6 When operating in either consumption or monetary currency mode, the meter shall be capable of operating a tariff that includes a daily standing charge. It shall be possible for this charge to be set to zero.

5.1.1.7 Where a prepayment meter incorporates a specific debt collection facility, debt collection shall cease when the agreed debt amount has been deducted from the available credit.

5.1.1.8 Meters shall show energy consumed as one of the register displays. When operating in consumption mode it shall also show kWh credit remaining and, when operating in the monetary currency mode it shall also show financial credit remaining.

5.1.1.9 Meters shall be capable of holding a minimum of two complete tariff programs with individual start dates. A tariff change shall be implemented automatically on the start date with the tariff program that is not in use being available to be overwritten. The tariff program that is in use shall be overwrite protected.

5.1.1.10 Where a tariff update is sent directly from the financial transaction system to the meter via a communications channel, the meter must be capable of informing the

financial transaction system that the tariff has been updated and shall, without prompting, send an information message confirming the tariff in use and the updated tariff with their start dates. The unprompted confirmation shall be sent [24] hours following receipt of the tariff update message.

5.2 Emergency Credit

5.2.1.1 On expiry of all prepaid credit, the meter shall operate according to a preprogramed emergency credit regime until a credit token is next applied to the meter.

5.2.1.2 Emergency credit shall be made available consistent with the Supply Terms for pre-payment meters approved by the Authority for Electricity Regulation, Oman and described in a Code of Practice relating to pre-payment meter services prepared by the licenced distribution network operator and approved by the Authority for Electricity Regulation, Oman. This Code of Practice may specify times when emergency credit is to be made available and times when it is not. They may also include different requirements for the application of emergency credit to vulnerable customers that are different from those generally applied.

5.2.1.3 When emergency credit is used in accordance with the appropriate Code of Practice, the load switch shall open and it shall not be possible for it to be closed until after additional credit is applied.

5.2.1.4 When a credit token is applied to a prepayment meter from which emergency credit has been utilised, the credit shall be first used to repay the emergency credit facility and restore its availability.

5.3 Requirements for Keypad Operated Prepayment Meters

5.3.1 General token handling

5.3.1.1 During input the numbers entered shall be shown on the meter display, scrolling from right to left, with such spaces or other symbol as shown on the paper or electronic message provided to the customer added automatically.

5.3.1.2 The maximum delay for accepting the input of the next digit shall be 20 seconds. After that time the display shall return to the default display and the token entry aborted without changing the validity status of the token.

5.3.1.3 After token input the display shall show the status of the token entry by displaying a message within the capability of the display for between 3 and 5 seconds showing that the token:

a) Has been accepted and its validity cancelled;

b) Has been rejected with its validity unchanged;

c) Has already been used;

d) Is too old to be able to be validated;

e) Has not been successfully added to the meter because it would breach the credit limit of the meter. In this case, the validity of the token must be unchanged.

5.3.1.4 Where a token is rejected, a delay before a reinput should be introduced after the third attempt. The period of the delay should increase on each further failed attempt until a delay period of up to 25 minutes is reached. The delay period shall be reset once a quiescent time of 50 minutes has elapsed.

5.3.1.5 When a token is accepted, the exact amount of credit shall be added to the appropriate register(s) of the prepayment meter. In all other circumstances no change shall be made to any of the settings or data of the meter.

6. Power Consumption

6.1.1.1 Maximum power consumption of prepayment meters shall be 3 W and 10 VA. The power source shall be the voltage circuit on the network side of the metering element. When a polyphase meter is operated on only one or two phases, the total consumption of the meter in each of those phases shall not exceed these same amounts.

6.1.1.2 Short-term increases in consumption due to the reading/writing of a token or the operation of a contactor are permitted. Where the meter is fitted with a token carrier acceptor and the token carrier can be retained in the payment meter, then the power consumption requirements shown in section 6.1.1.1 shall also be met with a normal token carrier retained in the meter in quiescent operation.

7. Load Switches and Auxiliary Switches

7.1.1 General Requirements

7.1.1.1 Prepayment meters shall have a minimum of two auxiliary switches that comply with the requirements of IEC 62055-31 and mirror the operation of the load switch.

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7.1.1.2 The meter shall display the status of the load switch (and/or auxiliary switches) and record the number of openings in a billing period and the time and duration of each opening. Where meters provide data to the financial system via a communications channel this information shall also be transferred.

7.1.2 Direct Connected Prepayment Meters

7.1.2.1 Load switches that are part of direct connected prepayment meters shall comply with the requirements of IEC 62055-31. The utilisation category shall be indelibly marked on the meter. The person responsible for the installation of a prepayment meter shall ensure that meter is capable of meeting the load breaking and fault making requirements of the location at which it is installed.

7.1.3 CT Operated Prepayment Meters

7.1.3.1 The customer shall provide an appropriate load switch operated by a signal within the operating capability of the auxiliary switches and capable of meeting the load breaking and fault making requirements of the location at which it is installed.

7.1.3.2 An appropriate load switch shall meet the performance requirements for load switches contained in the same case as a prepayment meter as specified in Annex C of IEC 62055-31 modified as appropriate for the maximum load current and prospective fault current at the location at which it is to be installed.

7.1.3.3 The load switch shall be constructed such that it cannot be dismantled without the breaking of a seal applied by the distribution company.

7.1.3.4 All terminations of the control and load circuitry associated with the load switch shall be protected by terminal covers of a type that can be sealed by the distribution company.

7.1.4 Tamper Detection

7.1.4.1 In the event that meter tampering is detected, in addition to the display of an alarm condition and the transfer of any alarm sent to the prepayment financial system, the load switch shall open. Where tampering is detected outside normal working hours, the distribution company may specify that opening of the load switch will be delayed until the start of normal working hours on the following day.

7.1.4.2 Where a load switch opens as a result of the detection of an incidence of meter tampering, it shall only be possible for the switch to be closed following the entry of a password directly at the meter. The password shall either be the password that

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permits access to parameters and settings or a separate password specifically allocated to control of the load switch as determined by the distribution company.

8. Communications

8.1.1.1 In addition to the requirements of the Technical Standard for Metering Systems the prepayment functionality shall be locally available using the specified communications interfaces with the same protection requirements that apply to other metrology parameter settings.

8.1.1.2 Where in house units are employed to provide information to a consumer or to allow the input of information to manage a prepayment arrangement, the communications system employed shall be designed and operated to ensure the protection of data and meet cyber security requirements specified by APSR that are no less rigorous than would be developed by following the requirements of the ISO/IEC 27001 suite of standards.

8.1.1.3 The meter shall only provide the scheduled information to the in-house unit. The meter shall only accept requests for the scheduled information and information required to manage the prepayment arrangement. Except for entering credit tokens in the in house unit that has the effect of providing credit to the prepayment meter, it shall not be possible to program either the in-house unit or the meter parameters using the communications link between them.

8.1.1.4 Where the meter provides signals that are intended to operate devices via the IoT, these signals shall be communicated via the In-House Unit which shall operate as a communications hub. The communications link between the meter and the In - House Unit shall meet the requirements specified in section 8.1.1.2.

8.1.1.5 Where a virtual token and/or tariff update message is sent directly from the financial transaction system to the meter via a communications channel, communication between the meter and the financial transaction system shall, in addition to the permitted communication between AMR Systems and meters with load switches as specified in the Technical Standard for Metering Systems, be limited to:

a) Amendment of tariff parameters as established in section 5.1.1.9;
b) Acceptance and application of an electronic token;
c) Token purchase information as established in section 5.1.1.2; and
d) Confirmation of tariff update as established in section 5.1.1.10.

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8.1.1.6 Before acknowledging and acting on any such electronic transmission, the prepayment meter shall:

a) Establish that the communication has entered the meter by the expected mechanism;
b) Establish that the necessary identification of the source of the communication has been accurately demonstrated;
c) Establish that the communication is a permitted communication;
d) Establish that the appropriate password for the instruction type has been provided.

In the event that the communication fails any one of the necessary proofs of accuracy, the meter shall not react to the receipt of any such message but shall send an alarm to the financial transaction system.

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