NMI M 6-2

Active-energy electricity meters (a.c.)

Part 2: Test report format

June 2022

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National Measurement Institute

Bradfield Road, Lindfield, NSW 2070

PO Box 264, Lindfield, NSW 2070

T: +61 2 8467 3600

F: +61 2 8467 3610

W: www.measurement.gov.au

Preface

This document provides the test report format for active-energy electricity meters to accompany NMI M 6-1, v4.0 (June 2022) *Active-energy Electricity Meters (a.c.), Part 1: Metrological and Technical Requirements*.

This test report format may clarify NMI M 6-1, 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 6-1. 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 6-1 to determine which tests are applicable for a particular meter.

This edition contains numerous changes from the first edition. The changes have been made to:

* align with the requirements specified in NMI M 6-1, v4.0
* update and clarify the information and results required by NMI
* increase alignment with the OIML test report format specified in OIML R 46-3.

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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 6-1, v4.0 (June 2022) |
| **Client details** |
| Applicant |  |
| Address |  |
| Remarks: |
|  |

# Meter Information

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

# Technical Specifications

|  |  |
| --- | --- |
| **Accuracy** |  |
| Accuracy class |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0.2 |  | 0.5 |  | 1 |  | 1.5 |

 |
| **Temperature ranges** | *Low High* |
| Specified operating range |

|  |  |  |  |
| --- | --- | --- | --- |
|  | °C  |  | °C |

 |
| Limit range of operation |

|  |  |  |  |
| --- | --- | --- | --- |
|  | °C |  | °C |

 |
| Storage and transportation |

|  |  |  |  |
| --- | --- | --- | --- |
|  | °C |  | °C |

 |
| **Connection type and design** |  |
| Connection type |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Direct-connected |  | Transformer-operated |

 |
| Design type |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Static |  | Induction |

 |
| **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 |

 |
| **Enclosure and Protective Class** |  |
| Enclosure type |

|  |
| --- |
|  |

 |
| Protective class |

|  |
| --- |
|  |

 |
| **Software/Firmware** |  |
| Software/firmware version |

|  |
| --- |
|  |

 |
| **Internal Clock** |  |
| Clock type(s) |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Synchronous |  | Crystal |

 |

# Requirements Checklist

| **Clause number and requirement (from NMI M 6-1)** | **Value / Remark** | **Result** |
| --- | --- | --- |
| **3** | **Units of measurement** |
| Valid units of measurement used |  |  |
| **4.1** | **Minimum measured quantity** |
| Minimum measured quantity |  | N/A |
| Smallest interval marked on indicator |  | N/A |
| The minimum measured quantity has the form 1 × 10n authorised units of energy, where n is an integer |  |  |
| The smallest interval marked on indicator shall not be less than the minimum measured quantity |  |  |
| **4.2** | **Maximum permissible variation between indicators** |
| No indicated difference between indications of same quantity on different indicators |  |  |
| **4.3** | **Calculated quantities** |
| Indicated quantity equals value obtained using indicated values with applicable rounding |  |  |
| If rounding applied it is ±0.5 minimum measured quantity |  |  |
| **4.6** | **Meter constant** |
| No error in relationship between test output and indication on display |  |  |
| **4.7** | **Class indices (accuracy class)** |
| Meter classified as one of 0.2, 0.5, 1 or 1.5 |  |  |
| **5.2** | **Temperature range** (ranges shall comply with the minimum acceptable ranges in Table 5) |
| Specified operating range |  |  |
| Limit range of operation |  |  |
| Storage and transportation |  |  |
| **5.7.2** | **Initial start up of the meter** |
| Time to start – shall be functional within 5 s |  |  |
| **5.7.3** | **Running with no load** |
| Test voltage value (V AC) |  | N/A |
| Test current value (A) |  | N/A |
| Test period (s) |  | N/A |
| Test output pulses – shall be no more than one |  |  |
| Rotor revolutions – may start but shall not complete a revolution |  |  |
| **5.7.4** | **Starting** |
| Test current value (A) |  | N/A |
| Meter starts and continues to register |  |  |
| Rotor revolutions – shall start and complete at least one revolution |  |  |

| **Clause number and requirement (from NMI M 6-1)** | **Value / Remark** | **Result** |
| --- | --- | --- |
| **7.2** | **Acting upon significant faults** (static meters only) |
| Either:No significant faults occur, or |  |  |
| Has capability to detect, log and communicate significant faults. Logged data kept in permanent record with date and time stamp. |  |  |
| **7.3** | **Display** |
| Meter has a display which is legible whilst operating |  |  |
| Visible to consumer in normal installation position |  |  |
| There is a procedure to show all relevant elements of indicator display, with sufficient time to check them |  |  |
| Able to display quantity of energy corresponding to *I*max for at least 4 000 h without returning to same index |  |  |
| Calculated value (energy at *I*max for 4 000 h) |  | N/A |
| Number of display digits |  | N/A |
| **8.1** | **Information to be displayed on meter exterior** |
| 1. Manufacturer’s name or mark
 |  |  |
| 1. Model designation
 |  |  |
| 1. Serial or identification number
 |  |  |
| 1. Space for NMI pattern approval number
 |  |  |
| 1. Number of phases, number of wires
 |  |  |
| 1. Reference frequency
 |  |  |
| 1. Specified operating temperature limits (if more restrictive than –10 °C to +55 °C)
 |  |  |
| 1. Meter constant
 |  |  |
| 1. Rated voltage
 |  |  |
| 1. Rated currents
 |  |  |
| 1. Class index
 |  |  |
| 1. ‘for indoor use only’ if for indoor use only
 |  |  |
| **8.2** | **Notices** |
| Any special notices or limitations of use shall be clearly marked or provided in manual |  |  |
| **9.1** | **Verification mark** |
| Provision for a verification mark |  |  |
| **9.2** | **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 |  |  |

# Maximum Permissible Errors

Refer to NMI M 6-1, **clause 4.8 (Tables 1 to 3)**.

## Direct-connected meters with 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** | **Limit (±%) for class** |
| **1** | **1.5** |
| 0.05 *I*b | 1 |  | 1.5 | 1.5 |
| 0.1 *I*b |  | 1.0 | 1.5 |
| 0.2 *I*b |  |
| *I*b |  |
| *I*max |  |
| 0.1 *I*b | 0.5 inductive |  | 1.5 | 1.5 |
| 0.2 *I*b |  | 1.0 | 1.5 |
| *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) |  |  |
| Where applicable in both directions |  |  |

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Phase** | **Current (A)** | **Power factor** | **Percentage error** | **Limit (±%) for class** |
| **1** | **1.5** |
| Phase 1 | 0.1 *I*b | 1 |  | 2.0 | 2.5 |
| 0.2 *I*b |  |
| *I*b |  |
| *I*max |  |
| 0.2 *I*b | 0.5 inductive |  | 2.0 | 2.5 |
| *I*b |  |
| *I*max |  |
| Phase 2 | 0.1 *I*b | 1 |  | 2.0 | 2.5 |
| 0.2 *I*b |  |
| *I*b |  |
| *I*max |  |
| 0.2 *I*b | 0.5 inductive |  | 2.0 | 2.5 |
| *I*b |  |
| *I*max |  |
| Phase 3 | 0.1 *I*b | 1 |  | 2.0 | 2.5 |
| 0.2 *I*b |  |
| *I*b |  |
| *I*max |  |
| 0.2 *I*b | 0.5 inductive |  | 2.0 | 2.5 |
| *I*b |  |
| *I*max |  |

## Transformer-operated meters with 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** | **Limit (±%) for class** |
| **0.2** | **0.5** | **1** |
| 0.01 *I*n | 1 |  | 0.4 | 1.0 |  |
| 0.02 *I*n |  | 1.5 |
| 0.05 *I*n |  | 0.2 | 0.5 | 1.0 |
| 0.1 *I*n |  |
| *I*n |  |
| *I*max |  |
| 0.02 *I*n | 0.5 inductive |  | 0.5 | 1.0 |  |
| 0.05 *I*n |  | 1.5 |
| 0.1 *I*n |  | 0.3 | 0.6 | 1.0 |
| *I*n |  |
| *I*max |  |
| 0.02 *I*n | 0.8 capacitive |  | 0.5 | 1.0 |  |
| 0.05 *I*n |  | 1.5 |
| 0.1 *I*n |  | 0.3 | 0.6 | 1.0 |
| *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) |  |  |
| Where applicable in both directions |  |  |

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Phase** | **Current (A)** | **Power factor** | **Percentage error** | **Limit (±%) for class** |
| **0.2** | **0.5** | **1** |
| Phase 1 | 0.05 *I*n | 1 |  | 0.3 | 0.6 | 2.0 |
| 0.1 *I*n |  |
| *I*n |  |
| *I*max |  |
| 0.1 *I*n | 0.5 inductive |  | 0.4 | 1.0 | 2.0 |
| *I*n |  |
| *I*max |  |
| Phase 2 | 0.05 *I*n | 1 |  | 0.3 | 0.6 | 2.0 |
| 0.1 *I*n |  |
| *I*n |  |
| *I*max |  |
| 0.1 *I*n | 0.5 inductive |  | 0.4 | 1.0 | 2.0 |
| *I*n |  |
| *I*max |  |
| Phase 3 | 0.05 *I*n | 1 |  | 0.3 | 0.6 | 2.0 |
| 0.1 *I*n |  |
| *I*n |  |
| *I*max |  |
| 0.1 *I*n | 0.5 inductive |  | 0.4 | 1.0 | 2.0 |
| *I*n |  |
| *I*max |  |

# Influence Factors and Disturbances

## Voltage Variation

Refer to NMI M 6-1, **Table 4** and **A.2.12**.

### Direct-connected Meters, Classes 1 and 1.5

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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 (% from *U*nom)** | **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** |
| --- | --- | --- | --- | --- |
| **1** | **1.5** |
| +10 | 0.05 *I*b | 1 |  | 0.7 | 1.0 |
| *I*b |  |
| *I*max |  |
| 0.1 *I*b | 0.5 inductive |  | 1.0 | 1.0 |
| *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 | 1.0 |
| *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 | 3.0 |
| *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 | 3.0 |
| *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 (% from *U*nom)** | **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, Classes 0.2 and 0.5

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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 (% from *U*nom)** | **Current (A)** | **Power factor** | **Variation in error (%)** | **Limit of variation (%) by class** |
| --- | --- | --- | --- | --- |
| **0.2** | **0.5** |
| +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 NMI M 6-1, **Table 4** and **A.2.13**.

### Direct-connected meters, Classes 1 and 1.5

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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** | **1.5** |
| +2 | 0.05 *I*b | 1 |  | 0.5 | 1.0 |
| *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 | 1.0 |
| *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, Classes 0.2 and 0.5

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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** | **0.5** |
| +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 |  |

## Harmonic Components in the Current and Voltage Circuits

Refer to NMI M 6-1, **Table 4**.

The variation in percentage error shall be measured under the most unfavourable phase displacement of the fifth harmonic in the current compared with the fundamental error.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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** | **Percentage error** | **Variation in error (%)** | **Limit of variation (%) by class** |
| ***f*nom** | ***f*nom + harmonics** | **0.2** | **0.5** | **1** | **1.5** |
| 0.5 *I*max | 1 |  |  |  | 0.4 | 0.5 | 0.8 | 1.0 |

## Reversed Phase Sequence

Refer to NMI M 6-1, **Table 4**.

Polyphase (three-phase four wire) meters shall measure and register within the limits of variation in percentage error if any one or two phases of the three phase network are interrupted.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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** | **Percentage error** | **Variation in error (%)** | **Limit of variation (%) by class** |
| **ABC** | **CBA** | **0.2** | **0.5** | **1** | **1.5** |
| 0.1 *I*b (0.1 *I*n) | 1 |  |  |  | 0.05 | 0.1 | 1.5 | 1.5 |

## Voltage Unbalance

Refer to NMI M 6-1, **Table 4**.

Polyphase (three-phase four wire) meters shall measure and register within the limits of variation in percentage error if any one or two phases of the three phase network are interrupted.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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** | **0.5** | **1** |
| *I*b (*I*n) | 1 | 1 phase – A |  | 0.5 | 1.0 | 2.0 |
| 1 phase – B |  |
| 1 phase – C |  |
| 2 phases – AB |  |
| 2 phases – AC |  |
| 2 phases – BC |  |

## Auxiliary Voltage ±15%

Refer to NMI M 6-1, **Table 4**.

Applicable only if the auxiliary supply is not internally connected to the voltage measuring circuit.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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) |  |  |

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

## DC Component in the AC Circuit

Refer to NMI M 6-1, **Table 4**.

This test does not apply to transformer-operated 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) |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **Variation in error (%)** | **Limit of variation (%) by class** |
| ***f*nom** | **+ DC component** | **1** | **1.5** |
| *I*max / √2 | 1 |  |  |  | 3.0 | 6.0 |

## Continuous Magnetic Induction of External Origin

Refer to NMI M 6-1, **Table 4**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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** | **0.5** | **1** | **1.5** |
| *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 NMI M 6-1, **Table 4**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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** | **0.5** | **1** | **1.5** |
| *I*b (*I*n) | 1 |  | 0.5 | 1.0 | 2.0 | N/A |
| *I*b (0.5 *I*n) | 1 |  | N/A | N/A | N/A | 2.0 |

## Electromagnetic RF Fields

Refer to NMI M 6-1, **Table 4** and **A.2.****9** (test with current test).

Meters constructed with passive elements only, including electromechanical meters, are exempt from this test.

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

Frequency range: 80 to 2 400 MHz

Modulation: 80% AM, 1 kHz sine wave

Field strength: 10 V/m

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| During the test, the behaviour of the meter shall not be perturbed |  |  |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |
| --- | --- | --- |
| **Current (A)** | **Power factor** | **Limit of variation (%) by class** |
| **0.2** | **0.5** | **1** | **1.5** |
| *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 (%)** |
|  |  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

## Conducted RF Fields

Refer to NMI M 6-1, **Table 4** and **A.2.10**.

Meters constructed with passive elements only, including electromechanical meters, are exempt from this test.

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

RF amplitude (50 Ω): 10 V (e.m.f.)

Modulation: 80% AM, 1 kHz sine wave

Frequency range: 0.15 to 80 MHz

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| During the test, the behaviour of the meter shall not be perturbed |  |  |
| Variation in error does not exceed limits (see below) |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Power port or I/O port** | **Variation in error (%)** | **Limit of variation (%) by class** |
| **0.2** | **0.5** | **1** | **1.5** |
| *I*b (*I*n) | 1 |  |  | 1.0 | 2.0 | 2.0 | 3.0 |
|  |  |
|  |  |

## Fast Transient Bursts

Refer to NMI M 6-1, **Table 4** and **A.2.15**.

Meters constructed with passive elements only, including electromechanical meters, are exempt from this test. During the test, a temporary degradation or loss of function or performance is acceptable.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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** | **0.5** | **1** | **1.5** |
| *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 |  |

## Variations due to Short-time Overcurrents

Refer to NMI M 6-1, **Table 4** and **A.2.16**.

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

### Test A

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Test** | **Over-current value (A)** | **Duration (ms)** | **Phase** | **Variation in error (%)** | **Limit of variation (%) by class** |
| **0.2** | **0.5** | **1** | **1.5** |
| *I*b | 1 | A | 30 *I*max | 10 | 1 |  | N/A | N/A | 1.5 | 1.5 |
| 2 |  |
| 3 |  |

### Test B

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Test** | **Over-current value (A)** | **Duration (ms)** | **Phase** | **Variation in error (%)** | **Limit of variation (%) by class** |
| **0.2** | **0.5** | **1** | **1.5** |
| *I*n | 1 | B | 20 *I*max | 500 | 1 |  | 0.05 | 0.05 | 0.5 | N/A |
| 2 |  |
| 3 |  |

### Tests C

* 250 A, 60 ms

|  |  |  |
| --- | --- | --- |
| **Requirement**  | **Remark** | **Result** |
| No damage to surrounding equipment |  |  |

### Tests D

* 50 A, 60 ms

|  |  |  |
| --- | --- | --- |
| **Requirement**  | **Remark** | **Result** |
| No damage to surrounding equipment |  |  |

## Operation of Accessories

Refer to NMI M 6-1, **Table 4**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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 continuously operated
* Value of current is 0.05 *I*b for class 1 direct-connected meters, 0.05 *I*n for class 1 transformer-operated meters, and 0.01 *I*n for class 0.2 / class 0.5 transformer-operated meters.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Accessory** | **Variation in error (%)** | **Limit of variation (%) by class** |
| **0.2** | **0.5** | **1** | **1.5** |
|  | 1 |  |  | 0.05 | 0.1 | 0.5 | 1.0 |
|  |  |
|  |  |
|  |  |
|  |  |

## Sub-harmonics in the AC Circuit

Refer to NMI M 6-1, **Table 4** and **A.2.17**.

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

Test waveform: sinusoid, 2 cycles on, 2 cycles off

Current amplitude: 2 × reference current

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **Variation in error (%)** | **Limit of variation (%) by class** |
| ***f*nom** | **Test waveform** | **0.2** | **0.5** | **1** | **1.5** |
| 0.5 *I*b (0.5 *I*n) | 1 |  |  |  | 0.5 | 0.75 | 1.5 | 3.0 |

## Odd Harmonics in the AC Circuit

Refer to NMI M 6-1, **Table 4** and **A.2.18**.

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

Test waveform: sinusoid, set to zero for first and third quarters of each period

Current amplitude: 2 × reference current

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **Variation in error (%)** | **Limit of variation (%) by class** |
| ***f*nom** | **Test waveform** | **0.2** | **0.5** | **1** | **1.5** |
| 0.5 *I*b (0.5 *I*n) | 1 |  |  |  | 0.4 | 0.5 | 0.8 | 1.0 |

## Tilt at 3° in any Direction from the Vertical

Refer to NMI M 6-1, **Table 4**.

This test is only required for induction meters and any other meters which may be influenced by their working position.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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** | **Direction of 3° tilt** | **Variation in error (%)** | **Limit of variation (%) by class** |
| **0.2** | **0.5** | **1** | **1.5** |
| 0.1 *I*b | 1 | Forward |  | 1.0 | 2.0 | 2.0 | 3.0 |
| Backward |  |
| Left |  |
| Right |  |

## Current Coil Self-heating

Refer to NMI M 6-1, **Table 4**.

This test is only required for induction meters and any other meters which may be influenced by their working position.

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

Initial error: determine for each load while current coil is still unheated

Precondtioning: 1 h with voltage circuit at *U*nom, current circuit with zero current

Test: continue until error becomes constant

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **Variation in error (%)** | **Limit of variation (%) by class** |
| **Coil unheated (initial error)** | **Coil heated** | **1.5** |
| *I*max | 1 |  |  |  | 1.0 |
| *I*max | 0.5 inductive |  |  |  | 1.0 |

## Alternative Usage and Phase Reversal (Balanced Two-element Driven)

Refer to NMI M 6-1, **Table 4**.

This test is only required for induction meters and any other meters which may be influenced by their working position.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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** | **Phase sequence** | **Percentage error** | **Variation in error (%)** | **Limit of variation (%) by class** |
| **1.5** |
| 0.05 *I*b | 1 | A1 leading A2 by 180° |  |  |  |
| A1 leading A2 by 120° |  |  | 1.0 |
| A2 leading A1 by 120° |  |  |
| *I*b | 1 | A1 leading A2 by 180° |  |  |  |
| A1 leading A2 by 120° |  |  | 0.5 |
| A2 leading A1 by 120° |  |  |

## Alternative Usage and Phase Reversal (Single-element Driven)

Refer to NMI M 6-1, **Table 4**.

This test is only required for induction meters and any other meters which may be influenced by their working position.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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** | **Phase sequence** | **Percentage error** | **Variation in error (%)** | **Limit of variation (%) by class** |
| **1.5** |
| 0.1 *I*b | 1 | A1 leading A2 by 180° |  | N/A | N/A |
| A1 leading A2 by 120° |  |  | 1.0 |
| A2 leading A1 by 120° |  |  |
| 2 *I*b | 1 | A1 leading A2 by 180° |  | N/A | N/A |
| A1 leading A2 by 120° |  |  | 0.5 |
| A2 leading A1 by 120° |  |  |

## Register Friction

Refer to NMI M 6-1, **Table 4**.

This test is only required for induction meters and any other meters which may be influenced by their working position. For a multi-rate meter, the changeover device shall be in each operating condition in turn.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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** | **Changeover device operating condition** | **Rotor Speed** | **Variation in error (%)** | **Limit of variation (%) by class** |
| **Heaviest load** | **Register disengaged** | **1.5** |
| 0.05 *I*b | 1 |  |  |  |  | 0.5 |
|  |  |  |  |
|  |  |  |  |

## Register Changeover

Refer to NMI M 6-1, **Table 4**.

This test is only required for induction meters and any other meters which may be influenced by their working position.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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** | **Changeover device operating condition** | **Rotor Speed** | **Variation in error (%)** | **Limit of variation (%) by class** |
| **1.5** |
| 0.05 *I*b | 1 |  |  | N/A | N/A |
|  |  |  | 0.4\* |
|  |  |  |

\* An additional variation of 0.5% may be permitted for certain multiple-element meters
(refer to AS 1284.1, clause 4.3.15).

## Shock

Refer to NMI M 6-1, Table 4.

This test is only required for induction meters and any other meters which may be influenced by their working position.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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) |  |  |

Initial error: determine for each load prior to subjecting to shock

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Initial error (before shock)** | **After shock test** | **Variation in error (%)** | **Limit of variation (%) by class** |
| **1.5** |
| 0.05 *I*b | 1 |  |  |  | 0.5 |
| *I*b | 1 |  |  |  | 0.3 |
| *I*b | 0.5 inductive |  |  |  | 0.3 |

# Ambient Temperature Variation

Refer to NMI M 6-1, **Table 6** and **A.2.3**.

The meter error shall be determined at a minimum of four temperature values across the whole operating range. The mean temperature coefficient shall then be determined for each of the temperature intervals between successive temperature values.

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 $\frac{e\_{U}-e\_{L}}{T\_{U}-T\_{L}}$

## 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 temperature ranges that span the operating temperature range |  |  |

|  |  |  |
| --- | --- | --- |
| **Current (A)** | **Power factor** | **Mean temperature coefficient (%/°C) by class** |
| **1** | **1.5** |
| 0.1 *I*b to *I*max | 1 | 0.05 | 0.05 |
| 0.2 *I*b to *I*max | 0.5 inductive | 0.07 | 0.07 |

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **Mean temperature coefficient (%/°C)** |
| ***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 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 temperature ranges that span the operating temperature range |  |  |

|  |  |  |
| --- | --- | --- |
| **Current (A)** | **Power factor** | **Mean temperature coefficient (%/°C) by class** |
| **0.2** | **0.5** | **1** | **1.5** |
| 0.05 *I*n to *I*max | 1 | 0.01 | 0.03 | 0.05 | 0.05 |
| 0.1 *I*n to *I*max | 0.5 inductive | 0.02 | 0.05 | 0.07 | 0.07 |

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **Mean temperature coefficient (%/°C)** |
| ***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 temperature ranges)*

# Internal Clocks

Refer to NMI M 6-1, **clause 6**.

This test applies to all solid state internal clock intended for use for trade.

## 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 |  |  |  |  |

## Other requirements

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| Meters must demonstrate a convenient methodology of clock synchronisation via the local optical or serial port. |  |  |
| For meters recording load profile for tariff calculation, the clock synchronisation must not permit clock adjustment that crosses an interval boundary. |  |  |

# Performance Tests

## Optical Port Requirements

Refer to NMI M 6-1, **7.4** and **A.1.3**. AS 62056.21, **4.3.5.4** and **5.2**.

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| The optical path (data transmission) shall not be affected by surrounding light of intensity 16 000 lux. |  |  |
| Transmission speed |  |  |

## Dry Heat Test

Refer to NMI M 6-1, **A.2.1**.

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

Duration: 72 h

Meter/EUT: In operating condition except whilst temperature is lowered or raised.

|  |  |
| --- | --- |
| High temperature: |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (during test)** | **Remark** | **Result** |
| Error shall not exceed limits (see below) taking into account appropriate temperature coefficient  |  |  |

|  |  |  |
| --- | --- | --- |
| **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** |
| **At reference before heat** | **At high temperature after 72 h** | **Reference after recovery** | **0.2** | **0.5** | **1** | **1.5** |
| *I*b (*I*n) | 1 |  |  |  | 0.2 | 0.5 | 1 | 1.5 |

## Cold Test

Refer to NMI M 6-1, A.2.2.

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

Duration: 72 h

Meter/EUT: In operating condition except whilst temperature is lowered or raised.

|  |  |
| --- | --- |
| Low temperature: |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (during test)** | **Remark** | **Result** |
| Error shall not exceed limits (see below) taking into account appropriate temperature coefficient  |  |  |

|  |  |  |
| --- | --- | --- |
| **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** |
| **At reference before heat** | **At low temperature after 72 h** | **Reference after recovery** | **0.2** | **0.5** | **1** | **1.5** |
| *I*b (*I*n) | 1 |  |  |  | 0.2 | 0.5 | 1 | 1.5 |

## Damp Heat Cyclic Test

### Damp Heat Cyclic Test

Refer to NMI M 6-1, **A.2.4**.

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

Duration (cycles): 6 × 24 h cycles

Meter/EUT: non-operating condition

Low temperature: 25 °C

|  |  |
| --- | --- |
| High temperature: |  |

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| No trace of corrosion likely to affect the functional properties of the EUT shall be present |  |  |

24 h after the end of this test, submit the EUT to the following tests.

### AC Voltage Test

NMI M 6-1, A.2.20 – refer to clause 8.13.

### Impulse Voltage Test

NMI M 6-1, A.2.19, except 0.8 of impulse voltage

Refer to NMI M 6-1, A.2.19.

Impulse waveform at no load: 1.2/50 impulse

Meter/EUT: non-operating condition

#### For circuits and between circuits

Impulse voltage: 9.6 kV +0%, –15%

Source capacitance: 0.125 μF

Source impedance: 40 Ω ± 5 Ω

Stored energy: 9.0 J ± 1.0 J

|  |  |  |
| --- | --- | --- |
| **Requirement (during the test)** | **Remark** | **Result** |
| No flashover, disruptive discharge or puncture |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (after the test)** | **Remark** | **Result** |
| No mechanical damage to the EUT |  |  |
| Variation in in error does not exceed the uncertainty of measurement (see below) |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **Variation in error (%)** | **Limit** |
| **Before** | **After** |
| *I*b (*I*n) | 1 |  |  |  |  |

#### For electric circuits relative to earth

Impulse voltage: 8 kV +0%, –10%

Source impedance: 500 Ω ± 50 Ω

Stored energy: 0.5 J ± 0.05 J

|  |  |  |
| --- | --- | --- |
| **Requirement (during the test)** | **Remark** | **Result** |
| No flashover, disruptive discharge or puncture |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (after the test)** | **Remark** | **Result** |
| No mechanical damage to the EUT |  |  |
| Variation in in error does not exceed the uncertainty of measurement (see below) |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **Variation in error (%)** | **Limit** |
| **Before** | **After** |
| *I*b (*I*n) | 1 |  |  |  |  |

## Solar Radiation Test

Refer to NMI M 6-1, **A.2.5**.

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

UV lamp output: 21 750 lm to 27 000 lm

Duration: 48 h and distance of 250 mm

Meter/EUT: non-operating condition

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| For transparent parts – no noticeable deterioration or loss in transparency |  |  |
| For non-transparent parts – no noticeable effect |  |  |
| The function of the meter shall not be impaired (see below) |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **MPE by class** |
| **0.2** | **0.5** | **1** | **1.5** |
| *I*b (*I*n) | 1 |  | 0.2 | 0.5 | 1 | 1.5 |

## Dust Test

Refer to NMI M 6-1, **A.2.6**.

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

Enclosure category: 2

Duration: 8 h

Meter/EUT: non-operating condition

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| No dust accumulation which could affect meter operation or safety |  |  |
| No dust deposition that could lead to tracking along creepage distances |  |  |
| The function of the meter shall not be impaired (see below) |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **MPE by class** |
| **0.2** | **0.5** | **1** | **1.5** |
| *I*b (*I*n) | 1 |  | 0.2 | 0.5 | 1 | 1.5 |

## Vibration (Sinusoidal) Test

Refer to NMI M 6-1, **A.2.7**.

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

Severity level: 2

Frequency range: 10 to 150 Hz

Max acceleration level: 10 m/s2

No sweep cycles per axis: 10

Meter/EUT: non-operating condition

|  |  |  |
| --- | --- | --- |
| **Requirement** | **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** | **0.5** | **1** | **1.5** |
| *I*b (*I*n) | 1 |  | 0.2 | 0.5 | 1 | 1.5 |

## Mechanical Shock Test

Refer to NMI M 6-1, **A.2.8**.

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

Severity level: 1

Pulse shape: half-sine

Peak acceleration: 200 m/s2

Pulse duration: 18 ms

Meter/EUT: non-operating condition, without packing

|  |  |  |
| --- | --- | --- |
| **Requirement** | **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** | **0.5** | **1** | **1.5** |
| *I*b (*I*n) | 1 |  | 0.2 | 0.5 | 1 | 1.5 |

## Radiated Electromagnetic Radiofrequency Fields Test without Current

Refer to NMI M 6-1, **A.2.9**.

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

Frequency range: 80 to 2400 MHz (continuous)

Modulation: 80% AM, 1 kHz sine wave

Field strength: 30 V/m

Meter/EUT: in operating condition, reference voltage, current terminal open-circuit

|  |  |  |
| --- | --- | --- |
| **Requirement** | **Remark** | **Result** |
| The behaviour of the equipment shall not be perturbed |  |  |

## Electrostatic Discharge Test

Refer to NMI M 6-1, **A.2.11**.

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

Number of discharges: at least 10

Polarity of discharges: the most sensitive polarity

Severity level: 4

Meter/EUT: in operating condition, reference voltage, current terminal open-circuit

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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, Horizontalcoupling plane | Contact |  |  |  |  |  |  |  |
| Indirect, Verticalcoupling 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** | **0.5** | **1** | **1.5** |
| *I*b (*I*n) | 1 |  | 0.2 | 0.5 | 1 | 1.5 |

## Voltage Dips and Short-term Interruptions Test

Refer to NMI M 6-1, **A.2.14**.

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

Meter/EUT: in operating condition, reference voltage, no current

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

## Impulse Voltage Test

Refer to NMI M 6-1, **A.2.19**.

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

Impulse waveform at no load: 1.2/50 impulse

Meter/EUT: non-operating condition

### For circuits and between circuits

Impulse voltage: 12 kV +0%, –15%

Source capacitance: 0.125 μF

Source impedance: 40 Ω ± 5 Ω

Stored energy: 9.0 J ± 1.0 J

|  |  |  |
| --- | --- | --- |
| **Requirement (during the test)** | **Remark** | **Result** |
| No flashover, disruptive discharge or puncture |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (after the test)** | **Remark** | **Result** |
| No mechanical damage to the EUT |  |  |
| Variation in in error does not exceed the uncertainty of measurement (see below) |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **Variation in error (%)** | **Limit** |
| **Before** | **After** |
| *I*b (*I*n) | 1 |  |  |  |  |

### For electric circuits relative to earth

Impulse voltage: 10 kV +0%, –10%

Source impedance: 500 Ω ± 50 Ω

Stored energy: 0.5 J ± 0.05 J

|  |  |  |
| --- | --- | --- |
| **Requirement (during the test)** | **Remark** | **Result** |
| No flashover, disruptive discharge or puncture |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (after the test)** | **Remark** | **Result** |
| No mechanical damage to the EUT |  |  |
| Variation in in error does not exceed the uncertainty of measurement (see below) |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **Variation in error (%)** | **Limit** |
| **Before** | **After** |
| *I*b (*I*n) | 1 |  |  |  |  |

## AC Voltage Test

Refer to NMI M 6-1, **A.2.20**.

*This test is performed as part of the damp heat cyclic test (refer to NMI M 6-1,* ***A.2.4****).*

|  |  |  |
| --- | --- | --- |
| **Requirement (during the test)** | **Remark** | **Result** |
| 2 kV: during the test, no flashover, disruptive discharge or puncture shall occur |  |  |
| 4 kV: during the test, no flashover, disruptive discharge or puncture shall occur |  |  |
| 40 V: during the test, no flashover, disruptive discharge or puncture shall occur |  |  |

|  |  |  |
| --- | --- | --- |
| **Requirement (after the test)** | **Remark** | **Result** |
| No mechanical damage to the EUT |  |  |
| Variation in in error does not exceed the uncertainty of measurement (see below) |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Current (A)** | **Power factor** | **Percentage error** | **Variation in error (%)** | **Limit** |
| **Before** | **After** |
| *I*b (*I*n) | 1 |  |  |  |  |