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1. Introduction

This document specifies the requirements for three phase programmable meters which can be utilised as manual read meters or can be interfaced through to a Data Acquisition System (DAS) for the remote downloading of billing data. This specification does not cater for AMI (advanced metering infrastructure) applications and is purely there for a metering only application.

2. Supporting clauses

2.1 Scope

2.1.1 Purpose

This standard sets out the requirements for all programmable three phase energy meters. This document describes the requirements for the hardware, the software, support for the equipment, and training required for the correct use of the metering equipment.

2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited.

2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] ISO 9001 Quality Management Systems.

[2] 240-69387766 (old DST 34-391), Standard for programmable meter configuration.

[3] SANS 62052 part 11, Electricity metering equipment - General requirements, tests and test conditions

[4] SANS 62053 part 21, Electricity metering equipment (AC) - Particular requirements: Static meters for active energy (classes 1 and 2)

[5] SANS 62053 part 22, Electricity metering equipment (AC) - Particular requirements: Static meters for active energy (classes 0.2S and 0.5S)

[6] SANS 62053 part 23, Electricity metering equipment (AC) - Particular requirements: Static meters for reactive energy (classes 2 and 3)

[7] SANS 62053 part 24, Electricity metering equipment (AC) - Particular requirements: Static meters for reactive energy (classes 0.5S and 1S)

[8] IEC 62053 part 31, Electricity metering equipment (AC) - Particular requirements: Pulse output devices for electromechanical and electronic meters (two wires only)

[9] SANS 62056 part 21, Electricity metering - Data exchange for meter reading, tariff and load control: Direct local data exchange

[10] IEC 62058-31: Electricity metering equipment (AC) – Acceptance inspection – Part 31: Particular requirements for static meters for active energy (classes 0,2 S, 0,5 S, 1 and 2)

[11] BS 5685-1, Electricity meters — Part 1: Specification for class 0,5, 1 and 2 single-phase and polyphase, single rate and multi rate watt-hour meters

[12] 240-76624509, The control of new products and version changes in technical software, firmware and hardware in the measurement field

[13] SANS 474, Electricity metering – standard requirements

[14] 240-56364444, Standard minimum requirements for the metering of electrical energy and demand.

[15] 240-69387766, Standard for programmable meter configuration.

[16] 240-76628631, Standard for sealing metering equipment.

2.2.2 Informative

None

2.3 Definitions

2.3.1 General

Definition	Description
"Tested" sticker	A sturdy label applied to the side of the meter cover, indicating that the meter was calibrated by whom, and when.
Activation date	The date on which a new tariff or season or year becomes active. **Note:** All the rate period totals for the billing month up to this date shall be saved and the new totals created and used for the remaining period of the billing month.
Active energy	The active energy is the time integral of the active power measured in kilowatt-hours (kWh).
Auxiliary input/output	The input/output from the relay contacts in the meter or the power supply provided to the meter for the meter to operate. This power is used, for example, to light up the display or to energize internal components of the metering device without burdening the voltage transformer.
Billing period	(Also referred to as billing month) The time between consecutive billing dates, nominally in months (e.g. one, three or six months) but in practice defined as a number of days (e.g. 28, 31, 60, 89, 90, 91).
Calibration	Comparison of the indication of an instrument under test, or registration of the meter under test, with an appropriate standard.
Channel	An input or register for raw data corresponding to a specific meter. **Note:** If the encoder has built-in meters, the meter shall be considered to have four channels with values corresponding to kWh import and kWh export, and kvarh leading and kvarh lagging.
Data Acquisition System (DAS)	A software package capable of reading the data from all meter types for the transfer to other applications such as the billing system.
Demand	The average value of power or a related quantity over a specified interval of time.
Demand integration period	The interval of time upon which the demand measurement is based. EXAMPLE: 15 min, 30 min.
Electronic interface	A medium for communication, used between electronic metering equipment and master stations, where metering information is stored in memory and/or where the metering device can be configured in some way. In the case of optical interfaces, this is defined in various international standards i.e. SANS 62056 part 21, but is not limited to this specification
Historical readings (stack)	Meter readings of the previous season or previous billing month.
kVA (Demand)	$\sqrt{kW^2 + kvar^2}$

Definition	Description
Mass memory	Mass memory in the meter is used as a load-profiling tool. Half hourly, or any other duration specified in the relevant enquiry specification, energy values and power quality values are stored in this memory in the meter for later retrieval.
Maximum current (I_{max})	The highest current the meter can carry continuously and remain safe, and at which it purports to meet the accuracy requirements of the relevant standard.
Maximum demand	The average value of power (active or apparent) over a specified interval of time. Demand can be based either on active or apparent demand, depending on the tariff in use. Maximum demand is relevant only on tariffs which have a demand component. The maximum demand is the highest value of demand which occurred during a billing period.
Meter constant	Value expressing the relation between the energy registered by the meter and the corresponding value of the test output. If the test output is pulses, the constant should be either pulses per kilowatt-hour (imp/kWh) or watt-hours per pulse (Wh/imp).
Metering device configuration	The configuration of clocks, registers, and memory which can be configured in any way by the user so as to implement switching times, rate registers, display sequences, integrating periods etc. The action of changing the configuration of the device is called configuring. This definition is included to address the confusion of terms - reference is often made to “programming” the meters by the users, whereas what actually occurs is the configuration of meters. See “metering device program”.
Metering device program	The code executing on the embedded controller or other form of processor or processors implemented in the metering device. This code is produced by the meter manufacturer and cannot be changed by the user in any way. This is usually referred to as the firmware of the meter.
Metering element	A device in a meter that carries out the required functions of multiplication of the voltage and current in order to obtain electrical power and integration to obtain energy.
Metering information	The origin of metering information is the metering point or the point of supply. All information related to metering equipment will be referred to as metering information. The term “information” is used to include data (unprocessed information), processed and stored information. This includes the following: • Configuration data: This relates directly to the metering device itself. It uniquely describes the processing inherent in the device which converts secondary electrical quantities (voltage and current) into the required measurand. See “metering device configuration”. • Status data: This data relates to the condition of the metering device and the validity of the metering information which originates from it. It could be contained in the information presented at the site interface, or elsewhere in the metering system.3 • Metering data: This refers to the measurands of energy values, (active, reactive and apparent), and the instantaneous values which may be available from the meter.
MV90	The software package used as the DAS. This package is developed by Utility Translation Services of the USA.
MVLT	A subset of the MV90 software package specifically designed to be loaded onto laptop computers for the local reading of meters in the field.

Definition	Description
MVP	A subset of the MV90 software package specifically designed to be loaded onto hand held units for the local reading of meters in the field. This software can also be loaded onto laptop computers.
Nominal current current (I_n)	Nominal current is that value of the current in accordance with which the relevant performance of the meter is fixed.
Non-volatile memory	A storage device, which can retain information in the absence of power. NOTE: The information is to be retained for a period of at least two years.
Power loss	The active power and apparent power loss in each voltage and current circuit at nominal voltage and basic current.
Programmable metering device	A device that is capable of calculating, storing and displaying active and/or reactive energy values according to a user defined configuration.
Rated current (In)	Value of the current in accordance with which the relevant performance of a transformer operated meter is fixed.
Reactive energy	The reactive energy is the time integral of the reactive power. For the purpose of this document, reactive energy is the energy measured in kvarh.
Real time clock	A device which maintains, to an acceptable level of accuracy, information describing the date and time of day. This information is maintained irrespective of whether power is supplied to the unit within which the clock is installed.
Register	This term was derived from the visible dial on the faceplate of the electro-mechanical meters, where the register provided an indication of the energy usage. In electronic meters, this term refers to the non-volatile memory locations within the metering device where similar energy usage information is stored.
Software custodian:	A person appointed by the Metering and Measurements Study committee to configure, test and maintain standard metering configuration schemes for a particular set of metering software.
Starting current (I_{st})	For AC meters the current at which the meter is required to start and continue to register active electrical energy at cos(φ)=1 (and in case of polyphase meters, with balanced load) or reactive electrical energy at sin(φ)=1 (inductive or capacitive, and in case of polyphase meters, with balanced load)..
Time-of-use metering:	Metering installations where the recorded energy or demand is derived over certain time periods of a day.
Nominal voltage (U_n)	. Voltage in accordance with which the relevant performance of the meter is fixed. NOTE: For the purpose of this specification, the voltage is 400 V phase-to-phase for direct connected meters and 110 V phase-to-phase for transformer connected meters.

2.3.2 Disclosure classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Description
AC	Alternating Current
AMI	Advanced Metering Infrastructure
COSEM	Companion Specification for Energy Metering
CT	Current Transformer
DAS	Data Acquisition System [Also known as Master Station]
DC	Direct Current
DLMS	Device Language Message Specification
GM	General Manager
IEC	International Electrotechnical Commission
ILAC	International Laboratory Accreditation Cooperation
I_{max}	Maximum current of meter
I_n	Nominal current of the meter
IP	Ingress Protection
LAP	List of Accepted Products
LED	Light-emitting Diode
n/a	not applicable
PTM&C	Protection, Telecoms, Metering and Control
QOS	Quality of Supply
RCC	Regulatory Compliance Certificate
SABS	South African Bureau of Standards
SANAS	South African National Accreditation System
SC	Study Committee
U_n	Nominal voltage
VT	Voltage Transformer

2.5 Roles and responsibilities

The requirements of this document shall be used during technical evaluations of programmable single phase meters. The Metering and Measurement Study Committee shall appoint technical evaluators to assist with tenders.

2.6 Process for monitoring

The Metering and Measurement Study Committee shall ensure that this standard be implemented.

2.7 Related/supporting documents

Not appl;icable.

3. Requirements

3.1 General

a) The devices defined in this standard are for three-phase three-wire and three-phase four-wire applications.

b) The meters shall be able to record active and reactive energy and active and apparent demand in all four quadrants.

3.1.1 Accuracy class

a) The accuracy class with whole current meters for active energy will be at least class 1.0, in accordance with SANS/IEC 62053 part 21 and class 2 for reactive energy, in accordance with SANS/IEC 62053 part 23

b) Transformer fed meters shall cater for the accuracy class requirements as specified in the table.

Table 1: Accuracy class requirements

Item	Active energy (kWh)		Reactive energy (kvarh)	
	Class	Specification	Class	Specification
1	0.1S, 0.2S & 0.5S	SANS/IEC 62053 part 22	0.5S, 1S & 1	SANS/IEC 62053 part 24
2	1 & 2	SANS/IEC 62053 part 21	2 & 3	SANS/IEC 62053 part 23

3.1.2 Master station (MV90) compatibility

Certificates stating compliance with MV90 and MVLT shall be obtained from the distributors or local support agency of MV90 and provided to Eskom during the meter evaluation process, or with a formal tender process.

3.1.3 Communication protocols

a) Device Language Message Specification (DLMS)/Companion Specification for Energy Metering (COSEM) is the only protocol that has been standardized upon by the International Electrotechnical Commission (IEC). DLMS/COSEM is thus the preferred protocol for use with programmable meters, but this specification shall not limit itself only to DLMS/COSEM compliant meters.

b) Communication protocols (including proprietary protocols) must be freely available to all third-party users.

3.2 Mechanical requirements

3.2.1 General

The mechanical and climatic requirements for the meter shall be in accordance with SANS 62052 part 11 & part 31 and the following:

3.2.1.1 Insulation

Meters shall meet the insulation requirements of protective class II.

3.2.2 Meter cover

a) In cases where the meter cover is removable then it shall be sealed by at least two securing screws.

b) The securing screws for surface mount meters of class 0.5 and class 1 shall be of a shear-off type where the top part will break off if due force is applied to the screw to allow for a permanent fixture.

3.2.3 Terminals

a) For surface-mount meters, the terminal blocks shall be positioned at the base of the meter and the terminal arrangement shall be in accordance with BS 5685-1.

b) Fastening of the supply wiring shall either be by means of two securing screws on each terminal, or by means of a clamp terminal using at least one screw.

c) Auxiliary inputs and outputs may either be spring-clamp terminals or screw-type terminals with one securing screw.

d) The terminals for whole current meters shall have a bore diameter of at least 8 mm for meters with an I_{max} of 100 A, and at least 12 mm for meters with an I_{max} of 160 A. The terminals for transformer-connected meters shall be at least 4 mm.

e) The securing screws and terminals shall be of non-ferrous metal and of sufficient length so as to securely clamp/fasten the conductor/wire in the terminal block.

f) Terminal blocks shall be mounted in a fashion that does not exert undue forces on internal circuitry.

g) No circuits that carry current from instrumentation current transformers shall be routed by way of a printed circuit board.

h) Terminal covers shall be in accordance with SANS 62052 part 31 and the following:

1) The terminal cover shall enclose the actual terminals and the conductor fixing screws.

2) When the meter is installed, no access to the terminals shall be possible without breaking a mechanical seal on the cover.

3.2.4 Ingress protection rating

a) The meter‘s electronic circuitry under the meter cover shall be suitably protected against the ingress of solid objects and liquids.

b) The Ingress Protection (IP) rating of this part of the meter shall be IP52 or better.

3.2.5 Markings

a) All rating plates shall be in accordance with SANS 62052 part 11 & part 31.

b) The meter’s serial number shall comply with the requirements of SANS 474 and shall also be presented in barcode format.

c) All markings shall be indelible, distinct and legible on the outside of the meter.

d) Terminal markings shall be clearly indicated on the meter itself.

e) Meter connection diagrams shall be in accordance with SANS 62052 part 11 & part 31 and shall be fixed inside the terminal block cover.

3.3 Electrical requirements

3.3.1 General electrical requirements

Any batteries used shall have a minimum life of ten years under normal operating conditions and shall have a backup capacity of at least three years in the absence of auxiliary power.

3.3.2 Current and voltage inputs

a) The standard reference frequency is 50Hz ±2 %.

b) The standard reference voltage is 110 V for 110 V 1 A and 5 A three-wire meters; 63,5 V for 63,5 V 1 A and 5 A four-wire meters; and 400 V for 400 V 5 A and 400 V 100 A and 160 A four-wire meters.

c) The standard nominal current is 1 A for a 1 A meter and 5 A for a 5 A meter. Whole current meters shall have a nominal current of ≤ 20 A for meters with an I_{max} of 100 A and ≤ 40 A for meters with an I_{max} of 160 A.

d) The meter shall operate correctly with a maximum current input of at least 120% of the maximum current.

e) The meter shall operate correctly with a maximum voltage input of at least 115% of the standard reference voltage of the meter.

f) The meter shall have the facility to assign two user-configurable multipliers to the meter readings for transformer fed meters. These will be the current transformer and the voltage transformer ratios. It shall be possible to enter non-standard ratios such as 500 V to 110 V.

3.3.3 Auxiliary power circuits

a) Meters with an accuracy class of 0.5 or lower shall operate from the phase voltages.

b) Meters of class 0.1S, 0.2S and 0.2 for active energy shall operate from either the phase voltages or from a single-phase auxiliary supply (these may be different meter models).

c) If present, the auxiliary supply shall operate normally on an AC auxiliary supply ranging from 95 V to 265 V, 50 Hz and/or a DC auxiliary supply ranging from 100 V to 230 V.

d) The meter shall operate reliably with an auxiliary supply over a range of ±15% of nominal and a frequency of 50 Hz ± 2%.

3.3.4 Pulse outputs

a) The meter shall have a minimum of four pulse outputs provided by potential free contacts for retransmission of parameters. Options shall be provided to increase this to six outputs when specified.

b) For the retransmitting of active and reactive energy, the contacts shall be fully configurable in terms of the measurand being indicated and the energy value of each pulse.

c) The meter shall also support pulsing of the following parameters:

1) Integration period resets.

2) Active tariff rates.

3) Events (as specified in 3.4.9).

4) Voltage fail alarms

d) These output contacts shall comply with the following rating:

1) A power rating of at least 50 VA.

2) Switching voltage of at least U_{DC} = 110 V and/or U_{AC} = 230 V.

3) A life expectancy of at least 10^9 operations.

e) The pulse retransmission contacts shall be normally open contacts. It is preferred that these contacts are not commoned with each other.

f) The energy pulse output shall have a nominal duration of 80 ms ± 20 ms.

g) All contacts shall be bounce free.

h) All relays used for external signalling shall have a minimum isolation of 2 kV between the relay coil and the contacts.

3.4 Functional requirements

3.4.1 Power flow measurables required

1) The meters shall be able to measure import and export active and reactive energy and resolve the reactive energy into the four energy quadrants.

2) The meters shall be required to register both kilowatt demand and its time and date of occurrence, and kilovolt-ampere demand and its time and date of occurrence. The meter shall be able to display these values locally on its display

3.4.2 Influence of harmonics on measurements

a) The accuracy of the meters shall not be adversely affected by the presence of harmonic components in the current and voltage circuits.

b) The limits of errors under these conditions shall be at least according to the limits as specified by SANS/IEC 62053 part 21 and SANS/IEC 62053 part 22. For reactive energy meters, the requirements as stated in SANS/IEC 62053 part 24 shall suffice.

3.4.3 Real time clock

a) Each meter, and, if applicable, each concentrator shall have a real time clock that is accurate to better than +/- 2.0 s/day under normal operating conditions.

b) Synchronisation of the clock shall not be based on power system frequency.

c) The clock of each meter shall be automatically synchronized through the master station or locally through the optical interface.

d) During any loss of supply, the time of the clock shall be maintained for at least 3 months.

3.4.4 Calibration facilities

a) The meters shall have an optical test output device as specified in SANS 62052-11.

b) Where active and reactive energy is measured and two LEDs are provided on the faceplate, these LEDs shall be positioned at least 20 mm apart, centre to centre, for compatibility with existing calibration equipment.

3.4.5 Local display

a) The meters shall be equipped with a display to facilitate manual meter reading when required.

b) The displayed registers shall be in accordance with the requirements of 240-69387766.

c) The display shall be fully configurable to display the register contents in any sequence as required by the user.

d) The registers of the meters shall have at least 7 (seven) significant digits.

e) It shall be possible to display the register contents in secondary values or primary values by internally multiplying the secondary values by the appropriate constants.

f) It must be possible to assign a unique register number for each value to be displayed locally on the meter.

g) The display shall have antiglare and non-blinking properties. The intensity of the display shall not be sensitive to variations in auxiliary supply voltage and frequency, for variations of ±15% for the voltage and ±2% for the frequency

h) The meter shall support, as a minimum, the display of the following engineering data:

   1) Voltages per phase

2) Currents per phase

3) Angle between the associated voltage and current per phase

4) Number of power outages

5) History of configurations (time and date of last configuration)

6) CT ratio

7) VT ratio

8) Historical energy readings

i) The meter shall support the display of these values through the local display and it shall support remote communication retrieval

3.4.6 Communication interface

a) The meter shall have an optical port for meter reading and configuration that will conform to SANS 62056 part 21.

b) The meter shall have a serial port (such as RS 232 or RS 485 (preferably an RJ12 or RJ45 connection for RS485)) that will be used for communication to a remote system.

c) It shall be possible to cascade at least eight meters through the communication port without the use of additional external hardware.

3.4.7 Maximum demand reset

a) The meter shall maintain a register that contains the maximum demand over a billing month period. For this reason, a demand-reset switch shall be supplied as part of the metering device. The requirements of this reset switch are as follows:

1) The facility shall exist to manually or automatically reset the maximum demand registers at the end of the billing month. Registers for at least the previous three billing periods shall be maintained in the meter.

2) If the metering device has the facility to reset all the monthly registers to zero at the start of each billing month, this facility shall be stated and it shall be possible to disable this facility.

3) The manual reset mechanism shall be sealable with a mechanical seal in accordance with 240-76628631. An electronic seal such as password protection mechanism will not be acceptable. A key reset mechanism will also not be acceptable.

3.4.8 Load profile (Mass memory)

The meter shall support two independent stacks of load profile memory – one dedicated to billing data and the other to engineering and quality of supply data.

3.4.8.1 Billing data

a) The meter shall cater for at least six channels of load profile memory for billing purposes (import and export active energy and reactive energy in all four quadrants) for a period of at least 100 days over a 30 min integration period.

b) Meters performing line loss compensation or transformer loss compensation shall have a minimum of 12 channels of load profiling memory. It shall be possible to register the compensated and uncompensated values.

c) These channels shall be user configurable depending on the needs of the installation.

d) The integration period shall be user configurable to cater for typical intervals of 60 min, 30 min and 15 min.

3.4.8.2 Engineering data

a) The meter shall cater for at least nine channels of data recording.

b) The following shall be supported as a minimum in the Engineering memory stack:

1) Voltages per phase

2) Current per phase

3) Phase angle per phase

c) These channels shall be user configurable depending on the needs of the installation.

d) The integration period shall be user configurable to cater for typical intervals of 60 min, 30 min, 15 min, 10 min, 5 min, 2 min and 1 min.

3.4.9 Meter memory

The following non-interval data shall also be stored on the meter and it shall be able to retrieve this data through remote communications:

a) Total energy

b) Energy per Time-of-use period

c) Status alarms

d) Event recording

The following status alarms shall be catered for as a minimum:

a) Integrity of the metering data

b) Failed battery or low battery voltage

The following event recording shall be catered for as a minimum:

a) Voltage phase failure

b) Over and under voltage

1) The limit setting shall be configurable from ±5% to ±15% of nominal voltage, as a minimum.

2) An event shall be recorded if over or under voltage is sustained for a predefined and configurable period.

3) This period shall be settable from 1 s to 3 600 s.

4) The date and time of the beginning of the event, and the date and time of the end of the event, shall be stored.

5) For each under-voltage event, the minimum voltage that occurred during the period shall be recorded. For each over-voltage event, the maximum voltage that occurred during the period shall be recorded. For three phase meters, the phases affected shall also be recorded.

c) Phase sequence reversal

d) Negative active energy

e) Functionality shall be available for the automatic reporting of at least three of these events to the master station (configurable).

f) The meter shall be capable of storing data equivalent to an average 100 days of events.

g) All data and events (interval and non-interval) shall be date and time stamped at the meter with a resolution of at least 1 min.

3.4.10 Quality of supply

a) The supplier shall state conformance to quality of supply monitoring for class A and class B measurements according to SANS 1816.

b) The supplier shall state the recording capabilities supported by the meter for the storage of Quality of Supply (QOS) data. Specifically, the following shall be stated:

1) Load profile capability.

2) Independence of QOS integrating period requirements versus meter billing data integrating period.

3) Retrieval method for QOS data.

3.4.11 Line loss compensation

a) The supplier shall state the capabilities supported by the meter on line loss compensation. Specifically, the following shall be catered for:

1) The meter shall be capable of performing line loss compensation and transformer loss calculations for all measurable quantities, i.e. import and export active and reactive energy.

2) The supplier shall provide details of the algorithms used for calculating line loss compensation and transformer loss compensation for Eskom's approval.

3) Provision shall be made for meters performing line loss compensation, to make available both the compensated and uncompensated values in the registers and the load profile.

3.5 Software

3.5.1 General software requirements

a) The metering systems shall be supplied with configuration software.

b) All software supplied with the system shall be documented comprehensively, with all the features and functions discussed, including a set of examples as to how the meters can be configured for different tariff structures and applications. Included in the documentation shall be a list of possible problems and how to solve them.

c) Training shall be provided for all relevant staff by the supplier of the meter. This training shall cover the installation, maintenance and operation of the system and the configuration software

d) Eskom shall be given an Eskom wide licence agreement for all software offered.

e) Future revisions of software shall be supplied in terms of a contract but shall be submitted in accordance with Eskom standard 240-76624509.

3.5.2 Security within the software

a) Security measures, such as a hierarchical password system shall prevent the configuration information, in the meter and the configuration software, from being changed by unauthorised personnel.

b) Three levels of security will be provided within the software to enable the following functions:

1) Read only mode whereby all the registers within the meter may be read.

2) Reading and programming access to the meter.

3) Reading, programming and configuration access.

c) Within the access to programming of the meter it must be further possible to only configure the following parameters without changing any of the other parameters within the meter:

1) Public holidays

2) Transformer factors (CT ratio and or VT ratio)

3) Output pulse values

4) Time and date

3.5.3 Tariff implementation through the software

The configuration software shall cater as a minimum for all the different tariff structures applied within Eskom. The following shall be catered for:

a) The meter shall be capable of measuring and recording import and export active energy and reactive energy in all four quadrants for various time periods.

b) The time definitions shall be configurable in the meter in the following way:

1) It shall be possible to set up at least three different seasons within the meter's switching schedules.

2) The meter shall be able to accept day, month and year when assigning seasons and holidays.

3) Each season will provide for at least four different day types. The tariff switching will be different in each of the different days.

4) At least four different time periods will be provided for within each day, and it will be possible to switch them in any possible combination.

5) Two different weekend day switching schedules will be provided for.

6) Two different types of holiday day switching schedules will be provided for.

7) At least 16 holiday days shall be provided for.

c) The meter shall be capable of recording active and apparent demand. The date and time of occurrence shall also be captured.

d) It shall be possible to record active and apparent maximum demand in certain time periods, e.g. only during Peak time or a combination of Peak and Standard time, etc.

e) Cumulative demand values shall also be available.

f) All these values shall be displayed through the meter's display in a user-defined sequence. This display sequence shall be flexible enough to enable shifting displayed values in any sequence.

3.5.4 Remote verification requirements

a) The software shall cater for remote engineering data verification and the following shall be remotely retrievable as a minimum:

1) Meter configuration.

2) Billing and engineering/quality of supply profile data.

3) Voltage and current phasor data (equipment supporting phasor diagrams shall be given preference).

4) Cumulative energy values.

5) Status data.

6) Event data.

b) Provision shall be made in the configuration software to export the raw data in a flat ASCII format suitable for incorporating into a spreadsheet or similar package.

3.6 Firmware

a) For the purposes of this document, the firmware of the meter is considered to form an integral part of the meter.

b) The firmware will determine the correct functioning of the metering device in accordance with the requirements of this specification, and any related enquiry specification.

c) Future versions of firmware shall be supplied in terms of any contract by shall be submitted in accordance with Eskom standard 240-76624509.

3.7 Facilities for sealing the meter

a) Provision shall be made for sealing the meter in accordance with 240-76628631.

b) It shall be able to seal the terminal cover and meter cover separately (if the cover is removable).

3.8 Documentation

3.8.1 Drawings

a) All metering equipment shall be accompanied by drawings as listed below:

1) Outline and mounting details of each item.

2) Electrical termination and cabling details. These diagrams shall also be mounted on the metering device, under the terminal cover.

3) An exploded view or similar diagram to indicate each physical part with its part number and description.

3.8.2 Manuals

All metering equipment shall be supplied with instruction manuals that shall be detailed enough to enable Eskom staff to install, maintain, test, configure and use each item of equipment.

3.9 Training

a) Training shall be provided on request for Eskom staff.

b) This training shall cover the installation, maintenance, and operation of the system and the configuration software.

c) Training shall include formal assessments of attendees.

3.10 Packaging

a) The meter serial number and barcode shall be printed onto the packaging of the meter.

b) Where multiple meters are supplied within one package, all the serial numbers and barcodes of the individual meters shall be printed onto the packaging.

3.11 Spares

a) The supplier shall supply a comprehensive schedule of spares to be held, relating to all the meters and or part thereof. The supplier is encouraged to include in this list any or all items recommended for the routine maintenance of the offered meters in service.

b) All spares shall be priced individually, and shall be unambiguously referenced and described in the schedule.

c) The supplier shall commit to being able to supply spares for all the meters and or parts thereof locally for a minimum period of ten (10) years, subsequent to the expiry of the supply contract.

d) The delivery time of locally held spares shall not exceed 24 h, ex-works, on receipt of a bona fide order.

3.12 Support

a) Dedicated local expertise to support all meters or parts thereof offered by the supplier shall be available.

b) If any of the meters or parts thereof are sourced from overseas, Eskom requires the maximum transfer of technology from the supplier's principals, to enhance local expertise capacity. The supplier shall make the necessary arrangements in this regard.

4. Test and calibration requirements

4.1 Type testing

a) The meters shall be type tested according to the requirements specified in SANS 62052 part11, and the relevant SANS/IEC 62053 type specifications. The type tests shall be done at an approved test facility (test facility accredited by a full member facility that is listed at International Laboratory Accreditation Cooperation (ILAC)).

b) Full details of accelerated life-cycle testing (type of tests performed) shall also be submitted with a tender.

c) Eskom may require that accelerated life-cycle testing be done according to its own requirements if the tests done by the manufacturer are considered to be insufficient.

4.2 Testing procedures

Eskom reserves the right to appoint a representative to inspect the equipment at any stage in the manufacturing process and to witness any tests.

4.3 Evaluation procedure

a) All meter types shall be subjected to Eskom's internal evaluation procedure.

b) The supplier shall state compliance with requirements of this specification.

c) Two sample units shall be submitted to Eskom for functional evaluation, together with the configuration software.

d) The supplier shall indicate the version of the meter hardware, the firmware in the meter and the software version; and these versions shall be the versions as evaluated. Version changes shall be made in accordance with 240-76624509.

4.4 Calibration requirements

a) All meters shall be tested at a South African National Accreditation System (SANAS) accredited test facility (refer to SANS 474/ NRS057) before delivery.

Note: The meters shall be tested at the various load points as specified in table 2 & 3 and the final error results shall be within these limits.

Table 2: Calibration limits for active energy meters

Load Point	Current		Pf	Applicable for meter type	Load	Max. error limit for meters of class in %				
	Direct connect meters	Transformer operated meters				0.1S	0.2S	0.5S	1	2
1	5% I_n	2% I_n	1	Single and polyphase	Balanced	±0,2	±0,4	±1,0	±1,5	±2,5
2	100% I_n	100% I_n	1	Single and polyphase	Balanced	±0,1	±0,2	±0,5	±1,0	±2,0
3	100% I_n	100% I_n	0,5 lag	Single and polyphase	Balanced	±0,15	±0,3	±0,6	±1,0	±2,0
4	100% I_n	100% I_n	1	Polyphase	Single phase[a]	±0,15	±0,3	±0,6	±2,0	±3,0
5	100% I_n	100% I_n	1	Polyphase	Single phase[b]	±0,15	±0,3	±0,6	±2,0	±3,0
6	100% I_{max}	100% I_{max}	1	Polyphase	Balanced	±0,1	±0,2	±0,5	±1,0	±2,0

[a] The meter shall be supplied with three phase symmetrical voltage. The current shall be applied to any of the phases.

[b] The meter shall be supplied with three phase symmetrical voltage. The current shall be applied to a phase different from the phase in test 4.

Note: Eskom may request that the calibration tests be done in all four quadrants for bidirectional metering applications

Table 3: Calibration limits for reactive energy meters

Load Point	Current		Pf	Applicable for meter type	Load	Max. error limit for meters of class in %			
	Direct connect meters	Transformer operated meters				0.5S	1S & 1	2	3
1	5% I_n	2% I_n	0	Single and polyphase	Balanced	±1,0	±1,5	±2,5	±4,0
2	100% I_n	100% I_n	0	Single and polyphase	Balanced	±0,5	±1,0	±2,0	±3,0
3	100% I_n	100% I_n	0,866 lag	Single and polyphase	Balanced	±1,0	±1,5	±2,5	±4,0
4	100% I_n	100% I_n	0	Polyphase	Single phase[a]	±0,7	±1,5	±3,0	±4,0
5	100% I_n	100% I_n	0	Polyphase	Single phase[b]	±0,7	±1,5	±3,0	±4,0
6	100% I_{max}	100% I_{max}	0	Polyphase	Balanced	±0,5	±1,0	±2,0	±3,0

[a] The meter shall be supplied with three phase symmetrical voltage. The current shall be applied to any of the phases.

[b] The meter shall be supplied with three phase symmetrical voltage. The current shall be applied to a phase different from the phase in test 4.

Note: Eskom may request that the calibration tests be done in all four quadrants for bidirectional metering applications.

b) The reference conditions under which testing is to be performed shall be as stated in IEC 62058 part 31.

c) A 'TESTED' sticker shall be applied to each meter after calibration. The sticker shall indicate the date of accuracy testing and the facility that has tested the meter.

d) The following tests shall also be performed on each meter:

1) Running with No Load – not more than one pulse shall be produced by the test output of the meter over a period of 10 min.

2) Starting Current Test – The meter shall start and continue to register at a maximum of 0.4% I_b at unity power factor.

3) Dial/register Constant Test – the meter shall register a known amount of energy to verify that the dial/register constant is correct.

Table 4: Value of current for starting test

Meter type	Class of meter				Power factor
	0.1S & 0.2S	**0.5S & 0.5**	**1**	**2 & 3**	
Direct connection	-	-	0. 4% I_b	0. 5% I_b	1
Transformer connected	0. 1% I_n	0. 1% I_n	0. 2% I_n	0. 3% I_n	1

e) The measuring process shall be such that the overall uncertainty of measurement does not exceed the values as stated in IEC 62058 part 31.

f) Each individual meter shall be delivered with its calibration certificate attached under the meter terminal cover.

g) The calibration results shall be available to Eskom in an electronic format as an import file compatible with Microsoft Windows software.

5. Authorization

This document has been seen and accepted by:

Name and surname	Designation
N Hari	General Manager: Power Delivery Engineering
N Luthuli	Senior Manager: Transmission PTM&C Engineering
P Madiba	Senior Manager: Electrical and C&I
A Pillay	Senior Manager: PTM
M Viljoen	Senior Manager: PEIC, Electrical and C&I
A Mashao	Senior Manager: Dx PTM&C Engineering
D Van Rooi	Middle Manager: Dx Metering, Security and DC Technologies Manager
L Malaza	Middle Manager: Electrical Plant COE
M Van Rensburg	Senior Manager: Transmission Grids
J Pieterse	Chief Engineer: Transmission
S Mkhabela	Senior Manager: Distribution

6. Revisions

Date	Rev	Compiler	Remarks
March 2022	3	HPD Groenewald	2.3.1 Amended definitions in alignment with relevant SANS documents 3.3.3 Changed requirements for the auxiliary supply voltage 3.3.4 Added pulse output for voltage fail alarm 3.4.5 Removed requirement for displaying previous billing period quantities 3.4.8.1.b Compensated and uncompensated values to be displayed for line loss data 4.1 The RCC requirements removed – not practical Table 1, 2 & 4 added requirements for class 0.1S
March 2017	2	HPD Groenewald	Reference documents numbering changed to new 240 numbers. 3.3.2.a) Frequency amended from 50Hz ±5% to 50Hz ±2%. 3.3.2.c) For 160A meters I_{max} ≤ 40 A 3.3.2.e) Voltage amended from 120% to 115% 3.3.3.d) Voltage over a range ±15% of nominal and a frequency of 50 Hz ± 2% 4.1.b) Reference to SABS for RCC certificates removed – done via NRCS
March 2014	1	HPD Groenewald	New number allocated to document 240-52840736 Development team expanded. 3.1 The meter shall record both import and export kWh to cater for co-generation applications 3.2.3 Specified shear-off screws for the terminal cover. 3.3.2.c) Lowered the basic current to 10A 3.4.4.e) Test mode resolution specified 3.4.6.a) Two channels of load profile specified 4.4 Calibration tests shall be done for both import and export

7. Development team

The following people were involved in the development of this document:

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8. Acknowledgements

Not applicable

Annex A – Requirements for the "Tested" sticker

- It shall be a polyurethane, permanent sticker.
- Printing shall be black on a yellow or white background.
- The sticker surface shall accept writing with a permanent marker.
- The size of the sicker shall be 40mm long and 8mm wide.
- The test facility's name shall be pre-printed on the sticker by using a bolt Arial font, size 8 and all in capital letters - see samples.
- The "TESTED /20" shall be pre-printed on the sticker by using a bolt Arial font, size 12 and all in capital letters - see samples.
- The letter spacing shall be as shown in the samples.

Figure A.1: Sample sticker

Instructions for the use of the sticker

- A permanent, black marker shall be used for writing. The month of calibration shall be written in the space between "TESTED" and "/20" on the sticker. Numbers shall be used, for example 01 for January and 12 for December. The year of calibration shall be written in the space after "/20" on the sticker. Two digits shall be used, for example 01 for 2001 and 05 for 2005.
- The sticker shall be applied to the nameplate of the meter. It shall be clearly visible from outside the meter with the meter cover in place. It shall not obscure information on the nameplate of the meter.