|  |  |
| --- | --- |
| blue%20tiff | 2 CD OIML R 46-3  Date: **13 Nov 2024**  Reference number: **TC12\_p1\_N072**  Supersedes document: TC12\_p1\_N057 |
| OIML TC 12 Instruments for measuring electrical quantities  Secretariat/Convenor: Phillip Mitchell, Australia  Email: [Phillip.mitchell@measurement.gov.au](mailto:Phillip.mitchell@measurement.gov.au) | Circulated to P- and O-members and liaison bodies and external organisations for:   |  |  |  | | --- | --- | --- | | |  | | --- | | X | | Discussion at meeting in March 2025 | |  |  | | |  | | --- | |  | | Comments by | |  |  | | |  | | --- | | X | | Vote (P-members only) and comments by: 20 February 2025 | |
| TITLE OF THE CD (English):  OIML R 46-3  **Electricity Meters – Alternating Current (a.c.)**  Part 3: Test report format | |

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Foreword

[To be added]

Explanatory Notes

Meaning of symbols used in this report

|  |  |  |
| --- | --- | --- |
| base m.p.e | = | base maximum permissible error |
| *b* | = | base maximum permissible error (at the appropriate current) expressed as a percentage (%) and taken as a positive value |
| *c* | = | mean temperature coefficient |
| *eu* and *el* | = | errors at the uppermost and the lowest temperatures respectively in the temperature interval of interest |
| *tu* and *tl* | = | uppermost and the lowest temperatures respectively in the temperature interval of interest |
| *f*nom | = | nominal frequency |
| *U*nom | = | nominal voltage |
| *U*test | = | test voltage |
| *I*max | = | maximum current |
| *I*tr | = | transitional current |
| *I*min | = | minimum current |
| *I*st | = | starting current |
| H1 | = | humidity class 1: enclosed locations where the instruments are not subjected to condensed water, precipitation, or ice formations |
| H2 | = | humidity class 2: enclosed locations where the instruments may be subjected to condensed water, to water from sources other than rain and to ice formations. |
| H3 | = | humidity class 3: open locations with average climatic conditions |
|  | = | absolute value of x |
| *τ* | = | expected time between two pulses (period) |
| *m* | = | number of elements |
| *k* | = | is the number of pulses emitted by the test output per kilowatt hour (the meter constant expressed in imp/kWh) |
| Δ*t* | = | test period (for test of no-load condition) |

References to the test procedures in Part 2 of this Recommendation are given in brackets after each test heading.

# Information

## Test information

Test Report

|  |  |
| --- | --- |
| Report reference number: |  |
| Date of issue: |  |
| Date(s) of testing: |  |

Laboratory

|  |  |
| --- | --- |
| Name: |  |
| Address: |  |
| Contact details: |  |

Client / applicant

|  |  |
| --- | --- |
| Name: |  |
| Address: |  |

Test specification

Record any variations from Parts 1 and 2 of this Recommendation.

|  |
| --- |
|  |

## Meter information

Manufacturer and type

|  |  |
| --- | --- |
| Meter manufacturer: |  |
| Meter type (model designation): |  |

Sample meters

|  |  |
| --- | --- |
| Serial number(s): |  |

Remarks

|  |
| --- |
|  |

## Meter specification

Accuracy and measured quantities

**Active electrical energy**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy class: |  |  | A / 2 |  | B / 1 |  | C / 0.5 |  | D / 0.2 |  | E / 0.1 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Demand |  | Fundamental frequency only |

**Apparent electrical energy**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy class: |  |  | A / 2 |  | B / 1 |  | C / 0.5 |  | D / 0.2 |  | E / 0.1 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Demand |  | Fundamental frequency only |

**Reactive**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy class: |  |  | A / 2 |  | B / 1 |  | C / 0.5 |  | D / 0.2 |  | E / 0.1 |

|  |  |  |
| --- | --- | --- |
|  |  | Demand |

Electrical parameters

|  |  |  |
| --- | --- | --- |
| Nominal frequency, *f*nom: |  | Hz |
| Nominal voltage, *U*nom: |  | V |
| Maximum current, *I*max: |  | A |
| Transitional current, *I*tr: |  | A |
| Minimum current, *I*min: |  | A |
| Starting current, *I*st: |  | A |

Environment

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Lower specified temperature: |  |  | −55 °C |  | −40 °C |  | −25 °C |  | −10 °C |  | +5 °C |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Upper specified temperature: |  |  | +30 °C |  | +40 °C |  | +55 °C |  | +70 °C |  | +85 °C |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Humidity class: |  |  | H1 |  | H2 |  | H3 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| For use: |  |  | Outdoor |  | Indoor use only |

Connection mode(s)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Direct-connected |  | Current transformer |  | Current and voltage transformers |

|  |  |
| --- | --- |
| Phases, wires, elements: |  |

Direction of energy flow and load balance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Single-register, bi-directional |  | Single-register, positive direction only |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Two-register, bi-directional |  | Single-register, uni-directional |

For bi-directional and poly-phase meters:

|  |  |  |
| --- | --- | --- |
|  |  | Concurrent flow of current in the positive and negative directions on different phases |

Testability

|  |  |  |
| --- | --- | --- |
| Meter constant, active energy: |  | *(include units of measurement)* |
| Meter constant, reactive energy: |  | *(include units of measurement)* |
| Meter constant, apparent energy: |  | *(include units of measurement)* |

Number of pulses to ensure a standard deviation of measurement less than 0.1 base m.p.e.:

|  |  |
| --- | --- |
| at maximum current, *I*max: |  |
| at transitional current, *I*tr: |  |
| at minimum current, *I*min: |  |

Interval meter

|  |  |
| --- | --- |
| Interval data storage capability: |  |

Internal clock

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Clock type(s): |  |  | Synchronous |  | Crystal-controlled |

Hardware and software

|  |  |  |
| --- | --- | --- |
| Hardware version(s): |  | |
| Software version(s): |  | |
| Sensitive frequencies[[1]](#footnote-1): |  | *(include units of measurement)* |

Auxiliary devices

Provide information about any auxiliary devices

|  |
| --- |
|  |

Remarks

|  |
| --- |
|  |

## Adjustments or modifications

Provide information about any authorised and agreed upon adjustments or modifications for sample meters during the evaluation.

|  |
| --- |
|  |

## Test values and configuration

Specify the values used for testing (unless otherwise specified in individual tests).

|  |  |  |
| --- | --- | --- |
| Test voltage: |  | V |
| Test frequency: |  | Hz |
| Test connection mode: |  | |

Remarks

|  |
| --- |
|  |

## Critical change value

The critical change value is used as part of the acceptance criteria for some disturbance tests. See OIML R 46-2, 2.1.3.

|  |  |  |  |
| --- | --- | --- | --- |
| Number of measuring elements: | *m* |  |  |
| Nominal voltage: | *U*nom |  | V |
| Maximum current: | *I*max |  | A |
| Critical change value: |  |  | *(include units)* |

## Test equipment

List all test equipment used in this report.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Equipment name | Manufacturer | Type no. | Serial no. | Used for (test reference) |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Remarks

|  |
| --- |
|  |

# Tests for compliance with maximum permissible error

## Initial intrinsic error for positive and negative flow (2.2.1)

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Quantity (electrical energy):** |  |  | **Active** |  | **Reactive** |  | **Apparent** |

If a meter is specified with alternate connection modes, this test shall be made for all specified connection modes.

|  |  |
| --- | --- |
| Connection mode: |  |

|  |  |
| --- | --- |
| Value of most inductive power factor in test: |  |
| Value of most capacitive power factor in test: |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Positive energy flow** | | | | | |
| Test Current (A) | Power Factor | Error (%) with test current from… | | Mean error1 (%) | Base m.p.e. (%) |
| Low to high | High to low |
| *I*min | unity |  |  |  |  |
| *I*tr |  |  |  |  |
| 10 *I*tr |  |  |  |  |
| *I*max |  |  |  |  |
| *I*tr | (most inductive) |  |  |  |  |
| 10 *I*tr |  |  |  |  |
| *I*max |  |  |  |  |
| *I*tr | (most capacitive) |  |  |  |  |
| 10 *I*tr |  |  |  |  |
| *I*max |  |  |  |  |
| **Negative energy flow** | | | | | |
| *I*tr | unity |  |  |  |  |
| *I*max |  |  |  |  |
| *I*tr | (most inductive) |  |  |  |  |
| *I*max |  |  |  |  |
| *I*tr | (most capacitive) |  |  |  |  |
| *I*max |  |  |  |  |
| Note 1: Mean error is the mean of the error with increasing and decreasing currents for each testpoint. | | | | | |

* Check that each

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Reverse energy flow (2.2.1)

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

*Applicable for positive direction only meters*

|  |  |  |  |
| --- | --- | --- | --- |
| Calculation for test time for reverse flow | | *I*min | *I*max |
| a) | Time that the test output would register ten pulses in the forward energy flow direction (minutes): |  |  |
| b) | Time that the primary register would register 2 units of the least significant digit in the forward energy flow direction (minutes): |  |  |
| c) | 1 minute: | 1 | 1 |
| Test time is the maximum of a), b) and c) (minutes): | |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test Current (A) | Power Factor | Test Time (minutes) | Change in register | | Number of test pulses | |
| Measured | Limit | Measured | Limit |
| *I*min | unity |  |  | 0 |  | 1 |
| *I*max |  |  |  |

* Check that there is no change in the energy registered in the primary register.
* Check that the number of test pulses emitted ≤ 1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Initial intrinsic error for demand meters (2.2.1)

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Quantity (electrical energy):** |  |  | **Active** |  | **Reactive** |  | **Apparent** |

|  |  |  |  |
| --- | --- | --- | --- |
| Test Current (A) | Power Factor | Error (%) | Base m.p.e (%) |
| 10 *I*tr | Unity |  |  |
| *I*max | Unity |  |  |

* Check that each

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Starting current (2.2.2)

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

|  |  |
| --- | --- |
| Expected time between pulses (period) | τ (seconds) |
|  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Meter started (Yes/No) | Error (%) | Base m.p.e. (%) |
|  | Unity |  |  |  |

* Check that

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Test of no-load condition (2.2.3)

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

|  |  |  |
| --- | --- | --- |
| Test voltage, *U*test (V) | 110 % of *U*nom |  |
| Minimum test period (hours) |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test current (A) | Test voltage, *U*test (V) | Test period Δ*t* (hours) | Test output | |
| Number of pulses emitted | Limit |
| No current |  |  |  | 1 |

* Check if the test period Δ*t* ≥ minimum test period.
* Check if the number of pulses emitted ≤ 1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

# Tests for influence factors

## Temperature dependence (2.3.1)

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

* The mean temperature coefficient, *c*, is calculated by .
* The temperature intervals, , span at least 15 °C and no more than 23 °C; and the set of intervals span the entire specified operating range (intervals may overlap).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Temperature interval, *tl* to *tu* (°C): | | |  | | | |
| Test Current (A) | Power factor | Error (%) | | | Mean temperature coefficient (%/K) | |
| *el* | | *eu* | *c* | Limit |
| *I*tr | unity |  | |  |  |  |
| 10 *I*tr or 20 *I*tr |  | |  |  |
| *I*max |  | |  |  |
| *I*tr | 0.5 inductive |  | |  |  |  |
| 10 *I*tr or 20 *I*tr |  | |  |  |
| *I*max |  | |  |  |

*Add temperature coefficients table for each temperature interval.*

* Check that each .
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Self-heating (2.3.2)

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

|  |  |
| --- | --- |
| Voltage circuits energised for time (hours): |  |
| Base m.p.e, at *I*max and unity power factor: |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Time at *Imax* (minutes) | Error (%) | Error shift (%) | Limit (%) |
| *Imax* | Unity | 0 (intrinsic error) |  | N/A | N/A |
|  |  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| Has the error shift levelled out? |  | *If no, continue test according to (a) or (b) below.* |

(a) *If the load can be changed in less than 30 seconds*:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Intrinsic Error (%) | Error (%) | Error shift (%) | Limit (%) |
| *Imax* | 0.5 inductive |  |  |  |  |

(b) *Else, allow meter to return to its initial temperature and repeat test for power factor 0.5 inductive*.

|  |  |
| --- | --- |
| Voltage circuits energised for time (hours): |  |
| Base m.p.e, at *I*max and power factor 0.5 inductive: |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Time at *Imax* (minutes) | Error (%) | Error shift (%) | Limit (%) |
| *Imax* | 0.5 inductive | 0 (intrinsic error) |  | N/A | N/A |
|  |  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Load balance (2.3.3)

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

|  |  |
| --- | --- |
| Reference voltage applied to all voltage circuits: |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Test circuit | Test circuit current flow direction | Load in other circuits and direction | Error (%) | Error shift (%) | Limit (%) |
| 10 *I*tr | unity | Balanced (reference) | | |  | N/A | |
| 10 *I*tr | 0.5 inductive |  |
| *I*max | unity |  |
| *I*max | 0.5 inductive |  |
| 10 *I*tr | unity | L1 |  |  |  |  |  |
| 10 *I*tr | 0.5 inductive |  |  |  |
| *I*max | unity |  |  |  |
| *I*max | 0.5 inductive |  |  |  |
| 10 *I*tr | unity | L3 |  |  |  |  |  |
| 10 *I*tr | 0.5 inductive |  |  |  |
| *I*max | unity |  |  |  |
| *I*max | 0.5 inductive |  |  |  |
| 10 *I*tr | unity | L3 |  |  |  |  |  |
| 10 *I*tr | 0.5 inductive |  |  |  |
| *I*max | unity |  |  |  |
| *I*max | 0.5 inductive |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Voltage variation (2.3.4)

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *U*nom (V): |  | | | | |
| Test current (A) | Power factor | Voltage variation | Error (%) | Error shift (%) | Limit (%) |
| 10 *I*tr or 20 *I*tr | unity | Reference (*U*nom) |  | N/A | N/A |
| 0.9 *U*nom |  |  |  |
| 1.1 *U*nom |  |  |
| 10 *I*tr or 20 *I*tr | 0.5 inductive | Reference (*U*nom) |  | N/A | N/A |
| 0.9 *U*nom |  |  |  |
| 1.1 *U*nom |  |  |

*Add tables for additional Unom values as required.*

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Frequency variation (2.3.5)

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *f*nom (Hz): |  | | | | |
| Test current (A) | Power factor | Frequency variation | Error (%) | Error shift (%) | Limit (%) |
| 10 *I*tr or 20 *I*tr | unity | Reference (*f*nom) |  | N/A | N/A |
| 0.98 *f*nom |  |  |  |
| 1.02 *f*nom |  |  |
| 10 *I*tr or 20 *I*tr | 0.5 inductive | Reference (*f*nom) |  | N/A | N/A |
| 0.98 *f*nom |  |  |  |
| 1.02 *f*nom |  |  |

*Add tables for additional fnom values as required.*

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Harmonics in voltage and current (2.3.6.1)

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

* The quadriform waveform is specified in OIML R 46-2, clause 2.3.6.1, Table 7 and Figure 1.
* The peaked waveform is specified in OIML R 46-2, clause 2.3.6.1, Table 8 and Figure 2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Harmonics applied to both voltage and current circuits | Error (%) | Error shift (%) | Limit (%) |
| 10 *I*tr | unity | Reference, sinusoidal waveform |  | N/A | N/A |
| Quadriform waveform |  |  |  |
| Peaked waveform |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Integral cycle load control test (2.3.6.2)

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

* The test current waveform is specified in OIML R 46-2, clause 2.3.6.2 and Figure 3.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Current signal | Error (%) | Error shift (%) | Limit (%) |
| 10 *I*tr | unity | Reference sinusoidal waveform |  | N/A | N/A |
| Test current waveform |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Odd harmonics in the AC current circuit (2.3.6.3)

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

* The phase fired waveforms are specified in OIML R 46-2, clause 2.3.6.3 and Figures 4, 5 and 6.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Current signal | Error (%) | Error shift (%) | Limit (%) |
| 10 *I*tr | unity | Reference sinusoidal waveform |  | N/A | N/A |
| 1. 45° phase fired waveform |  |  |  |
| 1. 90° phase fired waveform |  |  |  |
| 1. 135° phase fired waveform |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## High-order harmonics (2.3.6.4)

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Asynchronous test signal frequency | Voltage ciruits | | Current circuits | | Limit (%) |
| Error (%) | Error shift (%) | Error (%) | Error shift (%) |
| *I*tr | unity | 15 *f*nom |  |  |  |  |  |
| 16 *f*nom |  |  |  |  |
| 17 *f*nom |  |  |  |  |
| 18 *f*nom |  |  |  |  |
| 19 *f*nom |  |  |  |  |
| 20 *f*nom |  |  |  |  |
| 21 *f*nom |  |  |  |  |
| 22 *f*nom |  |  |  |  |
| 23 *f*nom |  |  |  |  |
| 24 *f*nom |  |  |  |  |
| 25 *f*nom |  |  |  |  |
| 26 *f*nom |  |  |  |  |
| 27 *f*nom |  |  |  |  |
| 28 *f*nom |  |  |  |  |
| 29 *f*nom |  |  |  |  |
| 30 *f*nom |  |  |  |  |
| 31 *f*nom |  |  |  |  |
| 32 *f*nom |  |  |  |  |
| 33 *f*nom |  |  |  |  |
| 34 *f*nom |  |  |  |  |
| 35 *f*nom |  |  |  |  |
| 36 *f*nom |  |  |  |  |
| 37 *f*nom |  |  |  |  |
| 38 *f*nom |  |  |  |  |
| 39 *f*nom |  |  |  |  |
| 40 *f*nom |  |  |  |  |
| 41 *f*nom |  |  |  |  |
| 42 *f*nom |  |  |  |  |
| 43 *f*nom |  |  |  |  |
| 44 *f*nom |  |  |  |  |
| 45 *f*nom |  |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## DC in the AC current circuit (2.3.6.5)

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Current test wave | Error (%) | Error shift (%) | Limit (%) |
|  | unity | Sinusoidal (intrinsic error) |  | N/A | N/A |
|  | Half-wave rectified |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Reversed phase sequence (any two phases interchanged) (2.3.7)

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Phase sequence | Error (%) | Error shift (%) | Limit (%) |
| 10 *I*tr or 20 *I*tr | unity | Reference (L1, L2, L3) |  | N/A | N/A |
| L1, L3, L2 |  |  |  |
| L2, L1, L3 |  |  |
| L3, L2, L1 |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Magnetic field (AC, power frequency) of external origin (2.3.8)

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

|  |  |
| --- | --- |
| Meter state: | Operating |
| Voltage applied to voltage circuits: |  |
| Applicable standard: | IEC 61000-4-8 |
| Magnetic field: | Continuous, 1 min |
| Magnetic field strength: | 0.5 mT (400 A/m) |
| Magnetic field frequency (*f* = *f*nom): |  |

|  |
| --- |
| Specify or illustrate the three orthogonal directions relative to the meter designated as x, y & z: |
|  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Magnetic field axis direction | Phase | Error (%) | Error shift (%) | Limit (%) |
| 10 *I*tr or 20 *I*tr | unity | Reference (no magnetic induction) | |  | N/A | N/A |
| *I*max | unity |  | N/A | N/A |
| 10 *I*tr or 20 *I*tr | unity | x-axis |  |  |  |  |
| *I*max | unity |  |  |  |  |
| 10 *I*tr or 20 *I*tr | unity | y-axis |  |  |  |  |
| *I*max | unity |  |  |  |  |
| 10 *I*tr or 20 *I*tr | unity | z-axis |  |  |  |  |
| *I*max | unity |  |  |  |  |
| The reported values are the greatest error shifts for each test point and direction under the most unfavourable condition of phase. | | | | | | |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Radiated, radio frequency (RF), electromagnetic fields – Test condition 1 – with current (2.3.9.1)

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

|  |  |
| --- | --- |
| Meter state: | Operating |
| Applicable standard: | *(IEC 61000-4-3 or IEC 61000-4-20)* |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Antenna / facility: | | |  | | | | |
| Field Strength (V/m): | | |  | | | | |
| Dwell time: | | |  | | | | |
| Test current (A) | Power factor | Frequency value / range (MHz) | | Polarization | Facing meter | Error shift (%) | Limit (%) |
| 10 *I*tr or 20 *I*tr | unity |  | | Vertical | Front |  |  |
| Back |  |
| Right |  |
| Left |  |
| Top |  |
| Bottom |  |
| Horizontal | Front |  |
| Back |  |
| Right |  |
| Left |  |
| Top |  |
| Bottom |  |

*Extend for each antenna/facility, field strength and frequency values (including sensitive frequencies).*

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Immunity to conducted disturbances, induced by radiofrequency fields (2.3.9.2)

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

|  |  |
| --- | --- |
| Meter state: | Operating |
| Applicable standard: | IEC 61000-4-6 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| RF Amplitude: | | |  | | |
| Frequency range: | | |  | | |
| Dwell time: | | |  | | |
| Test current (A) | Power factor | Power or I/O port | | Error shift (%) | Limit (%) |
| 10 *I*tr or 20 *I*tr | unity |  | |  |  |
|  | |  |
|  | |  |
|  | |  |
|  | |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Fast load current variation test (2.3.10)

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

|  |  |
| --- | --- |
| Applicable standard: | IEC 62052-11 |
| Voltage applied to voltage circuits (highest nominal): |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Test profile | Error (%) | Error shift (%) | Limit (%) |
| 10 *I*tr or 20 *I*tr | unity | Reference |  | N/A | N/A |
| 1. 10 s on, 10 s off |  |  |  |
| 1. 5 s on, 5 s off |  |  |
| 1. 5 s on, 0.5 s off |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

# Test for disturbances

## Magnetic field (AC, power frequency) of external origin (2.4.1)

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

|  |  |
| --- | --- |
| Meter state: | Operating, with no current |
| Voltage applied to voltage circuits: |  |
| Applicable standard: | IEC 61000-4-8 |
| Magnetic field: | Short-duration, 3 s |
| Magnetic field strength: | 1.26 mT (1000 A/m) |
| Magnetic field frequency (*f* = *f*nom): |  |

|  |
| --- |
| Specify or illustrate the three orthogonal directions relative to the meter designated as x, y & z: |
|  |

Check for significant fault (critical change value)

|  |  |  |  |
| --- | --- | --- | --- |
| Magnetic field axis direction | Change in energy | | Critical change value |
| Register | Test output |
| x-axis |  |  |  |
| y-axis |  |  |
| z-axis |  |  |

Check base m.p.e.

|  |  |  |  |
| --- | --- | --- | --- |
| Test current (A) | Power factor | Error (%) | Base m.p.e. (%) |
| *I*tr | unity |  |  |
| 10 *I*tr | 0.5 inductive |  |  |

* Check that each change in energy is not more than the critical change value.
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance
  + the meter still fulfils the base m.p.e.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Electrostatic discharge (2.4.2)

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

|  |  |
| --- | --- |
| Meter state: | Operating, with no current |
| Voltage applied to voltage circuits: |  |
| Applicable standard: | IEC 61000-4-2 |

Check for significant fault (critical change value)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Application | Discharge mode | Test voltage (kV) | Polarity | Number of discharges (≥ 10) | Change in energy | | Critical change value |
| Register | Test output |
| Direct | Contact | 8 | Positive |  |  |  |  |
| Negative |  |  |  |
| Air | 15 | Positive |  |  |  |
| Negative |  |  |  |
| Indirect, Horizontal  coupling plane | Contact | 8 | Positive |  |  |  |
| Negative |  |  |  |
| Indirect, Vertical  coupling plane | Contact | 8 | Positive |  |  |  |
| Negative |  |  |  |

Check base m.p.e.

|  |  |  |  |
| --- | --- | --- | --- |
| Test current (A) | Power factor | Error (%) | Base m.p.e. (%) |
| *I*tr | unity |  |  |
| 10 *I*tr | 0.5 inductive |  |  |

* Check that each change in energy is not more than the critical change value.
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance
  + the meter still fulfils the base m.p.e.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Fast transients (2.4.3)

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

|  |  |
| --- | --- |
| Meter state: | Operating |
| Voltage applied to voltage circuits: |  |
| Applicable standards: | IEC 62052-11, IEC 61000-4-4 |
| Duration of test: | 60 s at each polarity |
| Repetition rate: | 100 kHz |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Circuit | Test Voltage (kV) | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 10 *I*tr or 20 *I*tr | unity | Reference | |  | N/A | N/A |
|  |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Severe voltage variations (2.4.4)

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

|  |  |
| --- | --- |
| Meter state: | Operating |
| Value of nominal voltage (V): |  |

Test procedure 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Voltage variation | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 10 *I*tr or 20 *I*tr | unity | Reference (*U*nom) |  | N/A | N/A |
| 0.8 *U*nom |  |  |  |
| 0.85 *U*nom |  |  |
| 1.15 *U*nom |  |  |

Test procedure 2

|  |  |
| --- | --- |
| Does the meter have distinct shut-down / turn-on voltages? (Yes/No): |  |
| Shut-down voltage (V): |  |
| Turn-on voltage (V): |  |

*If yes, two additional mandatory testpoints (shutdown low and shutdown high) shall be included. Shutdown low shall be within a 2 V range below the shut-down voltage. Shutdown high shall be within a 2 V range above the turn-on voltage.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Voltage variation | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 10 *I*tr or 20 *I*tr | unity | Reference (*U*nom) |  | N/A | N/A |
| 0.7 *U*nom |  |  | +10 to −100 |
| 0.6 *U*nom |  |  |
| 0.5 *U*nom |  |  |
| 0.4 *U*nom |  |  |
| 0.3 *U*nom |  |  |
| 0.2 *U*nom |  |  |
| 0.1 *U*nom |  |  |
| 0 *U*nom |  |  |
| *(shutdown low)* |  |  |
| *(shutdown high)* |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## One or two phases interrupted (2.4.5)

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

|  |  |
| --- | --- |
| Meter state: | Operating |
| Voltage applied to voltage circuits: |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Load | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 10 *I*tr or 20 *I*tr | unity | Reference (no phases removed) |  | N/A | N/A |
| Phase L1 removed |  |  |  |
| Phase L2 removed |  |  |
| Phase L3 removed |  |  |
| Phases L1, L2 removed |  |  |
| Phases L1, L3 removed |  |  |
| Phases L2, L3 removed |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Continuous (DC) magnetic induction of external origin (2.4.6)

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

|  |  |
| --- | --- |
| Meter state: | Operating |
| Voltage applied to voltage circuits: |  |
| Magnetic field: | Continuous |
| Magnetic field strength along axis of magnet’s core: | 400 mT at 0 mm from surface |

|  |
| --- |
| Specify or illustrate the surfaces designated as front, back, top, bottom, left and right. |
|  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Meter surface tested | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 10 *I*tr or 20 *I*tr | unity | Reference (no magnetic induction) |  | N/A | N/A |
| Front |  |  |  |
| Back |  |  |
| Top |  |  |
| Bottom |  |  |
| Left |  |  |
| Right |  |  |
| The reported values are the greatest faults (error shifts) of 6 points per meter surface for each test point and direction under the most unfavourable condition of phase. | | | | | |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Voltage dips and short interruptions on AC power supply (2.4.7.1)

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

|  |  |
| --- | --- |
| Meter state: | Operating, with no current |
| Voltage applied to voltage circuits: |  |
| Applicable standards: | IEC 62052-11, IEC 61000-4-11 |

Check for significant fault (critical change value)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Event / Test | Voltage reduction relative to *U*nom (%) | Duration (cycles1) | No. of events | Inception angle | Change in energy | | Critical change value |
| Register | Test output |
| Interruption  Test 1 | 100 | 5/6 | 3 | 0 |  |  |  |
| Interruption  Test 2 | 100 | 50/60 | 3 | 0 |  |  |
| Interruption  Test 3 | 100 | 1/1 | 1 | 0 |  |  |
| Interruption  Test 4 | 90 | 250/300 | 3 | 0 |  |  |
| Dip Test 5 | 60 | 5/6 | 3 | 0 |  |  |
| Dip Test 6 | 60 | 50/60 | 3 | 0 |  |  |
| Dip Test 7 | 30 | 0.5/0.5 | 3 | 0 |  |  |
| 3 | 180 |  |  |
| Dip Test 8 | 30 | 1/1 | 3 | 0 |  |  |
| Dip Test 9 | 50 | 3000/3600 | 3 | 0 |  |  |

Note 1: Cycles are given for 50 Hz and 60 Hz power line frequencies. E.g. 5/6 means 5 cycles for 50 Hz, and 6 cycles for 60 Hz.

Check base m.p.e.

|  |  |  |  |
| --- | --- | --- | --- |
| Test current (A) | Power factor | Error (%) | Base m.p.e. (%) |
| *I*tr | unity |  |  |
| 10 *I*tr | 0.5 inductive |  |  |

* Check that each change in energy is not more than the critical change value.
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance
  + the meter still fulfils the base m.p.e.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Voltage dips and short interruptions on DC power supply (2.4.7.2)

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

|  |  |
| --- | --- |
| Meter state: | Operating, with no current |
| Voltage applied to voltage circuits: |  |
| Applicable standards: | IEC 62052-11, IEC 61000-4-29 |

Check for significant fault (critical change value)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Event / Test | Voltage reduction relative to *U*nom (%) | Duration (s) | No. of events | Time between events | Change in energy | | Critical change value |
| Register | Test output |
| Interruption Test 1 | 100 | 1 | 3 | 10 |  |  |  |
| Interruption Test 2 | 100 | 0.01 | 3 | 10 |  |  |
| Interruption Test 3 | 100 | 0.001 | 3 | 10 |  |  |
| Dip Test 4 | 60 | 0.3 | 3 | 10 |  |  |
| Dip Test 5 | 60 | 0.03 | 3 | 10 |  |  |
| Dip Test 6 | 30 | 0.3 | 3 | 10 |  |  |
| Dip Test 7 | 30 | 0.03 | 3 | 10 |  |  |

Check base m.p.e.

|  |  |  |  |
| --- | --- | --- | --- |
| Test current (A) | Power factor | Error (%) | Base m.p.e. (%) |
| *I*tr | unity |  |  |
| 10 *I*tr | 0.5 inductive |  |  |

* Check that each change in energy is not more than the critical change value.
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance
  + the meter still fulfils the base m.p.e.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Radiated, radio frequency (RF), electromagnetic fields – Test condition 2 – without current (2.4.8)

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

|  |  |
| --- | --- |
| Meter state: | Operating, with no current |
| Voltage applied to voltage circuits: |  |
| Applicable standard: | IEC 61000-4-3 |

Check for significant fault (critical change value)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Antenna / facility: | |  | | | | |
| Field Strength (V/m): | |  | | | | |
| Dwell time: | |  | | | | |
| Frequency value / range (MHz) | Polarization | | Facing meter | Change in energy | | Critical change value |
| Register | Test output |
|  | Vertical | | Front |  |  |  |
| Back |  |  |
| Right |  |  |
| Left |  |  |
| Top |  |  |
| Bottom |  |  |
| Horizontal | | Front |  |  |
| Back |  |  |
| Right |  |  |
| Left |  |  |
| Top |  |  |
| Bottom |  |  |

*Extend for each antenna/facility, field strength and frequency values (including sensitive frequencies).*

Check base m.p.e.

|  |  |  |  |
| --- | --- | --- | --- |
| Test current (A) | Power factor | Error (%) | Base m.p.e. (%) |
| *I*tr | unity |  |  |
| 10 *I*tr | 0.5 inductive |  |  |

* Check that each change in energy is not more than the critical change value.
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance
  + the meter still fulfils the base m.p.e.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Surge immunity test (2.4.9)

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

|  |  |
| --- | --- |
| Meter state: | Operating, with no current |
| Voltage applied to voltage circuits: |  |
| Applicable standard: | IEC 61000-4-5 |
| Number of tests: | 5 positive, 5 negative |
| Repetition rate: | Maximum 1 per minute |

Check for significant fault (critical change value)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Voltage circuits, application | Test voltage (kV) | Generator source impedance (Ω) | Phase angle | Polarity | Change in energy | | Critical change value |
| Register | Test output |
| Voltage circuits line to line | 2 | 2 | 0° | Positive |  |  |  |
| Negative |  |  |  |
| 90° | Positive |  |  |  |
| Negative |  |  |  |
| 180° | Positive |  |  |  |
| Negative |  |  |  |
| 270° | Positive |  |  |  |
| Negative |  |  |  |
| Voltage circuits line to earth | 4 | 2 | 0° | Positive |  |  |  |
| Negative |  |  |  |
| 90° | Positive |  |  |  |
| Negative |  |  |  |
| 180° | Positive |  |  |  |
| Negative |  |  |  |
| 270° | Positive |  |  |  |
| Negative |  |  |  |
| Current circuits, application | Test voltage (kV)1 | Generator source impedance (Ω) | Phase angle | Polarity2 | Change in energy | | Critical change value |
| Register | Test output |
| Between supply and load ports | 2 | 2 | 0° | Positive |  |  |  |
| Negative |  |  |  |
| 90° | Positive |  |  |  |
| Negative |  |  |  |
| 180° | Positive |  |  |  |
| Negative |  |  |  |
| 270° | Positive |  |  |  |
| Negative |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Signal lines, application | Test voltage (kV)1 | Generator source impedance (Ω) | Phase angle | Polarity2 | Change in energy | | Critical change value |
| Register | Test output |
| All the lines together (common mode) to earth | 0.5 | 42 | 0° | Positive |  |  |  |
| Negative |  |  |  |
| 90° | Positive |  |  |  |
| Negative |  |  |  |
| 180° | Positive |  |  |  |
| Negative |  |  |  |
| 270° | Positive |  |  |  |
| Negative |  |  |  |
| Auxiliary circuits, application | Test voltage (kV)1 | Generator source impedance (Ω) | Phase angle | Polarity2 | Change in energy | | Critical change value |
| Register | Test output |
| Auxiliary circuits line to line | 1 | 42 | 0° | Positive |  |  |  |
| Negative |  |  |  |
| 90° | Positive |  |  |  |
| Negative |  |  |  |
| 180° | Positive |  |  |  |
| Negative |  |  |  |
| 270° | Positive |  |  |  |
| Negative |  |  |  |
| Auxiliary circuits line to earth | 2 | 42 | 0° | Positive |  |  |  |
| Negative |  |  |  |
| 90° | Positive |  |  |  |
| Negative |  |  |  |
| 180° | Positive |  |  |  |
| Negative |  |  |  |
| 270° | Positive |  |  |  |
| Negative |  |  |  |

Check base m.p.e.

|  |  |  |  |
| --- | --- | --- | --- |
| Test current (A) | Power factor | Error (%) | Base m.p.e. (%) |
| *I*tr | unity |  |  |
| 10 *I*tr | 0.5 inductive |  |  |

* Check that each change in energy is not more than the critical change value.
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance
  + the meter still fulfils the base m.p.e.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Damped oscillatory waves immunity test (2.4.10)

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

|  |  |
| --- | --- |
| Meter state: | Operating |
| Voltage applied to voltage circuits: |  |
| Applicable standard: | IEC 61000-4-18 |
| Test duration: | 60 s (15 cycles with 2 s on, 2 s off, for each frequency) |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Mode | Test Voltage (kV) | Test frequency (kHz) | Repetition rate (Hz) | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 20 *I*tr | unity | Reference (intrinsic error) | | | |  | N/A | N/A |
| 0.5 inductive | Reference (intrinsic error) | | | |  | N/A | N/A |
| Voltage Circuits | | | | | | | | |
| 20 *I*tr | unity | Common | 2.5 | 100 | 40 |  |  |  |
| 1000 | 400 |  |  |  |
| 0.5 inductive | Common | 2.5 | 100 | 40 |  |  |  |
| 1000 | 400 |  |  |  |
| 20 *I*tr | unity | Differential | 1.0 | 100 | 40 |  |  |  |
| 1000 | 400 |  |  |  |
| 0.5 inductive | Differential | 1.0 | 100 | 40 |  |  |  |
| 1000 | 400 |  |  |  |
| Auxiliary Circuits | | | | | | | | |
| 20 *I*tr | unity | Common | 2.5 | 100 | 40 |  |  |  |
| 1000 | 400 |  |  |  |
| 0.5 inductive | Common | 2.5 | 100 | 40 |  |  |  |
| 1000 | 400 |  |  |  |
| 20 *I*tr | unity | Differential | 1.0 | 100 | 40 |  |  |  |
| 1000 | 400 |  |  |  |
| 0.5 inductive | Differential | 1.0 | 100 | 40 |  |  |  |
| 1000 | 400 |  |  |  |

* Check that each
* Check that the meter function shall not be perturbed during the disturbance
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Short-time overcurrent (2.4.11)

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

|  |  |
| --- | --- |
| Meter state: | Operating |
| Voltage applied to voltage circuits: |  |
| Short-time overcurrent (A): |  |
| Duration: |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Before application of short-time overcurrent | | | | After return to normal temperature | | |
| Test current (A) | Power factor | Phase | Intrinsic Error (%) | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 10 *I*tr or 20 *I*tr | unity | L1 |  |  |  |  |
| L2 |  |  |  |
| L3 |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Impulse Voltage (2.4.12)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Meter serial no. |  |  |  | At start | At end |
| Observer: |  |  | Temperature (°C): |  |  |
| Date (dd/mm/yyyy): |  |  | Time (hh:mm): |  |  |
|  |  |  | Relative humidity (%): |  |  |
|  |  |  | Atmospheric pressure (kPA): |  |  |

|  |  |
| --- | --- |
| Impulse waveform: | 1.2/50 µs impulse specified in IEC 60060-1 |
| Voltage rise time: | ± 30 % |
| Voltage fall time: | ± 20 % |
| Source energy: | 10.0 J |
| Source impedance: | 500 Ω |

Check for significant fault (critical change value)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test | Circuits tested | Impulse Voltage (V) | Polarity | Change in energy | | Critical change value |
| Register | Test output |
| For circuits and between circuits |  |  | Positive |  |  |  |
| Negative |  |  |
| Circuits relative to earth |  |  | Positive |  |  |
| Positive |  |  |

Note: For each test, the impulse voltage is applied 10 times for each polarity. Minimum of 30 s between impulses.

Check base m.p.e.

|  |  |  |  |
| --- | --- | --- | --- |
| Test current (A) | Power factor | Error (%) | Base m.p.e. (%) |
| *I*tr | unity |  |  |
| 10 *I*tr | 0.5 inductive |  |  |

* Check that each change in energy is not more than the critical change value.
* Check that during the test, there is no flashover, disruptive discharge or puncture.
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance
  + the meter still fulfils the base m.p.e.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Earth Fault (2.4.13)

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

|  |  |
| --- | --- |
| Voltage (1.1 *U*nom): |  |
| Duration: | 4 hours |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Before application of earth-fault condition | | | After return to normal temperature | | |
| Test current (A) | Power factor | Intrinsic Error (%) | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 10 *I*tr or 20 *I*tr | unity |  |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Operation of auxiliary devices (2.4.14)

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

|  |  |
| --- | --- |
| Meter state: | Operating |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Auxiliary Device | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| *I*tr | unity | Reference |  | N/A | N/A |
| *I*max |  | N/A | N/A |
| *I*tr | unity |  |  |  |  |
| *I*max |  |  |  |
| *I*tr |  |  |  |  |
| *I*max |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Vibrations (2.4.15.1)

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

|  |  |
| --- | --- |
| Meter state: | Non-operating, without packing |
| Frequency range: | 10 Hz to 150 Hz |
| *f* < 60 Hz: | Constant amplitude of movement 0.075 mm |
| *f* < 60 Hz: | Constant acceleration, 9.8 m/s2 |
| Number of sweep cycles per axis | 10 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Before application of vibrations | | | After application of vibrations | | |
| Test current (A) | Power factor | Intrinsic Error (%) | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 10 *I*tr or 20 *I*tr | unity |  |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance
* Supply and load control switches are allowed to change state during the disturbance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

## Shock (2.4.15.2)

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

|  |  |
| --- | --- |
| Meter state: | Non-operating, without packing |
| Pulse shape: | Half-sine |
| Peak acceleration: | 300 m/s2 |
| Duration of the pulse: | 18 ms |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Before application of shock | | | After application of shock | | |
| Test current (A) | Power factor | Intrinsic Error (%) | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 10 *I*tr or 20 *I*tr | unity |  |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance
* Supply and load control switches are allowed to change state during the disturbance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Protection against solar radiation (2.4.16)

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

|  |  |
| --- | --- |
| Meter state: | Non-operating |
| Applicable standard: | ISO 4892-3 |
| Test cycle: | 8 h dry, 4 h condensation (12 h) |
| Spectral irradiance: | 0.76 W·m–2·nm–1 at 340 nm |
| Duration: | 66 days (132 cycles) |

Check for significant fault (critical change value)

|  |  |  |  |
| --- | --- | --- | --- |
| After exposure to solar radiation test | Change in energy | | Critical change value |
| Register | Test output |
|  |  |  |

Check base m.p.e.

|  |  |  |  |
| --- | --- | --- | --- |
| Test current (A) | Power factor | Error (%) | Base m.p.e. (%) |
| *I*tr | unity |  |  |
| 10 *I*tr | 0.5 inductive |  |  |

* Check that each change in energy is not more than the critical change value.
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance
  + the meter still fulfils the base m.p.e.
  + the appearance and, in particular, the legibility of markings and displays is not altered
  + the means of protecting the metrological properties, including the case and sealing, are not affected

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Extreme temperatures - Dry Heat (2.4.17.1)

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

|  |  |
| --- | --- |
| Meter state: | Non-operating |
| Applicable standards: | IEC 60068-2-2, IEC 60068-3-1 |
| Test temperature (one step higher than upper specified temperature) (°C): |  |
| Duration: | 2 h |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Before application of dry heat | | | After application of dry heat | | |
| Test current (A) | Power factor | Intrinsic Error (%) | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 10 *I*tr or 20 *I*tr | unity |  |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

## Extreme temperatures - Cold (2.4.17.2)

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

|  |  |
| --- | --- |
| Meter state: | Non-operating |
| Applicable standards: | IEC 60068-2-1, IEC 60068-3-1 |
| Test temperature (one step lower than lower specified temperature) (°C) |  |
| Duration (hours) | 2 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Before application of cold | | | After application of cold | | |
| Test current (A) | Power factor | Intrinsic Error (%) | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 10 *I*tr or 20 *I*tr | unity |  |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Damp Heat, steady-state (non-condensing), for humidity class H1 (2.4.17.3)

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

|  |  |
| --- | --- |
| Meter state: | Operating, with no current |
| Applicable standards: | IEC 60068-2-78, IEC 60068-3-4 |
| Test temperature: | 30 °C |
| Humidity: | 85 % |
| Duration: | 2 days |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Before application of damp heat | | | After application of damp heat | | |
| Test current (A) | Power factor | Intrinsic Error (%) | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 10 *I*tr | unity |  |  |  |  |

After 24 h, check base m.p.e.

|  |  |  |  |
| --- | --- | --- | --- |
| Test current (A) | Power factor | Error (%) | Base m.p.e. (%) |
| *I*tr | unity |  |  |
| 10 *I*tr | 0.5 inductive |  |  |

* Check that each
* Check that 24 h after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance
  + the meter still fulfils the base m.p.e.
  + there is no evidence of any mechanical damage or corrosion which may affect the functional properties of the meter

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Damp Heat, cyclic (condensing), for humidity class H2 and H3 (2.4.17.4)

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

|  |  |
| --- | --- |
| Meter state: | Operating, with no current |
| Applicable standards: | IEC 60068-2-30, IEC 60068-3-4 |
| Specified humidity class: |  |
| Upper temperature: |  |
| Lower temperature: | 25 °C |
| Humidity: | 85 % |
| Duration: | 2 days (2 cycles) |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Before application of damp heat | | | After application of damp heat | | |
| Test current (A) | Power factor | Intrinsic Error (%) | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 10 *I*tr | unity |  |  |  |  |

After 24 h, check base m.p.e.

|  |  |  |  |
| --- | --- | --- | --- |
| Test current (A) | Power factor | Error (%) | Base m.p.e. (%) |
| *I*tr | unity |  |  |
| 10 *I*tr | 0.5 inductive |  |  |

* Check that each
* Check that 24 h after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance
  + the meter still fulfils the base m.p.e.
  + there is no evidence of any mechanical damage or corrosion which may affect the functional properties of the meter

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Durability (2.4.18)

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

|  |  |
| --- | --- |
| Standard(s): |  |

Specify details of durability test including test conditions and severity levels

|  |
| --- |
|  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Before application of durability test | | | After application of durability test | | |
| Test current (A) | Power factor | Intrinsic Error (%) | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| *I*tr | unity |  |  |  |  |
| 10 *I*tr | unity |  |  |  |  |
| *I*max | unity |  |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Ring wave test (2.4.19)

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

|  |  |
| --- | --- |
| Applicable standards: | IEC 61000-4-12, IEC 62052-11 |

Check for significant fault (critical change value)

|  |  |  |  |
| --- | --- | --- | --- |
| After application of ring wave test | Change in energy | | Critical change value |
| Register | Test output |
|  |  |  |

Check base m.p.e.

|  |  |  |  |
| --- | --- | --- | --- |
| Test current (A) | Power factor | Error (%) | Base m.p.e. (%) |
| *I*tr | unity |  |  |
| 10 *I*tr | 0.5 inductive |  |  |

* Check that each change in energy is not more than the critical change value.
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance
  + the meter still fulfils the base m.p.e.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Conducted differential mode current disturbances (2-150 kHz) (2.4.20)

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

|  |  |
| --- | --- |
| Applicable standards: | IEC 62052.11, IEC 61000-4-19 |
| Meter state: | Operating |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Before application of disturbance | | | After application of disturbance | | |
| Test current (A) | Power factor | Intrinsic Error (%) | Error (%) | Fault (%)  (error shift) | Fault limit (%) |
| 10 *I*tr or 20 *I*tr | unity |  |  |  |  |

* Check that each
* Check that after the test:
  + the meter shows no damage
  + the meter operates with no degradation to metrological performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

# Tests for technical requirements

## Tests for the evaluation of software-controlled meters (2.5.1)

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Requirements for software-controlled meters (OIML R 46-1 | Validation method | Validation Description | Passed | Failed |
| Software identification (7.3.2.1) | VFTSw |  |  |  |
| Correctness of metrological algorithms and functions (OIML R 46-1, 7.3.2.2) | VFTSw / VFTM |  |  |  |
| Software securing and protection (OIML R 46-1, 7.3.2.3) | VFTSw |  |  |  |
| Audit trails (OIML R 46-1, 7.3.2.4) | VFTSw |  |  |  |
| Prevention of misuse (OIML R 46-1, 7.3.2.5) | VFTSw |  |  |  |
| Support of fault and defect detection (OIML R 46-1, 7.3.2.6) | VFTSw |  |  |  |
| Shared indications (OIML R 46-1, 7.3.3.1.4) | VFTSw |  |  |  |
| Protection of stored data (OIML R 46-1, 7.3.3.3.2) | VFTSw |  |  |  |
| Automatic storage (OIML R 46-1, 7.3.3.3.3) | VFTSw / VFTM |  |  |  |
| Deletion of stored data (OIML R 46-1, 7.3.3.3.4) | VFTSw |  |  |  |
| Protection of transmitted data (OIML R 46-1, 7.3.3.4.2) | VFTSw |  |  |  |
| Transmission delay or interruption (OIML R 46-1, 7.3.3.4.3) | VFTSw |  |  |  |
| Indications from dynamic modules of legally relevant software (OIML R 46-1, 7.3.3.5) | VFTSw |  |  |  |

|  |
| --- |
| Remarks: |
|  |

## Meter constants (2.5.2)

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Quantity (electrical energy):** |  |  | **Active** |  | **Reactive** |  | **Apparent** |

|  |  |
| --- | --- |
| Does the meter have multiple registers or pulse outputs under legal control? (Yes/No) |  |
| If yes, is there a system in place to guarantee identical behaviour of meter constants? (Yes/No) |  |
| If yes, specify the system, otherwise all registers and pulse outputs must be tested. | |
|  | |

Determine the minimum energy (*E*min) to be passed through the meter:

|  |  |  |
| --- | --- | --- |
| Register to be tested: |  | |
| Test output to be tested: |  | |
| Apparent resolution of basic energy register, *R* *(include units of measurement)*: | |  |
| Minimum energy to be passed through, *(include units of measurement)*: | |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Energy measured by | | Count of test output pulses | Relative difference (%) | Limit (%)  (10% of base m.p.e.) |
| Register (*r*) | Test output (*t*) |
|  | Unity |  |  |  |  |  |

* Check that each

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Test mode for demand meters (2.5.3)

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Quantity (electrical energy):** |  |  | **Active** |  | **Reactive** |  | **Apparent** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test current (A) | Power factor | Demand error in test mode, Etest (%) | Initial intrinsic demand error, Enorm (%) | Error difference, Ediff (%) | Limit (%) |
| 10 *I*tr | Unity |  |  |  | 0.2 % |
| *Imax* | Unity |  |  |  |

* Check that each

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

# Tests for demand meters

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Requirements for demand meters (OIML R 46-1, clause 7.7) | | Comments | Passed | Failed |
| Maximum demand register (7.7.1) | The meter has a maximum demand register that operates correctly and is able to be displayed. |  |  |  |
| The maximum demand register is able to be displayed on the meter. |  |  |  |
| Maximum demand reset device (7.7.2) | The meter has a maximum demand reset device that operates correctly. |  |  |  |
| The maximum demand reset device is protected from unauthorised modification or resetting |  |  |  |
| Demand interval (7.7.3) | Demand intervals do not deviate from the nominal demand interval by more than 0.2 % |  |  |  |
| Demand interval indication (7.7.4) | The meter has a demand interval indication that operates correctly. |  |  |  |
| Demand interval changes (7.7.5) | Demand meters comply with the demand interval changes requirements. |  |  |  |
| Calculation of demand (7.7.6) | Demand calculation comply with the requirements. |  |  |  |
| Allocation of demand (7.7.7) | Demand quantities are appropriately allocated to demand registers |  |  |  |
| Performance requirements (7.7.8) | All demand values comply with the performance requirements (see 2.3) |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

# Tests for multi-tariff meters and interval meters

## Multi-tariff register tests

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

**Alternative 1**

* The error limit for tariff registers is the base mpe plus the equivalent energy of one pulse of the test output.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tariff register | Test time for register | Energy indicated in register | Error | Limit |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

* The difference limit 0, except for any rounding errors in the indicating device.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Total cumulative register | Energy indicated in register | Sum of applicable tariff registers | Difference | Limit |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Alternative 2**

* The error limit for registers is the applicable base m.p.e.

|  |  |  |  |
| --- | --- | --- | --- |
| Tariff register | Energy indicated in register | Error | Limit |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

* The difference limit 1/10 of the applicable base m.p.e.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Total cumulative register | Energy indicated in register | Sum of applicable tariff registers | Difference | Limit |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

* Check that each error is not more than the limit.
* Check that each difference is not more than the limit.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

## Time indication for internal clocks (2.7.2, 2.7.3, 2.7.4 and 2.7.5)

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

|  |  |
| --- | --- |
| Applicable standards: | IEC 62054-21 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Internal clock: |  |  | Crystal controlled |  | Synchronous |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test | Temperature (°C) | Duration | Result (s/day) | Limit (s/day) |
| Mains operation: |  |  |  |  |
| Operation reserve: |  |  |  |  |
| High temperature (upper temperature limit): |  |  |  |  |
| Low temperature (lower temperature limit): |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Electromagnetic disturbances | Time indication error (s/day) | Difference with and without disturbance (s/day) | Maximum permissible difference (MPD) (s/day) |
| No disturbance (reference conditions): |  | N/A | N/A |
| Electrostatic discharges: |  |  |  |
| Fast transients: |  |  |  |
| Voltage dips and short interruptions: |  |  |  |
| Surges: |  |  |  |
| Damped oscillatory waves: |  |  |  |
| Ring waves: |  |  |  |

* Check that each
* Check that each

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

# Tests for multi-branch meters

### Cross-channel Influences (B.2.3)

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Quantity (electrical energy):** |  |  | **Active** |  | **Reactive** |  | **Apparent** |

|  |  |
| --- | --- |
| Test channel: |  |

Accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Other channels | | Test channel | | | |
| Current | Power factor | Current | Power factor | Error (%) | Base m.p.e. (%) |
| *I*max | 1 | *I*min | 1 |  |  |
| 0.5 inductive |  |
| 0.8 capacitive |  |
| 0.5 inductive | *I*min | 1 |  |
| 0.5 inductive |  |
| 0.8 capacitive |  |
| 0.8 capacitive | *I*min | 1 |  |
| 0.5 inductive |  |
| 0.8 capacitive |  |

* Check that each

No Load

|  |  |  |
| --- | --- | --- |
| Test voltage, *U*test (V) | 110 % of *U*nom |  |
| Minimum test period (hours) |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Other channels | | Test current (A) | Test voltage, *U*test (V) | Test period Δ*t* (hours) | Test output | |
| Current | Power factor | Number of pulses emitted | Limit |
| *I*max | 1 | No current |  |  |  | 1 |
| 0.5 inductive | No current |  |  |  |
| 0.8 capacitive | No current |  |  |  |

* Check if the test period Δ*t* ≥ minimum test period.
* Check if the number of pulses emitted ≤ 1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Passed |  | Failed |

|  |
| --- |
| Remarks: |
|  |

1. As required by OIML R 46-2, clause 2.3.9.1. An example could be clock output frequencies. [↑](#footnote-ref-1)