EDC 1 (4500) CD1

ICS: 17.220.20; 91.140.50

DRAFT TANZANIA STANDARD

(Draft for comments only)

Electricity Metering-Requirements

TANZANIA BUREAU OF STANDARDS

 First Edition 2026

Electricity Metering-Requirements

National Foreword

This draft Tanzania Standard is being prepared by the Electrical Equipment Technical Committee, under the supervision of the Electrotechnical Divisional Standards Committee (EDC)

During preparation of this standard, assistance was derived from **SANS 474:2022**, *Electrical Metering-Standard requirements, published by the South African Bureau of Standards*

In reporting the results of a test or analysis made in accordance with provision of this Tanzania Standard, if the final value observed or calculated is to be rounded off, it shall be done in accordance with TZS 4 (see Clause 2)

0 Introduction

These electricity metering requirements have been prepared to establish and promote uniform requirements for application in the Tanzania Electricity Supply Industry.

This code of practice contains requirements that licensees might only be in a position to conform to progressively. Engagement with the national Energy Regulator will be required to formulate and agree an implementation plan which could evolve over time.

Notwithstanding the requirement to structure and agree on an implementation plan, the Energy Regulatory expresses the wish that all supply authorities will adopt the requirements of this code of practice in so far as their particular conditions will permit. Any differences between the requirements of this code of practice and the licensee's requirements should be submitted for consideration in future revisions of this code of practice.

Electrical Metering – Standard Requirements

Scope

1.1 This Tanzania Standard specifies the procedures and requirements to be adhered to by electricity licensees, their agents, and other relevant stakeholders in the operation and maintenance of new and existing metering installations used for billing purposes.. This standard is applicable to metering installations in their entirety, including all measuring transformers, wiring, cabling, metering panel construction, active and reactive energy meters, data loggers, and associated test facilities.

1.2 This standard sets out best practices to be adopted by electricity licensees, wherever practicable. (See NOTES 1 and 2)

NOTE 1 Some requirements might be the subject of mandatory compliance through reference in codes regulated by the relevant national energy regulator In cases where compliance with mandatory requirements will not be practicable, the national energy regulator should be approached for exemption.

NOTE 2 This standard should be interpreted as applicable to new and refurbished metering systems. Practices in place before the publication of this standard might be deemed to be acceptable for an agreed time frame.

1.3 This standard specifies requirements for the initial calibration and certification of metering equipment and compliance testing of metering installations. It describes procedures to ensure that metering installations continue to comply with relevant standards and sets out steps to be taken to reconfirm compliance after any modifications to the metering installation.

1.4 This standard specifies procedures for the retrieval, manipulation and storage of metering data.

1.5 This standard specifies the qualifications required for meter workers based on specified categories of metering installations.

1.6 This standard specifies a standard format for the unique numbering of meters.

1.7 This standard does not cover all possible variations in metering installations. Where features additional or alternative to those specified in this standard are required, they will be appropriately tested or inspected (or both) to confirm the integrity of the overall metering installation.

2. Normative References

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies while for undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62055, Electricity metering - Payment systems

ISO/IEC 7812-1:2006*, Identification cards – Identification of issuers – Part 1: Numbering system.*

ISO/IEC 15417, *Information technology– Automatic identification and data capture techniques – Code 128 bar code symbology specification.*

IEC 61869-1*, Instrument transformers – Part 1: General requirements*.

IEC 61869-2, *Instrument transformers – Part 2: Additional requirements for current* transformers.

IEC 61869-3, *Instrument transformers – Part 3: Additional requirements for inductive voltage transformers.*

IEC 61869-4, *Instrument transformers – Part 4: Additional requirements for combined* transformers.

IEC 61869-5, *Instrument transformers – Part 5: Additional requirements for capacitor voltage transformers.*

IEC 62051, *Electricity metering - Glossary of terms.*

IEC 62052-11, *Electricity metering equipment (a.c.) – General requirements, tests and test conditions – Part 11: Metering equipment.*

IEC 62053-11, *Electricity metering equipment (a.c.) – Particular requirements – Part 11: Electromechanical meters for active energy (classes 0,5, 1 and 2).*

IEC 62053-21, *Electricity metering equipment (a.c.) – Particular requirements – Part 21: Static meters for active energy (classes 1 and 2).*

IEC 62053-22, *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.) – Particular requirements – Part 23: Static meters for reactive energy (classes 2 and 3).*

IEC 62053-24, *Electricity metering equipment (a.c.) – Particular requirements – Part 24: Static meters for reactive energy at fundamental classes frequency (classes 0.5 S,1 S and 1*

IEC 62055-31, *Electricity metering – Payment systems – Part 31: Particular requirements – Static payment meters for active energy (classes 1 and 2).*

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).*

TZS 1374, Power quality-Quality of services and reliability

ISO/IEC 15417, Information technology — Automatic identification and data capture techniques — Code 128 bar code symbology specification

3. Terms, definitions and abbreviations

For the purposes of this document, the terms and definitions given IEC 62051, IEC Electropedia: available at http://www.electropedia.org/, ISO Online browsing platform: available at http://www.iso.rog/obp and the following apply.

3.1 Terms and definitions

3.1.1
accreditation
procedure by which an authoritative body gives formal recognition that a body or person is competent to carry out specific tasks

3.1.2
accredited calibration laboratory
laboratory that has been accredited by the relevant recognized accreditation body

3.1.3
accredited test laboratory
laboratory that has been accredited by the relevant recognized accreditation body

3.1.4
accuracy class index
number that gives the limits of the permissible percentage error as defined in the applicable specification for a meter when the meter is tested under reference conditions

Note to Entry: Multi range and multipurpose instruments may have more than one accuracy class index.

3.1.5
active energy
integral of the active power with respect to time

3.1.6
actual transformer ratio
ratio of the actual primary current to the actual secondary current

3.1.7
archived data
data from the operational metering database that was saved or stored on a storage medium

Note to entry: Example of such storage medium includes but not limited to Tape-drives, compact disc.

3.1.8
back up meter
additional meter installed on the same primary plant as the main meter for the purpose of storing back-up data in the event of failure of the main meter
[IEC 62051]

3.1.9
batch testing
process of using a statistical method to evaluate the characteristics of a manufactured batch based on the test results of a representative sample

Note to entry: The acceptable quality level, the inspection level and the type of inspection should be specified to determine the sample size in accordance with ISO 2859-1.

3.1.10
billing
process of producing and delivering a bill (an account) for payment by a customer, calculated from the tariff schedule, and for the majority of customers, the consumption measured and recorded by the metering system

Note to Entry: Bills are also calculated on estimated consumption for unmetered installations. Customers are billed at regular cycles (e.g. monthly, bimonthly, quarterly or yearly) and when an account is finalized or when a special reading is requested.

3.1.11
burden
value of the impedance of the secondary circuit expressed in ohms (or in volts per ampere at the rated secondary current) at the relevant power factor

3.1.12
calibration
set of operations that establishes, under specified conditions, the relationship between the values indicated by a measuring system and the corresponding values of a quantity realized by a reference standard or a working standard

3.1.13
calibration report
report that contains the results of all calibration tests carried out on a metering installation or a component of a metering installation by an accredited laboratory as part of the certification process

3.1.14
certification
procedure by which a third party gives written assurance that a product, process or service conforms to specified requirements

3.1.15
compliance testing
procedure whereby a metering installation and its component parts are proved to comply with applicable requirements

Note The procedure includes the issuing of a compliance report.

3.1.16

configuration
setting of measurement and communication parameters to operate the meter correctly

3.1.17
code of practice
document that recommends practices or procedures for the design, manufacture, installation, maintenance or utilization of equipment, structures or products

Note to Entry: A code of practice can be a standard, a part of a standard or independent of a standard

3.1.18
current circuit
internal connections of the meter and part of the measuring element through which flows the current of the circuit to which the meter is connected

3.1.19
customer
organization or person that receives a product

Note to Entry: For the purpose of this standard, a customer is a legal entity or a person that has entered into an electricity supply agreement with a utility.

3.1.20
data
information that is contained in electronic format

Note to Entry: Data includes information regarding the quantity of energy used, the revenue due by the customer, and the information about the metering installation.

3.1.21
data logger
device that is capable of registering meter data such as consumption and demand data referenced to time and date and that has the capability of communicating data to a central point by means of an electronic interface

3.1.22 demand
3.1.22.1
authorized capacity

capacity per point of supply/stand that has been provided and paid for by the customer/developer

3.1.22.2
authorized maximum demand (AMD)
maximum load that the customer is authorized by the licensee to take from that point of supply (POS)

3.1.22.3
auxiliary circuit
the elements (lamps, contacts, etc.) and connections of an auxiliary device within the meter case that are intended to be connected to an external device, for example a clock, a relay, an impulse counter

3.1.22.4
maximum demand (MD)
highest average demand measured in kilovolt-amperes or kilowatts, during any integrating period within a designated billing period that is usually one month

3.1.22.5
notified maximum demand
contracted maximum demand for a specific period notified in writing by the customer and accepted by the utility as that which the customer requires

3.1.22.6
demand integration period
interval of time on which the demand measurement is based

Note to Entry: EXAMPLE 15 min, 20 min, 30 min.

3.1.22.7
kVA (demand)

$$\frac{\text{kVAh}}{T} = \frac{\sqrt{\text{kWh}^2 + \text{kvarh}^2}}{T}$$

Note to Entry: T stands for the demand integration period (**3.1.22.6**) expressed in hours

3.1.22.8
kW (demand)

$$\frac{\text{kWh}}{\text{T}}$$

Note to Entry: **T stands for the** demand **integration period (3.1.22.6) expressed in hours**

3.1.23
design report/design template
document that records the technical design of a metering installation

Note to Entry: For complex individual designs, the document is referred to as a design report. In the case of a

repetitive standard design, the document is referred to as a design template.

3.1.24 electricity meter

Note to Entry: In general, a meter consists of a sensor and an integrating device that records the total consumption in metrological units.

3.1.24.1
electromechanical meter

meter in which currents in fixed coils react with the currents induced in the conducting moving element, generally (a) disk(s), which causes their movement proportional to the energy to be measured (Ferraris principle)

3.1.24.2
multi-rate meter

energy meter provided with a number of registers, each becoming operative for specified time intervals corresponding to different tariff rates

3.1.24.3
static meter

meter in which current and voltage act on solid state (electronic) elements to produce an output proportional to the energy to be measured

3.1.24.4
var-hour meter (reactive energy meter)

instrument intended to measure reactive energy by integrating reactive power with respect to time

3.1.24.5
watt-hour meter (active energy meter)

instrument intended to measure active energy by integrating active power with respect to time

3.1.24.6
smart meter

an integrated, fixed-network system that enables two-way communication between utilities and customers

Note to Entry: The system collects, stores, analyzes and presents energy usage data, providing utility companies the ability to monitor electricity usage in real time remotely.

3.1.24.7
prepayment meter

a meter that requires a customer to purchase energy before consumption

3.1.25 energy

3.1.25.1
active energy

product of voltage and current and the cosine of the phase angle between them integrated over a time period, and that is normally measured in kWh

3.1.25.2

reactive energy

product of voltage and current and the sine of the phase angle between them integrated over a time period, and that is normally measured in kVArh

3.1.26

estimation

process whereby values are inserted into the set of energy usage data for a customer and where such data is not available through mal-operation of equipment or failure to retrieve it within a specified performance period or when metering is deliberately not reading at every billing interval

3.1.27 instrument transformer

3.1.27.1

capacitor voltage transformer (CVT)

voltage transformer (VT) that comprises a capacitor divider unit and an electromagnetic unit so designed and interconnected that the secondary voltage of the electromagnetic unit is substantially proportional to and in phase with the primary voltage applied to the capacitor divider circuit

3.1.27.2

current transformer (CT)

instrument transformer in which the secondary current, in normal conditions of use, is substantially proportional to the primary current, and differs in phase by an angle which is approximately zero for an appropriate direction of the connections

3.1.27.3

voltage transformer (VT)

instrument transformer in which the secondary voltage, in normal conditions of use, is substantially proportional to the primary voltage, and differs in phase from it by an angle which is approximately zero for an appropriate direction of connections

3.1.28

licensee

the holder of a license granted by the Energy Regulator for conducting regulated activities including but not limited to the generation, transmission, distribution and supply of electricity;

Note to Entry: A license is renewed on a periodic basis.

3.1.29

meter type

designation that is used for defining a particular design of meter, manufactured by one manufacturer, that has similar metrological properties, the same uniform construction of parts determining these properties, the same number of amperes turns for the current winding at the basic current and the same number of volts turns for the voltage winding at the reference voltage, and the same ratio of the maximum current to the basic current

3.1.30
meter worker
artisan, special workman, meter tester, technician or engineer who performs metering work on specific categories of metering installations and who is therefore required to have the appropriate level of specialized training

3.1.31 metering

3.1.31.1
back-up metering
additional meter installed on the same CT core and VT winding as the main meter for the purpose of storing back-up data in the event of failure of the main meter

3.1.31.2
check metering
redundant metering system (a completely separate installation) that has dedicated CT cores but might have only one VT winding

3.1.31.3
main metering
metering system with one active energy meter, and, depending on the tariff in use, one reactive energy meter and one recorder (where applicable). This assembly of meters is fed from one current instrument transformer (CT) core and one voltage instrument transformer (VT) winding

3.1.31.4
main and back-up metering
metering system with two active energy meters, and, depending on the tariff in use, two reactive energy meters fed from a shared CT core and a shared VT winding

Note The recording equipment, where applicable, should also be duplicated.

3.1.31.5
main and check metering
metering system with two active energy meters, and, depending on the tariff in use, two reactive energy meters fed from two separate CT cores and two (or maybe only one) separate VT winding(s)

Note to Entry: The recording equipment, where applicable, should also be duplicated.

3.1.32
metering equipment
collection of components in the metering installation, i.e. the instrument transformers, cables, meters recorders and any housing and ancillary equipment such as test blocks

3.1.33
metering information
data (unprocessed information), processed information and stored information that relate to metering

equipment at the metering point or the point of supply (PoS)

Note to Entry: Metering information includes the following:

a) configuration / programming data. It relates directly to the metering device itself. It uniquely describes the processing inherent in the device that converts secondary electrical quantities (voltage and current) into the required measurand.

b) status data. It relates to the condition of the metering device and the validity of the metering information that originates from it. It could be contained in the information presented at the site interface, or elsewhere in the metering system.

c) metering data. It refers to the measurands of energy values (active, reactive and apparent), and the instantaneous values that may be available from the meter.

3.1.34
metering installation
all meters, fittings, equipment, wiring and installations, used for measuring the flow of electricity, and that comply with the relevant standards

3.1.35
rated burden

value of the burden on which the accuracy standards are based

3.1.36
raw meter data
any unprocessed information that is received directly from a metering installation

3.1.37
reference meter
meter used to measure the unit of electric energy

Note to Entry: It is usually designed and operated to obtain the highest accuracy and stability in a controlled laboratory environment.

3.1.38
reference standard
measuring instrument that has been calibrated by an accredited laboratory or a national standards laboratory

3.1.39
register
part of the meter which enables the measured value to be determined

Note to Entry: It can be an electromechanical device or an electronic device comprising both memory and display which stores and displays information. A single electronic display may be used with multiple electronic memories to form multiple electronic registers.

3.1.40
test block
device that permits access to voltage and current circuits for testing purposes while the metering installation is in normal service

3.1.41
type testing

procedure according to which the series of tests is carried out on one meter or on a small number of meters of the same type having identical characteristics, selected by the manufacturer, to verify that the respective type of meter complies with all the requirements of standards for the relevant class of meters

Note to Entry: For the purpose of this standard, type testing is carried out on equipment to prove compliance with certain specifications and hence its acceptability for the purpose for which it was intended as part of a metering installation.

3.1.42
uncertainty
parameter, associated with the result of a measurement that characterizes the dispersion of the values that could reasonably be attributed to the quantity being measured

3.1.43
wiring loom
an assembly of wires or cables that transmits signals or electrical power

3.1.44
embedded generation
generation and / or bi-directional storage system embedded in the utility distribution network that operates in parallel with the utility supply

3.1.45
embedded generation customers
an electricity customer of a supply licensee that owns and operates an embedded generation plant on the customer side of the metering point, primarily intended for own use

3.1.46
Feed-in-tariff
rates and charges approved by the energy regulator at which the supply licensee shall obtain a unit of renewable electricity from an embedded generation customer

3.1.47
energy regulator
a statutory body that conducts technical and economic regulation of the electricity supply industry

3.2 Abbreviations

CT current transformer

EAST East African Standard Time

FiT Feed in Tariff

LPU large power user

MD maximum demand

MCB miniature circuit breaker

PoS Point of supply

VT voltage transformer

pf power factor

VA volt ampere

4 Requirements of Metering Installations

This Section defines the requirements for metering installations at the connection (metering) point of any interface, which shall be complied with for eligibility for registration. Electricity utilities and other metering service providers shall ensure that all metering installations meet the prescribed accuracy, safety, and technical requirements set out in this Section.

For the purposes of this Section, metering installations include those associated with facilities connected to the transmission grid, distribution systems, and end-user systems. The term "meter" shall likewise apply to meters installed within the transmission grid, distribution systems, and end-user systems.

4.1 Metering System

4.1.1 The metering system consists of various components that are illustrated in Figure 1.

NOTE Some installations only consist of one part in which case there will typically be a meter only, such as in the case of a small domestic type of supply.

4.1.2 Each of the components has an influence on the total integrity of the installation and shall therefore comply with the requirements as listed in this standard.

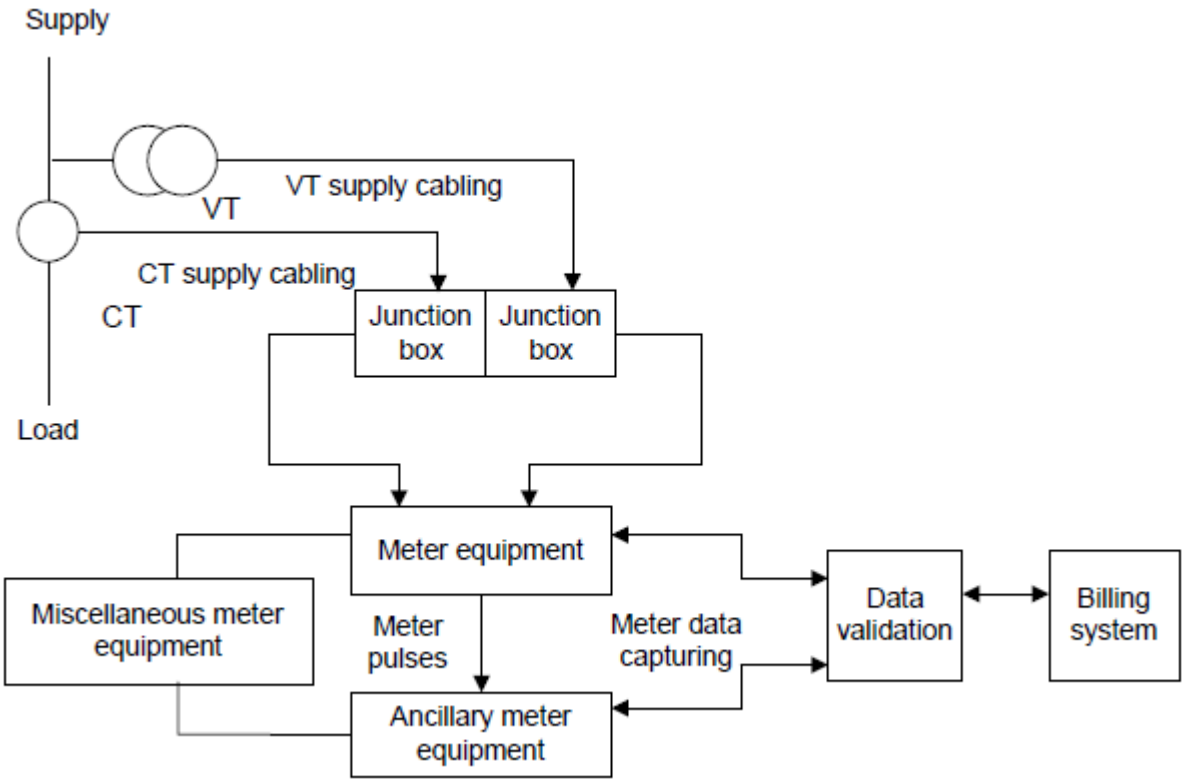


Figure 1 — Metering system diagram

4.2 Service conditions for metering installations

The Service Conditions for the Metering Installations shall be as follows:

a) Altitude (Above Sea Level) 2,000m
b) Maximum Outdoor Temperature 40°C
c) Minimum Outdoor Temperature 10°C
d) Maximum Monthly Mean Temperature 35°C
e) Annual Mean Temperature 22°C
f) Maximum Relative Humidity 96%
g) ISO keraunic Level (strokes per sq.km per year) 2 – 16
h) Maximum Wind Velocity 58km/H
i) Type of Environment Coastal

4.3 Equipment standards

4.3.1 General

Equipment shall comply with the standards applicable when originally installed or with an alternative standard, confirmed in writing by the National Standards Body or accredited test laboratory as being equivalent to, or better than, the specified standard.

4.3.2 Electricity meters

4.3.2.1 Communication Requirements

The Metering Services Providers, including other relevant licensees shall ensure that a dedicated communication link, either line or wireless, is installed in their respective Metering Installations.

4.3.2.2 All meters shall comply with the relevant standards as specified in **Table 1**.

Table 1 — Energy meter standards and requirements for meter accuracy class

1	2	3
Meter accuracy class	**Applicable standard: Active energy meters**	**Applicable standard: Reactive energy meters**
0.2 S	IEC 62052 -11 IEC 62053 -22	Not available
0.5 S	IEC 62052 -11 IEC 62053 -11 IEC 62053 -22	IEC 62052-11 IEC 62053-24

1	IEC 1524 -1 IEC 62052 -11 IEC 62053 -11 IEC 62053-21 IEC 62055-31	IEC 62052-11 IEC 62053-24
2	IEC 1524-1 IEC 62052-11 IEC 62053-11 IEC 62053-21 IEC 62055-31	IEC 62052-11 IEC 62053-23
3	Not applicable	IEC 62052-11 IEC 62053-23

4.3.3 Instrument transformers

All instrument transformers (Current transformers (CTs)) and Voltage transformers (VTs)) shall comply with the relevant standards as specified in Table 2.

Table 2 — Instrument transformer standards

1	2
Item	**Applicable standard: Active energy meters**
Current transformers (CT)	IEC 61869-2 and IEC 61869-1
Voltage transformers (VT)	IEC 61869-3 and IEC 61869-1
Combined transformers (CTVT)	IEC 61869-4 and IEC 61869-1
Capacitive voltage transformer (CVT)	IEC 61869-5 and IEC 61869-1

4.3.4 Communication Requirements

The Metering Services Providers shall ensure that a dedicated communication link, either line or wireless, is installed in their respective metering installations.

4.3.5 List of accepted products

4.3.5.1 Licensees shall maintain a list of accepted metering equipment which are deemed suitable for use within metering installations.

4.3.5.2 Licensees shall ensure that a proper evaluation has been done on equipment specified on the List of Accepted Products taking into account the following:

a) The type testing of equipment shall be according to the requirements specified in Tables 1 and 2 to confirm its specific characteristics and to prove that it complies with the requirements of the relevant standards and accuracy as specified.

b) The equipment shall be evaluated to the licensee's own technical specifications and requirements provided that such specification and requirements align with the applicable standards.

4.3.6 The licensee shall ensure that only metering equipment types that have proof of compliance are used with metering designs, equipment purchasing and commissioning.

4.4 Calibration of Equipment

4.4.1 Electricity Meters

4.4.1.1 All electricity meters shall make provision for calibration test circuitry which will allow for a standard reference meter to be used in checking the calibration of a meter.

4.4.1.2 New or replacement electricity meters shall be individually calibrated by an accredited calibration laboratory before their installation. This requirement is applicable to all three phase meters, post-paid single-phase meters and smart meters. Low-cost pre-payment meters are excluded from this requirement and requirements are specified in 4.4.3.

4.4.1.3 The competence of a calibration and test laboratory shall be verified by the relevant recognized accreditation body.

4.4.1.4 Copies of the calibration reports shall be held by the accredited calibration laboratory that carries out the certification.

4.4.1.5 Calibration certificates shall be made available to the person responsible for the meter installation.

4.4.1.6 Where a pulse output from a meter is to be used to derive loading information, the accuracy of the pulse output shall be included in the calibration.

4.4.2 Calibration test requirements

4.4.2.1 The meters shall, at least, be tested at the various load points as specified in Table 3 and Table 4 and the final error results shall be within the limits as indicated.

4.4.2.2 The reference conditions under which testing is to be performed shall be as stated in IEC 62058-31.

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

Table 3 — Calibration Limits for Active Energy Meters

1	2		3	4	5	6			
Load point	**Current**		**PF**	**Applicable for meter type**	**Load**	**Max. error limit for meters of class in %**			
	Direct connect meters	**Transformer operated meters**				**0.2S**	**0.5S**	**1**	**2**
1	5 % I_b	2 % I_n	1	Single and polyphase	Balanced	±0.4	±1.0	±1.5	±2.5
2	100 % I_b	100 % I_n	1	Single and polyphase	Balanced	±0.2	±0.5	±1.0	±2.0
3	100 % I_b	100 % I_n	0.5 lag	Single and polyphase	Balanced	±0.3	±0.6	±1.0	±2.0
4	100 % I_b	100 % I_n	1	Polyphase	Single phase [a]	±0.3	±0.6	±2.0	±3.0
5	100 % I_b	100 % I_n	1	Polyphase	Single phase [b]	±0.3	±0.6	±2.0	±3.0
6	100 % I_{max}	100 % I_{max}	1	Single and Polyphase	Balanced	±0.2	±0.5	±1.0	±2.0
	Note The licensee may request that the calibration tests be done in both directions for bidirectional metering applications.								

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

Table 4 — Calibration limits for reactive energy meters

1	2		3	4	5	6			
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 and 1	2	3
1	5 % I_b	2 % I_n	0	Single and polyphase	Balanced	±1.0	±1.5	±2.5	±4.0
2	100 % I_b	100 % I_n	0	Single and polyphase	Balanced	±0.5	±1.0	±2.0	±3.0
3	100 % I_b	100 % I_n	0,866 lag	Single and polyphase	Balanced	±1.0	±1.5	±2.0	±3.0
4	100 % I_b	100 % I_n	0	Polyphase	Single phase [a]	±0.7	±1.5	±3.0	±4.0
5	100 % I_b	100 % I_n	0	Polyphase	Single phase [b]	±0.7	±1.5	±3.0	±4.0
6	100 % I_{max}	100 % I_{max}	0	Single and Polyphase	Balanced	±0.5	±1.0	±2.0	±3.0
Note The licensee may request that the calibration tests be done in all four quadrants for bidirectional metering applications.									
[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.									

4.4.2.4 Calibration of a component shall be indicated by the attachment to the component of a calibration sticker that bears the following information:

a) the date of calibration;

b) the name of the accredited test laboratory that carried out the calibration;and

c) the reference number of the calibration report; and the serial number of the device tested.

4.4.3 Prepayment meter test requirements

4.4.3.1 It is acknowledged that it might not be practical to test every prepayment meter at an accredited test facility due to the large number of meters involved.

4.4.3.2 Prepayment meter manufacturers shall test for accuracy requirements at their manufacturing facility through the use of reference standards.

4.4.3.3 The reference standards shall be tested and certified at an accredited calibration facility.

4.4.3.4 The licensee shall perform batch testing on delivered prepayment meters in accordance with an acceptable statistical sampling method specified in ISO 2859-1.

4.4.4 Instrument transformer test requirements (CTs and VTs)

4.4.4.1 Instrument transformer manufacturers shall test for accuracy requirements at their manufacturing facility through the use of reference standards.

4.4.4.2 Multi ratio CTs shall be tested at all ratios.

4.4.4.3 Each unit shall have a calibration report that confirms compliance with the requirements of the relevant part of IEC 61869 and confirms that the component complies with the requirements of its accuracy class.

4.4.4.4 The reference standard shall be tested and certified at an accredited calibration facility.

4.4.4.5 The licensee shall perform batch testing on delivered instrument transformers.

4.5 Requirements for the design of metering installations

4.5.1 General

4.5.1.1 The metering equipment should be installed at the point of supply which defines the commercial boundary between the licensee and the customer. Where this is not possible, verifiable procedures shall be used to meter energy flows, adequately reflecting the flows at the point of supply.

4.5.1.2 Although this standard identifies separate items of equipment, items may be combined to perform the same task as in the case of the equipment specified, provided that the requirements of this standard are met.

4.5.1.3 Main and check metering equipment shall be installed in the case of all metering installations where the notified demand exceeds 10 MVA.

4.5.1.4 Back-up meters of the same class may be installed for other points at the discretion of the licensee.

4.5.1.5 Metering equipment used for revenue purposes (except measurement transformers and junction boxes) shall be accommodated in a clean and dry environment. The specified operating

range of the equipment shall be commensurate with the environmental conditions.

4.5.1.6 The accuracy of equipment shall be as specified in this standard, and the equipment shall be capable of the measurement of energy variables as required by the applicable tariff.

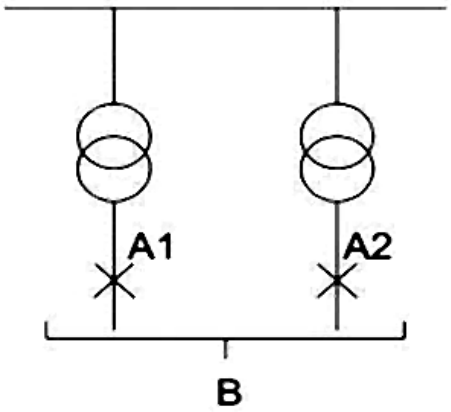
4.5.2 Accuracy class requirements

4.5.2.1 The accuracy class requirements for a metering point that consists of a meter(s) and associated instrument transformers are determined by the nominal size of the load, expressed in terms of apparent power, and are as specified in Table 5.

Table 5 — Requirements for meter and instrument transformer accuracy class requirement

1	2	3	4	5
Load	**Accuracy class**			
	Active energy meter	**Reactive energy meter**	**Current transformer**	**Voltage transformer**
> 100 MVA	0.2 S	0.5 S	0.2 (a)	0.2
10 MVA to < 100 MVA	0.5 S	1S	0.2 (a)	0.2
1 MVA to < 10 MVA	1	2	0.5	0.5
100 kVA to < 1 MVA	1	3	0.5	0.5
< 100 kVA and whole current	2	3	1 (Where applicable)	-
Note: Class 0.5 is acceptable at the lowest ratio of a multi-ratio current instrument transformer.				

4.5.2.2 These accuracy class requirements will be applicable to a point of measurement (PoM) and not necessarily to a point of delivery (PoD) (see Figure 2).



Note: A indicates PoMs while B stands for PoD

Figure 2 — Accuracy class requirements

4.5.2.3 Where the size of the load exceeds 100 MVA at the point of delivery (PoD), then metering shall be installed on all the points of measurement (PoMs) as defined in the >100 MVA row in Table 5.

4.5.2.4 Where the loading at a metering point is such that it covers operating conditions at very low loads and very high loads, then it is recommended that CTs of an accuracy class of 0.2 S, which have a much better accuracy range for measuring low and high loading conditions, are specified.

4.5.3 Instrument transformers

4.5.3.1 Current transformers

4.5.3.1.1 The current transformer cores shall be dedicated to metering, and measurement purposes only.

4.5.3.1.2 The CT ratio shall closely match the maximum load of the metering installation. The CT ratio setting used shall be appropriate for the maximum demand (MD).

4.5.3.1.3 The total burden on each current transformer shall be within the rated burden of the CT.

4.5.3.1.4 Where the condition or accuracy class (or both) of CTs already on site are unknown or the accuracy class is insufficient to meet the required overall accuracy requirements, and the cost of replacing them is substantial (particularly if it would require replacement switchgear), the following procedures shall be applied:

a) their replacement shall be at the discretion and financial responsibility of the licensee, by applying generally accepted engineering or other criteria; and

b) the CT accuracy shall be checked in situ (on site) by an appropriate method as part of the initial certification procedures for the metering installation.

4.5.3.2 Voltage transformers

4.5.3.2.1 Voltage transformers may be used for other purposes, such as protection, provided the overall accuracy and burden requirements are met.

4.5.3.2.2 The voltage transformer supplies to the meters shall be protected against the effects of short circuits by the use of fuses or miniature circuit breakers (MCBs). Any additional burdens shall be protected separately.

4.5.3.2.3 On low-voltage installations, the voltage supply to the metering equipment shall be protected as close as practicable to the point of supply.

4.5.3.2.4 Where the condition or accuracy class (or both) of existing VTs are either unknown or the accuracy class is insufficient to comply with the required overall accuracy requirements, and the cost of replacing them is substantial (particularly if it would require replacement switchgear), the procedures outlined for CTs (see 4.5.3.1.4) shall be followed for the VTs.

4.5.3.3.1 The burden of the voltage transformer shall be within specification or alternatively the licensee shall confirm that the accuracy class of the transformer remains valid at the actual burden.

4.5.3.3.2 The wiring arrangement (cabling) of the voltage transformer circuits shall be such that the associated voltage drop on the voltage transformer circuit wiring shall not contribute to the overall

measurement error by more than the accuracy class of the installed meter as shown in Table 6. For example, the maximum allowable error shall be 0.2 % for a class 0.2 installed meter.

Table 6 — Guide to voltage drop limits

1	2
Class of energy meter	**Voltage drops limit** (same as energy meter class)
Phase-to-neutral voltage (63.5 V)	
0.2	127 mV (0.2 %)
0.5	318 mV (0.5 %)
1	635 mV (1 %)
NOTE 1 Wiring should be at least rated 600/1 000 V phase-to-neutral. NOTE 2 The operating point of the VT should preferably be at least 25 % of the rated burden.	

4.5.3.3.3 Compliance with the voltage drop limits specified in Table 6 shall ensure that the accuracy of the metering installation is maintained under normal operating conditions. However, in order to protect metering equipment, including meters, instrument transformers, and associated wiring, against transient overvoltage, such as lightning impulses and switching surges, appropriate surge protection devices shall be installed. Such devices shall be selected, rated, and installed in accordance with IEC 60099-4.

4.5.3.3.4 4The surge protection provided shall not adversely affect the accuracy or performance of the metering system as specified in their relevant requirements of Table 1 and Table 2. The minimum requirements for lightning arresters applicable to metering installations are specified in Table 7.

Table 7: Minimum Requirements for Lightning Arresters.

Nominal System Voltage	**Max. Rated Voltage**	**Standard Lightning Impulse Withstand Voltage**	**Max. Continuous Operating Voltage**	**Max. Nominal Discharge Current**	**Maximum Line Discharge Class**		**Long Duration Current Impulse Withstand Capability**
[kV]	**[kV]**	**[kV]**	**[kV]**	**[kA]**	**IEC**	**ANSI**	**[KVA]**

13.8	15	95	12	10	CL 2	Station	100
34.5	36	170	29	10	CL 2	Station	100
69	72.5	325	58	10	CL 2	Station	100
115	123	550	98	10	CL 2	Station	100
138	145	650	116	10	CL 2	Station	100
230	245	900	196	10	CL 2	Station	100
500	525	1550	420	20	CL 4	Station	100

4.5.4 Meter panel ancillary equipment

4.5.4.1 General

The metering installation shall cater for test facilities that will allow for easy and safe maintenance activities.

4.5.4.2 Test blocks

4.5.4.2.1 All metering installations using instrument transformers shall be fitted with test blocks on the current transformer (CT) and voltage circuits. These shall be installed in close proximity to the meter(s).

4.5.4.2.2 Separate test terminal blocks or equivalent facilities shall be provided for the main meters and for the check meters of each circuit.

4.5.4.2.3 The test blocks shall allow the following operations to be performed without disturbing the current or voltage transformer circuit wiring:

- **a)** isolation of the meter from the current transformer circuit while short-circuiting the current transformer secondary terminals;
- **b)** isolation of the meter from the voltage transformer circuit while open-circuiting the voltage transformer secondary terminals;
- **c)** installation of an additional burden such as a check meter into the current and voltage transformer circuits; and
- **d)** secondary injection of current and voltage into the meter circuit.

4.5.4.2.4 Test blocks shall comply with appropriate standards and shall be insulation tested.

NOTE: The design and arrangement of test block connections should follow good engineering practice to ensure safety, reliability, and ease of testing. Particular attention should be given to maintaining continuity of current transformer circuits, correct sequencing of operations, and clear identification of terminals.

4.5.4.3 Voltage selection circuitry

4.5.4.3.1 The use of voltage selection circuitry is common at substations where the voltage supply can be obtained from multiple sets of VTs.

4.5.4.3.2 Where more than one set of voltage transformers can be used at a metering point of supply to supply a metering circuit, a selection relay scheme shall be installed that will direct the correct voltage supply to the meter at all times.

4.5.5 Meters

4.5.5.1 General requirements

4.5.5.1.1 Energy meters shall be configured such that the number of measuring elements is equal to or one less than the number of primary system conductors. These include the neutral conductor or the earth conductor (or both) where system configurations enable the flow of zero sequence energy.

4.5.5.1.2 Meters are classified according to meter type as given in Table 8.

Table 8 — Meter types and configuration

1	2	3
Meter type	**Configuration**	**Nominal voltage** V
Single-phase, whole current	Single -phase, two-wire	230
Single-phase, CT connected	Single -phase, two-wire	230
Three-phase, whole current	Three-phase, four-wire	230/400
Three-phase, CT connected	Three-phase, four-wire	230/400
Three-phase, VT and CT connected	Three-phase, three-wire or four-wire.	63.5/110

4.5.5.1.3 Where the condition of meters already on site is unknown, the following procedures shall be applied:

a) their replacement shall be at the discretion and financial responsibility of the licensee, by applying generally accepted engineering or other criteria; and

b) the meter accuracy shall be checked in situ by an appropriate method as part of the initial certification procedures for the metering installation.

4.5.5.2 Meter numbering

Meters shall be identified with a meter number as specified in annex A.

4.5.6 Metering installation design

4.5.6.1 General

A design report or design template shall be prepared by the metering designer in the case of a new metering installation and in the case where an existing metering installation is modified.

NOTE: A design template will be used typically in the case of less complex meter installations (e.g. those using direct connected meters), where the licensee has developed a standard design for repeated use for specific categories of customers.

4.5.6.2 Design report and design template

4.5.6.2.1 In the case of a new metering installation, the design report or design template shall contain the following information, where applicable:

a) the initial load of the metering installation;
b) the expected authorized capacity or expected notified maximum demand (NMD) of the metering installation;
c) the CT accuracy class, the volt ampere VA rating and specified burden;
d) the CT ratio;
e) the VT ratio and selected CT ratio;
f) the CT circuit burden;
g) the VT accuracy class, the VA rating and specified burden;
h) the VT circuit burden;
i) the CT and the VT earthing details;
j) the measured voltage drops across the secondary terminals of the VT to the meter;
k) the make, the model, version and accuracy of the meter;
l) the expected duration before register roll-over;
m) allocation of metering quantities to the meter's internal registers (interval data channel allocation);
n) external alarm points (e.g. main power supply failure) to be monitored by the meter;
o) means of monitoring unauthorized attempts to connect to the meter;
p) the make and model of the modem, if separate;
q) the calculated overall measurement uncertainty of the metering installation, and the method of calculation;
r) compensation arrangements, if any;
s) fusing details;
t) standards complied with (electrical and communications);
u) types of enclosure (including IP rating, where appropriate);
v) additional steps taken to minimize electromagnetic interference, if applicable;
w) special tests required;
x) non-metering equipment (distributor's equipment only) connected to measurement circuits;
y) confirmation that equipment is suitable for the environment in which it will operate; and
z) other relevant information.

4.5.6.2.2 Where an existing metering installation is being modified, the design report or design template may contain only relevant topics from the list in 4.5.6.2.1.

4.5.6.2.3 The report or template shall be accompanied by a drawing of the system for use by installation personnel. Both the design report or template and the drawing shall identify and be signed by the designer. The design report or template and the drawing shall be checked to ensure that the proposed metering installation will function correctly and that it complies with the requirements of this standard and any other relevant codes.

4.5.6.2.4 The person who carries out these checks shall sign the design report or template and the drawing to confirm that the checks have been carried out.

4.5.6.2.5 Installation personnel shall use a design checklist as specified in annex B to record metering installation information and to confirm that the installed equipment complies with the design.

4.6 Requirements for the installation of metering equipment

4.6.1 General

4.6.1.1 Except as otherwise provided for in this standard, only employees of licensees or authorized agents who have been certified as meter workers (see annex C) shall be permitted to carry out any work on, or make direct connections to, components of a metering installation or to take any action which might have an effect on any such components. Such work shall be restricted to the class of meter worker applicable to the category of metering installation. This requirement shall not include visual inspections of categories 1 and 2 metering installations.

4.6.1.2 When a metering installation is certified, the certification shall apply to the functional integrity of the metering installation as a whole. metering equipment shall be installed to comply with the requirements of this standard.

4.6.2 Meter panel (enclosure)

4.6.2.1 Metering equipment shall be housed in an enclosure designed to limit the ingress of dust, moisture, and vermin, in accordance with applicable standards such as IEC 60529."

4.6.2.2 In both indoor and outdoor situations, unauthorized access to wiring terminals and equipment shall be prevented. Access to the components of the metering equipment shall be suitably restricted by means of locks and seals.

4.6.2.3 The meter panel shall be situated such as to allow safe access to the components of the metering circuit.

4.6.3 Instrument transformer earths

4.6.3.1 Earthing of secondary instrument transformer circuits shall be in accordance with the earthing requirements of the metering configuration used.

4.6.3.2 Wherever practicable, all CT secondary wiring shall be terminated in the metering panel.

4.6.3.3 Wherever practicable, all VT secondary wiring shall be terminated as near as possible to the VT, usually in the VT junction box.

4.6.4 Wiring loom

4.6.4.1 The wiring loom shall be cabled as directly as practicable and should, wherever possible, be without intermediate terminations for all CT and VT wiring.

4.6.4.2 Where intermediate terminations are unavoidable, they shall be housed within sealable enclosures.

4.6.4.3 Wiring terminations between the test block and the meters shall be kept to a minimum.

4.6.4.4 The wiring shall be suitably rated and of such length that the maximum burden capabilities of the measurement transformers are not exceeded. See the guide in Table 6 for requirements (i.e. a minimum of 2.5 mm^2 for 1A circuits and 4 mm^2 for 5A circuits).

4.6.5 Measurement of current

In the case of low-voltage supplies where CTs are located within a switchboard, CTs shall be mounted securely within an enclosure that can be sealed against interference and unauthorized access. If the switchboard does not have a separate enclosure for the CTs, the CTs shall be fitted with sealable terminal covers.

4.6.6 Measurement of voltage

4.6.6.1 All meter potential supplies shall be adequately protected by appropriate fuses or circuit-breakers dedicated to the metering circuit.

4.6.6.2 Circuits shall be capable of withstanding fault levels that exist at the metering installation.

4.6.6.3 Where a VT supply loads external to the metering installation, these loads shall not be added to or be modified without the prior approval of the approved test laboratory or the institution responsible for the metering installation. The total burden on any VT shall not exceed its rating at the rated secondary current.

4.7 Requirements for the commissioning of the metering installation

4.7.1 General requirements

4.7.1.1 Except as otherwise provided for in this standard, only employees of licensees or authorized agents who have been certified as meter workers (see annex C) shall be permitted to carry out any work on, or make direct connections to, components of a metering installation or to take any action which might have an effect on any such components. Such work shall be restricted to the class of meter worker applicable to the category of metering installation. This requirement shall not include visual inspections of categories 1 and 2 metering installations.

4.7.1.2 In the case of a new metering installation that has all new components, the design shall be checked to ensure functionality and compliance with this standard.

4.7.1.3 In the case of an existing installation that is to become a metering installation for billing, all components shall be individually certified.

4.7.2 Commissioning report

4.7.2.1 Metering installation that is to be used for billing shall be tested for compliance with the relevant requirements of this standard by the licensee or its agent. This testing shall be confirmed by the compilation of a comprehensive commissioning report. (Annex B provide a list of the information to be recorded in a commissioning report.)

4.7.2.2 The commissioning report of the metering installation will be valid as long as the calibration of all components of the metering installation remains current. Where it considers such action appropriate, the licensee or its agent may set a review period for the verification of compliance of the installation which is shorter than any period dictated by the calibration periods of any of its components.

4.7.2.3 Calibration reports for each of the applicable components of the metering system are required as part of the input to the commissioning report for the entire metering installation. These reports shall give both the error and the uncertainty in that error for an adequate number of points of the full range of use of any component of a metering installation and shall demonstrate compliance with the requirements for the maximum permitted percentage of error of each of the components of the metering installation.

4.7.2.4 Records of all tests carried out under the provisions of this subclause shall be kept in accordance with the relevant requirements in annex C.

4.7.3 Commissioning requirements

4.7.3.1 Instrument transformer functional verification check

4.7.3.1.1 CTs and VTs shall be initially certified as stated in 4.4.4 but need to be tested on site to confirm the original tests and to confirm that the CT or VT is still functional.

4.7.3.1.2 Reference standards shall be used to confirm the functionality and accuracy of installed CTs and VTs.

4.7.3.1.3 The accuracy class index of the reference standards used in verifying the accuracy of

installed metering equipment shall, as a minimum, be two times better than that of the installed CT or VT.

4.7.3.1.4 commissioning tests include the following:

a) insulation tests;
b) magnetizing tests;
c) accuracy tests – both for ratio and phase angle;
d) polarity tests; and
e) if any in-situ verification test shows that an instrument transformer is outside the required specification limits, then the instrument transformer shall be replaced.

NOTE : Measurement transformer errors are the major cause of metering errors in the metering installation.

4.7.3.2 Meter functional verification check

4.7.3.2.1 Meters shall be initially certified as stated in 4.4.1, but need to be tested on site to confirm the original tests and to confirm that the meter is still functional.

4.7.3.2.2 Reference standards shall be used to confirm the functionality and accuracy of installed meters.

4.7.3.2.3 The accuracy class index of the reference standards used in verifying the accuracy of installed metering equipment shall, as a minimum, be two times better than that of the installed meters.

4.7.3.2.4 The accuracy of the meter shall be verified. This can either be done by checking the accuracy at the existing loading conditions or through secondary injection.

4.7.3.2.5 If any in-situ verification test shows that a meter is outside the required error limits, then the meter shall be replaced.

4.7.3.2.6 All pulse outputs that may be used in the metering installation shall be included in the testing process.

4.7.3.2.7 The meter shall be configured with the correct tariff scheme and CT and VT ratios (where applicable).

4.7.3.3 metering circuit burden check

4.7.3.3.1 This check is applicable to transformer driven meters.

4.7.3.3.2 Two values shall be checked when determining voltage circuit burdening, namely the voltage drop across the voltage leads from the VT to the energy meter, and the burden on the VT itself.

4.7.3.3.3 If the calculated voltage drop is higher than the values listed in table 6, then testing shall be done to confirm results and corrective action shall be done to limit the loading on the cables where

required.

4.7.3.3.4 The total VT and CT burdens shall be calculated by using measured current and voltage values. The calculated burdens shall be within the rated burden of the instrument transformer.

4.7.3.4 Phase rotation check

4.7.3.4.1 This check is applicable to transformer driven meters.

A phasor diagram shall be compiled in order to verify the correctness of the metering installation.

4.7.3.5 Meter data verification

The meter register advances shall be compared with the data captured in the billing system after the customer has taken load.

4.7.3.6 Time of Use meters (ToU)

4.7.3.6.1 Any type of metering equipment used where energy usage or demand (or both) based on fixed time intervals are determined, shall maintain time offsets not exceeding 5 min from East African Standard Time (ST) at any moment.

4.7.3.6.2 The meter time shall be set in accordance with the East African Standard Time (EAST) and calendar.

NOTE The time offset for certain customer metering equipment may be stricter and should be determined through relevant customer contracts.

4.7.4 Re-commissioning of an installation

If any part of the wiring of the metering installation is modified or replaced, or if additional components are connected to the metering installation (other than testing or monitoring equipment temporarily connected via the test block), the commissioning report of the metering installation shall be deemed to be invalid. A new commissioning report shall be issued after the tests and checks required by this standard have been satisfactorily carried out.

4.8 Requirements for the maintenance of metering installations

4.8.1 General

4.8.1.1 Except as otherwise provided for in this standard, only employees of licensees or authorized agents who have been certified competent by the licensee (see annex C) shall be permitted to carry out any work on, or make direct connections to, components of a metering installation or to take any action which might have an effect on any such components. Such work shall be restricted to the competence levels applicable to the category of metering installation. This requirement shall not include visual inspections of categories 1 and 2 metering installations.

4.8.1.2 Records shall be kept of results of tests performed during planned/breakdown maintenance, investigations, etc.

4.8.1.3 Percentage deviations found through testing shall be within the limits specified by the accuracy class of the equipment. If abnormal deviations are found on the metering equipment, then they shall be replaced and the installation re-commissioned.

4.8.1.4 4.8.1.4 To avoid the introduction of faults, all test methods should be non-intrusive where possible.

4.8.1.5 The accuracy class index of the reference standard used in verifying the accuracy of installed metering equipment shall, as a minimum, be two times better than that of the installed meter.

NOTE That the uncertainty of the reference standard influences the pass or fail limits of the test.

4.8.2 Frequency of maintenance and testing of metering equipment

4.8.2.1 Metering equipment shall be verified and refurbished, as necessary, at intervals not exceeding those specified in Table 9.

Table 9— Intervals for periodic verification of metering installations

1	2
Load	**Maintenance interval** (years)
> 100 MVA	5
10 MVA to < 100 MVA	5
1 MVA to < 10 MVA	10
100 kVA to < 1 MVA	10
< 100 kVA	10

4.8.2.2 Metering installations at generation plants shall be maintained according to their outage schedules.

In the case of whole current (direct connected) meters connected to loads < 100 kVA, the verification interval specified need not apply, provided that the utility has in place a sampling plan based on industry standards such as ISO 2859-1, which can demonstrate the statistical confidence that the accuracy of the meter population for that category of meters is within limits. It is recommended that such sampling plans be part of an obsolescence strategy, if replacement of meters is being considered. The results of such sampling plans shall be kept for at least five years and made available to the relevant recognized accreditation body on request.

4.8.3 Maintenance requirements

4.8.3.1 Instrument transformer functional verification check

4.8.3.1.1 The ratio of CTs and VTs shall be verified.

4.8.3.1.2 If the original CT or VT test and calibration certificates are not available, then an outage shall be arranged and an accuracy test shall be done with modern instrument transformer test equipment.

4.8.3.1.3 If the verification tests indicate a possible error, then an outage shall be arranged and an accuracy test shall be done with modern instrument transformer test equipment.

4.8.3.1.4 Capacitive voltage transformers (CVTs) shall be periodically tested in accordance with the manufacturer's specifications.

NOTE Instrument transformer errors are the major cause of metering errors in the metering installation.

4.8.3.2 Meter functional verification check

4.8.3.2.1 The accuracy of the meter shall be verified. This can either be done by checking the accuracy at the existing loading conditions to a reference standard or through secondary injection.

4.8.3.2.2 If there are no records found that the meter has been tested originally, then the meter shall be replaced and returned to an accredited calibration laboratory for calibration at reference conditions.

4.8.3.2.3 If any in-situ verification test cannot confirm a meter to be within the required error limits when taking the uncertainty into consideration, the meter shall be returned to an accredited calibration laboratory for calibration at reference conditions. If it can be shown that the prevailing influence quantity conditions are sufficiently different to the reference conditions to have caused the meter to be outside of the required error limits, the meter may be left in operation as long as these influence quantity conditions are temporary. A permanent signed record shall be kept and shall contain the calculations and observations to justify this and shall state that the influence quantities are temporary. If the meter is found to exceed the accuracy limits at reference conditions, it shall be adjusted if possible or replaced. Records shall be kept of pre-adjustment and post-adjustment readings.

4.8.3.3 Metering circuit burden check

4.8.3.3.1 This check is applicable to transformer driven meters.

4.8.3.3.2 Two values shall be checked when determining voltage circuit burdening, namely the voltage drop across the voltage leads from the VT to the energy meter, and the burden on the VT itself.

4.8.3.3.3 If the calculated voltage drop is higher than the values listed in table 6, then testing shall be done to confirm results and corrective action shall be done to limit the loading on the cables where required.

4.8.3.3.4 The total VT and CT burdens shall be calculated by using measured current and voltage

values. The calculated burdens shall be within the specified values.

4.8.3.3.5 Where the actual burden is found to be outside the instrument transformer specification appropriate measures shall be taken.

4.8.3.4 Phasor check

4.8.3.4.1 This check is applicable to transformer driven meters.

4.8.3.4.2 A phasor diagram shall be compiled in order to verify the correctness of the metering installation.

4.8.3.5 Meter data verification

Check the meter register advances with the data captured in the billing system.

4.8.3.6 Time of Use meters (ToU)

a) Any type of metering equipment used where energy usage or demand (or both) based on fixed time intervals are determined, shall maintain time offsets not exceeding 5 min from East African Standard Time (EAST) and Calendar at any moment.

b) The meter time shall be set in accordance with the East African Standard Time (EAST) and synchronize where required.

NOTE The time offset for certain customer metering equipment may be stricter and should be determined through relevant customer contracts.

4.8.4 Failure of tests

4.8.4.1 Once a fault is identified, it shall be comprehensively documented for future reference before it is rectified. If the metering installation fails the tests, the faulty component or components shall be identified and replaced with equivalents which have been recently calibrated and certified as compliant with the requirements of this standard.

4.8.4.2 The tests shall then be repeated to confirm that the faulty component or components have been eliminated.

4.8.5 Overall accuracy requirements for metering installations

Generally, it is impracticable to accurately determine the overall metering installation accuracy from the errors of its components. It is accepted that it is a minimum requirement that every component shall meet the required accuracy and that the installation is constructed, commissioned and maintained in such a manner as to ensure metering accuracy.

4.8.6 Retention period for calibration certificates

Calibration certificates shall be kept for the lifetime of the equipment and for a further five years after decommissioning.

4.9 Automated meter reading (AMR) for large power users

4.9.1 Automated meter reading (AMR) for large power users (LPUs) should be based on internationally recognized standards, including the IEC 62056 series for communication and data exchange, supported by relevant metering standards highlighted in this document.

4.9.2 Licensees may use these documents in developing their own AMR system.

4.10 Metering for Embedded Generators

4.10.1 Three metering configurations are known in the case of premises where embedded generators are operated. Dependent on the tariff structure required or implemented by the supplier. The details are given in 4.10.2 and 4.10.3.

4.10.1.1 The utility will advise what metering is required based on the application and location of the embedded generator.

4.10.1.2 Where applicable (manual reading), suitable signage will be attached at the meter, indicating that import and export registers need to be read.

4.10.2 Single-quadrant meter installation

4.10.2.1 For a single meter arrangement, the EG feeds into the customer network, offsetting the customer's own consumption. If the customer is a net electricity importer from the utility, the cumulative consumption meter reading will increase. If the customer is a net exporter, the cumulative consumption meter reading decreases.

4.10.2.2 As a result of using a single meter, the overall consumption and generation of the customer is not recorded. The net import and export of energy is metered and balanced over the metering period.

4.10.2.3 A net meter records and balances energy in a single register. An alternative to the net meter is a bi-directional meter which records energy import and export in separate registers. The registers need to be balanced off against each other to provide the necessary information to the billing system. Separate register meters may be preferred by utilities for reasons of revenue protection.

4.10.3 Multiple meter installation

Note: The feed-in tariff may be worded differently in policy documents, however, the principle is discussed in this section.

4.10.3.1 Feed-in Tariff (FiT) metering records all the energy generated from the embedded generator and reimburses the EG customer at the set FiT. The consumption of the EG customer is recorded in full and billed in the conventional manner. A customer with embedded generation and consumption therefore requires two meters or a bi-directional active energy meter that records energy flow in both directions.

4.10.3.2 The metering configuration for FIT metering is referred to as "separate metering". An existing consumption meter, whether prepayment or conventional, can remain in place. The

embedded generation meter shall be a bi-directional active energy meter that records energy flow in both directions.

4.10.3.3 This metering configuration records overall consumption and overall Embedded Generation (EG) which is exported to the utility network.

4.10.3.4 In the case where the output of the EG cannot physically be taken to the main distribution board of the customer's premises, an EG meter may be embedded in the customer's network. The overall generation of the EG is recorded in the bi-directional embedded generation meter while the overall consumption is balanced off between the net meter and the EG meter. The net meter shall be a bi-directional meter.

4.10.4 Types of Meters

4.10.4.1 Energy meters used in conjunction with embedded generation shall record active energy. The meters shall be bi-directional type meters. The meters can either be of the single or the separate register type.

4.10.4.2 The current specification for pre-payment meters does not cater for embedded generation.

4.10.4.3 In the event that installations with embedded generators are required to record reactive energy in conjunction with active energy, four-quadrant electronic meters shall be utilized.

4.10.4.4 Meters with the capability of metering quality of supply parameters shall activate the monitoring facility on the meter.

4.11 Sealing of metering equipment

Access to any equipment that makes up part of a metering system shall be restricted through the use of appropriately controlled locks and seals.

5 Billing data collection and transmission

5.1 Frequency of meter reading

The licensee shall be accountable for meter reading of credit meters at minimum intervals as listed in Table 10.

NOTE: Prepayment metering is excluded from this subclause, but some AMR systems might include meters that can be configured as both credit meters and prepayment meters.

Table 10 — Periodic meter reading intervals

1	2
Load	**Meter reading interval**

> 100 MVA	Daily
10 MVA to < 100 MVA	Weekly
1 MVA to < 10 MVA	Monthly
100 kVA to < 1 MVA	Monthly
< 100 kVA	Monthly

5.2 Meter data retention period

The licensee shall be accountable to retain meter billing information (historical billing information) for a period of at least five years.

5.3 Data to be downloaded

5.3.1 Communication integrity

All data transmissions shall employ techniques to ensure the integrity of the data transmitted and received.

5.3.2 Archiving of metering information

5.3.2.1 All downloaded metering information shall be archived in such a manner that it cannot be altered without leaving a detailed audit trail, and that a copy of the raw meter data is kept by the utility or independent meter operator for a minimum period of five years. This raw meter data shall be available on request.

5.3.2.2 The distributor licensee or independent meter operator shall ensure that procedures are in place to minimize the possibility of such raw meter data being accessed by unauthorized personnel, and to ensure that the raw meter data cannot be modified in any way. The means of storage of the raw meter data shall be such that any access to it is recorded.

5.3.3 Interrogation log

5.3.3.1 An interrogation log shall be generated to record details of all interrogations. This log shall form part of the interrogation audit trail and shall contain the following:

a) the date of interrogation;
b) the time of commencement of the interrogation;
c) the status of the interrogation attempt, i.e. attempt failed/was successful;
d) the operator ID (where appropriate);
e) the meter/data logger ID (where appropriate);
f) clock updated (where appropriate) and extent of change;
g) clock errors outside the range specified;

h) the method of interrogation (e.g. automatically, handheld); and

i) the ID of the handheld computer used for interrogation (where applicable).

Note: In cases where the interrogation of a failed meter is technically impossible, the historical consumption pattern shall be used to determine the amount of credit that may have been in the meter.

5.3.3.2 When there is a requirement for interrogation, the utility shall ensure that all interrogations are carried out within 30 calendar days.

5.3.3.3 The licensee shall share interrogation logs as and when requested by the customer within 21 working days.

5.4 Data validation

5.4.1 General

5.4.1.1 All raw meter data shall be checked for validity at regular intervals or at a frequency that will allow a further interrogation of the meter (or both) before the data is overwritten within the meter and before this data can be used for any purpose.

5.4.1.2 Validity checks shall include the following, as a minimum:

a) checks for missing data;

b) checks for invalid dates and times;

c) checks of zero consumption levels;

d) comparisons with standard or previous consumption patterns;

e) checks of the sum of demand values against the register advance; and

f) investigations of any meter error code.

5.4.1.3 Comparisons with meters and meter registers through to the billing system shall be made at intervals as specified in Table 11.

Table 11 — Time intervals for meter and meter register comparisons to billing system

1	2
Load	**Meter and meter register comparison time interval** [a]
> 100 MVA	Yearly
1 MVA to < 100 MVA	Two-yearly
< 1 MVA	Five-yearly
[a] These requirements are only applicable, where customers are billed on profile data.	

5.4.2 Data estimation

Data estimation will be required where actual meter readings are not available. TZS 1374 specifies the requirements for estimating meter readings.

5.4.3 Raw meter data integrity

In correcting any working data, the raw meter data shall be protected from being changed. In cases where raw meter data needs to be changed, it shall be archived.

5.4.4 Journals

In all cases where data is corrected or altered, a journal shall be automatically generated and archived with the raw meter data file. The journal shall contain the following, as a minimum requirement:

a) the date of the correction/alteration;

b) the time of the correction/alteration;

c) the ID of the operator;

d) the identification of the demand periods of data corrected/altered;

e) the technique used to arrive at the corrected/altered data; and

f) the reason for the correction or alteration.

5.5 Data transmission

5.5.1 General

5.5.1.1 Transmissions and transfers of metering information between parties and their agents (bureaux and test laboratories) shall be carried out electronically. The format and structure of transmitted files shall be agreed upon, in writing, by the parties before communications takes place.

5.5.1.2 Recognized and secure transmission media shall be used. Disks may be used only in emergency situations.

5.5.1.3 A complete audit trail shall exist for all data gathering, validation and processing functions. This audit trail shall apply to all archived data for a period of five years.

5.5.2 Logs

Logs of communications and processing activities shall form part of the audit trail. This shall apply most particularly where automated processes are in operation. Logs shall include the following, as a minimum:

a) an activity identifier;

b) the date and time of the activity; and

the operator identifier.

5.5.3 Storage media

Logs may be printed and filed as hard copy or maintained as data files, in a secure form, along with other archived information.

5.6 Confidentiality and security

5.6.1 General

The information is of an extremely sensitive nature, and security guidelines given in 5.6.2 to 5.6.8 (inclusive) shall be observed. The requirements of this standard shall be complied with at all times.

5.6.2 Personnel

Only authorized personnel shall have access to meter data.

5.6.3 Networks

Processing and interrogation systems connected to local or wide area networks shall have strict controls placed on those authorized to have access to data.

5.6.4 Back-ups

5.6.4.1 Appropriate back-up routines shall be established to ensure that data is kept secure at all times. Security and confidentiality requirements for back-up files shall be the same as for the original raw meter data files.

5.6.4.2 The timing of back-ups shall be dependent on the frequency of data logger interrogation and the number of days of storage maintained by the data loggers.

5.6.4.3 The storage location of the back-up data shall not be the same as that of the raw data.

5.6.5 Software

5.6.5.1 A register shall be kept of all copies of the software used in the data gathering or programming processes and the communication of meter data. All such software shall be password protected.

5.6.5.2 The register shall include a list of persons authorized to use each application.

5.6.6 Hardware

5.6.6.1 Appropriate security, such as a password in the basic input/output operating system (BIOS), shall be incorporated so that hardware cannot be operated should it be lost or stolen.

5.6.6.2 Hardware involved in interrogation shall be located in an access-controlled environment.

5.6.7 Passwords

5.6.7.1 Passwords shall be employed in such a manner that the password offered shall determine the level of access to the information or software within the interrogation and processing system.

5.6.7.2 It is preferred that a control register for the allocation of passwords is kept up to date by the licensee for auditing purposes.

5.6.7.3 Where access to meter data is provided on public networks, such as the internet the username and password exchange shall be done on secure protocols.

5.6.8 Bureaux services

The use of bureaux by licensees to carry out installation, interrogation and processing functions is acceptable. However, the licensees remain responsible for compliance with the requirements of this standard, and, therefore, the compliance thereof by such agents.

6 Site Equipment Identification Number (SEIN)

6.1 Objectives

The objectives of establishing a standard numbering system for identifying and numbering Metering Installations and its individual equipment are:

a) To facilitate the location of Metering Installations for administrative purposes by reflecting the geographical location of the Metering Installation in its Site Equipment Identification Number; and
b) To facilitate the identification of Metering Installations whose details are recorded in the Metering Database administered by the DNO and/or the TNSP

6.2 Guidelines

The Metering Services Providers shall follow the procedures when numbering and identifying Metering Installations and its individual equipment. This includes the naming convention that the Metering Service Providers must comply with when naming their Metering Installations.

6.3 Naming Procedures

6.3.1 Station or Plant ID

6.3.1.1 The ID for substations and Generating Plants connected to the national Grid shall be the first three (3) letters of their name. See example below:

Substation or Generating Plant	Station or Plant ID
Nyakato	NYA
Mwanza	MWA
Geita	GEI
Nymungu	NYM
JNHPP	JNH

6.3.1.2 On instances where substations and Generating Plants will have identical Station or Plant IDs based on the procedure above, the Station or Plant ID of the succeeding substations or Generating Plants alphabetically shall be the first letter of their name followed by two consonant letters in their name. The consonant letters that will be prioritized are those that are nearest to the start of the name. The consonant letters shall also appear in the Station or Plant ID in the order that it appears in the name of the substation or Generating Plant. See example below:

Substation or Generating Plant	ID 1	ID 2	ID 3	ID 4	ID 5	Station or Plant ID

Nyakato	NYA					NYA
Nyakanaz	NYA	**NYK**				NYK
Nyamongo	NYA	NYM				NYM

6.3.1.3 If no combination of consonant letters from the name of a substation or Generating Plant provides it a unique Station or Plant ID, the Station or Plant ID of the substation or Generating Plant shall be the first letter of its name followed by the next consonant in its name and the farthest letter in the alphabet that would provide the substation or Generating Plant a unique Station or Plant ID. See example below:

Substation or Generating Plant	**ID 1**	**ID 2**	**ID 3**	**ID 4**	**ID 5**	**Station or Plant ID**
Cabacungan	CAB					CAB
Cabagan	CAB	**CBG**				CBG
Substation or Generating Plant	**ID 1**	**ID 2**	**ID 3**	**ID 4**	**ID 5**	**Station or Plant ID**
CAT	CAT					CAT
Catbalogan	CAT	**CTB**				CTB
Catigbi-An	CAT	**CTG**				CTG
Catubig	CAT	**CTB**	**CTG**	**CBG**	CTZ	CTZ

6.3.1.4 For Generating Plants that form a complex, their Plant ID shall be the first letter of the name of the complex followed by the next consonant in the name of the complex and the first letter in the alphabet that would provide the Generating Plant a unique Plant ID. See example below:

Substation or Generating Plant	**Station or Plant ID**
Mak-Ban Plant A	MKA
Mak-Ban Plant B	MKB
Mak-Ban Plant Ormat	MKO

6.3.1.5 For substations or Generating Plants whose name begins with La, Mt., San or Sta., their Station or Plant ID shall be the first letter of the words La, Mt., San or Sta. followed by the first two letters of the word after the words La, Mt., San or Sta. See example below:

Substation or Generating Plant	**Station or Plant ID**

La Trinidad	LTR
Mt. Apo	MAP
San Roque	SRO
Sta. Clara	SCL

6.3.2 Metered Participant ID

The following guidelines shall be followed when determining the ID of a Metered Participant:

6.3.2.1 The Metered Participant shall be identified by four (4) alphanumeric characters except for alternatives provided in the section above.

6.3.2.2 The Metered Participant whose full name corresponds to a three-letter abbreviation shall be that three-letter abbreviation appended by the zero (0) character. See example below:

Participant' Name	**Metered Participant ID**
American Power Conversion	APC0
Bank of the Zanzibar	BZ0
Cultural Center of the Tanzania	CCT0

6.3.2.3 The Metered Participant whose corporate name is composed of only one or two words shall be the first letter of the first word, the succeeding two (2) consonants of the first word, and the first letter of the second word or the zero (0) character. See example below:

Participant's Name	**Metered Participant ID**
Amerton, Inc.	AMRI
Ayala Corp.	AYLC
Lancaster	LNC0
Magic Mall	MGCM
TIMEX	TMX0

6.3.2.4 The Metered Participant whose name consists of four (4) letters or less shall be its name itself appended by the zero (0) character, if necessary. See example below:

Participant's Name	**Metered Participant ID**
PHPC	PHPC

6.3.2.5 The Metered Participant that has numeric characters in its corporate name shall be the numeric characters and the abbreviation of the alphabetic characters. See example below:

Participant' Name	Metered Participant ID
14-678 PROPERTY HOLDINGS INC.	146PH
1590 ENERGY CORPORATION	159EC
18-2 PROPERTY HOLDINGS INC	182PH
19-1 REALTY CORPORATION	191RC
6-24 PROPERTY HOLDINGS INC.	624PH
6-3 PROPERTY HOLDINGS INC.	63PHI
21ST CENTURY STEEL MILLS, INC.	21CSM

6.3.2.6 The Metered Participant that has several facilities in its name shall be composed of six (6) alphanumeric characters. The Metered Participant ID shall be the combination of three (3) alpha-numeric characters corresponding to the abbreviation of their corporate name, two (2) numeric characters corresponding to the facility number, and one (1) numeric character corresponding to the Metering Installation in that location. See example below:

Participant' Name	Metered Participant ID
ROBINSONS LAND CORP., Dodoma	RLC011
ROBINSONS LAND CORP., Mbeya	RLC021
ROBINSONS LAND CORP., Mbeya	RLC022
ROBINSONS LAND CORP., Tanganyika	RLC031
ROBINSONS LAND CORP., Tabora	RLC041
ROBINSONS LAND CORP., Zanzibar	RLC051
ROBINSONS LAND CORP., Zanzibar	RLC052
ROBINSONS LAND CORP., Zanzibar	RLC053
ROBINSONS LAND CORP., Zanzibar	RLC054
ROBINSONS LAND CORP., Zanzibar	RLC055
ROBINSONS LAND CORP., Zanzibar	RLC056
ROBINSONS LAND CORP., Zanzibar	RLC057
ROBINSONS LAND CORP., Dar es Salaam	RLC061
ROBINSONS LAND CORP., Dar es Salaam	RLC062
ROBINSONS LAND CORP., Dar es Salaam	RLC063
ROBINSONS LAND CORP., Kilimanjaro	RLC071
ROBINSONS LAND CORP., Nwanza	RLC081

ROBINSONS LAND CORP., Mtwara	RLC091
ROBINSONS LAND CORP., Tanga	RLC101
ROBINSONS LAND CORP., Lindi	RLC111

6.4 Grid – Connected Metering Installation

A Metering Installation of a facility that is directly connected to the national Grid, or a Grid-Connected Metering Installation, and its equipment shall be labeled as specified in this Section.

6.4.1 Grid-Connected Metering Installations shall be labeled as:

A-BBB-CCCC-XX

Where,

A: Shall be a one-letter (1) designation of the purpose or function of the *Metering Installation*. Refer to Table B-1 for the designation of the *Meter* purpose.

BBB: Shall be a three-letter (3) designation of the substation or *Generating Plant* where the *Metering Installation* is connected to. Refer to Section 3.4.1 for the procedure on the determination of the Station or Plant ID of a substation or *Generating Plant*.

CCCC: Shall be a four-letter (4) designation of the Metered *Participant*. Refer to Section 3.4.2 for the procedure on the determination of the Metered Participant.

XX: Shall be a two-digit (2) number identifying the delivery or receiving point of the grid-connected *Participant*. Starting from 01, this number shall increase in accordance with the number of delivery or receiving points of the same *Participant* on the same substation or *Generation Plant*.

Example:

M-CHA-CEPA-01

Where,

M Main Grid-Connected Metering Installation Purpose Designation

CHA Station ID of Chalinze Substation

CEPA Metered Participant ID of CEPALCO

01 Receiving Point No. 1 of CEPALCO in Chalinze Substation

6.4.2 Grid-Connected Meters shall be labeled as:

DDY-(A-BBB-CCCC-XX)

Where,

DD Shall be a two-letter (2) designation of the purpose of the Meter. Refer to Table B-1 for the designation of Meter purposes.

Y Shall be a one-digit (1) designation for the purpose or function of the Meter (1 – Delivered or OUT, 2 – Received or IN, 3 – Bi-directional or IN & OUT)

(A-BBB-CCCC-XX) Shall be the Standard Equipment Identification Number of the Metering Installation where the Meter box is located.

Example:

MF3-(M-CHA-CEPA-01)

MF	Multi-Function Electronic Meter Designation
3	Bi-Directional (IN & OUT) Designation
(M-CHA-CEPA-	Site Equipment Identification Number of the Metering
01)	Installation where the Meter is located

6.4.3 Meter boxes shall be labelled as*:*

DD3-(A-BBB-CCCC-XX)

Where,

DD:	Shall be the two-letter (2) designation for Meter box. Refer to Table B-2 for the designation of metering equipment, devices and auxiliaries.
(A-BBB-CCCC-	Shall be the Standard Equipment Identification Number
XX)	of the Metering Installation where the Meter box is located

Example:

MB3-(M-CHA-CEPA-01)

Where,

MB	Meter Box Designation
3	Bi-Directional (IN & OUT) Designation
(M-CHA-CEPA	Site Equipment Identification Number of the Metering
01)	Installation where the Meter box is located

6.4.4 Meter test switches shall be labelled as:

DDYY-(A-BBB-CCCC-XX)

Where,

DD: Shall be the two-letter (2) designation for Meter test switch. Refer to Table B-2 for the designation of metering equipment, devices and auxiliaries.

YY: Shall be a two-digit (2) designation for the equipment number.

(A-BBB-CCCC-XX): Shall be the Standard Equipment Identification Number of the Metering Installation where the Meter test switch is located

Example:

TS01-(M-CHA-CEPA-01)

Where,

TS:	Meter Test Switch Designation
01:	Meter Test Switch No. 1

(M-CHA-CEPA01): Site Equipment Identification Number of the Metering Installation where the Meter test switch is located

6.4.5 Current Transformers, Voltage Transformers and lightning arresters shall be labelled as:

PDD-(A-BBB-CCCC-XX)

Where,

P Shall be a one-letter (1) designation for the phase where the Current Transformer, Voltage Transformer or lightning arrester is connected (A – Phase A, B – Phase B, C – Phase C, Z – Three-Phase or 3φ)

DD Shall be the two-letter (2) designation for the Current Transformer, Voltage Transformer or lightning arrester. Refer to Table B-2 for the designation of metering equipment, devices and auxiliaries.

(A-BBB-CCCC-XX) Shall be the Standard Equipment Identification Number of the Metering Installation where the Current Transformer is located.

Example: **ACT-(M-CHA-CEPA-01)**

Where,

A Phase A Designation

CT Current Transformer Designation

(M-CHA-CEPA-01) Site Equipment Identification Number of the Metering Installation where the Current Transformer is located

6.5 Embedded Metering Installation

A Metering Installation of a facility that is directly connected to Electricity Distribution System or End User System, or an Embedded Metering Installation, and its equipment shall be labeled as specified in this Section.

6.5.1 Embedded Metering Installations shall be labelled as **WWW-XXXX-YY-CCCC-NN**

Where,

WWW Shall be a three-letter (3) designation of the grid-connected substation where the Distribution Utility or Grid Connected End-User that owns the Metering Installation is connected to. Refer to Section 3.4.1 for the procedure on the determination of the Station ID of a substation.

XXXX Shall be a four-letter (4) designation of the Metering Installation. Refer to Section 3.4.2 for the procedure on the determination of the Metering

YY Shall be a two-digit (2) number identifying the delivery/receiving point. Starting from 01, this number shall increase in accordance with the number of delivery or receiving points of the same Participant on the same substation.

CCCC Shall be a four-letter (4) designation of the Metered Participant that the Metering Installation relates to. Refer to Section 3.4.2 for the procedure on the determination of the Metered Participant ID.

NN Shall be a two-digit (2) number identifying the Metering Installation of the Metered Participant. Starting from 01, this number shall increase in accordance with the number of Metering Installations of the same facility of the Metered Participant.

Example: **DOD-DLPC-06-SMDA-01**

Where,

DAV	Station ID of Davao Substation
DLPC	Metering Installation ID of Davao Light and Power Company
06	Receiving Point No. 6 of DLPC on Davao Substation
SMDA	Metered Participant ID of SM City in Davao City Metering Installation No. 1 of SM City

6.5.2 Embedded Meters shall be labeled as **BE-(WWW-XXXX-YY-CCCC-NN)**

Where,

B	Shall be a one-letter (1) designation of the purpose of the Meter. Refer to Table B-1 for the designation of Meter purposes.
E	Shall be one-digit (1) designation of the function of the Meter (1 – Delivered or OUT, 2 – Received or IN, 3 – Bidirectional or IN & OUT)
(WWW-XXXX-YY-CCCC-NN)	Shall be the Standard Equipment Identification Number of XXXX-YY- the Metering Installation where the Meter is located.

Example: **I3-(DAV-DLPC-06-SMDA-01)**

Where,

I	Main Embedded Meter Purpose Designation
3	Bi-Directional Function Designation
(DAV-DLPC-	Site Equipment Identification Number of the Metering
06-SMDA- 01)	Installation where the Meter is located

6.5 .3 Meter boxes and modems shall be labeled as **DD-(B-WWW-XXXX-YY-CCCC-NN)**

Where,

DD	Shall be a two-letter (2) designation for the Meter box or modem. Refer to Table B-2 for the designation of metering equipment, devices and auxiliaries.
(B	Shall be a one-letter (1) designation of the purpose of the Meter. Refer to Table B-1 for the designation of Meter purposes.
WWW-	Shall be the Standard Equipment Identification Number of XXXX-YY-
CCCC-NN)	the Metering Installation where the Meter box or modem located.

Example: **MB-(I-DAV-DLPC-06-SMDA-01)**

Where,

MB	Meter Box Designation
(I	Main Embedded Meter Purpose Designation

DAV-DLPC- Site Equipment Identification Number of the Metering

06-SMDA-01) Installation where the Meter box is located

6.5.4 Meter test switches shall be labelled as **DDYY-(B-WWW-XXXX-YY-CCCC-NN)**

Where,

DD	Shall be a two-letter (2) designation for the Meter test switch. Refer to Table B-2 for the designation of metering equipment, devices and auxiliaries.
YY	Shall be a two-digit (2) designation for the equipment number.
(B	Shall be a one-letter (1) designation of the purpose of the Meter. Refer to Table B-1for the designation of Meter purposes.
WWW-	Shall be the Standard Equipment Identification Number of XXXX-YY- the Metering Installation where the Meter box or modem CCCC-NN) is located.

Example: **TS01-(I-DAV-DLPC-06-SMDA-01)**

Where,

TS	Meter Test Switch Designation
01	Meter Test Switch No. 1
(I	Main Embedded Meter Purpose Designation
DAV-DLPC-	Site Equipment Identification Number of the Metering
06-SMDA-	Installation where the Meter box is located

6.5.5 Current Transformers, Voltage Transformers and lightning arresters shall be labeled as **PDD-(B-WWW-XXXX-YY-CCCC-NN)**

Where,

P	Shall be a one-letter (1) designation for the phase where the Current Transformer, Voltage Transformer or lightning arrester is connected (A – Phase A, B – Phase B, C – Phase C, Z – Three-Phase or 3φ)
DD	Shall be the two-letter (2) designation for the Current Transformer, Voltage Transformer or lightning arrester. Refer to Table B-2 for the designation of metering equipment, devices and auxiliaries.
(B	Shall be a one-letter (1) designation of the purpose of the Meter. Refer to Table B-1for the designation of Meter purposes.
WWW-XXXX-YY-CCCC-NN)	Shall be the Standard Equipment Identification Number of the Metering Installation where the Meter box or modem is located

Example: **ACT-(I-DAV-DLPC-06-SMDA-01)**

Where,

A	Phase A Designation
CT	Current Transformer Designation
(I	Main Embedded Meter Purpose Designation

DAV-DLPC-06-SMDA-01) Site Equipment Identification Number of the Metering Installation where the Meter box is located.

7 Registration and Deregistration of Metering Installation

7.1 Metering Installation Registration

The Electricity Metering Services Providers shall be responsible for registering Metering Installations with the TNSP or DNO. This Section provides the procedures to be followed by TNSP/DNO and other Metering Services Providers in the registration of Metering Installations located at the Connection Points of facilities of the Participants.

7.1.1 Meters for Registration

The Electricity Metering Services Providers shall register both the main Meter and backup Meter of a Metering Installation with the TNSP or DNO.

7.1.2 Registration Procedures

7.1.2.1 Submission of Application Form and Pertinent Documents

To initiate the registration of a Metering Installation at the Connection Point of the facility of a Participant, the Participant's Metering Services Provider shall submit the following to the TNSP/DNO:

a A completed Metering Installation Registration Form signed by both;
b Metering Services Provider and the Participant to whom the Metering Installation relates;
c Hourly metered demand for the previous twelve (12) months from the Metering Point associated with the Metering Installation being registered as well as its maximum and minimum hourly demand;
d Single Line Diagrams from the Grid Off-Take Meter to the Metering Point of the Participant;
e Certification of Meter commissioning test results from TANESCO with its corresponding seal, which indicates compliance of the Metering Installation;
f The Metering Services Provider test and calibration reports of the Instrument Transformers and Meters;
g Connection Agreement between the Participant and its Metering Services Provider; and
h Documentation of other special features of the Meter.

7.1.2.2 Validation of Documents

a. Upon receipt of the Metering Installation Registration Form, the TNSP/DNO shall inspect and validate the submitted documents for completeness and conformance to the requirements.
b. If TNSP/DNO deems that the submitted documents are incomplete or non-compliant with the requirements, they shall request the relevant Metering Service Provider to provide further clarifications within five (5) Business Days of receiving the documents from the Metering Services Provider.
c. To proceed with the registration process, the Metering Services Provider shall resubmit all necessary documents requested by the TNSP/DNO within five (5) Business Days of receiving the clarification request.

7.1.2.3 End-to-End Testing

a. In addition to the certified commission testing, the TNSP/DNO shall also require the Metering Services Provider to undertake End-to-End Tests on the Metering Installation being registered.
b. The TNSP/DNO shall instruct the Metering Services Provider to conduct End-to-End Tests on the Metering Installation being registered within one (1) Business Days of receiving complete registration documentation.
c. The Metering Services Provider shall conduct and complete the required tests within two (2) Business Days of being notified by the TNSP/DNO.

d. If the Metering Installation being registered satisfactorily passes all required tests, the Metering Services Provider shall submit all relevant reports to the TNSP/DNO within one (1) Business Day after completing the required tests.
e. If the Metering Installation being registered fails any of the required tests, the Metering Services Provider shall inform TANESCO within one (1) Business Day of being notified by TANESCO.
f. The Metering Services Provider shall rectify the defects or problems uncovered and repeat the required tests until all tests have passed and shall submit all relevant reports to TANESCO within one (1) Business Days of notifying

7.1.2.4 Approval of Application

a) If the requirements submitted are compliant with the TNSP or DNO's requirements, and the testing has been undertaken successfully, the TNSP/DNO shall approve the registration of the Metering Installation.
b) The TNSP/DNO shall notify the Metering Services Provider of the approval within three (3) Business Days of receiving complete documentation.

7.2 Deregistering of a Metering Installation

7.2.1 Triggers for Deregistering of a Metering Installation

The Deregistration of a Metering Installation may be triggered as follows:

a Upon the request of a Participant and/or the Metering Service Provider;
b Upon the cessation of the Participant to whom the Metering Installation relates;
c Upon retirement or decommissioning of the Metering Installation; or
d If there is a change in the nature or classification of the Metering Installation.

7.2.2 Process of Deregistration

The Metering Services Provider and licensees shall follow the following procedures for the Meter deregistration:

e The Participant or Metering Services Provider (as relevant) shall inform DNO or TNSP of the Metering Installation they wish to deregister along with the reasons for the request for deregistration.
f The DNO or TSO may request additional information from the Participant or Metering Services Provider.
g The DNO or TNSP shall deregister the Metering Installation and inform all affected parties within 10 (ten)Business Days of receiving the deregistration request or receiving clarifications from affected parties as required.

Annex A
(normative)

Meter numbering format

NOTE 1: It is intended that the meter numbering format in this standard be implemented through its incorporation in the labelling requirements in supply contracts for meters for the purpose of meter asset management.

NOTE 2: In the case of prepayment meters, the meter numbering format specified in this annex does not replace the 13-digit number format used by STS compliant meters and some proprietary prepayment meters for meter identification for the purposes of vending. The meter numbering system is specified in IEC 62055-41 and is administered by the Standard Transfer Specification (STS) Association.

NOTE 3 In the relevant IEC standards covering the STS, the meter number is known as the decoder reference number [DRN]. The range of the first 4 digits of the 13-digit meter number specified in this annex overlaps with the range of the first 4 digits of the 13-digit meter number as specified in IEC 62055-41. The STS association in its role of registration authority for IEC 62055-41 has agreed to allocate the ranges 1xxx and 3xxx of the first 4 digits for use by this standard

A.1 Meter number

The meter number may contain 13 digits composed in accordance with Table A.1.

Table A.1 — Meter number format

1	2
Description	**Number of digits**
Meter type (see A.2)	2 digits
Manufacturer code (see A.3)	2 digits
Meter serial number (see A.4)	8 digits
Check digit (see A.5)	1 digit
Number of digits	13 digits

A.2 Meter type code (see Table A.2)

The meter type code is a two-digit number that uniquely identifies the type of meter. (See the note under A.3 for allocation of these codes.)

A.2.1 The key for meter type code allocation is as follows:

a) Digit 1: Number of phase connections; and

b) Digit 2:

0 is electromechanical whole current

1 is static whole current

2 is programmable whole current

3 is electromechanical CT driven

4 is static CT driven

5 is programmable CT driven

A.3 Manufacturer's code

The manufacturer's code is a two-digit number that shall be used uniquely to identify the manufacturer of the meter.

NOTE The manufacturer codes specified in this standard are not the codes used in prepayment systems for the purpose of generating meter number for the purposes of vending tokens to prepayment meters.

A.4-meter serial number

The meter serial number is an eight-digit, unique serial number that can be generated internally by the manufacturer. Each manufacturer is responsible for the uniqueness of the meter serial number with respect to his manufacturer code.

A.5 Check digit

The check digit shall be a modulus 10 check digit, calculated using the Luhn formula, as specified in of ISO/IEC 7812-1. This check digit shall be calculated on the concatenation of the 12 digits comprising the meter type, the meter manufacturer code and the serial number.

A.6 Format of the meter number on a meter

A.6.1 General

If so, specified by the purchaser in a supply contract for meters, meter numbers shall be labelled on the front of the meter in numeric format in accordance with A.6.2 and in bar code format in accordance with A.6.3.

A.6.2 Numeric format

A.6.2.1 The shape of the characters is not specified, but the size of the characters shall be not less than 3 mm in height.

A.6.2.2 Each meter number shall consist of: 1 group of 4 digits followed by a space character, 1 group of 8 digits followed by a space character, and a single (check) digit

Example

The meter number of a programmable whole current single-phase meter (meter type code 12), manufacturer code 01) with a serial number of 12345678 will appear on the meter as follows:
1201 12345678 5.

A.6.3 Bar code format

The bar code representation of the meter number shall be generated using the code 128 symbology as specified in ISO/IEC 15417 No space characters shall be inserted in the bar code.

Table A.2 — Meter type codes

1	2	3
Meter type code	**Meter type**	**Remarks**
00	Reserved for prepayment meters	Prepayment only
10	Electromechanical whole current single -phase	–
11	Static whole current single-phase	–
12	Programmable whole current single-phase	–
30	Electromechanical whole current three -phase	–
31	Static whole current three-phase	–
32	Programmable whole current three-phase	–
33	Electromechanical CT driven three-phase	–
34	Static CT driven three-phase	–
35	Programmable CT driven three-phase	–

A.6.4 STS compliant meters

All STS compliant meters which incorporate a supply disconnection device shall follow the STS meter numbering standard irrespective if they are to be operated in a conventional metering mode or a prepayment mode.

Annex B

(normative)

Design checklist for recording of information during design, installation and commissioning

The following information, where applicable, shall be recorded during the design, installation and commissioning of a metering installation:

a) Customer details

1. name,
2. address,
3. metering point, physical location,
4. maximum demand,
5. date of commissioning,
6. tariff,
7. customer ID number (optional), and
8. customer cell phone number (optional).

b) Current transformers (CTs)

1) manufacturer,

2) serial numbers,

3) ratios available,

4) secondary current rating,

5) VA rating and rated burden for each core,

6) core configuration: #protection, #metering,

7) connected ratio,

8) class (on connected ratio),

9) accuracy, test certificates of CTs confirming compliance with IEC 61869-1,

10) dedicated cores for metering,

11) compliance with design report,

12) insulation test results,

13) recertification,

14) polarity test results, and

15) connected burden test results.

c) Voltage transformers (VTs)

1) manufacturer,

2) serial numbers,

3) primary and secondary voltages,

4) VA rating and rated burden,

5) winding configuration: # protection, # metering,

6) class,

7) test certificates of VTs confirming compliance with IEC 61869-3,

8) fuse ratings – primary and secondary,

9) dedicated metering supply,

10) compliance with design report,

11) insulation test results,

12) ratio verification test results,

13) polarity test results, and

14) connected burden test results.

d) Panel

1) enclosure type,

2) panel earthing checked,

3) panel wiring verified against drawings,

4) wiring continuity tested,

5) appropriate type of termination used,

6) VT circuit fuse rating,

7) panel ancillary equipment verified against panel specification (design report),

8) tightness checks on all connections, and 9) labels according to design document or drawings.

e) Cabling

1) size,

2) cable and wire numbers checked against drawings,

3) insulation test results for all CT and VT cables,

4) CT star point earthed in panel,

5) VT neutral earthed as near as possible to VTs,

6) voltage drop test results for VT cables,

7) appropriate type of termination used, and

8) tightness checks on all connections.

f) Meters

1) manufacturer,

2) type/model,

3) software version,

4) serial numbers,

5) class,

6) single-phase/three-phase,

7) three-wire/four-wire,

8) auxiliary supply details,

9) voltage rating,

10) current rating,

11) meter VT ratio,

12) meter CT ratio,

13) initial reading,

14) meter reading multiplication factor (k-factor) internal/external meter constants,

15) pulse value (units per impulse (UPI)), (pulse constant),

16) test certificates of meters confirming compliance with relevant IEC standards,

17) certification sticker attached,

18) software configuration,

19) meter time set,

20) configured tariff scheme,

21) digit configuration (significant and decimal digits), and

22) digit scroll-over period.

g) Prepayment meters

1) supply group code,

2) power limit,

3) tariff index,

4) key revision number,

5) the meter serial number,

6) the key type,

7) the available credit,

8) the total energy to date,

9) the tamper status and any additional tamper detection information,

10) installation address,

11) GPS coordinates for location of the meter stored during installation (optional), and

12) Date of last token entered.

h) Data loggers

1) manufacturer,

2) type/model,

3) serial numbers,

4) auxiliary supply details,

5) channel configuration,

6) channel multipliers,

7) battery checked,

8) meter units match data logger,

9) meter/data logger compatibility confirmed,

10) data logger time set,

11) data logger alarms working, and

12) certification report reference number.

i) Communication device

1) manufacturer,

2) type/model,

3) serial number,

4) auxiliary supply details,

5) communication number, and

6) communication network approved.

j) Drawings

1) adequacy of information,

2) scheme drawing number, and

3) as-commissioned mark-ups completed.

k) Commissioning requirements

1) polarity test results,

2) phase rotation test result,

3) meter on-load accuracy test results,

4) meter dial to data logger verification results,

5) meter dial to master station data verification results,

6) alarms through to host test results,

7) pulsing through to customer tested,

8) set meter time,

9) set data logger time,

10) commissioning data recorded at all stakeholders, and

11) earth leakage test.

l) Sealing details

1) CT enclosure/terminals locked or sealed,

2) CT test blocks sealed,

3) VT enclosure/terminals locked or sealed,

4) VT test blocks sealed,

5) VT circuit fusing sealed,

6) meter covers sealed,

7) meter terminal covers sealed,

8) data logger covers sealed,

9) data logger terminal covers sealed,

10) meter enclosure locked or sealed, and

11) where numbered seals are used the numbers on the seals removed and the numbers on the seals placed shall be recorded.

Annex C

(normative)

Categories of metering installations and classification of meter competence qualifications

C.1 Metering installation categories

Four categories of metering installations are defined as shown in table C.1, according to the classification of qualifications of meter installers required.

NOTE Where a licensee has an existing training scheme for meter installers that does not completely align with the scheme outlined in this annex, the licensee should use the requirements in this annex to align its training scheme with that specified, as far as is practicable. The scheme specified is intended to be used as the basis for a national scheme of meter installer training and certification in future.

Table C.1 — Metering installation categories

1	2	3	4
Metering installation category	**Voltage[a] and current**	**Measuring transformers**	**Class of meter worker**
1	1Ø, V ≤ 230 V *I* ≤ 100 A	None (whole current metering)	1
2	3Ø, V ≤ 400 V *I* ≤ 160 A	None (whole current metering)	2
3	3Ø, V ≤ 400 V	CT	3
4	3Ø, V > 400 V	VT and CT	4
[a] Voltages referred to are nominal Ø - Ø, where Ø is used to denote phase [b] Competence of personnel shall be determined by licensee.			

C.2 Meter competence level qualifications

C.2.1 General requirements

Due to varying levels of complexity, safety issues and training required, four classes of meter competence qualifications are specified according to the complexity of the metering installation.

C.2.1.1 Licensees shall be responsible for identifying and providing suitable training programs on meter installation.

C.2.1.2 Licensees and registered metering service providers appointed as their agents shall identify which of the four-meter competence classes each of their employees who perform meter work are qualified for.

C.2.1.3 The new meter competence certification requirements shall apply uniformly to any meter

installer in the employ of any licensee or metering service provider. Procedures shall be adopted to ensure that meter installers remain qualified over time.

C.2.1.4 Licensees and metering service providers appointed as their agents shall issue appropriate means of identification to each of their meter installers or employees who perform direct access meter work and shall ensure that their installers carry this identification while performing meter work. This identification shall indicate the installer's employer and the class of meter work the installer is qualified to perform.

C.2.1.5 If a licensee subcontracts its meter work to an independent registered metering service provider, the subcontracting entity shall ensure that the metering service provider issues each meter installer or employee such identification.

C.2.1.6 Meter installers who perform work for a licensee or a registered metering service provider, and has been contracted by a licensee before the publication of this standard shall be considered qualified and certified for the level of work they have been trained for.

C.2.2 Qualifications of a class 1-meter installer

C.2.2.1 Class 1-meter installers shall be permitted to work on category 1 metering installations only.

C.2.2.2 Class 1-meter installers shall be permitted to install, remove and replace category 1 meters provided that they work under the supervision of a responsible person. Meters shall not be removed or installed without first isolating the supply.

C.2.2.3 Essential technical skills for this class of installer are as follows:

a) the ability to identify energy diversion or tampering related to this class of meter work,

b) the ability to install and remove damaged and undamaged meters,

c) understanding of the meter panel and socket layout for the metering conditions related to this class of meter work,

d) the ability to read meters used in this class,
e) the ability to properly use tools appropriate to the work in this class, and
f) the ability to correctly wire category 1 metering installations.

C.2.3 Qualifications of a class 2-meter installer

C.2.3.1 Type of work undertaken by class 2-meter installers

C.2.3.1.1 Class 2-meter installers shall be permitted to work on category 1 and category 2 metering installations.

C.2.3.1.2 Class 2-meter installers shall be permitted to install, remove and replace all direct connected meters without supervision.

C.2.3.2 General skills and knowledge

Competency of a class 2-meter installer could be considered as having successfully completed a

course in high-voltage regulations. In general, the following aspects shall be taken into account when the technical competency of a class 2-meter installer is being assessed:

a) a good understanding of the general requirements of health and safety legislation and how these translate into personal duties and obligations. This might include the need to report incidents or equipment found faulty;

b) knowledge and experience of the specific work methods. This might have safety implications in that incorrectly performed work can cause danger, for example, incorrect polarity or overheating caused by unsatisfactory connection; and

c) the ability to recognize conditions under which work shall not be commenced, or its progress curtailed or ceased. This can include recognition of the meter installer's own shortcomings, lack of experience or training, including the need for assistance, supervision or more information.

C.2.3.3 Essential technical skills

Essential technical skills for this class of competence include all skills for class 1 installers and the following:

a) wiring and circuit diagrams: familiarity with wiring and circuit diagrams and their interpretation;

b) meters: ability to install and maintain meters; and

c) sealing: knowledge of this standard, together with special client requirements and in-house standards.

C.2.3.4 Specific safety criteria

The following are examples of the range of safety knowledge, acquired through training or experience (or both), which might be appropriate, depending upon the work that the installer is required to carry out:

Work in proximity to service terminations:

1) a knowledge of the dangers that arise from damage to service terminations, and

2) familiarity with the use of correct tools and equipment and the need to apply mechanical protection where necessary.

b) Removal of covers:

1) an awareness of the dangers such as those that can be caused by bare live conductors or terminals (or both) which might be exposed after removal of a cover,

2) knowledge of the precautions to be taken to screen or otherwise prevent injury, and

3) understanding that the work area shall not be left unattended whilst covers are removed.

c) Work in the vicinity of live (low-voltage) conductors:

Knowledge of materials and techniques to adequately screen the work area from the danger, taking

account of both electrical and mechanical considerations.

d) Removal of cut-out fuses or circuit-breakers:

1) an awareness of the need to visually inspect the cut-out before removal of covers and before removal of fuses,

2) understanding of the dangers which such inspection might reveal and the steps which might then need to be taken,

3) familiarity with the removal and replacement of fuses in a safe manner, including insertion techniques and the use of protective equipment where necessary, for example, insulating gloves, fuse pullers, insulating sheets, additional phase barriers, terminal shrouds, eye protection,

4) understanding of additional precautions to ensure continuing safety such as the use of caution notices and safekeeping of removed fuses, and

5) knowledge of the use of voltage testing devices to prove "not live" before work commences and to check restoration on completion of work.

e) Access to consumer stations:

understanding of the need for people of adequate authority to enter, and of the conditions under which access is allowed, which may include requirements to notify the parties affected and the consumer (where applicable), and to make suitable entries in a log book,

1) knowledge of basic precautions to be taken before and during entry, such as visual checks of surroundings and the equipment and tests for the presence of gas, including ensuring continuing safe egress, and

2) awareness of the dangers that might be inherent in equipment within the station and of the need to avoid actions which might lead to the operation of switches, circuit-breakers or protective devices.

C.2.3.5 Certification requirements

C.2.3.5.1 An installer can be certified as a class 2-meter installer if he qualifies for entry-level employment on the basis of being a journeyman level electrician, a technician or a graduate engineer and has successfully completed a metering training program suitable for that level.

C.2.3.5.2 A meter installer who does not comply with the requirements as stated in C.2.3.5.1 can be certified as a class 2-meter installer, provided that:

C.2.3.5.3 the installer has been qualified as a class 1-meter installer for at least six months;

C.2.3.5.4 the installer has completed at least three months "on-job-training" working alongside a class 2 (or higher) meter installer;

C.2.3.5.5 the installer has successfully completed the metering training program; and

C.2.3.5.6 a class 3 (or higher) meter installer has certified that the installer is competent to perform the tasks required for a class 2-meter installer.

C.2.4 Qualifications of a class 3-meter installer

C.2.4.1 Type of work undertaken by class 3-meter installer

C.2.4.1.1 Class 3-meter installers shall be permitted to work on category 1, category 2 and category 3-metering installations.

C.2.4.1.2 Class 3-meter installers shall be permitted to install, remove, and replace all meters in these three categories.

C.2.4.2 Essential technical skills

Essential technical skills for class 3-meter installers include all skills for class 2- meter installers and the following:

a) current transformers:

1) knowledge of principles of construction and operation;
2) appreciation of ratio and polarity; and
3) ability to verify CT ratios.

b) secondary wiring:

1) familiarity with wiring installation practices, with special reference to the functional identification of circuits; and
2) methods of testing insulation resistance and continuity.

c) meters:

1) understanding of the principles of measurement of kWh, kVAh and kVarh, and the use of three element polyphase meters; and
2) the ability to install, maintain and program meters including electronic multifunction meters.

d) testing and test equipment:

1) familiarity in the use of equipment for measurement of voltage and current, polarity and phase rotation, and active and reactive energy;
2) awareness of the accuracy limits of equipment and the requirement for regular calibration checks; and
3) ability to understand, interpret, identify, and take appropriate actions based upon diagnostics obtained from measurements to verify metering installations.

e) specific safety criteria:

Examples of the range of additional safety knowledge, acquired through training or experience (or both), which might be appropriate for a class 3-meter competence, depending upon the work that the installer is required to carry out, are as follows:

1) connection of meters to test facilities;
2) understanding of the procedures to interrupt the potential supply by withdrawal of fuses and short

out current transformers by means of suitable links;

3) ability to operate test bypass facilities or test blocks; and

4) familiarity with the practical methods of carrying out these precautions and steps to ensure that no unauthorized interference negates them.

C.2.4.3 Certification requirements

C.2.4.3.1 A installer can be certified as a class 3-meter installer if he qualifies for entry-level employment on the basis of being an electrical engineering technician or a graduate engineer and has successfully completed a metering training program suitable for that level

C.2.4.3.2 A meter installer who does not comply with the requirements as stated in the C.2.4.3.1 can be certified as a class 3-meter installer provided that

a) the installer has been qualified as a class 2-meter installer for at least six months,

b) the installer has completed at least six months "on-job-training" working alongside a class 4-meter installer,

c) the installer has successfully completed an advanced metering training program that covers CT connected meters (category 3), and

d) a class 4-meter installer has certified that the installer is competent to perform the tasks required for a class 3-meter installer.

C.2.5 Qualifications of a class 4-meter installer

C.2.5.1 Type of work to be undertaken by class 4-meter installers

C.2.5.1.1 Class 4-meter installers shall be permitted to work on categories 1, 2, 3 and 4-metering installations.

C.2.5.1.2 Class 4-meter installers shall be permitted to install, remove and replace all meters described in categories 1 to 4, and may perform in-field meter accuracy tests, calibrations, all types of meter maintenance and troubleshooting on all components of metering systems, including metering transformers and associated devices such as isolation relays and switches, and wiring between these transformers, associated devices, and meters. Class 4-meter installers may inspect wiring and instrument transformer ratios utilizing various apparatus as necessary.

C.2.5.2 Essential technical skills

Essential technical skills for class 4-meter installers include all those skills for class 3-meter installers and, in addition, the following:

a) current transformers:

Understanding of the relationship between burden, ratio and phase angle errors.

b) voltage transformers:

1) knowledge of principles of construction and operation; and

2) understanding of the relationship between burden, ratio and phase angle errors.

c) meters:

1) understanding of the principles of the measurement of kWh, kVAh and kvarh, and the use of two and three-element polyphase meters; and

2) the ability to perform calibration, retrofit, troubleshooting, data collection of meters, and to install, maintain, and program advanced metering technologies, including time of use metering, interval data, remote meter communication, and load control devices.

d) calculation of overall measurement uncertainty:

1) the requirements for overall uncertainty;

2) uncertainty of each calibration process undertaken by the accredited calibration laboratory;

3) sources of uncertainty in day-to-day operation of metering installations;

4) standard uncertainty and coverage factor; and

5) method of combining uncertainties.

e) specific safety criteria:

1) broad knowledge of and familiarity with high and medium voltage electrical distribution systems and operating characteristics; and

2) broad knowledge of and familiarity with safety practices when working in high-voltage chamber environments.

C.2.5.3 Certification requirements

An installer can be certified as a class 4-meter installer if

a) the worker qualifies for entry-level employment on the basis of being an electrical engineering technician or a graduate engineer and has successfully completed an advanced metering training program that covers CT and VT connected metering systems, or

b) the installer

1) has been qualified as a class 3-meter installer for at least one year,

2) has completed at least one year "on-job-training" working alongside a class 4-meter installer, and

3) has successfully completed an advanced metering training program that covers CT and VT connected metering systems.

C.2.6 Metering training programs

A metering service provider (whether independent or a licensee) may develop and implement a training program to train and certify their individual meter installers in any of the four metering work

classes. Where a licensee uses the services of a metering service provider, the licensee shall verify that all appropriate meter installer prerequisites are met before a meter worker is certified.

Bibliography

BS 6001-4, *Sampling procedures for inspection by attributes – Specification for sequential sampling plans.*

ISO/IEC Guide 2, *Standardization and related activities – General vocabulary.*

NRS 047-1, *Electricity supply – Quality of service – Part 1: Minimum standards.*

NRS 096-2, *Ancillary specifications – Part 2: Standard test block connections for electricity metering.*

SANS 473, *Automated meter reading for large power users.*

SANS 2859-1/ISO 2859-1, *Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection.*

SANS 17020/ISO/IEC 17020, *Conformity assessment – Requirements for the operation of various types of bodies performing inspection.*

SANS 17025/IEC/ISO 17025*, General requirements for the competence of testing and calibration laboratories.*

SANS 62055-41/IEC 62055-41, *Payment systems – Part 41: Standard transfer specification (STS) – Application layer protocol for one-way token carrier systems.*

Eswatini Vocational Qualifications Package - Unit Standards for Electrical Level 2, 3 & 4)

Other publications

IEC Dictionary.

The National Energy Regulator (NERSA). *The South African Grid Code:* January 2005.