

NRS 096-1:2007

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ELECTRICITY METERING — ANCILLARY SPECIFICATIONS

Part 1: The sealing of electricity meters

This document is not a South African National Standard



This rationalized user specification is issued by
the Technical Governance Department, Eskom,
on behalf of the
User Group given in the foreword
and is not a standard as contemplated in the Standards Act, 1993 (Act No. 29 of 1993).

Table of changes

Change No.	Date	Text affected

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Foreword

This part of NRS 096 was prepared on behalf of the Electricity Suppliers Liaison Committee (ESLC).

This part of NRS 096 was prepared by a working group which, at the time of publication, comprised the following members:

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A Manufacturers' Interest Group (MIG) was consulted on the contents of this part of NRS 096 and its comments were incorporated where the working group was in agreement. The MIG comprised the following member:

C Zellmer	Integrity Control Systems
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NRS 096 consists of the following parts, under the general title *Electricity metering – Ancillary specifications*:

Part 1: The sealing of electricity meters.

Part 2: Standard test block connections for electricity metering.

Annex A is for information only.

NRS 096-1:2007

Introduction

This part of NRS 096 has been prepared to establish and promote uniform requirements for the sealing of electricity meters for application in the South African Electricity Distribution Industry.

The Electricity Suppliers Liaison Committee expresses the wish that all supply authorities will adopt the text of this part of NRS 096 in so far as their particular conditions will permit. Any differences between the requirements of this part of NRS 096 and the purchaser's requirements should, where appropriate, be submitted for consideration in future revisions of this part of NRS 096.

Keywords

seals, sealing, sealing tool, meters, metering equipment, test (terminal) blocks, data registry, barcoding.

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ELECTRICITY METERING — ANCILLARY SPECIFICATIONS

Part 1: The sealing of electricity meters

1 Scope

This part of NRS 096 sets requirements for the sealing of electricity meters and related ancillary metering equipment.

The part of NRS 096 provides guidelines on the roles and responsibilities related to the management of seals and information on the requirements for various types of seal.

2 Normative references

The following documents contain provisions which, through reference in this text, constitute provisions of this part of NRS 096. All documents are subject to revision and, since any reference to a document is deemed to be a reference to the latest edition of that document, parties to agreements based on this specification are encouraged to take steps to ensure the use of the most recent editions of the documents listed below. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

NRS 055, *Code of practice for revenue protection*.

SANS 474/NRS 057, *Code of practice for electricity metering*.

3 Terms, definitions and abbreviations

For the purposes of this document, the following terms, definitions and abbreviations apply.

3.1 Terms and definitions

barcode

machine-readable code in the form of a pattern of parallel lines of varying widths, printed on a commodity and used to identify such for stock control purposes

data registry

information database

meter

device for measuring and totalling the variable consumption of electricity

NOTE In general a meter consists of a sensor and an integrating device that displays the total consumption in metrological units
[SANS 62051]

metering equipment

collection of components in the metering installation

NOTE Components include instrument transformers, cables, meters, recorders and any housing and ancillary equipment such as test blocks.

metering installation

all meters, fittings, equipment and wiring used for measuring the flow of electricity

seal

passive, one-time locking device, preferably with a unique number or other form of identification that is used to provide a reliable deterrent against tampering and to give an indication of tampering

NOTE Tampering can be unauthorized removal or attempted removal.

sealing

process whereby access to metering equipment is restricted by means of a mechanical seal to deter and identify unauthorized access to such equipment

sealing tool

device for securing the seal, where required

tampering

unauthorized interference with the supplier's equipment, or removal of the supplier's seal from a protective device or from metering equipment

test block

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

3.2 Abbreviations

CT: current instrument transformer

UV: ultraviolet

VT: voltage instrument transformer

4 Requirements

4.1 Objectives of sealing

4.1.1 The main objective of sealing any device is to ensure that access to certain sensitive parts of the device is restricted. This is especially so where energy meters are concerned, since energy meters form the basis from which revenue is obtained by the electricity supply utility. It is therefore imperative that strict sealing standards are established and that proper control is maintained to ensure that the requirements are adhered to.

4.1.2 A further aim of sealing is to provide a mechanism by which the last person to have worked on a specific piece of equipment can be traced. To ensure that this can be done, all seals and sealing tools shall be clearly and indelibly marked with unique serial numbers.

4.2 Implementation

NOTE In this part of NRS 096, "seals and sealing tools" should be read as "seals or sealing tools, or both"

The electricity supply utility shall be responsible for compiling a directive concerning the implementation of effective sealing measures in the area of operation.

The directive shall, at least, address the following issues:

- a) the control, issuing and management of seals and sealing tools;
- b) the types of seal utilized;
- c) the numbering and coding system used;
- d) a standard for sealing meters and ancillary equipment; and

- e) the auditing of distributed seals.

4.3 The control, management and responsibilities related to sealing

4.3.1 The control of seals and sealing tools

A single body or person shall take overall responsibility for the sealing process within an electricity supply utility's area of operation, and shall be accountable for

- a) the procurement and control of all seals and sealing tools in that functional area, and
- b) ensuring that a data registry is established, in which all movements and issuing of all seals and sealing tools under his control is recorded.

4.3.2 The management of seals and sealing tools

4.3.2.1 Seals and sealing tools shall be procured in a controlled way and it shall be ensured that the seals and sealing tools are recorded in the data registry upon receipt.

4.3.2.2 When pre-numbered seals are ordered, they shall be supplied in bags that indicate quantities specified by the user to simplify the issuing thereof.

4.3.2.3 These bags shall be registered on the database system by the responsible person as "received seals".

4.3.2.4 The seals and sealing tools shall be kept in a secure place at all times to prevent theft and the unauthorized issuing of seals.

4.3.2.5 A responsible person shall be appointed to control the issuing of seals and sealing tools.

4.3.2.6 Only authorized personnel (who do change-outs, audits, meter reading and new connections) shall request seals from the responsible person in charge of the seals.

4.3.2.7 Seals and sealing tools shall not be issued to any person or persons other than those who have been authorized in writing.

4.3.2.8 Authorized personnel will be issued with a controlled reasonable number of seals and they shall take responsibility for that number of seals by signing for them in a register.

4.3.2.9 The details of the seals and sealing tools issued shall be recorded in a central data registry. Details of the seals include the type, colour, markings and the numbers issued.

4.3.2.10 On completion of the commissioning, audits or maintenance tasks, the code numbers of the seals used shall be recorded on the relevant commissioning sheet or service order.

4.3.2.11 Any surplus seals shall be returned to the issuing authority for re-allocation.

4.3.3 Responsibilities of authorized users of seals and sealing tools

Any person who accepts custody of seals and sealing tools shall

- a) accept responsibility for the seals and sealing tools in writing,
- b) sign the sealing data register to confirm acceptance,
- c) undertake to keep the seals and sealing tools in a safe place at all times,

- d) never redistribute seals or lend the sealing tools to any other individual for any reason whatsoever,
- e) be held accountable for the whereabouts of the seals and sealing tools,
- f) report lost, defective or stolen seals and sealing tools as soon as possible to the responsible person, and
- g) in the case of all seals that have been removed, ensure that the seals are collected and disposed of properly. Discarded seals should not become litter at each metering point.

4.4 Sealing specifications

4.4.1 General

There are numerous sealing options available. Seals can, in general, be classified into

- a) tool-less seals,
- b) seals that require a tool (sealing pliers), and
- c) tamper-evident security labels.

Each option has its own advantages and disadvantages and the information in 4.4.2 to 4.4.4 will indicate these and also provide for a general specification of each option. See annex A for a matrix of sealing options and applications.

4.4.2 Tool-less seals

4.4.2.1 General

Tool-less seals do not require any tool to fit the seal to equipment to be sealed. This method is the preferred option for sealing. Metal seals that are prone to corrosion are not recommended.

4.4.2.2 General specification

4.4.2.2.1 The seal shall consist of a piece of wire or a plastic tail and an internal locking mechanism (body).

4.4.2.2.2 Once a seal has been opened, it shall not be re-usable. It shall not be possible to manipulate component parts to reconstruct a working or functional product. The component parts shall show clear signs of tampering.

4.4.2.2.3 The body shall preferably be see-through to provide easy and complete checking of the fixing mechanism and clear indication of tampering.

4.4.2.2.4 The material of the body shall be UV stabilized to withstand long-term exposure to direct sunlight (at least ten years).

4.4.2.2.5 Seals shall be available in various colours. The use of multicoloured seals will ensure that the history and status of the point of supply can be visually identified and traced.

4.4.2.2.6 Seals shall have unique serial numbers given in numerical order and, preferably, also in barcode format. Provision shall also be made for a company identifier or logo on the seal.

4.4.2.2.7 The numbers shall be clearly and indelibly marked on the body and it shall not be possible to remove or alter a number in any way without destroying the integrity of the seal.

4.4.2.2.8 The unique number shall consist of at least seven characters. The barcode format shall be code 128.

4.4.2.3 Advantages of tool-less seals

4.4.2.3.1 Uniquely numbered seals provide for a better way of managing sealing.

4.4.2.3.2 Seals of various colours can be used to identify the personnel, or processes and status of metering installations.

4.4.2.3.3 Tool-less seals are quick and easy to use (without any tools).

4.4.2.3.4 Lost, tampered, foreign or stolen seals can be identified by the unique numbering.

4.4.2.3.5 Barcoding of seals might simplify recording and identification of seals in the field.

4.4.2.4 Disadvantages of tool-less seals

4.4.2.4.1 The cost of seals.

4.4.2.4.2 Barcode scanners need to be employed to fully gain the advantages of these seals.

4.4.2.5 Colour-coding system of tool-less seals

Table 1 provides an example of a colour-coding system to uniquely identify the various tasks performed on metering equipment:

Table 1 — Colour-coding system of tool-less seals

1	2
Colour	Tasks
Transparent	Factory use and calibration
Yellow	First commissioning and certification
White	Demand reset during meter reading
Orange	Replacement after investigation
Blue	Non-payment, move-out or switch-off (where the customer pays to switch off the supply for renovations, extensions, etc.)
Red	Tampering
Green	Supply utility authorized by-pass

4.4.3 Seals that require sealing tools

4.4.3.1 Introduction

These seals require sealing tools (sealing pliers) to crimp the seal onto the sealing wire. Traditionally sealing by this method has been done with a lead seal and wire, but the lead seal lends itself to easy tampering. It is therefore not recommended to use any type of lead seal in metering installations but rather to use a stainless steel wire and tinned copper ferrules.

4.4.3.2 Requirements – General specification

4.4.3.2.1 A seal shall consist of a piece of wire and a ferrule.

4.4.3.2.2 The wire shall be made from stainless steel, consist of at least seven strands and have a maximum diameter of 1 mm.

4.4.3.2.3 The ferrule shall be made from tinned copper, shall be 12 mm long with an outer diameter of 4 mm and an inner diameter of 2 mm.

4.4.3.2.4 The seal shall be made by threading the wire through sealing holes provided on the device to be sealed and the ferrule shall be firmly crimped onto the wire in such a way that it is impossible to remove the seal without first breaking the wire.

4.4.3.2.5 The tag shall be crimped by a pair of ratchet-operated sealing tool (pliers) that are specifically designed for the task.

4.4.3.2.6 The sealing tool (pliers) shall have an identifiable unique coding engraved onto both jaws which leaves an imprint of the encoding on the ferrule after crimping. Provision shall also be made for a company identifier or logo on the seal.

4.4.3.3 Advantages of using this method of sealing

4.4.3.3.1 Relatively cheap sealing method.

4.4.3.3.2 It provides a very secure seal that is difficult to break. Strong cutting pliers will be required to break the seal.

4.4.3.3.3 Seals of various colours can be used to identify the personnel, processes and status of metering installations.

4.4.3.4 Disadvantages of using this method of sealing

4.4.3.4.1 A sealing tool is required to crimp the sealing ferrule.

4.4.3.4.2 Robust sealing tools are expensive.

4.4.3.4.3 Unique numbering is not possible.

4.4.3.4.4 Identification of the number is difficult after a poor crimp or when reading is done in bad light.

4.4.3.4.5 If a sealing tool is lost or stolen, all equipment sealed by that sealing tool needs to be investigated and re-sealed to ensure the integrity of all installations. The lost or stolen sealing tool can still be used to tamper with other installations without being noticed by the electricity supply utility.

4.4.3.4.6 Sealing tools have to be issued to contractors when they are required to seal equipment. One sealing tool can be used by numerous contractors. Seals can therefore not be traced to dubious contractors or employees.

4.4.3.4.7 Barcoding of seals that might simplify recording and identification of seals in the field is not possible with the normal ferrule. Special ferrules that accommodate barcoding can be costly.

4.4.4 Tamper-evident security labels

4.4.4.1 General

These seals are fitted over the equipment to be sealed (typically the meter face-plate cover and the meter body are covered). There are various types of label with various security features to indicate tampering, which include:

- a) a security message appears,

- b) permanent discoloration takes place,
- c) residue is left on equipment, and
- d) destruction.

4.4.4.2 Requirements — General specification

4.4.4.2.1 The label shall be self-adhesive.

4.4.4.2.2 The tamper-evident security label shall clearly and irreversibly indicate tampering.

4.4.4.2.3 Tamper-evident seals shall be available in various colours. The use of multicoloured seals will ensure that the history and status of the point of supply can be visually identified and traced.

4.4.4.2.4 Tamper-evident seals shall have unique serial numbers given in both numerical order and barcode format. Provision shall also be made for a company identifier or logo on the seal.

4.4.4.2.5 The numbers shall be clearly and indelibly marked on the body and it shall not be possible to remove or alter a number in any way without destroying the integrity of the seal.

4.4.4.2.6 The unique number shall consist of at least seven characters. The barcode format shall be code 128.

4.4.4.3 Advantages of tamper-evident security labels

4.4.4.3.1 Uniquely numbered seals provide for a better way of managing sealing.

4.4.4.3.2 Multicoloured seals can be used to identify the various personnel who work on equipment.

4.4.4.3.3 Tamper-evident labels are quick and easy to use (they do not require any tools).

4.4.4.3.4 Multiple entry points can be secured by one seal.

4.4.4.3.5 Lost or stolen seals can be identified by the unique numbering.

4.4.4.3.6 Barcoding of seals might simplify recording and identification of seals in the field.

4.4.4.4 Disadvantages of tamper-evident security labels

4.4.4.4.1 The use of this method is limited and certain equipment can't be sealed with this type of seal (for example fuses, miniature circuit-breakers and demand reset buttons).

4.4.4.4.2 The seal cannot be used for outside installations or installations that are very humid.

4.4.4.4.3 Barcode scanners need to be employed to fully gain the advantages of these seals.

4.4.4.4.4 When maintenance work needs to be performed on a meter already sealed with a "label" seal, a solvent will be required to remove the previous residue (or remains).

4.4.4.5 Colour coding system of tamper-evident security labels

Table 1 provides a proposed colour-coding system to uniquely identify the various tasks performed on metering equipment.

4.5 Requirements for sealing energy meters

The following separate seals shall be in place on energy meters at all times after the commissioning of meters:

- a) after the meter has been placed in service, each meter cover or case shall be sealed in such a way that it is impossible to gain access to the internal parts of the meter without breaking the seal;
- b) in cases where there are more than one sealing hole on the meter cover or case, at least two opposite sealing holes shall be sealed;
- c) the terminal cover (where applicable) shall be sealed in such a way that no access to the terminals shall be possible without the seals on the cover being broken; and
- d) If the meter is fitted with a maximum demand reset facility, it shall not be possible to reset the meter without first breaking a seal.

4.6 Requirements for sealing ancillary metering equipment

As a general requirement, any equipment that makes up part of a metering system shall be sealed in such a way that restricted access to the equipment is ensured, including the following:

- a) miniature circuit-breakers or fuses fitted onto VT supply wiring;
- b) all test blocks on metering circuits; and
- c) any device that receives pulses from a meter such as interposing relays, tariff modules, summators, summation CTs, and recording equipment that is used for recording billing information.

4.7 Requirements for disciplinary action against sealing abuse

Anyone found failing to seal a device as required by this part of NRS 096, tampering with, vandalizing or misusing the issue of seals, shall be dealt with according to standard procedures for disciplinary action.

4.8 Auditing the sealing process

The issuing, use and possession of seals and sealing tools shall be audited on a yearly basis.

Annex A

(informative)

Matrix for sealing options and applications**Table A.1 – Matrix for sealing options and applications**

1	2	3	4	5	6	7	8
Sealing option	Applications	Internal use suitability	External use suitability	High humidity/ moist conditions	Sealing tool required	Hand removal suitability	Tool removal required
Tool-less seals	Meter face-plate	√	√	√	X	(plastic tail)	(wire tail)
	Meter terminal cover	√	√	√	X	(plastic tail)	(wire tail)
	Maximum demand reset buttons	√	√	√	X	(plastic tail)	(wire tail)
	Metering CTs	√	√	√	X	(plastic tail)	(wire tail)
	Metering test blocks	√	√	√	X	(plastic tail)	(wire tail)
	Miniature circuit-breakers (MCBs)	√	√	√	X	(plastic tail)	(wire tail)
	Fuses	√	√	√	X	(plastic tail)	(wire tail)
	Prepayment meters	√	√	√	X	(plastic tail)	(wire tail)
	Meter kiosk doors	√	√	√	X	(plastic tail)	(wire tail)
Crimping seals (crimping ferrule and stainless steel wire)	Meter face-plate	√	√	√	√	X	√
	Meter terminal cover	√	√	√	√	X	√
	Maximum demand reset buttons	√	√	√	√	X	√
	Metering CTs	√	√	√	√	X	√
	Metering test blocks	√	√	√	√	X	√
	Miniature circuit-breakers (MCBs)	√	√	√	√	X	√
	Fuses	√	√	√	√	X	√
	Prepayment meters	√	√	√	√	X	√
	Meter kiosk doors	√	√	√	√	X	√

Annex A

(concluded)

1	2	3	4	5	6	7	8
Sealing option	Applications	Internal use suitability	External use suitability	High humidity/ moist conditions	Sealing tool required	Hand removal suitability	Tool removal required
Security labels	Meter face-plate cover	√	X	X	X	√	X
	Meter terminal cover	√	X	X	X	√	X
	Maximum demand reset buttons	X	X	X	X	√	X
	Metering CTs	X	X	X	X	√	X
	Metering test blocks	√	X	X	X	√	X
	Miniature circuit-breakers (MCBs)	X	X	X	X	√	X
	Fuses	X	X	X	X	√	X
	Prepayment meters	√	X	X	X	√	X
	Meter kiosk doors	X	X	X	X	√	X

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