NMI M 13-2

Active-energy electricity meters (a.c.)

Part 2: Test report format

June 2022

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Preface

This document provides the test report format for active-energy electricity meters (a.c.) to accompany NMI M 13-1, v1.0 (June 2022) *Active-energy Electricity Meters (a.c.), Part 1: Metrological and Technical Requirements*.

This test report format may clarify NMI M 13-1, but it does not add to or alter any requirements.

This document is primarily intended for use by test laboratories that are testing meters against the requirements of NMI M 13-1. This test report format is intended to make testing more efficient and consistent.

Note, the test report format provides for meters with different accuracy classes, connection types and capabilities. Refer to NMI M 13-1 to determine which tests are applicable for a particular meter.

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# 

# Test Information

|  |  |
| --- | --- |
| **Test Report** | |
| Report reference number |  |
| Date of issue |  |
| Date of testing |  |
| **Laboratory details** | |
| Name |  |
| Address |  |
| Contact details |  |
| **Test specification** | |
| Standard | NMI M 13-1, v1.0 (June 2022) |
| **Client details** | |
| Applicant |  |
| Address |  |
| Remarks: | |
|  | |

# Meter Information

|  |  |
| --- | --- |
| Manufacturer |  |
| Model |  |
| Serial number(s) |  |
| Remarks: | |
|  | |

# Meter Specifications

|  |  |
| --- | --- |
| **Accuracy** |  |
| Accuracy class | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | |  | 0.2 S |  | 0.5 S |  | 1 |  | 2 | |
| **Temperature ranges** | *Low High* |
| Specified operating range | |  |  |  |  | | --- | --- | --- | --- | |  | °C |  | °C | |
| Limit range of operation | |  |  |  |  | | --- | --- | --- | --- | |  | °C |  | °C | |
| Storage and transportation | |  |  |  |  | | --- | --- | --- | --- | |  | °C |  | °C | |
| **Environment** |  |
| Indoor/Outdoor | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | Indoor |  | Outdoor |  | Australian outdoor | |
| **Connection type and design** |  |
| Connection type | |  |  |  |  | | --- | --- | --- | --- | |  | Direct connected |  | Transformer-operated | |
| Design type | |  |  |  |  | | --- | --- | --- | --- | |  | Static |  | Induction | |
| Display type | |  |  |  |  | | --- | --- | --- | --- | |  | Electronic |  | Electromechanical | |
| **Electrical and measurement** |  |
| Number of phases | |  | | --- | |  | |
| Number of wires | |  | | --- | |  | |
| Number of elements | |  | | --- | |  | |
| Reference frequency *f*nom | |  |  | | --- | --- | | 50 | Hz | |
| Reference voltage(s) *U*nom | |  |  | | --- | --- | |  | V AC | |
| Basic current *I*b | |  |  | | --- | --- | |  | A *(for direct connected)* | |
| Rated current *I*n | |  |  | | --- | --- | |  | A *(for transformer-operated)* | |
| Maximum current *I*max | |  |  | | --- | --- | |  | A | |
| Meter constant | |  |  | | --- | --- | |  | *(include units)* | |
| Measurement direction(s) | |  |  |  |  | | --- | --- | --- | --- | |  | Positive |  | Negative | |
| **Internal Clock** |  |
| Clock type(s) | |  |  |  |  | | --- | --- | --- | --- | |  | Synchronous |  | Crystal | |

|  |  |
| --- | --- |
| **Enclosure and Protective Class** |  |
| Enclosure type | |  | | --- | |  | |
| Protective class | |  | | --- | |  | |
| **Software/Firmware** |  |
| Software/firmware version | |  | | --- | |  | |
| **Test Output** |  |
| Test output | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | Optical |  | Electrical (IEC 62053.31) |  | Other | |
| If other, describe the test output: | |  | | --- | |  | |
| Number of test pulses needed to ensure accuracy of at least 1/10 of the class of meter at different test points. | |  |  |  | | --- | --- | --- | | Current (A) | Power factor | Number of test pulses | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |
| **Reference conditions** |  |
| Reference temperature | |  |  |  |  | | --- | --- | --- | --- | |  | 23 °C |  | Other | |
| If other, specify | |  | | --- | |  | |
| **Power supply** |  |
| Is the power supply connected to the voltage circuits? | |  |  |  |  | | --- | --- | --- | --- | |  | Yes |  | No | |
| Remarks: | |
|  | |

# Metrological Checklist

Refer to indicated clauses in NMI M 13-1

| **Clause number and requirement (NMI M 13-1)** | | | | **Value / Remark** | **Result** |
| --- | --- | --- | --- | --- | --- |
| **3.1** | | **Units of measurement** | | | |
| Valid units of measurement used | |  |  |
| **3.2** | | **Calculated quantities** | | | |
| Indicated quantity equals value obtained using indicated values with applicable rounding | |  |  |
| If rounding applied it is ±0.5 minimum measured quantity | |  |  |
| **3.4** | **Information to be displayed on meter exterior** – see 5.6Marking of meter – name-plates | | | | |
| **3.5** | **Verification mark** | | | | |
| Provision for a verification mark | |  | |  |
| **3.6** | **Sealing** | | | | |
| Do mechanical seal protect parameters? | |  | |  |
| If not, solid state sealing is required: | |  | |  |
| Access to protected parameters protected | |  | |  |
| Access to protected parameters recorded | |  | |  |
| Records readily accessible | |  | |  |
| Record easily identifiable (not confused) | |  | |  |
| Reference record marked on meter | |  | |  |
| Record shall not repeat in a sequence of less than  99 alterations; record shall persist reliably for at least 2 years and persist through influence and disturbance tests | |  | |  |

# Mechanical requirements

## Shock test

Refer to AS 62052.11:2018, **5.2.2.2**. IEC 60068-2-27.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Meter in non-operating condition, without the packing

|  |  |  |
| --- | --- | --- |
| **Requirement (after test)** | **Remark** | **Result** |
| No damage to meter |  |  |
| No change of information |  |  |
| Meter shall operate correctly (see below) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **MPE by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 |  | 0.2 | 0.5 | 1 | 2 |

## Vibration (sinusoidal) test

Refer to AS 62052.11:2018, **5.2.2.3**. IEC 60068-2-6.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Meter in non-operating condition, without the packing

|  |  |  |
| --- | --- | --- |
| **Requirement (after test)** | **Remark** | **Result** |
| No damage to meter |  |  |
| No change of information |  |  |
| Meter shall operate correctly (see below) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **MPE by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 |  | 0.2 | 0.5 | 1 | 2 |

## Window

Refer to AS 62052.11:2018, **5.3**.

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Display is able to be read either through transparent cover or transparent window. |  |  |

## Display of measured values

Refer to AS 62052.11:2018, **5.10.**

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| For an electronic display, non-volatile memory shall have a retention time of at least 4 months. |  |  |
| All displays can be shown with the identification of each tariff applied. For at least 5 s with automatic sequencing. |  |  |
| The active tariff rate shall be indicated. |  |  |
| Electromechanical registers are compliant. |  |  |
| Register shall be able to record and display energy corresponding to maximum current, reference voltage and unity power factor without returning to the same index. |  |  |
| It shall be impossible to reset cumulative total energy register (without breaking a seal). |  |  |

## Output device

Refer to AS 62052.11:2018, **5.11**.

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| The meter shall have a test output device. |  |  |

**For electrical test output**

|  |  |  |
| --- | --- | --- |
| Complies with IEC 62053.31 |  |  |

**For optical test output**

Mechanical and electrical characteristics. Refer to AS 62052.11:2018, **5.11.1**.

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Accessible from the front |  |  |
| Maximum pulse frequency ≤ 2.5 kHz |  |  |
| Unmodulated output pulses have the shape shown in Figure D.2. |  |  |
| Transition time < 20 μs, verified by a reference receiver diode with *t*r ≤ 0.2 μs |  |  |

Optical characteristics. Refer to AS 62052.11:2018, **5.11.2**.

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Wavelength between 550 nm and 1000 nm. |  |  |
| On-condition 50 μW/cm2 ≤ E­T ≤ 1000 μW/cm2 |  |  |
| Off-condition E­T ≤ 2 μW/cm2 |  |  |

## Marking of meter – name-plates

Refer to AS 62052.11:2018, **5.12.1** and NMI M 13-1:2022, **3.4**.

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| 1. Manufacturer’s name or mark |  |  |
| 1. Model designation |  |  |
| Space for NMI pattern approval number |  |  |
| 1. Number of phases, number of wires |  |  |
| 1. Serial number and/or property number\* |  |  |
| Year of manufacture |  |  |
| 1. Reference voltage *U*nom |  |  |
| 1. For direct connected: basic current |  |  |
| For transformer-operated: rated current |  |  |
| Maximum current |  |  |
| 1. Reference frequency (Hz) |  |  |
| 1. Meter constant |  |  |
| 1. Class index |  |  |
| 1. Reference temperature if not 23 °C. |  |  |
| 1. Double square sign for insulating encased meters of protective class II. |  |  |
| 1. The suitable installation environment:   IM for indoor meter  AOM for Australian outdoor meter\*  OM for outdoor meter |  |  |

Note (\*): requirements indicated with an asterisk (\*) are AS modifications to the IEC standard.

## Marking of meter – connection diagrams and terminal marking

Refer to AS 62052.11:2018, **5.12.2.**

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Diagram of connection marked on meter (preferred) or refer to connection diagram |  |  |

# Climatic conditions

## Temperature range

Refer to AS 62052.11:2018, **6.1**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Temperature ranges (°C)** | **Meter** | **Indoor** | **Outdoor** | **AOM\*** | **Result** |
| Specified operating range |  | −10 to +45 | −25 to +45 | −10 to +55 |  |
| Limit range of operation |  | −25 to +55 | −40 to +70 | −10 to +70 |  |
| Limit range for storage and transportation |  | −25 to +70 | −40 to +70 | −25 to +70 |  |

Note (\*): Australian outdoor meter (AOM) is an AS modification to the IEC standard.

## Dry heat

Refer to AS 62052.11:2018, **6.3.1**. IEC 60068-2-2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Meter in non-operating condition
* Duration: 72 h

|  |  |
| --- | --- |
| Temperature: |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (after test)** | **Remark** | **Result** |
| No damage to meter |  |  |
| No change of information |  |  |
| Meter shall operate correctly (see below) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **MPE by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 |  | 0.2 | 0.5 | 1 | 2 |

## Cold

Refer to AS 62052.11:2018, **6.3.2**. IEC 60068-2-1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Meter in non-operating condition
* Duration: 72 h

|  |  |
| --- | --- |
| Temperature: |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (after test)** | **Remark** | **Result** |
| No damage to meter |  |  |
| No change of information |  |  |
| Meter shall operate correctly (see below) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **MPE by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 |  | 0.2 | 0.5 | 1 | 2 |

## Damp heat cyclic test

Refer to AS 62052.11:2018, **6.3.3**. IEC 60068-2-30.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Voltage and auxiliary circuits energised with reference voltage
* Without any current in the current circuits
* Duration: 6 cycles

|  |  |
| --- | --- |
| Upper Temperature: |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (24 h after end of test)** | **Remark** | **Result** |
| Conduct Impulse test for robustness with 0.8 voltage – 8 kV\* | | |
| No disruptive discharge |  |  |
| No damage to meter |  |  |
| No change of information |  |  |
| No trace of corrosion |  |  |
| Meter shall operate correctly (see below) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **MPE by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 |  | 0.2 | 0.5 | 1 | 2 |

Note (\*): AS modifications in AS 62052.31:2018, Appendix ZZ.

## Protection against solar radiation

Refer to AS 62052.11:2018, **6.3.4** and **Appendix ZA\***.

Note (\*): AS modification to the IEC standard.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Meter in non-operating condition
* UV lamp output: 21 750 lm to 27 000 lm
* Duration: 48 h and distance of 250 mm

|  |  |  |
| --- | --- | --- |
| **Requirement (after the test)** | **Remark** | **Result** |
| For transparent parts – no noticeable deterioration or loss in transparency |  |  |
| For non-transparent parts – no noticeable effect |  |  |
| Markings shall not peel or flake, and shall remain legible |  |  |

# Electrical requirements

## Limit, *x*

Refer to Refer to AS 62052.11:2018, **7.1.2**.

A number of tests refer to the limit, *x*, for changes in the register and test output.

|  |  |  |
| --- | --- | --- |
| **Number of measuring elements, *m*:** |  |  |
| **Reference voltage, *U*n:** |  | V |
| **Maximum current, *I*max:** |  | A |
|  |  | kWh |

## Voltage dips and short interruptions

Refer to AS 62052.11:2018, **7.1.2**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Voltage and auxiliary circuits energised with reference voltage
* Without any current in the current circuits

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test** | **Δ*U*** | **Duration** | **Number of interruptions** | **Restoring time** | **Change in Register** | **Change in test output** | **Limit, *x* (kW·h)** | **Result** |
| b) | 100% | 1 s | 3 | 50 ms |  |  |  |  |
| a) | 100% | 20 ms | 1 | n/a |  |  |  |  |
| c) | 50% | 1 min | 1 | n/a |  |  |  |  |
| Remarks: | | | | | | | | | |
|  | | | | | | | | | |

## Impulse test for robustness

Refer to AS 62052.11:2018, **7.3**, and AS 62052.31:2017, **Appendix ZZ\***.

Note (\*): AS modification to the IEC standard.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Impulse test voltage: 10 000 kV.
* Conventional output impedance: 40 Ω ±10%
* Apply to voltage circuits and auxiliary circuits.

|  |  |  |
| --- | --- | --- |
| **Requirement (after test)** | **Remark** | **Result** |
| No disruptive discharge |  |  |
| Meter shall operate correctly (see below) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **MPE by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 |  | 0.2 | 0.5 | 1 | 2 |

## Immunity to earth fault

Refer to AS 62052.11:2018, **7.4**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Earth fault conditions.
* Current: 0.5 *I*n and power factor 1.
* Duration 4 h.

|  |  |  |
| --- | --- | --- |
| **Requirement (after test when meter is back at nominal working temperature)** | **Remark** | **Result** |
| No damage to meter. |  |  |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 |  | 0.1 | 0.3 | 0.7 | 1.0 |

## Power consumption

Refer to AS 62053.21:2018, **7.1** / AS 62053.22:2018, **7.1**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* At reference voltage
* At basic / nominal current.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Circuit** | **Power consumption** | **Limit** | **Remark** | **Result** |
| Voltage Circuit |  |  |  |  |
| Current Circuit |  |  |  |  |
| Auxiliary power supply |  |  |  |  |

## Influence of short-time overcurrents

Refer to AS 62053.21:2018, **7.2** / AS 62053.22:2018, **7.2**.

* For polyphase meters, test phase-by-phase.

### Direct connected meters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Short-time overcurrent of 30 *I*max.
* Duration: one half-cycle at rated frequency.

|  |  |  |
| --- | --- | --- |
| **Requirement (after return to initial temperature)** | **Remark** | **Result** |
| No damage to meter. |  |  |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Phase** | **Variation in error (%)** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b | 1 |  |  | n/a | n/a | 1.5 | 1.5 |
|  |  |
|  |  |

### Transformer-operated meters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Short-time overcurrent of 20 *I*max.
* Duration: 0.5 s.

|  |  |  |
| --- | --- | --- |
| **Requirement (after return to initial temperature)** | **Remark** | **Result** |
| No damage to meter. |  |  |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Phase** | **Variation in error (%)** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*n | 1 |  |  | 0.05 | 0.05 | 0.5 | 1.0 |
|  |  |
|  |  |

## Influence of self-heating

Refer to AS 62053.21:2018, **7.3** / AS 62053.22:2018, **7.3**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Voltage circuits energised, without any current in the current circuits, for at least 2 h (1 h for class 2).
* Maximum current applied to current circuits.

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Time after *I*max applied** | **Variation in error (%)** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 |  |  | 0.1 | 0.2 | 0.7 | 1.0 |
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* Test repeated for 0.5 (inductive) power factor.

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Time after *I*max applied** | **Variation in error (%)** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 0.5 inductive |  |  | 0.1 | 0.2 | 0.7 | 1.0 |
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## Test of immunity to electrostatic discharges

Refer to AS 62052.11:2018, **7.5.2**. IEC 61000-4-2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Voltage circuits energised, without any current in the current circuits.
* Number of discharges: at least 10
* Polarity of discharges: the most sensitive polarity

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Application** | **Discharge mode** | **Test voltage (kV)** | **Polarity** | **No. of discharges** | **Change in Register** | **Change in test output** | **Limit, *x* (kW·h)** | **Result** |
| Direct | Contact |  |  |  |  |  |  |  |
| Direct | Air |  |  |  |  |  |  |  |
| Indirect, Horizontal  coupling plane | Contact |  |  |  |  |  |  |  |
| Indirect, Vertical  coupling plane | Contact |  |  |  |  |  |  |  |
| Remarks: | | | | | | | | | |
|  | | | | | | | | | |

|  |  |  |
| --- | --- | --- |
| **Requirement (after test)** | **Remark** | **Result** |
| No damage |  |  |
| Meter shall operate correctly (see below) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **MPE by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 |  | 0.2 | 0.5 | 1 | 2 |

## Test of immunity to electromagnetic RF fields

Refer to AS 62052.11:2018, **7.5.3**. IEC 61000-4-3.

* Frequency band: 80 MHz to 2400 MHz\*
* Number of discharges: at least 10
* Polarity of discharges: the most sensitive polarity

Note (\*): AS modification to the IEC standard.

### Test with current

Refer to AS 62052.11:2018, **7.5.3 a)**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Voltage and auxiliary circuits energised with reference voltage.
* Unmodulated test field strength: 10 V/m.

|  |  |  |
| --- | --- | --- |
| **Requirement (during test)** | **Remark** | **Result** |
| Behaviour of meter is not perturbed |  |  |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 | 1.0 | 2.0 | 2.0 | 3.0 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Antenna / facility** | **Frequency value / range (MHz)** | **Polarisation** | **Facing meter** | **Variation in error (%)** | **Limit of variation (%)** |
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### Test without current

Refer to AS 62052.11:2018, **7.5.3 b)**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Voltage and auxiliary circuits energised with reference voltage.
* Without current in the current circuits.
* Unmodulated test field strength: 30 V/m.

|  |  |  |
| --- | --- | --- |
| **Requirement (during test)** | **Remark** | **Result** |
| Change in register and change in test output within limit (see below) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Antenna / facility** | **Frequency value / range (MHz)** | **Polarisation** | **Facing meter** | **Change in Register** | **Change in test output** | **Limit, *x* (kW·h)** |
|  |  |  |  |  |  |  |
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## Fast transient burst test

Refer to AS 62052.11:2018, **7.5.4**. IEC 61000-4-4.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Voltage and auxiliary circuits energised with reference voltage.

|  |  |  |
| --- | --- | --- |
| **Requirement (during test)** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 | 1.0 | 2.0 | 4.0 | 6.0 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Circuit** | **Voltage peak (kV)** | **Polarity  (60 s at each)** | **Variation in error (%)** | **Limit of variation (%)** |
| Voltage | 4 | Positive |  |  |
| Negative |  |
| Current | 4 | Positive |  |
| Negative |  |
| Auxiliary circuit | 2 | Positive |  |
| Negative |  |

## Test of immunity to conducted disturbances, induced by radio-frequency fields

Refer to AS 62052.11:2018, **7.5.5**. IEC 61000-4-6.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Voltage and auxiliary circuits energised with reference voltage
* Frequency range: 150 kHz to 80 MHz
* Voltage level: 10 V

|  |  |  |
| --- | --- | --- |
| **Requirement (during test)** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Power or IO Port** | **Variation in error (%)** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 |  |  | 1.0 | 2.0 | 2.0 | 3.0 |
|  |  |
|  |  |

## Surge immunity test

Refer to AS 62052.11:2018, **7.5.6**. IEC 61000-4-5.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Voltage and auxiliary circuits energised with reference voltage
* Without current in the current circuits.
* Tested in differential mode (line to line)

|  |  |  |
| --- | --- | --- |
| **Requirement (during test)** | **Remark** | **Result** |
| Change in register and change in test output within limit (see below) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Circuit** | **Test voltage** | **Phase Angle** | **Polarity (5 tests at each)** | **Change in Register** | **Change in test output** | **Limit, *x* (kW·h)** |
| Voltage | 4 kV | 60° | Positive |  |  |  |
|  | Negative |  |  |
| 240° | Positive |  |  |
|  | Negative |  |  |
| Current | 4 kV | 60° | Positive |  |  |
|  | Negative |  |  |
| 240° | Positive |  |  |
|  | Negative |  |  |
| Auxiliary | 1 kV | 60° | Positive |  |  |
|  | Negative |  |  |
| 240° | Positive |  |  |
|  | Negative |  |  |

## Damped oscillatory waves immunity test

Refer to AS 62052.11:2018, **7.5.7**. IEC 61000-4-12.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Voltage and auxiliary circuits energised with reference voltage

|  |  |  |
| --- | --- | --- |
| **Requirement (during test)** | **Remark** | **Result** |
| Behaviour of meter is not perturbed |  |  |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 | 1.0 | 2.0 | 2.0 | 3.0 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Circuit** | **Mode** | **Test Voltage (kV)** | **Test frequency (kHz)** | **Repetition rate (Hz)** | **Variation in error (%)** | **Limit of variation (%)** |
| Voltage | Common | 2.5 | 100 | 40 |  |  |
| 1000 | 400 |  |
| 100 | 40 |  |
| 1000 | 400 |  |
| Differential | 1.0 | 100 | 40 |  |
| 1000 | 400 |  |
| 100 | 40 |  |
| 1000 | 400 |  |
| Auxiliary | Common | 2.5 | 100 | 40 |  |
| 1000 | 400 |  |
| 100 | 40 |  |
| 1000 | 400 |  |
| Differential | 1.0 | 100 | 40 |  |
| 1000 | 400 |  |
| 100 | 40 |  |
| 1000 | 400 |  |

# Accuracy requirements and influence quantities

## Limits of error due to variation of the current

Refer to AS 62053.21:2018, **8.1** / AS 62053.22:2018, **8.1**.

### Direct connected meters – balanced loads

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (during test)** | **Remark** | **Result** |
| Errors shall not exceed limits (see below) |  |  |
| Where applicable in both directions |  |  |

|  |  |
| --- | --- |
| Direction of energy measurement |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **Error Limit (±%) for class** | |
| **1** | **2** |
| 0.05 *I*b | 1 |  | 1.5 | 2.5 |
| 0.1 *I*b |  | 1.0 | 2.0 |
| 0.2 *I*b |  |
| *I*b |  |
| *I*max |  |
| 0.1 *I*b | 0.5 inductive |  | 1.5 | 2.5 |
| 0.2 *I*b |  | 1.0 | 2.0 |
| *I*b |  |
| *I*max |  |
| 0.1 *I*b | 0.8 capacitive |  | 1.5 | N/A |
| 0.2 *I*b |  | 1.0 | N/A |
| *I*b |  |
| *I*max |  |

### Direct connected meters – single-phase load with balanced polyphase voltages

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (during test)** | **Remark** | **Result** |
| Errors shall not exceed limits (see below) |  |  |
| Variation in error (between single-phase load and balanced polyphase load) does not exceed limits (see below) |  |  |
| Where applicable in both directions |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power Factor** | **Error Limits (±%) by class** | | **Limit of variation (±%) by class** | |
| **1** | **2** | **1** | **2** |
| 0.1 *I*b to *I*max | 1 | 2.0 | 3.0 | 1.5 | 2.5 |
| 0.2 *I*b to *I*max | 0.5 inductive | 2.0 | 3.0 | N/A | N/A |

|  |  |
| --- | --- |
| Direction of energy measurement |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Phase** | **Current (A)** | **Power factor** | **Percentage error** | **Error Limit (±%)** | **Variation in error (%)** | **Limit of variation (±%)** |
| L1 | 0.1 *I*b | 1 |  |  |  |  |
| 0.2 *I*b |  |  |
| *I*b |  |  |
| *I*max |  |  |
| 0.2 *I*b | 0.5 inductive |  |  | N/A | N/A |
| *I*b |  | N/A |
| *I*max |  | N/A |
| L2 | 0.1 *I*b | 1 |  |  |  |  |
| 0.2 *I*b |  |  |
| *I*b |  |  |
| *I*max |  |  |
| 0.2 *I*b | 0.5 inductive |  |  | N/A | N/A |
| *I*b |  | N/A |
| *I*max |  | N/A |
| L3 | 0.1 *I*b | 1 |  |  |  |  |
| 0.2 *I*b |  |  |
| *I*b |  |  |
| *I*max |  |  |
| 0.2 *I*b | 0.5 inductive |  |  | N/A | N/A |
| *I*b |  | N/A |
| *I*max |  | N/A |

### Transformer-operated meters – balanced loads

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (during test)** | **Remark** | **Result** |
| Errors shall not exceed limits (see below) |  |  |
| Where applicable in both directions |  |  |

|  |  |
| --- | --- |
| Direction of energy measurement |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **Error Limit (±%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| 0.01 *I*n | 1 |  | 0.4 | 1.0 | 1.5 | 2.5 |
| 0.05 *I*n |  | 0.2 | 0.5 | 1.0 | 2.0 |
| 0.1 *I*n |  |
| *I*n |  |
| *I*max |  |
| 0.02 *I*n | 0.5 inductive |  | 0.5 | 1.0 | 1.5 | 2.5 |
| 0.1 *I*n |  | 0.3 | 0.6 | 1.0 | 2.0 |
| *I*n |  |
| *I*max |  |
| 0.02 *I*n | 0.8 capacitive |  | 0.5 | 1.0 | 1.5 | N/A |
| 0.1 *I*n |  | 0.3 | 0.6 | 1.0 | N/A |
| *I*n |  |
| *I*max |  |

### Transformer-operated meters – single-phase load with balanced polyphase voltages

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (during test)** | **Remark** | **Result** |
| Errors shall not exceed limits (see below) |  |  |
| Variation in error (between single-phase load and balanced polyphase load) does not exceed limits (see below) |  |  |
| Where applicable in both directions |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power Factor** | **Error Limits (±%) by class** | | | | **Limit of variation (±%) by class** | | | | |
| **0.2 S** | **0.5 S** | **1** | **2** | | **0.2 S** | **0.5 S** | **1** | **2** |
| 0.05 *I*n to *I*max | 1 | 0.3 | 0.6 | 2.0 | 3.0 | | 0.4 | 1.0 | 1.5 | 2.5 |
| 0.1 *I*n to *I*max | 0.5 inductive | 0.4 | 1.0 | 2.0 | 3.0 | | N/A | N/A | N/A | N/A |

|  |  |
| --- | --- |
| Direction of energy measurement |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Phase** | **Current (A)** | **Power factor** | **Percentage error** | **Error Limit (±%)** | **Variation in error (%)** | **Limit of variation (±%)** |
| L1 | 0.05 *I*n | 1 |  |  |  |  |
| 0.1 *I*n |  |  |
| *I*n |  |  |
| *I*max |  |  |
| 0.1 *I*n | 0.5 inductive |  |  | N/A | N/A |
| *I*n |  | N/A |
| *I*max |  | N/A |
| L2 | 0.05 *I*n | 1 |  |  |  |  |
| 0.1 *I*n |  |  |
| *I*n |  |  |
| *I*max |  |  |
| 0.1 *I*n | 0.5 inductive |  |  | N/A | N/A |
| *I*n |  | N/A |
| *I*max |  | N/A |
| L3 | 0.05 *I*n | 1 |  |  |  |  |
| 0.1 *I*n |  |  |
| *I*n |  |  |
| *I*max |  |  |
| 0.1 *I*n | 0.5 inductive |  |  | N/A | N/A |
| *I*n |  | N/A |
| *I*max |  | N/A |

## Ambient temperature variation

Refer to AS 62053.21:2018, **8.2** / AS 62053.22:2018, **8.2**.

In the tables below:

* *T*L is the lower temperature in the range
* *T*L is the upper temperature in the range
* *e*L is the error at the lower temperature in the range
* *e*L is the error at the upper temperature in the range
* Mean temperature coefficient is calculated as

### Direct connected meters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (during test)** | **Remark** | **Result** |
| The mean temperature coefficient shall not exceed the limits (see below) |  |  |
| At least four 20 K temperature ranges that span the operating temperature range |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Mean temperature coefficient (%/K) by class** | |
| **1** | **2.0** |
| 0.1 *I*b to *I*max | 1 | 0.05 | 0.1 |
| 0.2 *I*b to *I*max | 0.5 inductive | 0.07 | 0.15 |

|  |  |  |
| --- | --- | --- |
| 20 K Temperature Range | *T*L (°C) | *T*U (°C) |
| Temperatures |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | | **Mean temperature coefficient (%/K)** | |
| ***e*L** | ***e*U** | **Calculated** | **Limit** |
| 0.1 *I*b | 1 |  |  |  |  |
| *I*b |  |  |  |
| *I*max |  |  |  |
| 0.2 *I*b | 0.5 inductive |  |  |  |  |
| *I*b |  |  |  |
| *I*max |  |  |  |

*(Repeat for all 20 K temperature ranges)*

### Transformer-operated meters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (during test)** | **Remark** | **Result** |
| The mean temperature coefficient shall not exceed the limits (see below) |  |  |
| At least four 20 K temperature ranges that span the operating temperature range |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Mean temperature coefficient (%/K) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| 0.05 *I*n to *I*max | 1 | 0.01 | 0.03 | 0.05 | 0.1 |
| 0.1 *I*n to *I*max | 0.5 inductive | 0.02 | 0.05 | 0.07 | 0.15 |

|  |  |  |
| --- | --- | --- |
| 20 K Temperature Range | *T*L (°C) | *T*U (°C) |
| Temperatures |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | | **Mean temperature coefficient (%/K)** | |
| ***e*L** | ***e*U** | **Calculated** | **Limit** |
| 0.05 *I*n | 1 |  |  |  |  |
| *I*n |  |  |  |
| *I*max |  |  |  |
| 0.1 *I*n | 0.5 inductive |  |  |  |  |
| *I*n |  |  |  |
| *I*max |  |  |  |

*(Repeat for all 20 K temperature ranges)*

## Voltage variation

Refer to AS 62053.21:2018, **8.2** / AS 62053.22:2018, **8.2**.

### Direct connected meters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |
| --- | --- |
| Value of *U*nom |  |

| **Voltage variation (%)** | **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** | |
| --- | --- | --- | --- | --- | --- |
| **1** | **2.0** |
| +10 | 0.05 *I*b | 1 |  | 0.7 | 1.0 |
| *I*b |  |
| *I*max |  |
| 0.1 *I*b | 0.5 inductive |  | 1.0 | 1.5 |
| *I*b |  |
| *I*max |  |
| –10 | 0.05 *I*b | 1 |  | 0.7 | 1.0 |
| *I*b |  |
| *I*max |  |
| 0.1 *I*b | 0.5 inductive |  | 1.0 | 1.5 |
| *I*b |  |
| *I*max |  |
| +15 | 0.05 *I*b | 1 |  | 2.1 | 3.0 |
| *I*b |  |
| *I*max |  |
| 0.1 *I*b | 0.5 inductive |  | 3.0 | 4.5 |
| *I*b |  |
| *I*max |  |
| –20 | 0.05 *I*b | 1 |  | 2.1 | 3.0 |
| *I*b |  |
| *I*max |  |
| 0.1 *I*b | 0.5 inductive |  | 3.0 | 4.5 |
| *I*b |  |
| *I*max |  |
| –50 | 0.05 *I*b | 1 |  | –100 to +10 | |
| *I*b |  |
| *I*max |  |
| 0.1 *I*b | 0.5 inductive |  |
| *I*b |  |
| *I*max |  |

### Transformer-operated meters – class 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |
| --- | --- |
| Value of *U*nom |  |

| **Voltage variation (%)** | **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** |
| --- | --- | --- | --- | --- |
| **1** |
| +10 | 0.02 *I*n | 1 |  | 0.7 |
| *I*n |  |
| *I*max |  |
| 0.05 *I*n | 0.5 inductive |  | 1.0 |
| *I*n |  |
| *I*max |  |
| –10 | 0.02 *I*n | 1 |  | 0.7 |
| *I*n |  |
| *I*max |  |
| 0.05 *I*n | 0.5 inductive |  | 1.0 |
| *I*n |  |
| *I*max |  |
| +15 | 0.02 *I*n | 1 |  | 2.1 |
| *I*n |  |
| *I*max |  |
| 0.05 *I*n | 0.5 inductive |  | 3.0 |
| *I*n |  |
| *I*max |  |
| –20 | 0.02 *I*n | 1 |  | 2.1 |
| *I*n |  |
| *I*max |  |
| 0.05 *I*n | 0.5 inductive |  | 3.0 |
| *I*n |  |
| *I*max |  |
| –50 | 0.02 *I*n | 1 |  | –100 to +10 |
| *I*n |  |
| *I*max |  |
| 0.05 *I*n | 0.5 inductive |  |
| *I*n |  |
| *I*max |  |

### Transformer-operated meters – class 0.2 S / class 0.5 S

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |
| --- | --- |
| Value of *U*nom |  |

| **Voltage variation (%)** | **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** | |
| --- | --- | --- | --- | --- | --- |
| **0.2 S** | **0.5 S** |
| +10 | 0.05 *I*n | 1 |  | 0.1 | 0.2 |
| *I*n |  |
| *I*max |  |
| 0.1 *I*n | 0.5 inductive |  | 0.2 | 0.4 |
| *I*n |  |
| *I*max |  |
| –10 | 0.05 *I*n | 1 |  | 0.1 | 0.2 |
| *I*n |  |
| *I*max |  |
| 0.1 *I*n | 0.5 inductive |  | 0.2 | 0.4 |
| *I*n |  |
| *I*max |  |
| +15 | 0.05 *I*n | 1 |  | 0.3 | 0.6 |
| *I*n |  |
| *I*max |  |
| 0.1 *I*n | 0.5 inductive |  | 0.6 | 1.2 |
| *I*n |  |
| *I*max |  |
| –20 | 0.05 *I*n | 1 |  | 0.3 | 0.6 |
| *I*n |  |
| *I*max |  |
| 0.1 *I*n | 0.5 inductive |  | 0.6 | 1.2 |
| *I*n |  |
| *I*max |  |
| –50 | 0.05 *I*n | 1 |  | –100 to +10 | |
| *I*n |  |
| *I*max |  |
| 0.1 *I*n | 0.5 inductive |  |
| *I*n |  |
| *I*max |  |

## Frequency Variation

Refer to AS 62053.21:2018, **8.2** / AS 62053.22:2018, **8.2**.

### Direct connected meters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

| **Frequency variation (%)** | **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** | |
| --- | --- | --- | --- | --- | --- |
| **1** | **2.0** |
| +2 | 0.05 *I*b | 1 |  | 0.5 | 0.8 |
| *I*b |  |
| *I*max |  |
| 0.1 *I*b | 0.5 inductive |  | 0.7 | 1.0 |
| *I*b |  |
| *I*max |  |
| –2 | 0.05 *I*b | 1 |  | 0.5 | 0.8 |
| *I*b |  |
| *I*max |  |
| 0.1 *I*b | 0.5 inductive |  | 0.7 | 1.0 |
| *I*b |  |
| *I*max |  |

### Transformer-operated Meters – class 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

| **Frequency variation (%)** | **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** |
| --- | --- | --- | --- | --- |
| **1** |
| +2 | 0.02 *I*n | 1 |  | 0.5 |
| *I*n |  |
| *I*max |  |
| 0.05 *I*n | 0.5 inductive |  | 0.7 |
| *I*n |  |
| *I*max |  |
| –2 | 0.02 *I*n | 1 |  | 0.5 |
| *I*n |  |
| *I*max |  |
| 0.05 *I*n | 0.5 inductive |  | 0.7 |
| *I*n |  |
| *I*max |  |

### Transformer-operated Meters – class 0.2 S / class 0.5 S

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

| **Frequency variation (%)** | **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** | |
| --- | --- | --- | --- | --- | --- |
| **0.2 S** | **0.5 S** |
| +2 | 0.05 *I*n | 1 |  | 0.1 | 0.2 |
| *I*n |  |
| *I*max |  |
| 0.1 *I*n | 0.5 inductive |  | 0.1 | 0.2 |
| *I*n |  |
| *I*max |  |
| –2 | 0.05 *I*n | 1 |  | 0.1 | 0.2 |
| *I*n |  |
| *I*max |  |
| 0.1 *I*n | 0.5 inductive |  | 0.1 | 0.2 |
| *I*n |  |
| *I*max |  |

## Reversed phase sequence

Refer to AS 62053.21:2018, **8.2** / AS 62053.22:2018, **8.2**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2.0** |
| 0.1 *I*b (0.1 *I*n) | 1 |  | 0.05 | 0.1 | 1.5 | 1.5 |

## Voltage unbalance

Refer to AS 62053.21:2018, **8.2** / AS 62053.22:2018, **8.2**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Phases interrupted** | **Variation in error (%)** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 | 1 phase – L1 |  | 0.5 | 1.0 | 2.0 | 4.0 |
| 1 phase – L2 |  |
| 1 phase – L3 |  |
| 2 phases – L1, L2 |  |
| 2 phases – L1, L3 |  |
| 2 phases – L2, L3 |  |

## Auxiliary voltage ±15%

Refer to AS 62053.22:2018, **8.2.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |
| --- | --- |
| Reference auxiliary voltage |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Voltage (% from reference)** | **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** | |
| **0.2 S** | **0.5 S** |
| +15 | 0.01 *I*n | 1 |  | 0.05 | 0.1 |
| –15 |  |

## Harmonic components in the current and voltage circuits

Refer to AS 62053.21:2018, **8.2 and 8.2.1** / AS 62053.22:2018, **8.2 and 8.2.1**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| 0.5 *I*max | 1 |  | 0.4 | 0.5 | 0.8 | 1.0 |

## DC and even harmonics in the a.c. current circuit

Refer to AS 62053.21:2018, **8.2 and 8.2.3**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** | |
| **1** | **2** |
| *I*max/ √2 | 1 |  | 3.0 | 6.0 |

## Odd harmonics in the a.c current circuit

Refer to AS 62053.21:2018, **8.2 and 8.2.2**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** | |
| **1** | **2** |
| 0.5 *I*b (0.5 *I*n) | 1 |  | 3.0 | 6.0 |

## Sub harmonics in the a.c. current circuit

Refer to AS 62053.21:2018, **8.2 and 8.2.2** / AS 62053.22:2018, **8.2 and 8.2.2**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| 0.5 *I*b (0.5 *I*n) | 1 |  | 0.6 | 1.5 | 3.0 | 6.0 |

## Continuous magnetic induction of external origin

Refer to AS 62053.21:2018, **8.2 and 8.2.4** / AS 62053.22:2018, **8.2 and 8.2.3**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Position of magnet** | **Variation in error (%)** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 | Front |  | 2.0 | 2.0 | 2.0 | 3.0 |
| Left-hand side |  |
| Right-hand side |  |
| Top |  |
| Bottom |  |

## Magnetic induction of external origin 0.5 mT

Refer to AS 62053.21:2018, **8.2** / AS 62053.22:2018, **8.2**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
| *I*b (*I*n) | 1 |  | 0.5 | 1.0 | 2.0 | 3.0 |
|  |
|  |
|  |
|  |

## Operation of accessories

Refer to AS 62053.21:2018, **8.2** / AS 62053.22:2018, **8.2**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Variation in error does not exceed limits (see below) |  |  |

* Accessories are energized intermittently
* Value of current is 0.05 *I*b for class 1 / class 2 direct-connected meters, 0.05 *I*n for class 1 / class 2 transformer-operated meters, and 0.01 *I*n for class 0.2 S / class 0.5 S transformer-operated meters.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Accessory** | **Variation in error (%)** | **Limit of variation (%) by class** | | | |
| **0.2 S** | **0.5 S** | **1** | **2** |
|  | 1 |  |  | 0.05 | 0.1 | 0.5 | 1.0 |
|  |  |
|  |  |
|  |  |
|  |  |

## Initial start-up of the meter

Refer to AS 62053.21:2018, **8.3.1** / AS 62053.22:2018, **8.3.1**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Meter shall be functional within 5 s of reference voltage being applied to terminals |  |  |

## Test of no-load condition

Refer to AS 62053.21:2018, **8.3.2** / AS 62053.22:2018, **8.3.2**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

* Voltage of 115% of *U*n applied to voltage circuits
* No current (open-circuit)

|  |  |
| --- | --- |
| Test period: |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| During the no-load condition, no more than one pulse from the test output |  |  |

## Starting

Refer to AS 62053.21:2018, **8.3.3** / AS 62053.22:2018, **8.3.3**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |
| --- | --- |
| Starting current: |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Meter shall start and continue to register – positive direction |  |  |
| Meter shall start and continue to register – negative direction (if applicable) |  |  |

## Meter constant

Refer to AS 62053.21:2018, **8.3.4** / AS 62053.22:2018, **8.3.4**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

|  |  |
| --- | --- |
| Meter constant: |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| The relationship between the test output and the indication is as marked on the name-plate (meter constant) |  |  |

# Time keeping accuracy of internal clocks

Refer to AS 62052.11:2018, **ZC1**. AS 62054.21:2006, **7.5.2**.

## Synchronous

### Mains Supply

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

Testing period: 30 days

Test temperature: 23°C

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Date | | Time | | Difference (s) | Variation (s/day) | |
| Ref | Test | Result | Limit |
| Start |  |  |  |  |  | 0.167 |
| End |  |  |  |  |

### Operational Reserve

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

Testing period: 36 h

Test temperature: 23°C

|  |  |  |  |
| --- | --- | --- | --- |
|  | Spring |  | battery/super-capacitor/primary cell |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Date | | Time | | Difference (s) | Variation (s/day) | | |
| Ref | Test | Result | Limit - Spring | Limit - Battery |
| Start |  |  |  |  |  | 120 | 1 |
| End |  |  |  |  |

## Crystal-controlled

### Mains Supply

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

Testing period: 30 days

Test temperature: 23°C

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Date | | Time | | Difference (s) | Variation (s/day) | |
| Ref | Test | Result | Limit |
| Start |  |  |  |  |  | 0.5 |
| End |  |  |  |  |

### Operational Reserve

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

Testing period: 36 h

Test temperature: 23°C

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Date | | Time | | Difference (s) | Variation (s/day) | |
| Ref | Test | Result | Limit |
| Start |  |  |  |  |  | 1 |
| End |  |  |  |  |

### High Temperature

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

Testing period: 24 h

Test temperature: 45°C

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Date | | Time | | Difference (s) | Variation (s/day) | |
| Ref | Test | Result | Limit |
| Start |  |  |  |  |  | 0.15 |
| End |  |  |  |  |

### Low Temperature

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Meter serial no.** |  |  |  | **At start** | **At end** |
| **Observer:** |  |  | **Temperature (°C):** |  |  |
| **Date:** |  |  | **Time (hh:mm):** |  |  |

Testing period: 24 h

Test temperature: –10°C

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Date | | Time | | Difference (s) | Variation (s/day) | |
| Ref | Test | Result | Limit |
| Start |  |  |  |  |  | 0.15 |
| End |  |  |  |  |