Australian Government
National Measurement Institute

NMI M 10-3
Meters Intended for the Metering of Water in Full Flowing Pipes

Part 3: Test Report

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PREFACE

NMI M 10-3 is based on *NMI R 49-3. Water Meters Intended for the Metering of Cold Potable Water and Hot Water. Part 3: Test Report* (which in turn is based on a modified version of OIML R 49-3:2006).

Some meters may have been previously tested and approved in accordance with NMI R 49 or OIML R 49 either in Australia or overseas.

In Australia, meters may be pattern approved against both NMI R 49 and NMI M 10. The pattern approval certificate will indicate against which standard the meter has been approved.

Some test results performed in accordance with NMI R 49 or OIML R 49, due to the similarity of the methodology, will be accepted as part of a pattern approval application for NMI M 10.

All tests performed in accordance with NMI R 49 or OIML R 49 will be recognised as being performed with potable water. Further testing with non-potable water may be required.

As well as minor editorial corrections, this second edition of NMI 10-3 differs from the first edition in that it reflects the changes between the previous editions of NMI M 10-1 and NMI M 10-2.

CONTENTS

EXPLANATORY NOTES

NMI M 10-3 specifies the recommended test report format for the pattern approval and verification of water meters intended for the metering of water in full flowing pipes. Meters approved against this document are designated as accuracy class 2.5 water meters.

The corresponding parts 1 and 2 of this document are:

- NMI M 10-1 Metrological and Technical Requirements; and
- NMI M 10-2 Test Methods.

At the time of each test the water quality shall be measured and recorded. Other variables such as the conductivity of the water may also be measured and recorded.

Part I shows the required format of a pattern evaluation report for a self-contained or insertion/strap-on meter. A pattern evaluation report for a separable calculator (including indicating device) or a measurement transducer (including flow or volume sensor) requires a similar format. However, some modifications to the tables may be required because a large number of variations in the design of these separable units are possible.

Part II shows some examples of tables for presenting the test results for separable units for initial verifications. These tables can also be adapted for pattern evaluation reports.

Symbols

The symbols used in the tables are:

+	pass
–	fail
n/a	not applicable
EUT	equipment under test
MPE	maximum permissible error
V	vertical
H	horizontal

Checklists

Complete examination and test checklists according to this example.

+	–	
×		pass
	×	fail
n/a	n/a	not applicable

Units of measurement for volume and flowrate

Units of measurement shall be written in the spaces provided. Units of measurement of:

- **volume** shall be in megalitres (ML), kilolitres (kL) or cubic metres (m^3); and
- **flowrate** shall be in megalitres per day (ML/day), litres per second (L/s), kilolitres per hour (kL/h) or cubic metres per hour (m^3/h).

PART I. PATTERN EVALUATION REPORT

1. INFORMATION CONCERNING THE PATTERN

1.1 General

Application number _____

Applicant _____

Authorised representative _____

Address _____

_____

Testing laboratory _____

Authorised representative _____

Address _____

_____

1.2 Model Submitted

New model _____

Variant of approved model(s)

Approval number _____

Variation of approved model _____

Submitted for approval tests	Yes	No	Remarks
Mechanical meter (self-contained)			
Electronic meter (self-contained)			
Mechanical insertion/strap-on meter			
Electronic insertion/strap-on meter			
Family of meters			
Separable calculator (including indicating device)			
Separable measurement transducer (including flow or volume sensor)			
Supplementary electronic device/s for testing (permanently attached to meter)			
Supplementary electronic device/s for data transmission (permanently attached to meter)			
Supplementary electronic device/s for testing (temporarily attached to meter)			
Supplementary electronic device/s for data transmission (temporary attached to meter)			
Ancillary devices			

1.3 Mechanical Meter (Self-contained or Insertion/Strap-on)

If a family of meters is submitted include these details for each size of meter.

Manufacturer _____

Model number _____

Pattern details

- Q_1 _____ …../….. (indicate units)
- Q_3 _____ …../….. (indicate units)
- Q_4 _____ …../….. (indicate units)
- Q_3/Q_1 _____
- Measuring principle _____
- Accuracy class _____
- Environmental class class B / class O / class M (circle correct one)
- Electromagnetic environment class E1 / class E2 (circle correct one)
- Maximum admissible temperature _____ °C
- Maximum admissible pressure _____MPa (_____ bar)
- Orientation limitation _____

EUT testing requirements (NMI M 10-2, 7.1.7)

- Category _____
- Case A / B / C / D / E (circle correct one)

Installation details

- Connection type (flange, screw thread, concentric manifold, insertion) _____
- Minimum straight length of inlet pipe _____ mm
- Minimum straight length of outlet pipe_____ mm
- Flow conditioner (details if required) _____
- Mounting _____
- Orientation _____
- Other relevant information _____

1.4 Electronic Meters (Self-contained or Insertion/Strap-on)

If a family of meters is submitted, include these details for each size of meter.

Manufacturer _____

Model number _____

Pattern details

- Q_1 _____ …../….. (indicate units)
- Q_3 _____ …../….. (indicate units)
- Q_4 _____ …../….. (indicate units)
- Q_3/Q_1 _____
- Measuring principle _____
- Accuracy class _____
- Environmental class class B / class O / class M (circle correct one)
- Electromagnetic environment _____ class E1 / class E2 (circle correct one)
- Maximum admissible temperature _____ °C
- Maximum admissible pressure _____MPa (_____ bar)
- Orientation limitation _____

EUT testing requirements (NMI M 10-2, 7.1.7)

- Category _____
- Case A / B / C / D / E (circle correct one)

Installation details (mechanical)

- Connection type (flange, screw thread, concentric manifold, insertion) _____
- Minimum straight length of inlet pipe _____ mm
- Minimum straight length of outlet pipe_____ mm
- Flow conditioner (details if required) _____
- Mounting _____
- Orientation _____
- Other relevant information _____

Installation details (electrical)

- Wiring instructions _____
- Mounting arrangement _____
- Orientation limitations _____

Power supply

- Type (battery, mains AC, mains DC) _____
- U_{max} _____ V
- U_{min} _____ V
- Frequency _____ Hz

1.5 Separable Calculator (Including Indicating Device)

Manufacturer _____

Model number _____

Pattern details

Q_1 _____ …../….. (indicate units)

Q_3 _____ …../….. (indicate units)

Q_4 _____ …../….. (indicate units)

Q_3/Q_1 _____

Measuring principle _____

Accuracy class _____

Environmental class class B / class O / class M (circle correct one)

Electromagnetic environment class E1 / class E2 (circle correct one)

Maximum admissible temperature _____ °C

Maximum admissible pressure _____MPa (_____ bar)

Orientation limitation _____

EUT testing requirements (NMI M 10-2, 7.1.7)

Category _____

Case A / B / C / D / E (circle correct one)

Maximum relative error specified by manufacturer _____ %

Installation details (electrical)

Wiring instructions _____

Mounting arrangement _____

Orientation limitations _____

Power supply

Type (battery, mains AC, mains DC) _____

U_{max} _____ V

U_{min} _____ V

Frequency _____ Hz

Approval number(s) of compatible measurement transducer(s) (including flow or volume sensor) _____

1.6 Separable Measurement Transducer (Including Flow or Volume Sensor)

Manufacturer _____

Model number _____

Pattern details

- Q_1 _____ …../….. (indicate units)
- Q_3 _____ …../….. (indicate units)
- Q_4 _____ …../….. (indicate units)
- Q_3/Q_1 _____
- Measuring principle _____
- Accuracy class _____
- Environmental class class B / class O / class M (circle correct one)
- Electromagnetic environment class E1 / class E2 (circle correct one)
- Maximum admissible temperature _____ °C
- Maximum admissible pressure _____MPa (_____ bar)
- Water conductivity range (if applicable) from _____ to _____ S/cm
- Orientation limitation _____

EUT testing requirements (NMI M 10-2, 7.1.7)

- Category _____
- Case A / B / C / D / E (circle correct one)

Maximum relative error specified by manufacturer _____ %

Installation details (mechanical)

- Connection type (flange, screw thread, concentric manifold, insertion) _____
- Minimum straight length of inlet pipe _____ mm
- Minimum straight length of outlet pipe _____ mm
- Flow conditioner (details if required) _____
- Mounting _____
- Orientation _____
- Other relevant information _____

Installation details (electrical)

- Wiring instructions _____
- Mounting arrangement _____
- Orientation limitations _____

Power supply

- Type (battery, mains AC, mains DC) _____
- U_{max} _____ V
- U_{min} _____ V
- Frequency _____ Hz

Approval number(s) of compatible calculator(s) (including indicating device) _____

1.7 Supplementary Electronic Device/s used for Testing (Permanently Attached to Meter)

Manufacturer _____

Model number _____

Power supply

Type (battery, mains AC, mains DC) _____

U_{max} _____ V

U_{min} _____ V

Frequency _____ Hz

Installation details (electrical)

Wiring instructions _____

Mounting arrangement _____

Orientation limitations _____

1.8 Supplementary Electronic Device/s used for Data Transmission (Permanently Attached to Meter)

Manufacturer _____

Model number _____

Power supply

Type (battery, mains AC, mains DC) _____

U_{max} _____ V

U_{min} _____ V

Frequency _____ Hz

Installation details (electrical)

Wiring instructions _____

Mounting arrangement _____

Orientation limitations _____

1.9 Supplementary Electronic Device/s used for Testing (Temporarily Attached to Meter)

Manufacturer _____

Model number _____

Power supply

Type (battery, mains AC, mains DC) _____

U_{max} _____ V

U_{min} _____ V

Frequency _____ Hz

Installation details (electrical)

Wiring instructions _____

Mounting arrangement _____

Orientation limitations _____

1.10 Supplementary Electronic Device/s used for Data Transmission (Temporarily Attached to Meter)

Manufacturer _____

Model number _____

Power supply

Type (battery, mains AC, mains DC) _____

U_{max} _____ V

U_{min} _____ V

Frequency _____ Hz

Installation details (electrical)

Wiring instructions _____

Mounting arrangement _____

Orientation limitations _____

1.11 Ancillary Devices

Manufacturer _____

Main functions _____

Model number _____

Electromagnetic environment class E1 / class E2 (circle correct one)

Power supply

Type (battery, mains AC, mains DC) _____

U_{max} _____ V

U_{min} _____ V

Frequency _____ Hz

Approval number(s) of compatible calculator(s) (including indicating device) _____

EUT testing requirements (NMI M 10-2, 7.1.7)

Category _____

Case A / B / C / D / E (circle correct one)

Installation details (electrical)

Wiring instructions _____

Mounting arrangement _____

Orientation limitations _____

Approval number(s) of compatible meters, calculator(s) (including indicating device) and measurement transducer(s) (including flow or volume sensor) _____

2. DOCUMENTATION

Details of all documents concerning the pattern shall be recorded (NMI M 10-1, 6.2.12.1).

Document reference	Date	Brief description

3. INFORMATION CONCERNING THE TEST EQUIPMENT

Details of all items of measuring equipment and test instruments used shall be recorded, including:

- manufacturer;
- model number;
- serial number;
- date of last calibration; and
- date of next calibration due, e.g. for instruments for measuring linear dimensions, pressure gauges, pressure transmitters, manometers, temperature transducers, reference meters, volume tanks, weighing machines, signal generators (for pulse, current or voltage).

Parameter measured or applied	Instrument/ equipment	Model number	Serial number	Calibration date		Used in test no. (NMI M 10-2, section no.)
				Last	Next	

Comments

4. CHECKLISTS

4.1 Checklist for External Examination

NMI M 10-1 clause no	Requirement	+	–	Remarks
Function of the indicating device				
5.9.1	The indicating device shall provide an easily read, reliable and unambiguous visual indication of the indicated volume.			
5.9.1	The indicating device shall include visual means for testing and calibration.			
5.9.1	The indicating device may include additional elements for testing and calibration by other methods, e.g. for automatic testing and calibration.			
5.9.1	The indicating device may display other parameters such as instantaneous or average flowrate.			
Unit of measurement and its placement				
5.9.1.1	The indicated volume of water shall be expressed in megalitres, cubic metres or kilolitres.			
5.9.1.1	The symbol ML, m^3 or kL shall appear on the dial or immediately adjacent to the numbered display.			
Indicating range				
5.9.1.2	The indicating device shall be able to record the indicated volume in megalitres, cubic metres or kilolitres corresponding to at least 200 days of operation at the permanent flowrate Q_3, without passing through zero. The indicated volume (V_i) corresponding to 200 days of operation is $V_i = Q_3 \times 200$ ML (or m^3 or kL) where Q_3 is the numerical value of the permanent flowrate Q_3 in ML/d (or L/s).			
Color coding of indicating devices				
5.9.1.3	The colour black should be used to indicate megalitres (cubic metres or kilolitres) and its multiples.			
5.9.1.3	The colour red should be used to indicate submultiples of a megalitre (cubic metre or kilolitre).			
5.9.1.3	These colours shall be applied to either to the pointers, indexes, numbers, wheels, discs, dials or aperture frames.			
5.9.1.3	Other means of indicating the megalitre (cubic metre or kilolitre), its multiples and its submultiples may be used, provided there is no ambiguity in distinguishing between the primary indication and alternative displays, e.g. submultiples for verification testing.			
Types of indicating device: type 1 — analogue device				
5.9.2.1	The indicated volume shall be indicated by continuous movement of either: (a) one or more pointers moving relative to graduated scales; or (b) one or more circular scales or drums each passing an index.			
5.9.2.1	The value expressed in megalitres (cubic metres or kilolitres) for each scale division shall be of the form 10^n, where n is a positive or negative whole number or zero, thereby establishing a system of consecutive decades.			
5.9.2.1	The scale shall be graduated in values expressed in megalitres (cubic metres or kilolitres) or accompanied by a multiplying factor (× 0.001; × 0.01; × 0.1; × 1; × 10; × 100; × 1000 etc.).			
5.9.2.1	Rotational movement of the pointers or circular scales shall be clockwise.			

NMI M 10-1 clause no	Requirement	+	–	Remarks
5.9.2.1	Linear movement of pointers or scales shall be left to right.			
5.9.2.1	Movement of numbered roller indicators shall be upwards.			
Types of indicating device: type 2 — digital device				
5.9.2.2	The indicated volume is given by a line of digits appearing in one or more apertures.			
5.9.2.2	The advance of one digit shall be completed while the digit of the next immediately lower decade changes from 9 to 0.			
5.9.2.2	For non-electronic devices, the movement of numbered roller indicators (drums) shall be upwards.			
5.9.2.2	For non-electronic devices, the lowest value decade may have a continuous movement, the aperture being large enough to permit a digit to be read without ambiguity.			
5.9.2.2	The actual or apparent height of the digits shall be at least 4 mm.			
5.9.2.2	For electronic devices, either permanent or non-permanent displays are permitted. Where a non-permanent display is used, the volume shall be able to be displayed at any time for at least 10 s.			
5.9.2.2	The electronic device shall include a feature that enables the correct operation of the display to be checked (e.g. by successive display of the various characters). Each step of the sequence shall last at least 1 s.			
Types of indicating device: type 3 — combination of analogue and digital devices				
5.9.2.3	The indicated volume is given by a combination of type 1 and type 2 devices and the respective requirements of each shall apply.			
Supplementary devices				
5.9.3	The meter may include supplementary devices that may be permanently incorporated or added temporarily for detecting movement of the flow sensor before this is clearly visible on the indicating device.			
5.9.3	The device may be used to detect movement of the flow sensor before this is clearly visible on the indicating device.			
5.9.3	The device may be used for testing and verifying the meter, provided that other means guarantee the satisfactory operation of the meter.			
Verification devices — general requirements				
5.9.4.1	Every indicating device shall provide means for visual, non-ambiguous verification testing and calibration.			
5.9.4.1	The visual verification may have either a continuous or a discontinuous movement.			
5.9.4.1	In addition to the visual verification display, an indicating device may include provisions for rapid testing by the inclusion of complementary elements (e.g. star wheels or discs) providing signals through externally attached sensors.			
Verification devices — visual verification displays				
5.9.4.2	The value of the verification scale interval (expressed in megalitres, cubic metres or kilolitres) shall be of the form: 1×10^n, or 2×10^n, or 5×10^n, where n is a positive or negative whole number or zero.			
5.9.4.2	For analogue or digital indicating devices with continuous movement of the first element, the verification scale interval may be formed from the division into 2, 5 or 10 equal parts of the interval between two consecutive digits of the first element. Numbering shall not be applied to these divisions.			
5.9.4.2	For digital indicating devices with discontinuous movement of the first element, the verification scale interval is the interval between two consecutive digits or incremental movements of the first element.			
5.9.4.3	On indicating devices with continuous movement of the first element,			

NMI M 10-1 clause no	Requirement	+	–	Remarks
	the apparent scale spacing shall not be less than 1 mm and not more than 5 mm.			
5.9.4.3	The scale shall consist of either: • lines of equal thickness not exceeding one-quarter of the scale spacing and differing only in length; or • contrasting bands of a constant width equal to the scale spacing.			
5.9.4.3	The apparent width of the pointer at its tip shall not exceed one-quarter of the scale spacing and in no case shall it be greater than 0.5 mm.			
Resolution of the indicating device				
5.9.4.4	The subdivisions of the verification scale shall be small enough to ensure that the resolution error of the indicating device does not exceed 0.5% of the actual volume passed during 1 h 30 min at the minimum flowrate, Q_1. Note: When a display of the first element is continuous, an allowance should be made for a maximum error in reading of not more than half the verification scale interval. When the display of the first element is discontinuous, an allowance should be made for a maximum error in each reading of not more than one digit of the verification scale.			
Marks and inscriptions				
5.8	The meter shall be clearly and indelibly marked with the information listed below, either grouped or distributed on the casing, the indicating device dial, an identification plate or on the meter cover if is not detachable. Alternatively, the information may be recorded in the memory of the meter and any such information made easily accessible.			
5.8(a)	Unit of measurement: megalitre, cubic metre or kilolitre.			
5.8(b)	Numerical value of Q_3 and the ratio Q_3/Q_1.			
5.8(c)	Pattern approval mark.			
5.8(d)	Name or trademark of the manufacturer.			
5.8(e)	Serial number (as near as possible to the indicating device)			
5.8(f)	Marking of the year of manufacture (optional)			
5.8(g)	Direction of flow (shown on both sides of the body; or on one side only, provided the direction of flow arrow is easily visible under all circumstances).			
5.8(h)	Maximum admissible pressure.			
5.8(i)	Letter V or H, if the meter can only be operated in the vertical or horizontal position.			
5.8(j)	Maximum pressure loss.			
5.8(k)	For insertion or strap-on meters, the pipe bore diameter and outside diameter in which the meter is required to operate.			
Additional markings for meters with electronic devices				
5.8(l)	For an external power supply: the voltage and frequency.			
5.8(m)	For a replaceable battery: the latest date that the battery is to be replaced. Alternatively, provision shall be made to allow this date to be recorded in the memory of the meter upon replacement of the battery and installation of the meter by a certified person.			
5.8(n)	For a non-replaceable battery: the latest date the meter has to be replaced. Alternatively, provision shall be made to allow this date to be recorded in the meter memory upon installation by a certified person.			
5.8(o)	The IP rating of the meter and its constituent parts.			
Verification mark and protection devices				
5.10	A place shall be provided on the meter for affixing the main verification mark, which shall be visible without dismantling the meter.			
5.10.1	Meters shall include protection devices which can be sealed so as to prevent, both before and after correct installation of the meter,			

NMI M 10-1 clause no	Requirement	+	–	Remarks
	dismantling or modification of the meter, its adjustment device or its correction device, without damaging these devices.			
Protection devices — electronic sealing devices				
5.10.2(a)	When access to parameters that influence the determination of the results of measurements is not protected by mechanical sealing devices, the protection shall fulfill the following provisions: (a) Access shall only be allowed to authorised people, e.g. by means of a code (keyword) or of a special device (e.g. a hard key). The code shall be capable of being changed. (b) It shall be possible for at least the last intervention to be memorised. The record shall include the date and a characteristic element identifying the authorised person making the intervention (see (a)). The traceability of the last intervention shall be assured for at least two years, if it is not overwritten on the occasion of a further intervention. If it is possible to memorise more than one intervention and if deletion of a previous intervention must occur to permit a new record, the oldest record shall be deleted.			
5.10.2(b)	For meters with parts which may be disconnected one from another and which **are** interchangeable, the following shall be fulfilled: (a) it shall not be possible to access parameters that participate in the determination of results of measurements through disconnected points unless the provisions of NMI M 10-1, 5.10.2(a) are fulfilled; (b) interposing any device which may influence the accuracy shall be prevented by means of electronic and data processing securities, or, if this is not possible, by mechanical means.			
5.10.2(c)	For meters with parts which may be disconnected one from the other and which **are not** interchangeable, NMI M 10-1, 5.10.2(b) shall apply. Moreover, these meters shall be provided with devices which do not allow them to operate if the various parts are not connected according to the manufacturer's configuration. Note: Disconnections which are not allowed to the user may be prevented, e.g. by means of a device that prevents any measurement after disconnecting and reconnecting.			
General requirements and power supply				
4.1	Meters with electronic devices shall be designed and manufactured in such a way that significant faults do not occur when they are exposed to the disturbances specified in NMI M 10-1, Annex A.5. These requirements shall be met durably.			
4.1	The meter shall also provide visual checking of the entire display which shall have the following sequence: • displaying all elements (e.g. an 'eights' test); and • blanking all the elements (a 'blanks' test). Each step of the sequence shall last at least 1 s.			
4.2	Three different kinds of basic power supplies may be used for meters with electronic devices: external power supply, non-replaceable battery and replaceable battery. These three types of power supplies may be used alone or in combination.			
External power supply				
4.2.1	Meters with electronic devices shall be designed such that in the event of an external power supply failure, the meter indication of volume just before failure is not lost, and remains accessible for a minimum of 1 yr.			
4.2.1	The corresponding memorisation shall occur at least either once per day or for every volume equivalent to 10 min of flow at Q_3.			
4.2.1	Any other properties or parameters of the meter shall not be affected by an interruption of the electrical supply. Note: Compliance with this clause will not necessarily ensure that the meter will continue to register the volume consumed during a power supply failure.			

NMI M 10-1 clause no	Requirement	+	–	Remarks
	The power supply shall be secured from tampering or any such tampering will be evident.			
Non-replaceable battery				
4.2.2	The manufacturer shall ensure that the indicated lifetime of the battery guarantees that the meter functions correctly for at least one year longer than the operational lifetime of the meter.			
4.2.2	The latest date by which the meter is to be replaced shall be indicated on the meter. Alternatively, provision shall be made to allow this date to be recorded in the memory of the meter upon installation by a certified person. Note: It is anticipated that a combination of maximum allowable volume, displayed volume, indicated operational lifetime, remote reading and extreme temperature will be considered when specifying a battery and during pattern approval. Alternative means of indicating impending battery failure may be allowed.			
Replaceable battery				
4.2.3	Where the electrical power supply is a replaceable battery, the manufacturer shall give precise rules for the replacement of the battery. These shall be made available in a manual, instruction booklet or electronically.			
4.2.3	The replacement date of the battery shall be indicated on the meter. Alternatively, provision shall be made to allow this date to be recorded in the memory of the meter upon replacement of the battery and installation of the meter by a certified person.			
4.2.3	The properties and parameters of the meter shall not be affected by the interruption of electrical supply when the battery is replaced. Note: A combination of maximum allowable volume, displayed volume, indicated operational lifetime, remote reading and extreme temperature will be considered when specifying a battery and during pattern approval. Alternative means of indicating impending battery failure may be allowed.			
4.2.3	The operation of replacing the battery shall be carried out in a way which does not necessitate breaking the seal required for verification. The battery compartment shall be secured from tampering or any such tampering will be evident.			
Combination of external power supply and rechargeable battery				
4.2.4	Where an external power source such as solar energy is used to recharge batteries, meters shall be designed such that in the event of failure of the solar power through damage or shading, the meter indication of volume just before battery failure is not lost, and remains accessible for a minimum of one year.			
4.2.4	The corresponding memorisation shall occur once per day or for every volume equivalent to 10 min of flow at Q_3.			
Frequency of measurement				
4.2.5	For meters operating at constant flowrate with only periodic measurement in order to conserve battery life, flow measurement shall occur at least every 5 min.			
Electromagnetic meter connection				
4.3	The maximum permissible cable length between primary and secondary devices of an electromagnetic meter shall be no more than 100 m or not more than the value X expressed in metres according to the following formula, whichever is smaller: $X = (k \times c) / (f \times C)$ where: $k = 2 \times 10^{-5}$ m c is the conductivity of the water in S/m f is the field frequency during the measuring cycle in Hz C is the effective cable capacitance per metre in F/m Note: It is not necessary to fulfil these requirements if the			

NMI M 10-1 clause no	Requirement	+	–	Remarks
	manufacturer's solutions ensure equivalent results.			

4.2 Checklist for Performance Tests

4.2.1 Performance Tests for all Meters

NMI M 10-1 clause no	Requirement	+	–	Remarks
Static pressure test				
6.2.1	The meter shall be capable of withstanding the following test pressures without leakage or damage: • 1.6 times the maximum admissible pressure for 15 min; • 2 times the maximum admissible pressure for 1 min.			
Errors of indication				
6.2.2	The errors of indication of the meter (in the measurement of the actual volume) shall be determined for at least the following flowrates, measured twice: • between Q_1 and 1.1 Q_1; • between 0.33 (Q_1 + Q_3) and 0.37 (Q_1 + Q_3); • between 0.67 (Q_1 + Q_3) and 0.74 (Q_1 + Q_3); • between 0.9 Q_3 and Q_3; and • between 0.95 Q_4 and Q_4. The errors of indication observed for each of the five flowrates shall not exceed the MPEs (±2.5%). If the error of indication observed on one or more meters is greater than the MPE at one flowrate only, the test at that flowrate shall be repeated. The test shall be declared satisfactory if two out of the three results lie within the MPE and the arithmetic mean of the results for the three tests at that flowrate is less than or equal to the MPE. If all the errors of indication of the meter have the same sign, at least one of the errors shall not exceed half the MPE. If the meter is marked as only operating in certain orientations, then the meter shall be tested in these orientations. In the absence of such marks, the meter shall be tested in at least three orientations. It is recommended that the characteristic error curve for each meter be plotted in terms of error against flowrate, so that the general performance of the meter over its flowrate range can be evaluated.			
Meter characteristics at zero flowrate				
3.2.7	The meter totalisation shall not change when the flowrate is zero.			
Water pressure test				

NMI M 10-1 clause no	Requirement	+	–	Remarks
6.2.3	The meter shall be tested to determine the effect of internal water pressure on errors of indication. The errors of indication observed for this test shall not exceed the MPEs.			
Reverse flow test				
6.2.4	The manufacturer shall specify whether or not the meter is designed to measure reverse flow. If a meter is designed to measure reverse flow, the actual volume passed during reverse flow shall either be subtracted from the indicated volume or the meter shall record it separately. The MPE (±2.5%) shall be met for both forward and reverse flow. If a meter is not designed to measure reverse flow, the meter installation shall either prevent reverse flow, or the meter shall withstand accidental reverse flow without deterioration, or change in its metrological properties for forward flow.			
Pressure loss				
6.2.5	The pressure loss value shall be determined at least at a flowrate of Q_3. Where pressure loss is determined at a flowrate other than Q_3 the pressure loss at Q_3 is equal to (Q_3^2 / measured flowrate ^{2}) × measured pressure loss.			
Flow disturbance test				
6.2.6	The relative error of indication of the meter shall not exceed the MPE for any of the flow disturbance tests. The error shift shall be less than one-third of the MPE.			
Endurance test				
6.2.7	Meters are required to maintain their performance characteristics and a required level of metrological accuracy over an extended period of operation. After initial error testing, the meter shall be installed into specified metering site. The meter shall register a volume of water corresponding to at least 1000 h of continuous flow at a flowrate of Q_3 at that metering site. Meters shall subsequently be tested to determine the final errors of indication. The following acceptance criteria apply: • the difference between the error of indication at the initial test and the test following the endurance regime shall not exceed 1.5% at each point on the curve; • the error of indication curve shall not exceed a maximum error limit of ±4%.			
Water quality disturbance test				
6.2.8	The meter shall be subjected to a discontinuous flow regime in order to determine the affect on the metrological performance of the meter caused by the presence of particulate matter in the water supply. The meter manufacturer shall define the class or classes of water quality used in the discontinuous flow reigime. The meter will subsequently be tested to determine the final errors of indication. The following acceptance criteria apply: • the difference between the error of indication at the initial			

NMI M 10-1 clause no	Requirement	+	–	Remarks
	test and the final test following the endurance regime shall not exceed 1.5% at each point on the curve; • the error of indication curve shall not exceed a maximum error limit of ±4%.			
Specific emplacement and installation tests				
6.2.9	The meter may be tested in an open channel emplacement or a certain installation configuration, as specified by the manufacturer. The error of indication shall not exceed the MPE for any of the tests.			
Test for Cartridge Meters and Meters with Interchangeable Inserts				
6.2.10	Cartridge meters and meter with interchangeable inserts may be tested in order to confirm that the cartridges or inserts are insensitive to the influence of connection interfaces produced in series production. Five connection interfaces and two cartridges or measuring inserts shall be selected from the number of meters presented for approval. The errors of indication shall be determined for each of the ten combinations of interfaces and measuring inserts. The following acceptance criteria apply: • the relative errors of indication for all of the tests shall not exceed the MPE in clause 3.2; • error variation within the five tests corresponding to each measuring insert shall not exceed 1/5 of the MPE in clause 3.2 (i.e. ±0.5%).			
Maintenance tests				
6.2.11	A manufacturer may test a specified maintenance activity as part of the pattern approval process. The relative errors of indication for each of the flow rates tested shall not deviate from the corresponding relative errors of indication observed in 6.3.3 by more than the uncertainty associated with the test method itself.			
Supplementary devices				
5.9.3	A meter may include supplementary devices which are permanently incorporated or temporarily added, e.g. for use in testing and remote reading of the meter. (a) Where a supplementary device is to be fitted temporarily to a meter for testing or other purposes, the error of indication of the meter with the supplementary device fitted shall not differ significantly from the error of indication of the meter without the supplementary device. (b) Where a supplementary device is fitted permanently to a meter, the indications of volume from the supplementary device shall not differ significantly from the readings of the indicating device.			

4.2.2 Performance Tests for Electronic Meters and Electronic Devices fitted to Mechanical Meters

NMI M 10-1 clause no	Requirements	+	–	Remarks
Dry heat				
A.5.1	The EUT shall be exposed to a temperature of 55°C under free air conditions for a 2 h period, after the EUT has reached temperature stability. During the application of the high temperature: (a) all functions shall operate as designed; (b) the error of indication shall not exceed the MPE of the upper flowrate zone.			
Cold				
A.5.2	The EUT shall be exposed to a temperature of either –10°C (class O or M) or 5°C (class B) under free air conditions for a 2 h period, after the EUT has reached temperature stability. During the application of the reduced temperature: (a) all functions shall operate as designed; (b) the error of indication shall not exceed the MPE of the upper flowrate zone.			
Damp heat, cyclic (condensing)				
A.5.3	After stabilisation and with its power supply turned off, the EUT shall be exposed to cyclic temperature variations between a lower temperature of 25°C and an upper temperature of either 55°C (class O or M) or 40°C (class B) maintaining the relative humidity at above 95% during the temperature changes and during the phases at the lower temperature, and at 93% at the upper temperature phases. During the temperature rise condensation shall occur on the EUT. After the application of the damp heat cycles and a recovery period: (a) all functions shall operate as designed; (b) the error of indication shall not exceed the MPE of the upper flowrate zone.			
Power voltage variation for meters powered by direct AC or by AC/DC converters				
A.5.4.1	The EUT is exposed to its upper and lower, power supply, voltage limits while operating under normal atmospheric conditions and at reference conditions. The error of indication of an EUT having a power supply with a single voltage is measured at its upper voltage limit U_{nom} + 10% and then at its lower voltage limit U_{nom} – 15%. The error of indication of an EUT having a power supply with a voltage range is measured at its upper voltage limit U_U + 10% and then at its lower voltage limit U_I – 15%. During the application of the voltage limits: (a) all functions shall operate as designed; (b) the error of indication shall not exceed the MPE of the upper flowrate zone.			
Power voltage variation for meters powered by DC batteries				
A.5.4.2	The error of indication of the EUT is measured at the specified upper battery voltage limit U_{max} and at the specified lower battery voltage limit U_{min}, while operating at reference conditions. During the application of the voltage limits: (a) all functions shall operate as designed; (b) the error of indication shall not exceed the MPE of the upper zone.			

NMI M 10-1 clause no	Requirements	+	–	Remarks
Vibration (random)				
A.5.5	After mounting the EUT on a rigid fixture by its normal mounting means, and with the gravitational force acting in the same direction as it would in normal use, with its power supply turned off, the EUT — not filled with liquid — shall be exposed to random vibrations in three mutually perpendicular axes. Apply the random vibrations over the frequency range 10 to 150 Hz for a period of at least 2 min per axis. During the application of the vibrations, the following conditions shall be met: total RMS level: 7 $m.s^{-2}$ ASD level 10 to 20 Hz: 1 $m^2.s^{-3}$ ASD level 20 to 150 Hz: –3 dB/octave After the application of the vibrations and recovery: (a) all functions shall operate as designed; (b) the error of indication shall not exceed the MPE of the upper zone.			
Mechanical shock				
A.5.6	The EUT, placed in its normal position of use on a rigid surface, is tilted towards one bottom edge and it is then allowed to fall freely on to the test surface. The EUT shall not be operating and not filled with liquid when the disturbance is applied. After the application of the disturbance and recovery: (a) all functions shall operate as designed; (b) all the errors of indication shall be within the MPEs.			
Short time power reductions				
A.5.7	The EUT shall be exposed to mains voltage interruptions from nominal voltage to zero voltage for a duration equal to a half cycle of line frequency (severity level 1a) and to mains voltage reductions from nominal voltage to 50% of nominal voltage for a duration equal to one cycle of line frequency (severity level 1b). At least 10 interruptions and 10 reductions are applied, with a time interval of at least 10 s between tests. The interruptions and reductions are repeated throughout the time necessary to measure the error of indication of the EUT; therefore more than 10 interruptions and reductions may be necessary. The difference between the intrinsic error and the error of indication measured during the test shall not exceed half of the MPE of the upper flowrate zone (or significant faults are detected and acted upon by means of a checking facility).			
Bursts				
A.5.8	The EUT is subjected to electrical bursts superimposed on the mains supply voltage. Bursts are double exponential waveform transient voltages with a peak amplitude of 1000 V (class E1) and 2000 V (class E2). Each voltage spike shall have a rise time of 5 ns and a half amplitude duration of 50 ns. The burst length shall be 15 ms and the burst period (repetition time interval) shall be 300 ms. All bursts shall be applied asynchronously, in asymmetrical mode (common mode). The bursts shall be applied for at least 1 min during the measurement, or simulated measurement, for each polarity. The error of indication of the EUT shall be measured during the application of the mains voltage bursts. The difference between the intrinsic error and the error of indication measured during the test shall not exceed half of the MPE of the upper zone (or significant faults are detected and acted upon by means of a checking facility).			

NMI M 10-1 clause no	Requirements	+	–	Remarks
Electrostatic discharge				
A.5.9	The error of indication of the EUT shall be measured while the EUT is subjected to electrostatic discharges at a severity level of 6 kV for contact discharges and of 8 kV for air discharges. At each test point, at least 10 discharges shall be applied with intervals of at least 10 s between discharges, throughout the period of the error of indication measurement. Air discharges shall only be applied where contact discharges cannot be applied. For indirect discharges, a total of 10 discharges shall be applied on the horizontal coupling plane and a total of 10 discharges for each of the various positions of the vertical coupling plane. The difference between the intrinsic error and the error of indication measured during the test shall not exceed half of the MPE of the upper zone (or significant faults are detected and acted upon by means of a checking facility). Where it has been proven that the EUT is immune to electrostatic discharges within the rated operating conditions for flowrate, the approving body shall be free to choose a flowrate of zero during the electrostatic discharge test. In this case the meter totalisation shall not change by more than the value of the verification scale interval during the test.			
Electromagnetic susceptibility — electromagnetic fields (radiated)				
A.5.10	The EUT is subjected to 20 discrete frequency bands of electromagnetic radiation in the frequency range 26 to 1000 MHz, at a field strength of either 3 V/m (class E1) or 10 V/m (class E2). The difference between the intrinsic error and the error of indication measured during the test shall not exceed half of the MPE of the upper zone (or significant faults are detected and acted upon by means of a checking facility). Where it has been proven that the EUT is immune to electromagnetic radiation at the severity level required for this test, within the rated operating conditions for flowrate, the approving authority shall be free to choose a flowrate of zero during the electromagnetic susceptibility test. In this case the meter totalisation shall not change by more than the value of the verification scale interval during the test.			
Water				
A.5.11	Mount the EUT on an appropriate fixture and subject it to impacting water generated from either an oscillating tube or a spray nozzle simulating spraying or splashing water (class B and class O and M for non-submersible components) or immerse components to a depth agreed to with the manufacturer (class O and M submersible components). All functions shall operate as designed and all the errors of indication measured after the application of the influence factor shall be within the MPE.			
Dust				
A.5.12	Mount the EUT in a dust chamber. Whilst cycling the temperature between 30°C and 65°C apply the dust conditions described in IEC 60529. All functions shall operate as designed and all the errors of indication measured after the application of the influence factor shall be within the MPE.			

5. TESTS FOR ALL METERS

Notes:

1. MPE[1] in the tables is the MPE as defined in NMI M 10-1, 3.2. If the EUT is a separable part of a meter, the MPE shall be defined by the manufacturer (NMI M 10-2, 8.4).
2. Units of measurement shall be written in the spaces provided. Units of measurement of:
   - **volume** shall be in megalitres (ML), kilolitres (kL) or cubic metres (m^3); and
   - **flowrate** shall be in megalitres per day (ML/day), litres per second (L/s), kilolitres per hour (kL/h) or cubic metres per hour (m^3/h).

5.1 Static Pressure Test (NMI M 10-2, 6.2)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Meter serial no	Maximum admissible pressure × 1.6 (MPa)	Start time	Initial pressure (MPa)	End time	Final pressure (MPa)	Remarks

Meter serial no	Maximum admissible pressure × 2 (MPa)	Start time	Initial pressure (MPa)	End time	Final pressure (MPa)	Remarks

Comments_____

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5.2 Determination of Intrinsic Errors of Indication and the Effects of Meter Orientation (NMI M 10-2, 6.3)

Application no ________________
Model ________________
____
Observer(s) ________________
____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water quality (optional)	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3________________________

____

Notes: Add tables for each flowrate according to 6.3.3 of NMI M 10-2.
Tables for each orientation (see 6.3.2.2.7.5 of NMI M 10-2) shall be provided for meters not marked H or V.

Meter serial no________________ Orientation (V, H, other) _______________

Actual flowrate $Q_{(\ )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
Test 1:								
Test 2:								
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								
Test 3:								
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								

Meter serial no________________ Orientation (V, H, other) _______________

Actual flowrate $Q_{(\ )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
Test 1:								
Test 2:								
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								
Test 3:								
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								

Meter serial no________________ Orientation (V, H, other) _______________

Actual flowrate $Q_{(\ )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
Test 1:								
Test 2:								
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								
Test 3:								
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								

Comments____

5.3 Absence of Flow Test (NMI M 10-2, 6.4)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Meter serial no	Start time	First reading V_1	Second reading V_2	Third reading V_3	Fourth reading V_4	Verification scale interval	Change in volume ($V_1 - V_4$)	Remarks

Comments_____

_____

5.4 Water Pressure Test (NMI M 10-2, 6.5)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water quality (optional)	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

Meter serial no_____ Orientation (V, H, other) _____

Application conditions	Reference flowrate	Actual flowrate Q	Initial supply pressure (MPa)	Initial inlet water temp (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m(%)	MPE[1] (%)
0.03 MPa										
Max admissible pressure										

Comments_____

_____

5.5 Flow Reversal Test (NMI M 10-2, 6.6)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water quality (optional)	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

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5.5.1 Meters Designed to Measure Reverse Flow (NMI M 10-2, 6.6.3.1)

Meter serial no_____ Orientation (V, H, other) _____

Application conditions	Nominal flowrate	Actual flowrate Q	Initial supply pressure (MPa)	Initial inlet water temp (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m(%)	MPE[1] (%)
Reverse flow	Q_1									
Reverse flow	Q_3									

Comments_____

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5.5.2 Meters Not Designed to Measure Reverse Flow (NMI M 10-2, 6.6.3.2)

Meter serial no_____ Orientation (V, H, other) _____

Application conditions	Nominal flowrate	Actual flowrate Q	Initial supply pressure (MPa)	Initial inlet water temp (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m(%)	MPE[1] (%)
Reverse flow	$0.9Q_3$									
Forward flow	Q_1									
Forward flow	Q_3									

Comments_____

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5.5.3 Meters which Prevent Reverse Flow (NMI M 10-2, 6.6.3.3)

Meter serial no_____ Orientation (V, H, other) _____

Application conditions	Nominal flowrate	Actual flowrate Q	Initial supply pressure (MPa)	Initial inlet water temp (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m(%)	MPE[1] (%)
Maximum admissible pressure at reverse flow	0									
Forward flow	Q_1									
Forward flow	Q_3									

Comments_____

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_____

5.6 Pressure Loss Test (NMI M 10-2, 6.7)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water quality (optional)	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

_____

Meter serial no_____

Measurement 1

Flowrate $Q_{(\ )}$	L_{UP} (mm)	L_{DN} (mm)	L_{UP2} (mm)	L_{DN1} (mm)	P_{UP} (MPa)	P_{DN} (MPa)	Measuring section (mm)	Pressure loss ΔP_1 (MPa)

Measurement 2

Flowrate $Q_{(\ )}$	L_{UP} (mm)	L_{DN} (mm)	L_{UP2} (mm)	L_{DN1} (mm)	P_{UP} (MPa)	P_{DN} (MPa)	Measuring section (mm)	Pressure loss ΔP_1 (MPa)	Meter pressure loss ΔP (MPa)

Comments_____

_____

_____

_____

5.7 Flow Disturbance Tests (NMI M 10-2, 6.8 and Annex B)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water quality (optional)	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Nominal diameter of pipe upstream of meter (mm)	
Nominal diameter of pipe downstream of meter (mm)	

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

No external straighteners are allowed for meters where the manufacturer has specified installation lengths of at least 15 × nominal diameter upstream and 5 × nominal diameter downstream of the meter.

The difference between the errors of indication in both non-disturbed and disturbed situations (the error shift) shall be less than one-third of the MPE in NMI M 10-1, 3.2. If this requirement is met no additional lengths of pipe are required. However, if this requirement is not met, the tests have to be continued by incorporating a longer upstream and/or downstream straight pipe and/or flow conditioner until the requirement for error shift is met.

Type 1 Disturbance (Left-handed Swirl)

Meter serial no_____ Orientation (V, H, other) _____

Lengths of pipe upstream/ downstream	Actual flowrate $Q_{(\ )}$	Pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
/									
/									
					Intrinsic error of indication (5.2)				
					Error shift				

Comments_____

_____

Type 2 Disturbance (Right-handed Swirl)

Meter serial no_____ Orientation (V, H, other) _____

Lengths of pipe upstream/ downstream	Actual flowrate $Q_{(\ )}$	Pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
/									
/									
					Intrinsic error of indication (5.2)				
					Error shift				

Comments_____

_____

Type 3 Disturbance (Partial Blockage)

Meter serial no_____ Orientation (V, H, other) _____

Lengths of pipe upstream/ downstream	Actual flowrate $Q_{(\ )}$	Pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
/									
/									
					Intrinsic error of indication (5.2)				
					Error shift				

Comments_____

_____

5.8 Endurance Tests (NMI M 10-2, 6.9)

5.8.1 Initial Error of Indication Test

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water quality (optional)	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

Sample size _____

Notes: Add tables for each flowrate according to 6.9.4 of NMI M 10-2.
Tables for each orientation (see 6.3.2.2.7.5 of NMI M 10-2) shall be provided for meters not marked H or V.
For acceptance criteria refer to NMI M 10-2, 6.9.5.

Meter serial no_____ Orientation (V, H, other)_____ Registered volume_____

Actual flowrate $Q_{(\ )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
Test 1:								2.5
Test 2:								2.5
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								2.5
Test 3:								2.5
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								2.5

Comments_____

_____

5.8.2 Final Error of Indication Test

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water quality (optional)	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

Sample size _____

Notes: Add tables for each flowrate according to 6.9.4 of NMI M 10-2.
Tables for each orientation (see 6.3.2.2.7.5 of NMI M 10-2) shall be provided for meters not marked H or V.
For acceptance criteria refer to NMI M 10-2, 6.9.5.

Meter serial no_____ Orientation (V, H, other)_____ Registered volume_____

Actual flowrate $Q_{(\ )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
Test 1:								4.0
Test 2:								4.0
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								4.0
Test 3:								4.0
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								4.0
				Initial error of indication (5.8.1)				2.5
				Error difference				1.5

Comments_____

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5.9 Water Quality Disturbance Test (NMI M 10-2, 6.10)

5.9.1 Initial Error of Indication Test

			At start	At end	
Application no		Ambient temperature			°C
Model		Ambient relative humidity			%
		Ambient atmospheric pressure			MPa
Observer(s)		Time			
		Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

Water quality class_____

Notes: Add tables for each flowrate according to 6.10.4 of NMI M 10-2.
For acceptance criteria refer to NMI M 10-2, 6.10.5.

Meter serial no_____

Actual flowrate $Q_{(\ )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
Test 1:								2.5
Test 2:								2.5
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								2.5
Test 3:								2.5
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								2.5

Comments_____

_____

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_____

_____

5.9.2 Final Error of Indication Test

			At start	At end	
Application no	_____	Ambient temperature			°C
Model	_____	Ambient relative humidity			%
	_____	Ambient atmospheric pressure			MPa
Observer(s)	_____	Time			
	_____	Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water quality (optional)	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

Water quality class_____

Notes: Add tables for each flowrate according to 6.10.4 of NMI M 10-2.
For acceptance criteria refer to NMI M 10-2, 6.10.5.

Meter serial no_____

Actual flowrate $Q_{(\ )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
Test 1:								4.0
Test 2:								4.0
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								4.0
Test 3:								4.0
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								4.0
				Initial error of indication (5.9.1)				2.5
				Error difference				1.5

Comments_____

_____

_____

_____

_____

5.10 Meters Used in Open Channel Emplacements (NMI M 10-2, 6.11)

5.10.1 Determination of Errors of Indication (NMI M 10-2, 6.11.5)

Application no _________________

Model _________________

____

Observer(s) _________________

____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water quality (optional)	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3______________________

____

Notes: Add tables for each flowrate according to 6.11.5.6 of NMI M 10-2.
For acceptance criteria refer to NMI M 10-2, 6.11.5.7.

Meter serial no________________ Orientation (V, H, other) _______________

Actual flowrate $Q_{( )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
Test 1:								
Test 2:								
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								
Test 3:								
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								

Meter serial no________________ Orientation (V, H, other) _______________

Actual flowrate $Q_{( )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
Test 1:								
Test 2:								
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								
Test 3:								
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								

Meter serial no________________ Orientation (V, H, other) _______________

Actual flowrate $Q_{( )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
Test 1:								
Test 2:								
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								
Test 3:								
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								

Comments____

5.10.2 Flow Disturbance Test (NMI M 10-2, 6.11.6)

		At start	At end	
Application no	Ambient temperature			°C
Model	Ambient relative humidity			%
	Ambient atmospheric pressure			MPa
Observer(s)	Time			
	Date			

Test method	Gravimetric / volumetric
Volume measures / weighbridge used	
Water quality (optional)	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Nominal diameter of pipe upstream of meter (mm)	
Nominal diameter of pipe downstream of meter (mm)	

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3 _____

_____

_____

No external straighteners are allowed for meters where the manufacturer has specified installation lengths of at least 15 × nominal diameter upstream and 5 × nominal diameter downstream of the meter.

The difference between the errors of indication in both non-disturbed and disturbed situations (the error shift) shall be less than one-third of the MPE in NMI M 10-1, 3.2. If this requirement is met no additional lengths of pipe are required. However, if this requirement is not met, the tests have to be continued by incorporating a longer upstream and/or downstream straight pipe and/or flow conditioner until the requirement for error shift is met.

The test shall be repeated for each plate orientation in accordance with NMI M 10-2, 6.11.6.3.

Meter serial no_____ Orientation (V, H, other) _____

Lengths of pipe upstream/ downstream	Actual flowrate $Q_{(\ )}$	Pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
/									
/									
/									
/									

Comments_____

_____

_____

_____

5.10.3 Head Loss Test (NMI M 10-2, 6.11.7)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water quality (optional)	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

_____

_____

_____

Meter serial no_____

Start time	Actual flowrate	Water temp T_w (°C)	Downstream level (mm)	Upstream level (mm)	Head loss (mm)	End time	Total time

Comments_____

_____

_____

_____

_____

5.11 Installation Tests (NMI M 10-2, 6.12)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water quality (optional)	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

Notes: Supply detailed technical drawings and diagrams of the installation.
Add tables for each flowrate according to 6.12.4 of NMI M 10-2.
Tables for each orientation (see 6.3.2.2.7.5 of NMI M 10-2) shall be provided for meters not marked H or V.
For acceptance criteria refer to NMI M 10-2, 6.12.5.

Meter serial no_____ Orientation (V, H, other) _____

Actual flowrate $Q_{(\ )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading V_i(i)	Final reading V_i(f)	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
Test 1:_____								
Test 2:_____								
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								
Test 3:_____								
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								

Meter serial no_____ Orientation (V, H, other) _____

Actual flowrate $Q_{(\ )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading V_i(i)	Final reading V_i(f)	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
Test 1:_____								
Test 2:_____								
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								
Test 3:_____								
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								

Comments_____

_____

_____

_____

5.12 Test for Cartridge Meters and Meters with Interchangeable Inserts (NMI M 10-2, 6.13)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water quality (optional)	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

Notes: Supply detailed technical drawings and diagrams of the installation.
Add tables for each flowrate and each combination of connection interface and measuring insert in accordance with 6.13.3 of NMI M 10-2.
For acceptance criteria refer to NMI M 10-2, 6.13.4.

Connection interface serial no _____

Measuring Insert serial no _____

Actual flowrate $Q_{(\ )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
Test 1:_____								
Test 2:_____								
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								
Test 3:_____								
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								

Connection interface serial no _____

Measuring insert serial no _____

Actual flowrate $Q_{(\ )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
Test 1:_____								
Test 2:_____								
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								
Test 3:_____								
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								

Comments_____

_____

_____

5.13 Maintenance Test (NMI M 10-2, 6.14)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water quality (optional)	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

Notes: Add tables for each flowrate according to 6.14.6 of NMI M 10-2.
Tables for each orientation (see 6.3.2.2.7.5 of NMI M 10-2) shall be provided for meters not marked H or V.

Meter serial no_____ Orientation (V, H, other) _____

Actual flowrate $Q_{(\ )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	Original error (%)
Test 1:								
Test 2:								
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								
Test 3:								
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								

Meter serial no_____ Orientation (V, H, other) _____

Actual flowrate $Q_{(\ )}$	Initial supply pressure (MPa)	Water temp T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	Original error (%)
Test 1:								
Test 2:								
If the MPE for test 1 and 2 is **less than** the MPE, calculate $\bar{E}_{m2}$ (mean value of tests 1 and 2)								
Test 3:								
If the MPE for test 1 or 2 is **more than** the MPE, calculate $\bar{E}_{m3}$ (mean value of tests 1, 2 and 3)								

Comments_____

_____

_____

_____

6. TESTS FOR ELECTRONIC METERS AND MECHANICAL METERS WITH ELECTRONIC COMPONENTS

The following numbered notes apply:

1 For a meter this is the MPE as defined in NMI M 10-1, 3.2. If the EUT is a separable part of a meter, the MPE shall be defined by the manufacturer (NMI M 10-2, 8.4).

2 Temperature and pressure shall be recorded using a data-logging device to ensure conformity with the relevant IEC standard.

6.1 Dry Heat (Non-condensing) (NMI M 10-2, 7.2)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

_____

_____

Meter serial no_____ Orientation (V, H, other) _____

Application conditions	Actual or simulated flowrate	Working pressure[2] P_w (MPa)	Working temp[2] T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
20°C									
55°C									
20°C									

Comments_____

_____

_____

_____

6.2 Cold (NMI M 10-2, 7.3)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

_____

_____

Environmental class_____ Meter serial no _____ Orientation (V, H, other) _____

Application conditions	Actual or simulated flowrate	Working pressure[2] P_w (MPa)	Working temp[2] T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
20°C									
+5°C or –10°C									
20°C									

Comments_____

_____

_____

_____

6.3 Damp Heat, Cyclic (Condensing) (NMI M 10-2, 7.4)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

_____

_____

Environmental class_____ Meter serial no _____ Orientation (V, H, other) _____

Pre-condition the meter. Apply damp heat cycles (duration 24 h); two cycles between 25°C and 40°C (class B) or 55°C (classes C and I)

Application conditions	Actual or simulated flowrate	Working pressure[2] P_w (MPa)	Working temp[2] T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
After cycling									

Comments_____

_____

_____

_____

6.4 Power Voltage Variation (NMI M 10-2, 7.5)

	At start	At end	
Application no _____	Ambient temperature		°C
Model _____	Ambient relative humidity		%
_____	Ambient atmospheric pressure		MPa
Observer(s) _____	Time		
_____	Date		

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

6.4.1 Meters Powered by Direct AC (Single-phase) or AC/DC Converters, Mains Power Supply (NMI M 10-2, 7.5.1)

Meter serial no_____ Orientation (V, H, other) _____

Application conditions	U_i V	Actual or simulated flowrate	Working pressure[2] P_w (MPa)	Working temp[2] T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
U_{nom} + 10%										
U_{nom} – 15%										

Note: Meters with a voltage range are tested at U_u + 10% and U_l – 15%.

Comments_____

_____

6.4.2 Meters Powered by Primary Batteries (NMI M 10-2, 7.5.2)

Meter serial no_____ Orientation (V, H, other) _____

Application conditions	U_i V	Actual or simulated flowrate	Working pressure[2] P_w (MPa)	Working temp[2] T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
U_{max}										
U_{min}										

Comments_____

_____

6.5 Vibration (Random) (NMI M 10-2, 7.6)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

_____

_____

Environmental class_____ Meter serial no _____ Orientation (V, H, other) _____

Apply random vibrations to the EUT over the frequency range 10 to 150 Hz, in three mutually perpendicular axes for a period of at least 2 min per axis. Total RMS level: 7 $m.s^{-2}$. ASD level at 10 to 20 Hz = 1 $m^2.s^{-3}$ and at 20 to 150 Hz = –3 dB/octave)

Application conditions	Actual or simulated flowrate	Working pressure[2] P_w (MPa)	Working temp[2] T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)	EUT functioning correctly	
After vibrations										Yes	No

Comments_____

_____

_____

_____

6.6 Mechanical Shock (NMI M 10-2, 7.7)

		At start	At end	
Application no _____	Ambient temperature			°C
Model _____	Ambient relative humidity			%
_____	Ambient atmospheric pressure			MPa
Observer(s) _____	Time			
_____	Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

_____

_____

Environmental class_____ Meter serial no _____ Orientation (V, H, other) _____

Apply shock. Place the EUT on a rigid level surface in its normal position of use and tilted towards one bottom edge until the opposite edge of the EUT is 50 mm above the rigid surface. The angle made by the bottom of the EUT and the test surface shall not exceed 30°. Allow the EUT to drop freely onto the rigid surface. Repeat the test for each bottom edge of the EUT.

Application conditions	Flowrate $Q_{(\ )}$	Working pressure[2] P_w (MPa)	Working temp[2] T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)	EUT functioning correctly	
After shock										Yes	No

Comments_____

_____

_____

_____

6.7 Short-time Power Reductions (NMI M 10-2, 7.8)

	At start	At end	
Application no _____	Ambient temperature			°C
Model _____	Ambient relative humidity			%
_____	Ambient atmospheric pressure			MPa
Observer(s) _____	Time			
_____	Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

_____

_____

Meter serial no_____ Orientation (V, H, other) _____

Apply voltage reductions:

- 100% voltage reduction per half cycle, 10 times
- 50% voltage reduction per one cycle, 10 times

Cycle to be repeated during the error of indication measurement

Application conditions	Actual or simulated flowrate	Working pressure[2] P_w (MPa)	Working temp[2] T_w (°C)	Initial reading V_i(i)	Final reading V_i(f)	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)	Fault $E_{m(2)} - E_{m(1)}$ (%)	SF (%)	EUT functioning correctly	
(1) Before reductions													
(2) During reductions												Yes	No

Note: SF, the significant fault, is equal to half the MPE in the upper flowrate zone.

Comments_____

_____

_____

_____

6.8 Bursts (NMI M 10-2, 7.9)

		At start	At end	
Application no _____	Ambient temperature			°C
Model _____	Ambient relative humidity			%
_____	Ambient atmospheric pressure			MPa
Observer(s) _____	Time			
_____	Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

_____

_____

Meter serial no_____ Orientation (V, H, other) _____

Apply randomly phased bursts, (class E1 – 1000 V peak amplitude electromagnetic environment, class E2 – 2000 V peak amplitude) asynchronously in asymmetrical mode (common mode).

Application conditions	Actual or simulated flowrate	Working pressure[2] P_w (MPa)	Working temp[2] T_w (°C)	Initial reading V_i(i)	Final reading V_i(f)	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)	Fault $E_{m(2)} - E_{m(1)}$ (%)	SF (%)	EUT functioning correctly	
(1) Before burst													
(2) During burst												Yes	No

Note 1: SF, the significant fault, is equal to half the MPE in the upper flowrate zone.
Note 2: Include extra tables for the application of bursts upon each power or communication port.

Comments_____

_____

_____

_____

6.9 Electrostatic Discharge (NMI M 10-2, 7.10)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

_____

_____

Meter serial no_____ Orientation (V, H, other) _____

Application conditions			Actual or simulated flowrate	Working pressure[2] P_w (MPa)	Working temp[2] T_w (°C)	Initial reading V_i(i)	Final reading V_i(f)	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)	Fault $E_{m(2)} - E_{m(1)}$ (%)	SF (%)	EUT functioning correctly	
(1) Reference conditions															
(2) DP	Mode														
	C	A												Yes	No
	C	A												Yes	No
	C	A												Yes	No

Note: SF, the significant fault, is equal to half the MPE in the upper flowrate zone.
DP is the discharge point; indicate the discharge point by drawings if necessary.
C is the contact discharge (6 kV).
A is the air discharge (8 kV).

Comments_____

_____

_____

6.10 Electromagnetic Susceptibility (NMI M 10-2, 7.11)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

Meter serial no_____ Orientation (V, H, other) _____

Application conditions	Antenna polarisation		Actual or simulated flowrate	Working pressure[2] P_w (MPa)	Working temp[2] T_w (°C)	Initial reading V_i(i)	Final reading V_i(f)	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)	Fault $E_{m(2)} - E_{m(1)}$ (%)	SF (%)	EUT functioning correctly	
(1) Reference conditions	V	H													
(2) Disturbance															
26–40 MHz	V	H												Yes	No
40–60 MHz	V	H												Yes	No
60–80 MHz	V	H												Yes	No
80–100 MHz	V	H												Yes	No
100–120 MHz	V	H												Yes	No
120–144 MHz	V	H												Yes	No
144–150 MHz	V	H												Yes	No
150–160 MHz	V	H												Yes	No
160–180 MHz	V	H												Yes	No
180–200 MHz	V	H												Yes	No
200–250 MHz	V	H												Yes	No
250–350 MHz	V	H												Yes	No
350–400 MHz	V	H												Yes	No
400–435 MHz	V	H												Yes	No
435–500 MHz	V	H												Yes	No
500–600 MHz	V	H												Yes	No
700–800 MHz	V	H												Yes	No
800–934 MHz	V	H												Yes	No
934–1000 MHz	V	H													

Notes: SF, the significant fault, is equal to half the MPE in the upper flowrate zone.
Antenna polarisation is vertical (V) or horizontal (H).

Comments_____

6.11 Water (NMI M 10-2, 7.12)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

_____

_____

Environmental class_____ Meter serial no _____ Orientation (V, H, other) _____

Application conditions	Actual or simulated flowrate	Working pressure[2] P_w (MPa)	Working temp[2] T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
20°C pre-application									
20°C post-recovery									

Comments_____

_____

_____

_____

6.12 Dust (NMI M 10-2, 7.13)

Application no _____
Model _____
_____
Observer(s) _____
_____

	At start	At end	
Ambient temperature			°C
Ambient relative humidity			%
Ambient atmospheric pressure			MPa
Time			
Date			

Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

_____

_____

Environmental class_____ Meter serial no _____ Orientation (V, H, other) _____

Application conditions	Actual or simulated flowrate	Working pressure[2] P_w (MPa)	Working temp[2] T_w (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Meter error E_m (%)	MPE[1] (%)
20°C pre-application									
20°C post-recovery									

Comments_____

_____

_____

_____

PART II. INITIAL VERIFICATION REPORT

The layout for reporting initial verifications and subsequent verifications is left largely to the verifying authority concerned. However, the report must contain the minimum information detailed in NMI M 10-1 (6.3 and 7) and NMI M 10-2 (9 and 10.2.2).

In addition, any special requirements and/or restrictions detailed in the pattern approval certificate must be applied, and a record must be kept of equipment, instrumentation and calibration details (see table in 2).

The following basic information should be included followed by the test results. Three examples of how the report may be formatted are given below.

Pattern approval number _____

Model number _____

Accuracy class _____

Meter designation/s Q_3 _____

Ratio Q_3/Q_1 _____

Maximum admissible pressure _____

Maximum pressure loss, ΔP_{max} _____

Flowrate at ΔP_{max} _____

Year of manufacture _____

Manufacturer _____

Authorised representative _____

Address _____

_____

Testing laboratory _____

Authorised representative _____

Address _____

_____

Example 1: Error of indication for an approved meter (NMI M 10-2, 9.1)

			At start	At end	
Application no	_____	Ambient temperature			°C
Model	_____	Ambient relative humidity			%
Date	_____	Ambient atmospheric pressure			MPa
Observer	_____	Time			

EUT testing case (NMI M 10-2, 7.1.7)	
Category for testing (one clause of NMI M 10-2, 7.1.7.1 to 7.1.7.5)	clause ……..
Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

Meter serial no_____ Orientation (V, H, other) _____

Nominal flowrate[1]	Actual flowrate	Working pressure (MPa)	Working temp (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Actual volume V_a	Error[2] E_m (%)	MPE[4] (%)
Q_1									
(0.5–0.6) Q_3									
Q_3									

Example 2: Error of indication for an approved calculator (including indicating device) (NMI M 10-2, 9.2)

			At start	At end	
Application no	_____	Ambient temperature			°C
Model	_____	Ambient relative humidity			%
Date	_____	Ambient atmospheric pressure			MPa
Observer	_____	Time			

EUT testing case (NMI M 10-2, 7.1.7)	
Category for testing (one clause of NMI M 10-2, 7.1.7.1 to 7.1.7.5)	clause ……..

Meter serial no_____ Orientation (V, H, other) _____

Nominal flowrate[1]	Applied pulse frequency[3] (Hz)	Simulated flowrate	Initial reading $V_i(i)$	Final reading $V_i(f)$	Total pulses injected[3] T_p	Indicated volume V_I	Actual volume V_a	Error[2] E_c (%)	MPE[4] (%)
Q_1									
(0.5–0.6) Q_3									
Q_3									

[1] These flowrates shall be applied unless alternatives are specified in the pattern approval certificate.

[2] Calculations for error (of indication) are described in NMI M 10-2, Annex A.

[3] Other types of signal may be appropriate according to the design of the meter.

Example 3: Error of indication for an approved measurement transducer (including flow or volume sensor) (NMI M 10-2, 9.2)

			At start	At end	
Application no	_____	Ambient temperature			°C
Model	_____	Ambient relative humidity			%
Date	_____	Ambient atmospheric pressure			MPa
Observer	_____	Time			

EUT testing case (NMI M 10-2, 7.1.7)	
Category for testing (one clause of NMI M 10-2, 7.1.7.1 to 7.1.7.5)	clause ……..
Test method	Gravimetric / volumetric
Volume measures/weighbridge used	
Water conductivity (electromagnetic induction meters only) (S/cm)	
Length of straight pipe before meter (mm)	
Length of straight pipe after meter (mm)	
Nominal diameter of pipe before and after meter (mm)	/

Describe flow straightener installation (if used) in accordance with NMI M 10-1, 5.5.3_____

_____

Meter serial no_____ Orientation (V, H, other) _____

Nominal flowrate[1]	Actual flowrate	Working pressure (MPa)	Working temp (°C)	Initial reading $V_i(i)$	Final reading $V_i(f)$	Indicated volume V_i	Total output pulses, T_p	Actual volume V_a	Error[2] E_m (%)	MPE[4] (%)
Q_1										
(0.5–0.6) Q_3										
Q_3										

[1] These flowrates shall be applied unless alternatives are specified in the pattern approval certificate.

[2] Calculations for error (of indication) are described in NMI M 10-2, Annex A.

[3] Other types of signal may be appropriate according to the design of the meter.

[4] Given in the pattern approval certificate.

[4] Given in the pattern approval certificate.