INTERNATIONAL RECOMMENDATION

OIML R 49-3

Edition 2004 (E)

Water meters intended for the metering of cold potable water

Part 3: Test Report Format

Compteurs d'eau destinés au mesurage de l'eau potable froide

Partie 3: Format du Rapport d'Essai

ORGANISATION INTERNATIONALE DE MÉTROLOGIE LÉGALE

INTERNATIONAL ORGANIZATION OF LEGAL METROLOGY

Contents

Foreword

The International Organization of Legal Metrology (OIML) is a worldwide, intergovernmental organization whose primary aim is to harmonize the regulations and metrological controls applied by the national metrological services, or related organizations, of its Member States.

The two main categories of OIML publications are:

- **International Recommendations (OIML R)**, which are model regulations that establish the metrological characteristics required of certain measuring instruments and which specify methods and equipment for checking their conformity; the OIML Member States shall implement these Recommendations to the greatest possible extent;
- **International Documents (OIML D)**, which are informative in nature and intended to improve the work of the metrological services.

OIML Draft Recommendations and Documents are developed by technical committees or subcommittees which are formed by the Member States. Certain international and regional institutions also participate on a consultation basis.

Cooperative agreements are established between OIML and certain institutions, such as ISO and IEC, with the objective of avoiding contradictory requirements; consequently, manufacturers and users of measuring instruments, test laboratories, etc. may apply simultaneously OIML publications and those of other institutions.

International Recommendations and International Documents are published in French (F) and English (E) and are subject to periodic revision.

This publication - reference OIML R 49-3, Edition 2004 - was developed by the OIML Subcommittee TC 8/SC 5 *Water meters*. It was approved for final publication by the International Committee of Legal Metrology in 2003.

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Water meters intended for the metering of cold potable water

Part 3 Test Report Format

Explanatory notes to the Test Report Format

Implementation of this Test Report Format is informative with regard to the implementation of R 49-1 and R 49-2 in national regulations; however, **its implementation is mandatory within the framework of the OIML Certificate System for Measuring Instruments** [R 49-2 10.1].

Section I shows the required format of a Pattern Evaluation Report for a complete or combined water 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 is possible.

Some examples of tables for presenting the test results for separable units are shown in Section II for Initial Verification Report. These tables can also be adapted for Pattern Evaluation Reports.

The symbols used in the tables are:

+ ..... Pass
- ..... Fail
n/a ..... Not applicable
EUT ..... Equipment under test
H ..... Horizontal
map ..... Maximum admissible pressure
mat ..... Maximum admissible temperature
mpe ..... Maximum permissible error
V ..... Vertical

For each examination and test the checklist shall be completed according to this example:

+	–	
X		Pass
	X	Fail
n/a	n/a	Not applicable

I. PATTERN EVALUATION REPORT

1 Information concerning the pattern

1.1 General

Application number: .....

Applicant: .....

Authorized representative: .....

Address: .....

.....

.....

.....

Testing laboratory: .....

Authorized representative: .....

Address: .....

.....

.....

.....

1.2 Model submitted

New model: .....

.....

.....

Variant of approved model (details): .....

Approval number: .....

.....

Variation of approved model: .....

Table 1 Model submitted

Submitted for approval tests	**Yes***	**No***	**Remarks**
Mechanical water meter (complete)			
Mechanical water meter (combined)			
Electronic water meter (complete)			
Electronic water meter (combined)			
Family of water 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			

** Tick as appropriate*

1.3 Mechanical water meter (complete or combined)

Manufacturer: .....
Model number: .....
Pattern details:

Q_1: ..... m^3/h
Q_2: ..... m^3/h
Q_3: ..... m^3/h
Q_4: ..... m^3/h
Q_2/Q_1: .....
Q_3/Q_1: .....

Measuring principle: .....
Accuracy class: .....
Environmental class: .....
Electromagnetic environment: .....
Maximum admissible temperature: ..... °C
Maximum admissible pressure: ..... MPa (..... bar)
Orientation requirements: .....

EUT testing requirements (R 49-2, section 7.1.7):

Category: .....
Case: .....

Installation details:

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

Note: If a family of meters is submitted, include the above details for each size of water meter.

1.4 Electronic water meter (complete or combined)

Manufacturer: .....
Model number: .....
Pattern details:

Q_1: ..... m^3/h
Q_2: ..... m^3/h
Q_3: ..... m^3/h
Q_4: ..... m^3/h
Q_2/Q_1: .....
Q_3/Q_1: .....

Measuring principle: .....
Accuracy class: .....
Environmental class: .....
Electromagnetic environment: .....
Maximum admissible temperature: ..... °C
Maximum admissible pressure: ..... MPa (..... bar)
Orientation limitations: .....

EUT testing requirements (R 49-2, section 7.1.7):

Category: .....
Case: .....

Installation details (mechanical):

Connection type (flange, screw thread, concentric manifold): .....
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

Note: If a family of meters is submitted, give the above details for each size of water meter.

1.5 Separable calculator (including indicating device)

Manufacturer: .....

Model number: .....

Pattern details:

Q_1: ..... m^3/h
Q_2: ..... m^3/h
Q_3: ..... m^3/h
Q_4: ..... m^3/h
Q_2/Q_1: .....
Q_3/Q_1: .....

Accuracy class: ....., ...
Environmental class: .....
Electromagnetic environment: .....

Maximum relative error (of indication) specified by the manufacturer:

Lower flowrate zone, $Q_1 \leq Q < Q_2$: ..... %
Upper flowrate zone, $Q_2 \leq Q \leq Q_4$: ..... %

EUT testing requirements (R 49-2, section 7.1.7):

Category: .....
Case: .....

Installation details (electrical):

Input signal specifications: .....
Interface specifications: .....
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: ..... m^3/h
Q_2: ..... m^3/h
Q_3: ..... m^3/h
Q_4: ..... m^3/h
Q_2/Q_1: .....
Q_3/Q_1: .....

Measuring principle: .....
Accuracy class: .....
Environmental class: .....
Electromagnetic environment: .....
Maximum admissible temperature: ..... °C
Maximum admissible pressure: ..... MPa (..... bar)
Orientation limitations: .....
Water conductivity range (if applicable): From ..... to ..... S/cm

EUT testing requirements (R 49-2, section 7.1.7):

Category: .....

Case: .....

Maximum relative error specified by the manufacturer:

Lower flowrate zone, $Q_1 \leq Q < Q_2$: ..... %

Upper flowrate zone, $Q_2 \leq Q \leq Q_4$: ..... %

Installation details (mechanical):

Connection type (flange, screw thread, concentric manifold): .....

Minimum straight length of inlet pipe: ..... mm

Minimum straight length of outlet pipe: ..... mm

Flow conditioner (details if required): .....

Mounting: .....

Orientation: .....

Other relevant information: .....

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: .....

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: .....
Main functions: .....
Model number: .....
Power supply:
Type (battery, mains AC, mains DC): .....
U_{max}: V
U_{min}: V
Frequency: ..... Hz

EUT testing requirements (R 49-2, section 7.1.7):
Category: .....
Case: .....

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: .....
Electromagnetic environment: .....
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: .....
Electromagnetic environment: .....
Power supply:
Type (battery, mains AC, mains DC): .....
U_{max}: V
U_{min}: V
Frequency: ..... Hz

EUT testing requirements (R 49-2, section 7.1.7):

Category: .....

Case: .....

Installation details (electrical):

Wiring instructions: .....

Mounting arrangement: .....

Orientation limitations: .....

1.11 Ancillary devices

Manufacturer: .....

Main functions: .....

Model number: .....

Electromagnetic environment: .....

Power supply:

Type (battery, mains AC, mains DC): .....

U_{max}: V

U_{min}: V

Frequency: ..... Hz

Approval numbers of compatible calculators (including indicating device): .....

EUT testing requirements (R 49-2, section 7.1.7):

Category: .....

Case: .....

Installation details (electrical):

Wiring instructions: .....

Mounting arrangement: .....

Orientation limitations: .....

Approval nos. of compatible water meters, calculator/s (including indicating device) and measurement transducer/s (including flow or volume sensor): .....

2 Documents concerning the pattern

A model list of documents submitted with the pattern approval application is given in Annex A.

3 General information concerning the test equipment

Details of all items of measuring equipment and test instruments used for the pattern examinations and initial verifications shall be listed in Annex B, including:

- Manufacturer,
- Model number,
- Serial number,
- Date of last calibration,
- Date of next calibration due of e.g. 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).

4 Checklist for water meter examinations and performance tests

4.1 Checklist for water meter examinations

Note: § (R 49-1) Refers to clause numbers in OIML R 49-1 *Water meters intended for the metering of cold potable water. Part 1: Metrological and technical requirements* Edition 2003 (E).

4.1.1 External examination for all water meters				
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Function of the indicating device				
5.7.1.1	The indicating device shall provide an easily read, reliable and unambiguous visual indication of the indicated volume.			
5.7.1.1	The indicating device shall include visual means for testing and calibration.			
5.7.1.1	The indicating device may include additional elements for testing and calibration by other methods, e.g. for automatic testing and calibration.			
Unit of measurement and its placement				
5.7.1.2	The indicated volume of water shall be expressed in cubic metres.			
5.7.1.2	The symbol m^3 shall appear on the dial or immediately adjacent to the numbered display.			
Indicating range				
5.7.1.3	The indicating device shall be able to record the indicated volume in cubic metres corresponding to at least 1600 hours of operation at the permanent flowrate Q_3, without passing through zero. The indicated volume corresponding to 1600 hours of operation is: $Q_3 \times 1600\ m^3$ Where Q_3 is the numerical value of the permanent flowrate of the water meter, Q_3, in m^3/h. This provision is that formulated below.			
5.7.1.3	For $Q_3 \leq 6.3$, minimum indicating range = 9 999 m^3.			
5.7.1.3	For $6.3 < Q_3 \leq 63$, minimum indicating range = 99 999 m^3.			
5.7.1.3	For $63 < Q_3 \leq 630$, minimum indicating range = 999 999 m^3.			
5.7.1.3	For $630 < Q_3 \leq 6300$, minimum indicating range = 9 999 999 m^3.			

4.1.1 External examination for all water meters (continued)				
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Color coding for indicating devices				
5.7.1.4	The color black should be used to indicate the cubic metre and its multiples.			
5.7.1.4	The color red should be used to indicate sub-multiples of a cubic metre.			
5.7.1.4	The colors shall be applied to either the pointers, indexes, numbers, wheels, discs, dials or aperture frames.			
5.7.1.4	Other means of indicating the cubic metre may be used provided there is no ambiguity in distinguishing between the primary indication and alternative displays, e.g. sub-multiples for verification and testing.			
Types of indicating device: Type 1 – Analogue device				
5.7.2.1	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.			
5.7.2.1	The value expressed in cubic meters for each scale division shall be of the form 10^n, where n is a positive or a negative whole number or zero, thereby establishing a system of consecutive decades.			
5.7.2.1	The scale shall be graduated in values expressed in cubic metres or accompanied by a multiplying factor (× 0.001; × 0.01; × 0.1; × 1; × 10; × 100; × 1000, etc.).			
5.7.2.1	Rotational movement of the pointers or circular scales shall be clockwise.			
5.7.2.1	Linear movement of pointers or scales shall be left to right.			
5.7.2.1	Movement of numbered roller indicators shall be upwards.			

4.1.1 External examination for all water meters (continued)				
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Types of indicating device: Type 2 – Digital device				
5.7.2.2	The indicated volume is given by a line of digits appearing in one or more apertures.			
5.7.2.2	The advance of one digit shall be completed while the digit of the next immediately lower decade changes from 9 to 0.			
5.7.2.2	Movement of numbered roller indicators (drums) shall be upwards.			
5.7.2.2	The lowest value decade may have a continuous movement, the aperture being large enough to permit a digit to be read without ambiguity.			
5.7.2.2	The actual or apparent height of the digits shall be at least 4 mm.			
Types of indicating device: Type 3 – Combination of analogue and digital devices				
5.7.2.3	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				
5.7.3	In addition to the indicating devices described above, the water 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.			
5.7.3	Where national regulations permit the devices may be used for testing or verification of the water meter.			
5.7.3	Where national regulations permit the devices may be used for remote reading of the water meter.			
Verification devices – General requirements				
5.7.4.1	Every indicating device shall provide means for visual, non-ambiguous verification testing and calibration.			
5.7.4.1	The visual verification may have either a continuous or a discontinuous movement.			
5.7.4.1	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.			

4.1.1 External examination for all water meters (continued)				
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Verification devices – Visual verification displays				
5.7.4.2.1	The value of the verification scale interval, expressed in cubic metres, 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.			
5.7.4.2.1	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.			
5.7.4.2.1	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.			
5.7.4.2.2	On indicating devices with continuous movement of the first element, the apparent scale spacing shall be not less than 1 mm and not more than 5 mm.			
5.7.4.2.2	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.			
5.7.4.2.2	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				
5.7.4.2.3	The sub-divisions of the verification scale shall be small enough to ensure that the resolution of the indicating device does not exceed 0.25 % of the actual volume for Class 1 meters, and 0.5 % of the actual volume for Class 2 meters, for a 1 hour 30 minute test at the minimum flow rate, Q_1. *Note 1:* When the display of the first element is continuous an allowance should be made for a maximum error in each reading of not more than half of the verification scale interval. *Note 2:* 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.			

4.1.1 External examination for all water meters (continued)				
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Marks and inscriptions				
5.6	The water 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.			
5.6 (a)	Unit of measurement: Cubic metre.			
5.6 (b)	The accuracy class, where it differs from Class 2.			
5.6 (c)	The numerical value of Q_3, the ratio Q_3/Q_1, and the ratio Q_2/Q_1, where it differs from 1.6.			
5.6 (d)	The pattern approval sign according to national regulations.			
5.6 (e)	The name or trademark of the manufacturer.			
5.6 (f)	The year of manufacture and serial number (as near as possible to the indicating device).			
5.6 (g)	The direction of flow (shown on both sides of the body; or on one side only, provided the direction of flow arrow will be easily visible under all circumstances).			
5.6 (h)	The maximum admissible pressure if it exceeds 1 MPa (10 bar). (The unit bar may be used where national regulations permit).			
5.6 (i)	The letter V or H, if the meter can only be operated in the vertical or horizontal position.			
5.6 (j)	The maximum admissible temperature if it exceeds 30 °C.			
5.6 (k)	The maximum pressure loss if required.			
Additional markings for water meters with electronic devices				
5.6 (l)	For an external power supply: the voltage and frequency.			
5.6 (m)	For a replaceable battery: the latest date that the battery has to be replaced.			
5.6 (n)	For a non-replaceable battery: the latest date that the meter has to be replaced.			
Protection devices				
5.8.1	A place shall be provided on the meter for affixing the main verification mark, which shall be visible without dismantling the meter.			
5.8.2	Water meters shall include protection devices, which can be sealed to prevent, both before and after correct installation, dismantling or modification of the meter or its adjustment device without damaging these devices.			

4.1.2	***Examination of checking facilities for electronic water meters and mechanical water meters with electronic devices***			
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Protection devices – Electronic sealing devices				
5.8.3.1	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 authorized people, e.g. by means of a code (key-word) or of a special device (hard key, etc.). The code shall be capable of being changed. b) It shall be possible for at least the last intervention to be memorized. The record shall include the date and a characteristic element identifying the authorized person making the intervention (see a) above). 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 memorize more than one intervention and if deletion of a previous intervention must occur to permit a new record, the oldest record shall be deleted.			
5.8.3.2	For meters with parts which may be disconnected one from another by the user and which are interchangeable, the following provisions 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 R 49-1, 5.8.3.1 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.			
5.8.3.3	For meters with parts which may be disconnected one from the other by the user and which are not interchangeable, the provisions in R 49-1, 5.8.3.2 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, for example by means of a device that prevents any measurement after disconnecting and reconnecting.			

4.1.2 Examination of checking facilities for electronic water meters and mechanical water meters with electronic devices (continued)				
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Examination and testing of checking facilities				
General requirements for examining checking facilities				
4.1.2	Water meters with electronic devices shall be provided with the checking facilities specified in R 49-1, 4.3, except in the case of non-resettable measurements between two constant partners.			
4.1.2	Checking facilities are required only where the delivered volume of water is prepaid by the customer and cannot be confirmed by the supplier.			
4.1.2	All meters equipped with checking facilities shall prevent or detect reverse flow, as laid down in R 49-1, 3.2.5.			
Action of checking facilities				
4.3.1	The detection by the checking facilities of significant faults shall result in the following actions, according to the type: For checking facilities of type P or type I: a) Automatic correction of the fault, or b) Stopping only the faulty device when the water meter without that device continues to comply with the regulations, or c) A visible or audible alarm; this alarm shall continue until the cause of the alarm is suppressed. In addition, when the water meter transmits data to peripheral equipment, the transmission shall be accompanied by a message indicating the presence of a fault. (This requirement is not applicable to the application of disturbances specified in R 49-1, A.6).			
4.3.1	In addition, the instrument may be provided with devices to estimate the quantity of liquid having passed through the meter during the occurrence of the fault. The result of this estimate shall not be capable of being mistaken for a valid indication.			
4.3.1	Where checking facilities are used, a visible or audible alarm is not allowed in the following cases unless this alarm is transferred to a remote station: ▪ Two constant partners, ▪ Non-resettable measurements, ▪ Non-prepaid measurements. Note: The transmission of the alarm and repeated measured values, from the meter to the remote station, need not be secured if the measured values are repeated at that station.			

4.1.2 Examination of checking facilities for electronic water meters and mechanical water meters with electronic devices (continued)				
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Checking facilities for the measurement transducer				
4.3.2	The objective of these tests is to ensure that the checking facilities verify that: ▪ The flow sensor is present and is operating correctly, ▪ Data is transmitted correctly from the flow sensor to the calculator, ▪ Reverse flow is detected and/or prevented, where electronic means are used for this function.			
4.3.2.1	When the signals generated by the flow sensor are in the form of pulses, each pulse representing an elementary volume, tests shall be carried out to ensure that the checking facilities for pulse generation, transmission and counting fulfill the following tasks: a) Correct counting of pulses, b) Detection of reverse flow, where applicable, c) Checking of correct function. *Note:* These type P checking functions may be tested by means of either: ▪ Disconnecting the flow sensor from the calculator, or ▪ Interrupting the signal from the flow sensor to the calculator, or ▪ Interrupting the electrical supply to the flow sensor.			
Checking facilities for the measurement transducer of electromagnetic meters				
4.3.2.2	For electromagnetic meters, in which the amplitude of the signal generated by the flow sensor is proportional to the flowrate, the following procedure may be used to test the checking facilities. A simulated signal, with a shape similar to that of the measurement signal of the meter and representing a flowrate between Q_1 and Q_4, shall be fed into the input of the calculator and the following observations and tests shall be made: ▪ That the checking facility is of type P or type I, ▪ That, where the checking facility is of type I, its checking function shall occur at intervals of not more than five minutes, ▪ That the checking facility checks the flow sensor and the calculator functions, ▪ That the equivalent digital value of the signal is within the pre-determined limits stated by the manufacturer and is consistent with the maximum permissible errors.			
4.3.2.3	The cable length between flow sensor and calculator or ancillary device of an electromagnetic water meter shall be measured to ensure that it does not exceed either 100 metres or the value L expressed in metres according to the following formula, whichever is smaller: $L = (k \times c) / (f \times C)$ where: $k =$ 2×10^{-5} m $c =$ the conductivity of the liquid, in S/m $f =$ the field frequency during the measuring cycle, in Hz $C =$ the effective cable capacitance per metre, in F/m *Note:* If the manufacturer's solutions ensure equivalent results, these requirements can be ignored.			

4.1.2 Examination of checking facilities for electronic water meters and mechanical water meters with electronic devices (continued)				
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Checking facilities for measurement transducers using other measuring principles				
4.3.2.4	When water meters employing measurement transducers using technologies not covered in R 49-1, 4.3.2 are submitted for pattern approval, verify that the checking facilities have equivalent levels of security to those described in R 49-1, 4.3.2.			
Checking facilities for the calculator				
4.3.3	The objective of these tests is to verify that the checking facilities ensure that the calculator functions correctly and that calculations are valid. No special means are required for indicating that these checking facilities function correctly.			
4.3.3.1	The checking facilities for the calculator functions shall be of either type P or type I. For type I facilities, the calculator function checks shall occur at least once per day or at each volume equivalent to 10 minutes of flow at Q_3. The checking facilities for validating the functioning of the calculator shall verify: a) That the values of all permanently memorized instructions and data are correct. *Note:* These functions may operate by such means as: ▪ Summing all instruction and data codes and comparing the sum with a fixed value, ▪ Line and column parity bits (LRC and VRC), ▪ Cyclic redundancy check (CRC 16), ▪ Double independent storage of data, ▪ Storage of data in "safe coding", for example protected by checksum, line and column parity bits, b) That all internal transfers and storage of data relevant to the measurement result are performed correctly. *Note:* These functions may operate by such means as: ▪ Write-read routines, ▪ Conversion and re-conversion of codes, ▪ Use of "safe coding" (check sum, parity bit), ▪ Double storage.			
Checking facilities for validating the calculations of the calculator				
4.3.3.2	The checking facilities for validating the calculations shall be of either type P or type I.			
4.3.3.2	For type I facilities, the calculation checks shall be made at least once per day or at each volume equivalent to 10 minutes of flow at Q_3.			
4.3.3.2	The values of all data related to the measurement, either stored internally, or transmitted to peripheral equipment through an interface, are correct. *Note:* The checking facilities may use such means as parity bit, check sum, or double storage for checking the integrity of the data.			
4.3.3.2	The calculation system shall be provided with a means of controlling the continuity of the calculation program.			

4.1.2 Examination of checking facilities for electronic water meters and mechanical water meters with electronic devices (continued)				
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Checking facilities for the indicating device				
4.3.4	The checking facility shall verify that the primary indications are displayed and that they correspond to the data provided by the calculator. In addition, the checking facility shall verify the presence of the indicating device when the indicating device is removable. The checking facilities for the indicating device shall be either of the form defined in R 49-1, 4.3.4.1 or of the form defined in R 49-1, 4.3.4.2.			
4.3.4.1	The checking facility of the primary indicating device shall be of type P. If the indicating device is not the primary device, it may be of type I. *Note 1:* The means used for checking may include: ▪ For indicating devices using incandescent filaments or LEDs, measuring the current in the filaments, ▪ For indicating devices using fluorescent tubes, measuring the grid voltage, ▪ For indicating devices using multiplexed liquid crystals, output checking of the control voltage of segment lines and of common electrodes, so as to detect any disconnection or short circuit between control circuits. *Note 2:* The checks mentioned in R 49-1, 4.1.5 are not required.			
4.3.4.2	The checking facility for the indicating device shall include type P or type I checking of the electronic circuits used for the indicating device (except the driving circuits of the display itself). The checking facility shall meet the requirements of R 49-1, 4.3.3.2 (also see 4.3.3.2 above).			
4.3.4.3	It shall be possible during pattern approval to determine if the checking facility of the indicating device is working, either: ▪ By disconnecting all or part of the indicating device, or ▪ By an action that simulates a failure in the display, such as using a test button.			
Checking facilities for ancillary devices				
4.3.5	An ancillary device (repeating device, printing device, memory device, etc.) with primary indications shall include a checking facility of type P or I. The checking facility shall verify that the ancillary device is connected to the water meter and that it is functioning and transmitting data correctly.			
Checking facilities for associated measuring instruments				
4.3.6	In addition to the primary measurement of volume, water meters may have integrated facilities for measuring and displaying other parameters, e.g. flowrate, water pressure and water temperature. Where these additional measurement functions are present, a checking facility of either type P or type I is required. The checking facility shall be able to check that the signal from the associated measuring instrument is within a predetermined measuring range. Examples are: ▪ Four wire transmission for resistive temperature sensors, ▪ Control of driving current for 4−20 mA pressure sensors.			

4.2 Checklist for water meter performance tests

Note: § (R 49-1) Refers to clause numbers in OIML R 49-1 *Water meters intended for the metering of cold potable water. Part 1: Metrological and technical requirements* Edition 2003 (E) (with amendments to Annex A in the process of publication).

4.2.1 Performance tests for all water meters				
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Static pressure test				
6.2.5	The meter shall be capable of withstanding the following test pressures without leakage or damage: ▪ 1.6 times the maximum admissible pressure for 15 minutes, ▪ 2 times the maximum admissible pressure for 1 minute.			
Intrinsic errors (of indication)				
6.2.4.1	The errors (of indication) of the water meter (in the measurement of the actual volume), shall be determined for at least the following flowrates, measured twice, which shall be at the following flowrates: a) Between Q_1 and 1.1 Q_1 b) Between 0.5 (Q_1 + Q_2) and 0.55 (Q_1 + Q_2) (for $Q_2/Q_1 > 1.6$) c) Between Q_2 and 1.1 Q_2 d) Between 0.33 (Q_2 + Q_3) and 0.37 (Q_2 + Q_3) e) Between 0.67 (Q_2 + Q_3) and 0.74 (Q_2 + Q_3) f) Between 0.9 Q_3 and Q_3 g) Between 0.95 Q_4 and Q_4 The water meter should be tested without its temporary supplementary devices attached (if any). During a test all other influence factors shall be held at reference conditions. Other flowrates may be tested depending on the shape of the error curve The errors observed for each of the above indicated flowrates shall not exceed the maximum permissible errors. If the error observed on one or more meters is greater than the maximum permissible error 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 maximum permissible error and the arithmetic mean of the results for the three tests at that flowrate is less than or equal to the maximum permissible error.			
Meter orientation tests				
6.2.4.3	If meters are marked as operating only 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. These tests may be combined with the intrinsic error (of indication) tests.			
Sign of the errors (of indication)				
6.2.4.2	If all the errors have the same sign, at least one of the errors shall not exceed one half of the maximum permissible error.			

4.2.1 Performance tests for all water meters (continued))				
§ (R 49-1)	**Requirement**	**+**	**-**	***Remarks***
Water temperature test				
3.2.6	The requirements relating to the maximum permissible errors shall be met for all water temperature variations within the ROC of the meter.			
Water pressure test				
3.2.6	The requirements relating to the maximum permissible errors shall be met for all water pressure variations within the rated operating conditions of the meter.			
Reverse flow test				
3.2.5	A water meter designed to measure reverse flow shall either: a) Subtract the reverse flow volume from the indicated volume, or b) Record the reverse flow volume separately. The maximum permissible errors shall be met for forward and reverse flow.			
3.2.5	A water meter not designed to measure reverse flow shall either, a) Prevent it, or b) Be capable of withstanding an accidental reverse flow without any deterioration or change in its metrological properties for forward flow.			
Meter characteristics at zero flowrate				
3.2.7	The water meter totalization shall not change when the flowrate is zero.			
Supplementary devices				
5.7.3	A water 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 water 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 water meter, the indications of volume from the supplementary device shall not differ significantly from the readings of the indicating device.			

4.2.1 Performance tests for all water meters (continued)				
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Pressure loss test				
5.5	The pressure loss of the water meter, including its filter where the latter forms an integral part of the water meter, shall not be greater than 0.1 MPa (1 bar) between Q_1 and Q_4.			
Flow disturbance test				
5.3.4	If the accuracy of water meters is likely to be affected by disturbances in the upstream or downstream pipeline, the meter shall be provided with sufficient lengths of straight pipe, with or without a flow straightener (as specified by the manufacturer), so that the indications of the installed water meter do not exceed the maximum permissible errors according to the accuracy class of the meter. (See R 49-2 6.8 and Annex C). Forward flow tests Reverse flow tests (where applicable)			
Endurance tests				
6.2.7	The water meter shall undergo an endurance test according to the permanent flowrate Q_3 and the overload flowrate Q_4 of the meter, simulating service conditions.			
6.2.7	Meters with $Q_3 \leq 16$ m^3/h: a) 100 000 flow cycles between zero flow and Q_3 b) 100 hours at Q_4			
6.2.7	Meters with $Q_3 > 16$ m^3/h: a) 800 hours at Q_3 b) 200 hours at Q_4			
6.2.7.1	Accuracy class 1 meters: The variation in the error curve shall not exceed 2 % for flowrates in the lower flowrate zone ($Q_1 \leq Q < Q_2$) and 1 % for flowrates in the upper flowrate zone ($Q_2 \leq Q \leq Q_4$). For the purpose of these requirements, the arithmetic mean value of the errors (of indication) $\bar{E}$ for each flowrate shall apply. The error curves shall not exceed a maximum error limit of ± 4 % for flowrates in the lower flowrate zone ($Q_1 \leq Q < Q_2$) and 1.5 % for flowrates in the upper flowrate zone ($Q_2 \leq Q \leq Q_4$).			
6.2.7.2	Accuracy class 2 meters: The variation in the error curve shall not exceed 3 % for flowrates in the lower flowrate zone ($Q_1 \leq Q < Q_2$) and 1.5 % for flowrates in the upper flowrate zone ($Q_2 \leq Q \leq Q_4$). For the purpose of these requirements, the arithmetic mean value of the errors (of indication) $\bar{E}$ for, each flowrate shall apply. The error curves shall not exceed a maximum error limit of ± 6 % for flowrates in the lower flowrate zone ($Q_1 \leq Q < Q_2$) and 2.5 % for flowrates in the upper flowrate zone ($Q_2 \leq Q \leq Q_4$).			

4.2.2	***Performance tests for electronic water meters and electronic devices fitted to mechanical meters***			
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Dry heat				
A.6.1	The equipment under test shall be exposed to a temperature of 55 °C under free air conditions for a 2-hour 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) during the application of the influence factor shall not exceed the maximum permissible error of the upper flowrate zone.			
Cold				
A.6.2	The equipment under test shall be exposed to a temperature of either − 25 °C (environmental class C or I) or 5 °C (environmental class B) under free air conditions for a 2-hour 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) during the application of the influence factor shall not exceed the maximum permissible error of the upper flowrate zone.			
Damp heat, cyclic, condensing				
A.6.3	After stabilization and with its power supply turned off, the equipment under test shall be exposed to cyclic temperature variations between a lower temperature of 25 °C and an upper temperature of either 55 °C (environmental class C or I) or 40 °C (environmental 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 should 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) at reference conditions shall not exceed the maximum permissible error of the upper flowrate zone.			
Power voltage variation, for water meters powered by direct AC or by AC/DC converters				
A.6.4.1	The equipment under test 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 maximum permissible error of the upper flowrate zone			

4.2.2	*Performance tests for electronic water meters and electronic devices fitted to mechanical meters (continued)*			
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Power voltage variation, for water meters powered by DC batteries				
A.6.4.2	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 maximum permissible error of the upper flowrate zone.			
Vibration (random)				
A.6.5	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 equipment under test shall be exposed to random vibrations in three mutually perpendicular axes. Apply the random vibrations over the frequency range 10 Hz to 150 Hz for a period of at least 2 minutes 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 a recovery period: a) All functions shall operate as designed, b) The error (of indication) at reference conditions shall not exceed the maximum permissible error of the upper flowrate zone.			
Mechanical shock				
A.6.6	With the power supply switched off, place the EUT on a rigid level surface, in its normal position of use. Tilt the EUT towards one bottom edge until the opposite edge of the EUT is 50 mm above the rigid surface. However, the angle made by the bottom of the EUT and the test surface shall not exceed 30°. Allow the EUT to fall freely onto the test surface. Repeat this procedure for each bottom edge. If a flow sensor is included in the EUT it shall not be filled with water for the mechanical shock test. After the application of the mechanical shocks and a recovery period: a) All functions shall operate as designed, b) The error (of indication) at reference conditions shall not exceed the maximum permissible error of the upper flowrate zone.			

4.2.2	*Performance tests for electronic water meters and electronic devices fitted to mechanical meters (continued)*			
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Short time power reductions				
A.6.7	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 ten interruptions and ten reductions are applied, with a time interval of at least ten seconds between tests. The interruptions and reductions are repeated throughout the time necessary to measure the error (of indication) of the EUT; therefore more than ten interruptions and reductions may be necessary. The difference between the intrinsic error and the error (of indication) measured whilst the EUT is subjected to mains voltage interruptions and reductions, at the same reference conditions, shall not exceed one half of the maximum permissible error of the upper flowrate zone (or significant faults are detected and acted upon by means of a checking facility).			
Bursts				
A.6.8	The equipment under test is subjected to electrical bursts superimposed on the mains supply voltage. The EUT is subjected to bursts of double exponential waveform transient voltages with a peak amplitude of 1000 V (for electromagnetic environment E1) and 2000 V (for electromagnetic environment E2). Each voltage spike shall have a rise time of 5 ns and a one 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 one minute 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 whilst the EUT is subjected to mains voltage bursts, at the same reference conditions, shall not exceed one half of the maximum permissible error of the upper flowrate zone (or significant faults are detected and acted upon by means of a checking facility).			

4.2.2	***Performance tests for electronic water meters and electronic devices fitted to mechanical meters (continued)***			
§ (R 49-1)	**Requirement**	**+**	**-**	**Remarks**
Electrostatic discharge				
A.6.9	The error (of indication) of the equipment under test 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 location, at least ten discharges shall be applied with intervals of at least 10 seconds 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 ten discharges shall be applied on the horizontal coupling plane and a total of ten discharges for each of the various positions of the vertical coupling plane. The difference between the intrinsic error and the error (of indication) measured whilst the EUT is subjected to electrostatic discharges, at the same reference conditions, shall not exceed one half of the maximum permissible error of the upper flowrate 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 metrological authority shall be free to choose a flowrate of zero during the electrostatic discharge test. In this case the meter totalization shall not change by more than the value of the verification scale interval during the test.			
Electromagnetic susceptibility – electromagnetic fields (radiated)				
A.6.10	The equipment under test is subjected to 20 discrete frequency bands of electromagnetic radiation in the frequency range 26 MHz to 1000 MHz, at a field strength of either 3 V/m (for electromagnetic environment E1) or 10 V/m (for electromagnetic environment E2). The difference between the intrinsic error and the error (of indication) measured whilst the EUT is subjected to the electromagnetic radiation, at the same reference conditions, shall not exceed one half of the maximum permissible error of the upper flowrate 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 metrological authority shall be free to choose a flowrate of zero during the electromagnetic susceptibility test. In this case the meter totalization shall not change by more than the value of the verification scale interval during the test.			

5 Pattern evaluation tests (for all water meters)

5.1 Static pressure test (R 49-2, 6.2)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Meter serial no:	map × 1.6 bar	Start time	Initial pressure bar	End time	Final pressure bar	Remarks

Meter serial no:	map × 2 bar	Start time	Initial pressure bar	End time	Final pressure bar	Remarks

Comments:

5.2 Determination of the intrinsic errors (of indication) and the effects of meter orientation (R 49-2, 6.3)

			At start	At end	
Application No:	____________	Ambient temperature:			°C
Model:	____________	Ambient relative humidity:			%
Date:	____________	Ambient atmospheric pressure:			kPa
Observer:	____________	Time:			

Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (Electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

Meter serial No:__________ Orientation (V, H, other):______________

Actual flowrate $Q_{( )}$ m^3/h	Initial supply pressure bar	Water temp. T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %
(2)								
						$\bar{E}_{m2}$		
						$\bar{E}_{m3}$		

Meter serial No:__________ Orientation (V, H, other):______________

Actual flowrate $Q_{( )}$ m^3/h	Initial supply pressure bar	Water temp. T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %
(2)								
						$\bar{E}_{m2}$		
						$\bar{E}_{m3}$		

Meter serial No:__________ Orientation (V, H, other):______________

Actual flowrate $Q_{( )}$ m^3/h	Initial supply pressure bar	Water temp. T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %
(2)								
						$\bar{E}_{m2}$		
						$\bar{E}_{m3}$		

E_m = The value of the error (of indication) taken at the actual flowrate $Q_{( )}$

$\bar{E}_{m2}$ = Mean value of two measurements of the error (of indication) taken at the same nominal flowrate
$\bar{E}_{m3}$ = Mean value of three measurements of the error (of indication) taken at the same nominal flowrate

(1) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable sub-assembly the mpe shall be defined by the manufacturer (R 49-2, 8.4). For acceptance criteria refer to R 49-2, 6.3.4.

(2) Perform 3rd test if test 1 or 2 is greater than the mpe (R 49-2, 6.3.4).

Notes:
1) Tables for each flowrate according to 6.3.3 of R 49-2 shall be added.

2) Tables for each orientation, which shall be as described in 6.3.2.2.7.5 of R 49-2, shall be provided for meters not marked either ‘H’ or ‘V’.

Comments:

5.3 Water temperature test (R 49-2, 6.4)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (Electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

Meter serial No:_____ **Orientation (V, H, other):_____**

Application conditions	Nominal flowrate m^3/h	Actual flowrate Q m^3/h	Initial supply pressure bar	Initial inlet water temp. °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %
10 °C	Q_2									
mat	Q_2									
Comments:										

(1) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable sub-assembly the mpe shall be defined by the manufacturer (R 49-2, 8.4).

5.4 Water pressure test (R 49-2, 6.5)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (Electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

Meter serial No:_____ **Orientation (V, H, other):_____**

Application conditions	Nominal flowrate m^3/h	Actual flowrate Q m^3/h	Initial supply pressure bar	Initial inlet water temp. °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %
0.3 bar	Q_2									
map	Q_2									
Comments:										

(1) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable sub-assembly the mpe shall be defined by the manufacturer (R 49-2, 8.4).

5.5 Flow reversal test (R 49-2, 6.6)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (Electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

5.5.1 Meters designed to measure accidental reverse flow (R 49-2, 6.6.3.1)

Meter serial No:_____ **Orientation (V, H, other):_____**

Application conditions	Nominal flowrate m^3/h	Actual flowrate $\bar{Q}$ m^3/h	Initial supply pressure bar	Initial inlet water temp. °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %
Reverse flow	Q_1									
Reverse flow	Q_2									
Reverse flow	Q_3									
Comments:										

5.5.2 Meters not designed to measure accidental reverse flow (R 49-2, 6.6.3.2)

Meter serial No:_____ **Orientation (V, H, other):_____**

Application conditions	Nominal flowrate m^3/h	Actual flowrate $\bar{Q}$ m^3/h	Initial supply pressure bar	Initial inlet water temp. °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %
Reverse flow	$0.9Q_3$									
Forward flow	Q_1									
Forward flow	Q_2									
Forward flow	Q_3									
Comments:										

5.5.3 Meters which prevent reverse flow (R 49-2, 6.6.3.3)

Meter serial No:_____ **Orientation (V, H, other):_____**

Application conditions	Nominal flowrate m^3/h	Actual flowrate Q m^3/h	Initial supply pressure bar	Initial inlet water temp. °C	Initial reading Vi(i) m^3	Final reading Vi(f) m^3	Indicated volume Vi m^3	Actual volume m^3	Meter error E_m %	mpe (1) %
map at reverse flow	0									
Forward flow	Q_1									
Forward flow	Q_2									
Forward flow	Q_3									
Comments:										

(1) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable sub-assembly the mpe shall be defined by the manufacturer (R 49-2, 8.4).

5.6 Pressure-loss test (R 49-2, 6.7)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Meter serial No:_____

Measurement 1

Flowrate $Q_{( )}$ m^3/h	L mm	L_1 mm	L_2 mm	P_1 bar	P_2 bar	Measuring section mm	Pressure loss ΔP_1 bar

Measurement 2

Flowrate $Q_{( )}$ m^3/h	L mm	L_1 mm	L_2 mm	P_1 bar	P_2 bar	Measuring section mm	Pressure loss ΔP_2 bar	Meter pressure loss ΔP bar
Comments:								

5.7 Flow disturbance tests (R 49-2, 6.8 and Annex C)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Test method:	Gravimetric / Volumetric
Volume measures / weighbridge used:	
Water conductivity (electromagnetic induction meters only) (S/cm):	
Nominal diameter DN of pipe upstream of meter (or manifold) (mm):	
Nominal diameter DN of pipe downstream of meter (or manifold) (mm):	

Installation arrangement (see R 49-2, Annex C) [(1)]

Test number	Flow-disturber type (location)	Flow-straightener installed	Installation dimensions (see key Fig 1) (mm)						
			L_1	L_2	L_3	L_4	L_5	L_6	L_7
1	1 (upstream)	No							
1A	1 (upstream)	Yes							
2	1 (downstream)	No							
2A	1 (downstream)	Yes							
3	2 (upstream)	No							
3A	2 (upstream)	Yes							
4	2 (downstream)	No							
4A	2 (downstream)	Yes							
5	3 (upstream)	No							
5A	3 (upstream)	Yes							
6	3 (downstream)	No							
6A	3 (downstream)	Yes							

(1) For each test applied, insert the actual pipe dimensions used (as stated by the meter manufacturer).

Comments:

Direction of flow: forward / reverse

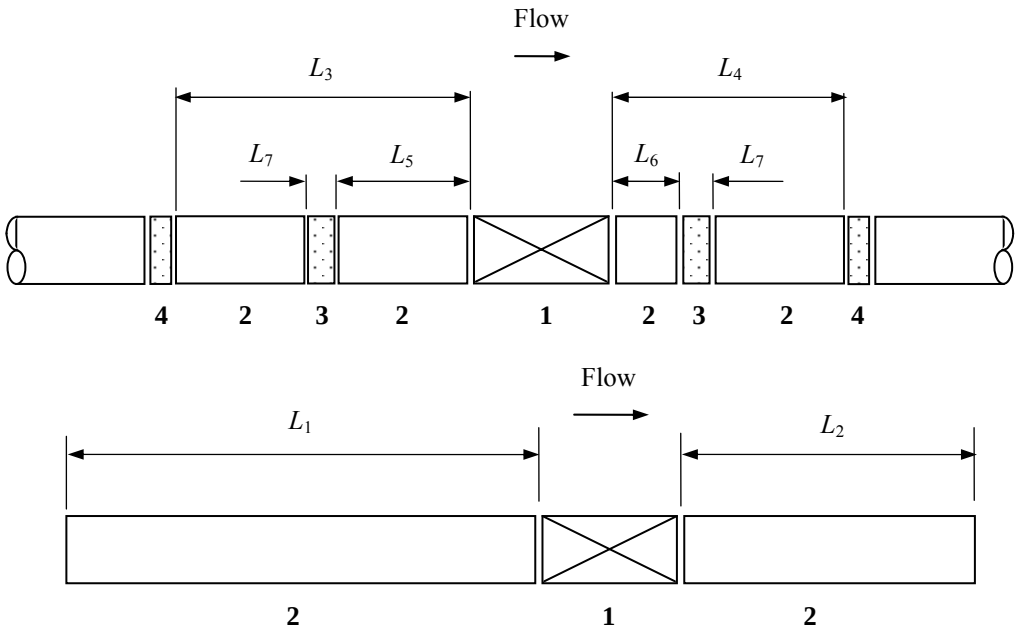
Meter serial No:_____ Orientation (V, H, other):_____

Test number (1) (2)	Actual flowrate $Q_{(\,)}$ m^3/h	Pressure bar	Water temp. T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (3) %
1									
1A									
2									
2A									
3									
3A									
4									
4A									
5									
5A									
6									
6A									
Comments:									

(1) For meters where the manufacturer has specified installation lengths of at least 15 × DN upstream and 5 × DN downstream of the meter, no external straighteners are allowed.

(2) When a minimum straight pipe length (L_2) of 5 × DN downstream of the meter is specified by the manufacturer, only tests numbers 1, 3 and 5 are required.

(3) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable sub-assembly the mpe shall be defined by the manufacturer (R 49-2, 8.4).



Symbol	Length
L_1	Straight inlet pipe, without flow-disturber or flow-straightener
L_2	Straight outlet pipe, without flow-disturber or flow-straightener
L_3	Outlet of upstream flow-disturber to inlet of meter (or manifold)
L_4	Outlet of meter (or manifold) to inlet of downstream flow-disturber
L_5	Outlet of upstream flow-straightener to inlet of meter (or manifold)
L_6	Outlet of meter (or manifold) to inlet of downstream flow-straightener
L_7	Flow-straightener

Fig 1: Key to relative positions of:

1. Water meter
2. Straight pipes
3. Flow-straightener and
4. Flow-disturber

5.8 Endurance tests (R 49-2, 6.9)

5.8.1 Discontinuous flow test (R 49-2, 6.9.1)

(Applicable only to Accuracy class 2 meters with values of $Q_3 \leq 16$ m^3/h)

Application No:	
Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (Electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter/manifold (mm):	/
Describe flow straightener installation if used:	

Daily readings taken during the test(1)

Meter serial No:_____

Date	Time	Observer	Up-stream pressure bar	Down-stream pressure bar	Up-stream temp. °C	Actual flowrate m^3/h	Meter reading m^3	Flow cycle times s				Total volume discharged m^3	Total no. of flow cycles
								rise	on	fall	off		
								Totals at end of test =				_____	_____
								Theoretical total (2) =				_____	

(1) Recorded every 24 hours, or once for every shorter period if so divided.

(2) Minimum theoretical volume passed by meters during the test is 0.5 x Q_3 x 100000 x 32 / 3600 expressed in m^3.
Minimum number of test cycles during the test = 100000.

Comments:

Date:

Observer: _____

	At start	At end	
Ambient temperature:			°C
Ambient relative humidity:			%
Ambient atmospheric pressure:			kPa
Time:			

Errors (of indication) measured after the discontinuous flow test

Meter serial No:_____

Actual flowrate $Q_{( )}$ m^3/h	Working pressure P_w bar	Working temp. T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_I m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %	Curve variation error $\bar{E}_m(B) - \bar{E}_m(A)$ %	mpe (of curve variation error) (2) %
(3)										
						$\bar{E}_{m2}$				
						$\bar{E}_{m3}$				
						$\bar{E}_m(B)$				
Comments:										

E_m = The value of the error (of indication) taken at the actual flowrate $Q_{( )}$.
$\bar{E}_{m2}$ = Mean value of two measurements of the error (of indication) taken at the same nominal flowrate.
$\bar{E}_{m3}$ = Mean value of three measurements of the error (of indication) taken at the same nominal flowrate.

$\bar{E}_m(A)$ = Mean intrinsic error (of indication). See test report 5.2.
$\bar{E}_m(B)$ = Mean error (of indication) measured after this discontinuous flow test.

(1) For mpe values refer to R 49-1, 3.2. For acceptance criteria refer to R 49-2, 6.3.4.
(2) For mpe values and acceptance criteria refer to R 49-2, 6.9.1.4.
(3) Perform the 3rd test if test 1 or 2 is greater than the mpe (R 49-2, 6.3.4).

5.8.2 Continuous flow test (R 49-2, 6.9.2)

Application No:	
Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (Electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter/manifold (mm):	/
Describe flow straightener installation if used:	

Readings taken during the test [(1)]

Meter serial No:_____

Date	Time	Observer	Up-stream pressure bar	Down-stream pressure bar	Up-stream temp. °C	Flowrate m^3/h	Meter reading m^3	Volume discharged m^3	Hours run (2) h
					Totals values at end of test =				
					Minimum volume discharged [(2)] =				
Comments:									

(1) Recorded every 24 hours, or once for every shorter period if so divided.

(2) For meters with $Q_3 \leq 16$ m^3/h, total hours run = 100 h at Q_4 (minimum volume discharged at end of test is $(Q_4) \times 100$, expressed in m^3, where Q_4 is the number equal to the value of Q_4, expressed in m^3/h).

For meters with $Q_3 > 16$ m^3/h, total hours run = 800 h at Q_3 (minimum volume discharged at end of test is $(Q_3) \times 800$, expressed in m^3, where Q_3 is the number equal to the value of Q_3, expressed in m^3/h) and 200 h at Q_4 (minimum volume discharged at end of test is $(Q_4) \times 200$, expressed in m^3 , where Q_4 is the number equal to the value of Q_4, expressed in m^3/h).

Date: _____

Observer: _____

	At start	At end	
Ambient temperature:			°C
Ambient relative humidity:			%
Ambient atmospheric pressure:			kPa
Time:			

Errors (of indication) measured after the continuous flow test

Meter serial No:_____

Actual flowrate $Q_{(\,)}$ m^3/h	Working pressure P_w bar	Working temp. T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_I m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %	Curve variation error $\bar{E}_m(B) - \bar{E}_m(A)$ %	mpe (of curve variation error) (2) %
(3)										
						$\bar{E}_{m2}$				
						$\bar{E}_{m3}$				
						$\bar{E}_m(B)$				
Comments:										

E_m = The value of the error (of indication) taken at the actual flowrate $Q_{(\,)}$.
$\bar{E}_{m2}$ = Mean value of two measurements of the error (of indication) taken at the same nominal flowrate.
$\bar{E}_{m3}$ = Mean value of three measurements of the error (of indication) taken at the same nominal flowrate.

$\bar{E}_m(A)$ = Mean intrinsic error (of indication). See test report 5.2.
$\bar{E}_m(B)$ = Mean error (of indication) measured after this continuous flow test (= either $\bar{E}_{m2}$ or $\bar{E}_{m3}$).

(1) For mpe values refer to R 49-1, 3.2. For acceptance criteria refer to R 49-2, 6.3.4.
(2) For mpe values and acceptance criteria refer to R 49-2, 6.9.2.4.
(3) Perform the 3rd test if test 1 or 2 is greater than the mpe (R 49-2, 6.3.4).

6 Pattern evaluation tests (for electronic water meters and mechanical water meters with electronic components)

6.1 Dry heat (non-condensing) (R 49-2, 7.2)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

Meter serial No:_____ **Orientation (V, H, other):_____**

Application conditions	Actual or simulated flowrate Q m^3/h	Working pressure (1) P_w bar	Working temp. (1) T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (2) %
20 °C									
55 °C									
20 °C									
Comments:									

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

(2) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable part of a water meter, the mpe shall be defined by the manufacturer.

6.2 Cold (R 49-2, 7.3)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

Environmental class:_____

Meter serial No:_____ **Orientation (V, H, other):_____**

Application conditions	Actual or simulated flowrate Q m^3/h	Working pressure (1) P_w bar	Working temp. (1) T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_I m^3	Actual volume V_a m^3	Meter error E_m %	mpe (2) %
20 °C									
+5 or −25 °C									
20 °C									
Comments:									

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

(2) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable part of a water meter, the mpe shall be defined by the manufacturer.

6.3 Damp heat, cyclic (condensing) (R 49-2, 7.4)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

Environmental class:_____

Meter serial No:_____ **Orientation (V, H, other):_____**

Application conditions	Actual or simulated flowrate Q m^3/h	Working pressure (1) P_w bar	Working temp. (1) T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (2) %
1) Pre-condition meter. 2) Apply damp heat cycles (duration 24 hours). 2 cycles between 25 °C and 40 °C (severity level 1) or 55 °C (severity level 2).									
After cycling									
Comments:									

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

(2) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable part of a water meter, the mpe shall be defined by the manufacturer.

6.4 Power voltage variation (R 49-2, 7.5)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

6.4.1 Meters powered by direct AC (single phase) or AC/DC converters, mains power supply (R 49-2, 7.5.1)

Meter serial No:_____ **Orientation (V, H, other):_____**

Application conditions (single voltage) (1)	U_i V	Actual or simulated flowrate Q m^3/h	Working pressure P_w bar	Working temp. T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (2) %
U_{nom} + 10 %										
U_{nom} – 15 %										
Comments:										

(1) Water meters with a voltage range are tested at U_u +10 % and U_l – 15 %.

(2) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable part of a water meter, the mpe shall be defined by the manufacturer.

6.4.2 Meters powered by primary batteries (R 49-2, 7.5.2)

Meter serial No:_____ **Orientation (V, H, other):_____**

Application conditions	U_i V	Actual or simulated flowrate Q m^3/h	Working pressure bar	Working temp. °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %
U_{bmax}										
U_{bmin}										
Comments:										

(1) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable part of a water meter, the mpe shall be defined by the manufacturer.

6.5 Vibration (random) (R 49-2, 7.6)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

Environmental class:_____

Meter serial No:_____ **Orientation (V, H, other):_____**

Application conditions	Actual or simulated flowrate $Q_{(\ )}$ m^3/h	Working pressure P_w bar	Working temp. T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %	EUT functioning correctly	
1) Apply vibrations	Apply random vibrations to the EUT, over the frequency range 10 Hz to 150 Hz, in three mutually perpendicular axes, for a period of at least 2 minutes 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)										
2) After vibrations										Yes	No
Comments:											

(1) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable part of a water meter, the mpe shall be defined by the manufacturer.

6.6 Mechanical shock (R 49-2, 7.7)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

Environmental class:_____

Meter serial No:_____ **Orientation (V, H, other):_____**

Application conditions	Flowrate $Q_{( )}$ m^3/h	Working pressure P_w bar	Working temp. T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %	EUT functioning correctly	
1) 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.										
2) After shock										Yes	No
Comments:											

(1) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable part of a water meter, the mpe shall be defined by the manufacturer.

6.7 Short-time power reductions (R 49-2, 7.8)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

Meters powered by direct AC (single-phase) mains power supply

Meter serial No:_____ **Orientation (V, H, other):_____**

Application conditions	Actual or simulated flowrate Q m^3/h	Working pressure P_w bar	Working temp. T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %	Fault $E_{m2)} - E_{m1)}$ %	Significant fault %	EUT functioning correctly	
Reference conditions 1) Before voltage reductions	No voltage reductions.												
2) During voltage reductions	100 % voltage reduction per ½ cycle, 10 times and 50 % voltage reduction, per 1 cycle, 10 times (cycle to be repeated during the error (of indication) measurement).												
												Yes	No
Comments:													

(1) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable part of a water meter, the mpe shall be defined by the manufacturer.

(2) The significant fault is equal to half the mpe in the upper flowrate zone.

6.8 Bursts (R 49-2, 7.9)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

Meters powered by direct AC (single-phase) mains power supply

Meter serial No:_____ **Orientation (V, H, other):_____**

Application Conditions	Actual or simulated flowrate Q m^3/h	Working pressure P_w bar	Working temp T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %	Fault $E_{m2)} - E_{m1)}$ %	Significant fault %	EUT functioning correctly	
Reference conditions 1) Before burst	With no significant noise in mains supply.												
2) After bursts	Randomly phased bursts, (electromagnetic environment, E1 – 1000 V peak amplitude electromagnetic environment, E2 – 2000 V peak amplitude) applied asynchronously in asymmetrical mode (common mode).												
												Yes	No
Comments:													

(1) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable part of a water meter, the mpe shall be defined by the manufacturer.

(2) The significant fault is equal to half the mpe in the upper flowrate zone.

6.9 Electrostatic discharge (R 49-2, 7.10)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

Meter serial No:_____ **Orientation (V, H, other):_____**

Test condition			Actual or simulated flowrate Q m^3/h	Working pressure P_w bar	Working temp. T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	Mpe (3) %	Fault $E_{m2)} - E_{m1)}$ %	Signif-icant fault (4) %	EUT functioning correctly	
1) Reference conditions (no-discharges)															
2) Discharge point (1)	Mode (2)													Yes	No
	C	A												Yes	No
	C	A												Yes	No
	C	A												Yes	No
	C	A												Yes	No
Comments:															

(1) Indicate by drawings if necessary.

(2) C - contact discharge (6 kV), A - air discharge (8 kV).

(3) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable part of a water meter, the mpe shall be defined by the manufacturer.

(4) The significant fault is equal to half the mpe in the upper flowrate zone.

6.10 Electromagnetic susceptibility (R 49-2, 7.11)

			At start	At end	
Application No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

Meter serial No:_____ **Orientation (V, H, other):_____**

Test condition	Antenna polarization Vertical / Horizontal		Actual or simulated flowrate Q m^3/h	Working pressure P_w bar	Working temp. T_w °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Meter error E_m %	mpe (1) %	Fault $E_{m2)} - E_{m1)}$ %	Signif-icant fault %	EUT functioning correctly	
1) Reference conditions (no noise)	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												Yes	No
Comments:															

(1) For a complete water meter this is the maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2 according to the accuracy class of the meter. If the EUT is a separable part of water meter, the mpe shall be defined by the manufacturer.
(2) The significant fault is equal to half the mpe in the upper flowrate zone.

II. Initial verification report

The specific format layout for reporting initial verifications and subsequent verifications of water meters is left largely to the metrological authorities and the individual organizations carrying out verification tests. However, the report (records) must contain the minimum information detailed in R 49-1 (6.3 and 7) and R 49-2 (9 and 10.2.2).

In addition to this any special requirements and/or restrictions for initial verification detailed in the pattern approval certificate for the EUT must be applied. A record of equipment and instrumentation used with calibration details (see Annex A) shall be kept.

The following basic information should also be included in the verification report (record) followed by the results of the tests (three examples of how the report may be formatted are given below):

1 Information concerning the EUT verified

Pattern approval number of the EUT: _____

Details of the EUT:

Model number: _____

Accuracy class: _____

Meter designation(s) Q_3: _____

Ratio Q_3/Q_1: _____

Ratio Q_2/Q_1: _____

Maximum pressure loss ΔP_{max}: _____

Flowrate at ΔP_{max}: _____

Year of manufacture: _____

The manufacturer: _____

Authorized representative: _____

Address: _____

_____

_____

_____

Testing laboratory: _____

Authorized representative: _____

Address: _____

_____

_____

2 Initial verification test report (R 49-2, clause 9)

Example 1

Approved water meter (complete or combined) (R 49-2, 9.1)

			At start	At end	
Approval No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Error (of indication) tests

EUT testing case (R 49-2, 7.1.7):	
Category for testing (R 49-2, <clause number>):	(1)
Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

(1) Enter clause number according to the configuration of the EUT.

Meter serial No:_____ **Orientation (V, H, other):_____**

Nominal flowrate (1)	Actual flowrate Q m^3/h	Working pressure bar	Working temp. °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Indicated volume V_i m^3	Actual volume V_a m^3	Error E_m (3) %	mpe (2) %
Q_1									
Q_2									
Q_3									
Comments:									

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

(2) The maximum permissible error as defined in R 49-1, 3.2.1 or 3.2.2, according to the accuracy class of the meter.

(3) Calculations for error (of indication) are described in R 49-2, Annex B.

Example 2

Approved calculator (including indicating device) (R 49-2, 9.2)

			At start	At end	
Approval No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Error (of indication) tests

EUT testing case (R 49-2, 7.1.7):	
Category for testing (R 49-2, <clause number>) (1):	

(1) Enter clause number according to one of the configuration categories for testing the EUT listed in R 49-2, 7.1.7.1 to 7.1.7.4

Meter serial no: _____ Orientation (V, H, other) _____

Nominal flowrate (1)	Applied pulse frequency (2) Hz	Simulated flowrate Q m^3/h	Initial reading $V_I(i)$ m^3	Final reading $V_I(f)$ m^3	Total pulses injected (2) T_p	Indicated volume (3) V_I m^3	Actual volume V_a m^3	Error (3) E_c %	mpe (4) %
Q_1									
Q_2									
Q_3									
Comments:									

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

(2) Other types of input signal may be appropriate according to the design of the water meter.

(3) Calculations for error (of indication) are described in R 49-2, Annex B.

(4) The maximum error (of indication) allowed for the calculator (including indicating device) is given in the pattern approval certificate.

Example 3

Approved measurement transducer (including flow or volume sensor) (R 49-2, 9.2)

			At start	At end	
Approval No:		Ambient temperature:			°C
Model:		Ambient relative humidity:			%
Date:		Ambient atmospheric pressure:			kPa
Observer:		Time:			

Error (of indication) tests

Meter serial no: _____ Orientation (V, H, other) _____

EUT testing case (R 49-2, 7.1.7):	
Category for testing (R 49-2, <clause number>) (1):	
Test method:	Gravimetric / Volumetric
Volume measures/weighbridge used:	
Water conductivity (electromagnetic induction meters only) (S/cm):	
Length of straight pipe before meter (or manifold) (mm):	
Length of straight pipe after meter (or manifold) (mm):	
Nominal diameter DN of pipe before and after meter (or manifold) (mm):	/
Describe flow straightener installation if used:	

(1) Enter clause number according to the configuration of the EUT.

Nominal flowrate (1)	Actual flowrate Q m^3/h	Working pressure bar	Working temp. °C	Initial reading $V_i(i)$ m^3	Final reading $V_i(f)$ m^3	Total output pulses T_p (2)	Indicated volume (3) V_I m^3	Actual volume V_a m^3	Error (3) E_t %	mpe (4) %
Q_1										
Q_2										
Q_3										
Comments:										

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

(2) Other types of output signal may be appropriate according to the design of the water meter.

(3) Calculations for the error (of indication) are described in R 49-2, Annex B.

(4) The maximum error (of indication) allowed for the measurement transducer (including flow or volume sensor) is given in the pattern approval certificate

Annex A
(Mandatory)

List of documents concerning the pattern
(R 49-1, 6.2.8.1)

Document reference	Date	Brief description

Annex B
(Mandatory)

List of test equipment used in examinations and tests

Parameter measured or applied	Instrument/ equipment	Model number	Serial number	Calibration date		Used in test no. (R 49-2, subclause no.)
				Last	Next	
Comments:						