Asia-Pacific
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Legal Metrology
Forum

OIML R 49-1

Water meters intended for the metering of cold potable water and hot water meters

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APEC/APLMF Training Courses
in Legal Metrology

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OIML

Organisation Internationale
de Métrologie Légale

International Organization
of Legal Metrology

Measurement Canada
An Agency of Industry Canada

Mesures Canada
Un organisme d'Industrie Canada

Canada

Water Meter Standards

"**Water meter as a measurement device may be subject to international or national standards.**"

International Standards

- Major International Standards:
  - International Organization of Legal Metrology (OIML)
    - OIML R49-1
    - OIML R49-2
    - OIML R49-3
  - International Standards Organization (ISO)
    - ISO 4064 Part 1
    - ISO 4064 Part 2
    - ISO 4064 Part 3
  - EC 51/2003 Legislation (MID)
    - Annex MI-001

International Standards

- Major International Standards (cont.):
  - Comite Europeén de Normalisation (CEN)
    - EN 14154-1
    - EN 14154-2
    - EN 14154-3
  - American Water Work Association (AWWA)
    - AWWA C 700 (PD Meters)
    - AWWA C 701 (Turbine Meters)
    - AWWA C 702 (Compound Meters)
    - AWWA C 703 (Fire Service Meters)
    - AWWA C 708 (Multi-Jet Meters)
    - AWWA C 712 (Fluidic Oscillator Meters)
    - AWWA C 713 (Single-Jet Meters)
    - AWWA M6 (Meters- Selection, Installation, Testing and Maintenance)

National Standards

- Examples of National Standards:
  - NMI 49-1 (Australia)
  - NIST Handbook 44, Section 3.36 (USA)
  - BS 5728 (United Kingdom)
  - Draft Weights and Measures Regulation, Division XIV (Canada)
  - National Measurement Law (Japan)

OIML R 49-1
Scope

- Applies to all water meters used to meter the actual volume of cold potable water and hot water flowing through a fully charged, closed conduit
- Water meters shall indicate the integrated volume
- Pattern approval and initial verification
- Includes ancillary devices

OIML R 49-1
History

- The original version of OIML R 49 was published in 1977
- The second version was published in 2000. Many changes in this document
- The 2003 edition was an amended edition of the 2000 document
- with the following changes:
  - criteria of acceptance for the endurance test
  - Annex A and the bibliography were amended (update of the standards)
  - the terminology used has been harmonized with the VIML (2000)
- The 2006 edition is a revision of the 2003 version with the inclusion of R 72 (hot water meters) and combination meters
- The United Kingdom had been the secretariat of OIML TC8/SC5 since it’s inception.

OIML R 49-1
Current Developments

- Harmonization of OIML R 49-1, OIML R 49-2 & OIML R 49-3 Document with ISO 4064 and EN 14154 Documents
- Working Group met in London – June, 2008
- Proposed changes would need to be ratified by CIML (Target Date October 2009)

OIML R 49-1
Selected Terminology

2.1.1 Water meter

An instrument intended to measure continuously, memorize and display the volume of water passing through the meter at metering conditions.

Water meter will include a measurement transducer (flow sensor), calculator and indicating device.

OIML R 49-1
Selected Terminology

2.1.12 Meter for two constant partners

Meter permanently installed and only used for deliveries from one supplier to one customer.

2.2.1 Actual volume (*Va*)

Total volume of water passing through the water meter.

2.2.2 Indicated volume (*Vi*)

Volume of water indicated by the meter.

OIML R 49-1
Selected Terminology

2.2.3 Primary indication

Indication (displayed, printed or memorized) which is subject to legal metrological control.

2.2.4 Error (of indication)

Indicated volume minus the actual volume.

2.2.5 Relative error (of indication)

Error (of indication) divided by the actual volume.

OIML R 49-1
Selected Terminology

2.2.6 Maximum permissible error (mpe)

Extreme values of the relative error (of indication) of a water meter permitted by this Recommendation.

2.2.7 Intrinsic error

Error (of indication) of a water meter determined under reference conditions.

2.2.8 Initial intrinsic error

Intrinsic error of a water meter as determined prior to all performance tests.

OIML R 49-1
Selected Terminology

2.2.11 Durability

Capability of the water meter to maintain its performance characteristics over a period of use.

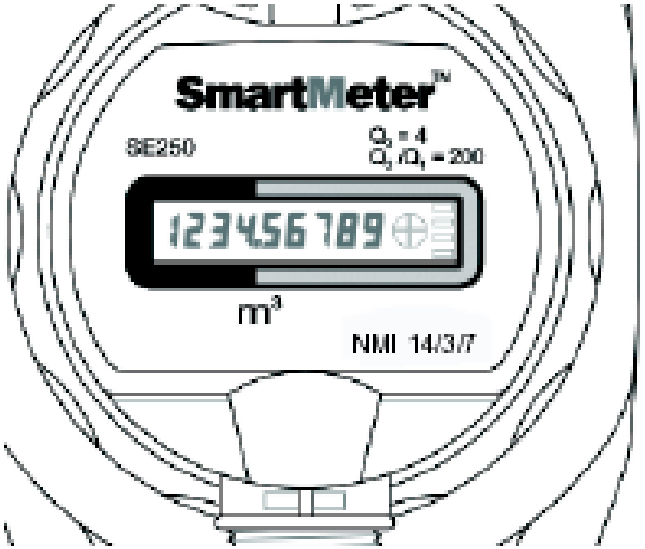
2.2.14 Verification scale interval

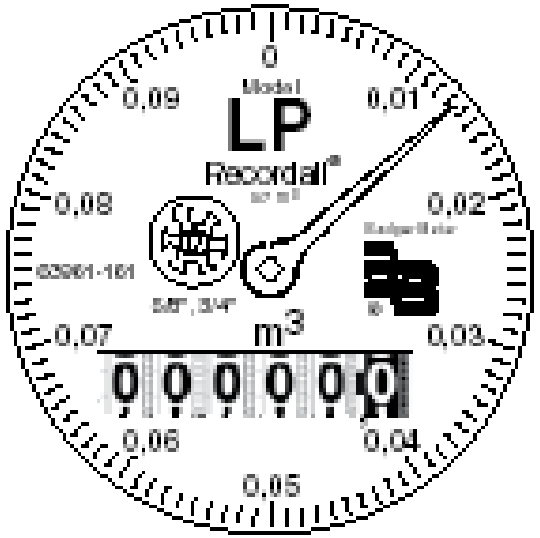
Lowest value scale division of the first element of an indicating device.

OIML R 49-1
Selected Terminology

2.2.15 Resolution (of an indicating device)

Smallest difference between indications of an indicating device that can be meaningfully distinguished For a digital device, this is the change in the indication when the least significant digit changes by one step.





OIML R 49-1
Selected Terminology

2.3.1 Flowrate (*Q*)

Quotient of the actual volume of water passing through the water meter and the time taken for this volume to pass through the water meter.

2.3.2 Permanent flowrate (*Q*3)

Highest flowrate within the rated operating conditions, at which the water meter is required to operate in a satisfactory manner within the maximum permissible error.

2.3.3 Overload flowrate (*Q*4)

Highest flowrate at which a water meter is required to operate, for a short period of time, within its maximum permissible error, whilst maintaining its metrological performance when it is subsequently operated within its rated operating conditions.

OIML R 49-1
Selected Terminology

2.3.4 Transitional flowrate (*Q*2)

Flowrate between *Q*3 and *Q*1, that divides the flowrate range into two zones, the upper flowrate zone and the lower flowrate zone, each characterized by its own maximum permissible error.

2.3.5 Minimum flowrate (*Q*1)

Lowest flowrate at which the water meter is required to operate within the maximum permissible error.

2.3.6 Combination meter changeover flowrate (*Q*x)

- Change-over flowrate *Q*x1 is when flow stops in the larger meter with decreasing flowrate.
- Change-over flowrate *Q*x2 is when flow starts in the larger meter with increasing flowrate.

OIML R 49-1
Selected Terminology

2.3.7 Minimum and maximum admissible temperature (mAT and MAT)

Minimum and maximum water temperatures that a water meter can withstand permanently, within its rated operating conditions, without deterioration of its metrological performance. mAT and MAT are respectively the lower and upper of the rated operating conditions (ROC).

2.3.8 Maximum admissible pressure (MAP)

Maximum internal pressure that a water meter can withstand permanently, within its rated operating conditions, without deterioration of its metrological performance.

OIML R 49-1
Selected Terminology

2.3.9 Working temperature (*T*w)

Average water temperature in the pipe measured upstream and downstream of the water meter.

2.3.10 Working pressure (*P*w)

Average water pressure in the pipe measured upstream and downstream of the water meter.

2.3.11 Pressure loss (Δ *p)*

Pressure loss, at a given flowrate, caused by the presence of the water meter in the pipeline.

OIML R 49-1
Selected Terminology

2.4.4 Rated operating conditions (ROC)

Conditions of use for which the errors (of indication) of the water meter are required to be within the maximum permissible errors.

2.4.7 Performance test

Test intended to verify whether the water meter is capable of accomplishing its intended functions.

2.4.8 Endurance test

Test intended to verify whether the water meter is able to maintain its performance characteristics over a period of use.

OIML R 49-1
Q Values

3.1.1 The flowrate characteristics of a water meter shall be defined by the values of Q1, Q2, Q3, and Q4.

3.1.2 A water meter shall be designated by the numerical value of Q3 in m3/h and the ratio Q3 / Q1.

3.1.3 The value of Q3 shall be chosen from the following list: (Q3 expressed in m3/h)

1	1.6	2.5	4	6.3
10	16	25	40	63
100	160	250	400	630
1 000	1 600	2 500	4 000	6 300

Note: The list may be extended to higher or lower values in the series.

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OIML R 49-1
Q Ratios

3.1.4 The value of the ratio Q3 / Q1 shall be chosen from the following list:

10	12.5	16	20	25
31.5	40	50	63	80
100	125	160	200	250
315	400	500	630	800

Note: The list may be extended to higher values in the series.

3.1.5 The ratio Q2 / Q1 shall be 1.6.

- until 30 April, 2009, Q2 / Q1 may also be 2.5, or 4, or 6.3, provided that Q3 / Q2 > 5.

3.1.6 The ratio Q4 / Q3 shall be 1.25.

Classification Comparison

Old classification system - 15 mm meter				
	Class A	**Class B**	**Class C**	**Class D**
Q_{max} (q_s)	3.0 m^3/h	3.0 m^3/h	3.0 m^3/h	3.0 m^3/h
Q_n (q_p)	1.5 m^3/h	1.5 m^3/h	1.5 m^3/h	1.5 m^3/h
Q_t	150 l/h	120 l/h	22.5 l/h	17.25 l/h
Q_{min}	60 l/h	30 l/h	15 l/h	11.25 l/h

New classification system – q_3 = 1.6 m^3/h				
	q_3/q_1 = 20	**q_3/q_1 = 80**	**q_3/q_1 = 100**	**q_3/q_1 = 200**
Q_4	2.0 m^3/h	2.0 m^3/h	2.0 m^3/h	2.0 m^3/h
Q_3	1.6 m^3/h	1.6 m^3/h	1.6 m^3/h	1.6 m^3/h
Q_2	128 l/h	32 l/h	25.6 l/h	12.8 l/h
Q_1	80 l/h	20 l/h	16 l/h	8 l/h

OIML R 49-1
Accuracy Classes & MPE

3.2 Water meters shall be designed and manufactured such that their errors (of indication) do not exceed the mpe.

- These requirements shall be met durably.
- Water meters shall be designated as either accuracy class 1 or accuracy class 2.

OIML R 49-1
Accuracy Class 1 Meters

3.2.1 The maximum permissible error for the upper flowrate zone ($Q2 \leq Q \leq Q4$) is $\pm$ 1 %, for temperatures from 0.1 ° C to 30 ° C, and $\pm$ 2 % for temperatures greater than 30 ° C.

- The maximum permissible error for the lower flowrate zone ($Q1 \leq Q < Q2$) is $\pm$ 3 %.
- Accuracy class 1 designation shall be applied only to water meters with $Q3 \geq 100$ m3/h.
- **Note:** Class 1 meters not common for customer billing

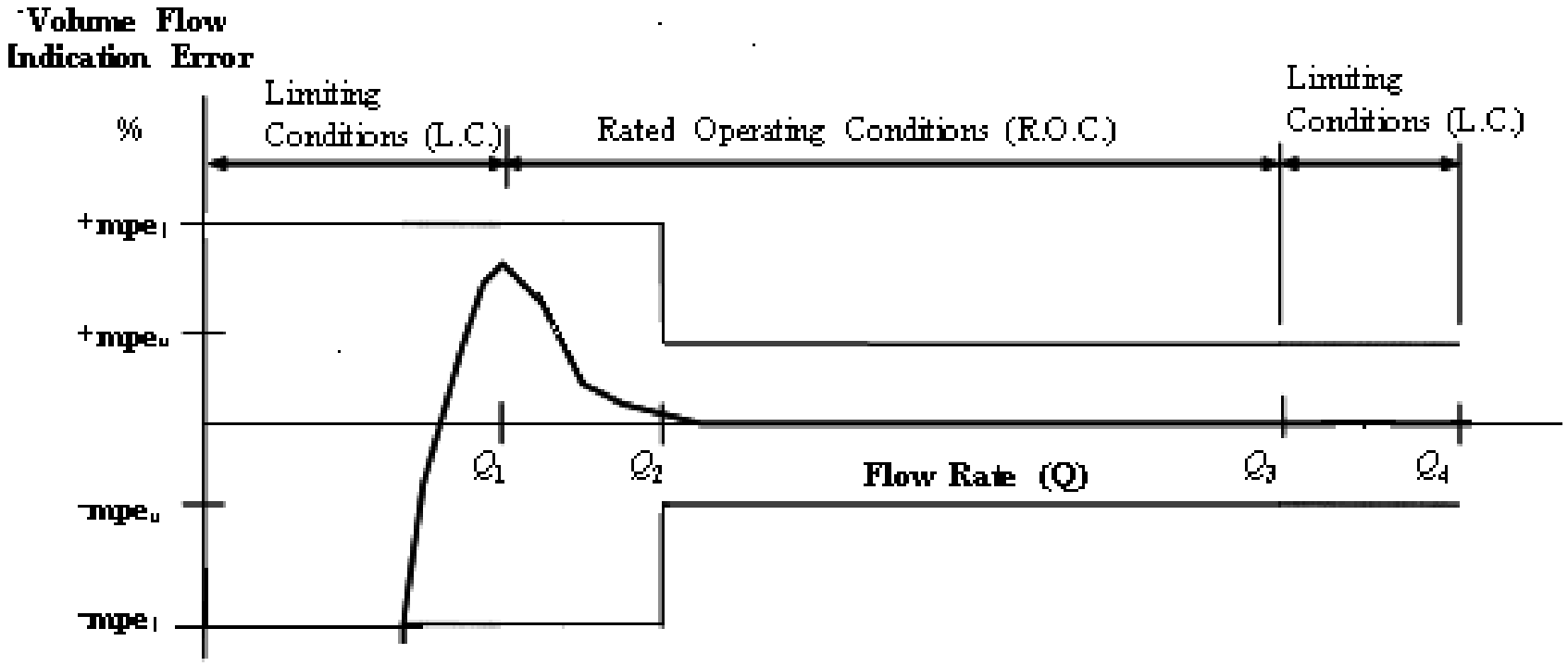
OIML R 49-1
Accuracy Class 2 Meters

3.2.2 The maximum permissible error for the upper flowrate zone ($Q2 \leq Q \leq Q4$) is $\pm$ 2 %, for temperatures from 0.1° C to 30 ° C, and $\pm$ 3 % for temperatures greater than 30 ° C.

- The maximum permissible error for the lower flowrate zone ($Q1 \leq Q < Q2$) is $\pm$ 5 %.

- Accuracy class 2 designation shall be applied to all water meters with $Q3 < 100$ m3/h and may be applied to water meters with values of $Q3 \geq 100$ m3/h.

OIML R 49-1
Meter Accuracy Curve



OIML R 49-1
Temperature Classes (3.2.3)

Class	mAT(◦c)	mAT(◦c)	Reference Conditions (◦c)
T 30	0.1	30	20
T 50	0.1	50	20
T 70	0.1	70	20 and 50
T 90	0.1	90	20 and 50
T 130	0.1	130	20 and 50
T 180	0.1	180	20 and 50
T 30/70	30	70	50
T 30/90	30	90	50
T 30/130	30	130	50
T 30/180	30	180	50

Note: Water temperature measured at the inlet of the meter

OIML R 49-1
Reverse Flow

3.2.6 The manufacturer shall specify whether or not the water 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 applicable **mpe** shall be met both for forward and reverse flow.

- If a meter is not designed to measure reverse flow, the meter shall either prevent reverse flow, or it shall withstand accidental reverse flow without deterioration or change in its metrological properties for forward flow.

OIML R 49-1
Metrological Requirements

3.2.7 The requirements relating to the maximum permissible errors shall be met for all temperature and pressure variations occurring within the rated operating conditions of the water meter.

3.2.8 The water meter totalization shall not change when the flowrate is zero.

OIML R 49-1
In-Service mpe

3.2.9 The maximum permissible errors of a water meter while in service shall be twice the maximum permissible errors given in 3.2.1 or 3.2.2. (Section may be revoked in future revisions to OIML R 49-1).

Country	Re-verification	In-service	Sampling
Germany	mpe_u ± 2 % mpe_l ± 5 %	mpe_u ± 4 % mpe_l ± 10 %	mpe_u ± 3 % mpe_l ± 8 %
Australia	mpe_u ± 4.0 % mpe_l n/a	mpe_u ± 4 % mpe_l ± 10 %	n/a
United Kingdom	mpe_u ± 2.5 % mpe_l ± 6.0 %	n/a	n/a
Canada*	mpe_u ± 2 % mpe_l ± 5 %	mpe_u ± 4 % mpe_l ± 10 %	tbd

Note: Canada is developing in-service and sampling mpe

OIML R 49-1
Metrological Requirements

3.3.2 Adjustment device

- A device incorporated in the meter.
- Only allows the error curve to be shifted generally parallel to itself.
- Object is bring errors (of indication) within the maximum permissible errors.
- Can be electronic or mechanical.

OIML R 49-1
Metrological Requirements

3.3.3 Correction device

- Connected to or incorporated in the meter.
- Automatically corrects the volume at metering conditions, by taking into account the flowrate and/or the characteristics of the water to be measured (e.g. temperature and pressure).
- In normal operation, non-corrected volume is not displayed.
- The correction device shall not allow the correction of a pre-estimated drift, for example in relation to time or volume.
- Correction devices shall not be used for adjusting the errors (of indication) of a water meter to values other than as close as practical to zero, even when these values are within the maximum permissible errors.

OIML R 49-1
Metrological Requirements

3.3.5 Electronic indicating device

- The continuous display of volume during the period of measurement is not mandatory.

3.3.6 Ancillary devices (OIML R 117 (6))

- Zero-setting device
- Price indicating device
- Printing or memory device
- Pre-setting or self-service device

OIML R 49-1
Water Meters Equipped with Electronic Devices

4.1 General Requirements

- 4.1.1 Water meters with electronic devices shall be designed and manufactured such that significant faults do not occur when they are exposed to disturbances specified in A.6.

- Dry heat
- Cold
- Damp heat, cyclic
- Power voltage variation
- DC batteries
- Vibration
- Mechanical Shock
- Short time power reduction
- Bursts
- Electrostatic discharge
- EMC susceptibility

OIML R 49-1
Water Meters Equipped with Electronic Devices

4.1.2 Checking facilities

- Only required when the delivered volume of water is prepaid by the customer and cannot be confirmed by the supplier
- Not required for meters that are used for non-resettable measurements between two constant partners

OIML R 49-1
Water Meters Equipped with Electronic Devices

4.1.5 Display and Blanking

- The meter shall provide visual checking of the entire display
  - Each step shall be in the following sequence:
    - Display all the elements (ex. “eights test”)
    - Blank all the elements (ex. “blank test”)
  - Each step of the sequence shall last at least one second.

OIML R 49-1
Water Meters Equipped with Electronic Devices

4.2 Power Supply Display and Blanking

- Three types of power supplies may be used alone or in combination
  - External power supply
  - Non-replaceable battery
  - Replaceable battery

OIML R 49-1
Technical Requirements

5.1 Materials and Construction

- Adequate strength and durability
- Not adversely affected by water temperature variations
- Shall be non-toxic, non-contaminating and biologically inert
- Resistant to internal and external corrosion (parts can be coated, ex. Epoxy)
- Indicating device shall be protected by a transparent window

OIML R 49-1
Technical Requirements

5.1 Materials and Construction (cont.)

- Shall incorporate devices for elimination of condensation (register)

  Example
  - Hermetically seal the capsule with a dry atmosphere such as nitrogen
  - Coat the window with a hydrophilic coating so that condensation spreads over the surface rather that forming small droplets which make the indicating device unreadable
  - Install a wiping device
  - Fill the indicating device with a clear/clean liquid
  - Use wet dial techniques

OIML R 49-1
Technical Requirements

5.4 Rated Operating Conditions

Flow Rate Range	Q1 to Q3 inclusive
Ambient Temperature Range	+ 5 °C to + 55 °C
Water Temperature Range	Table 1 – Clause 3.2.3
Ambient Relative Humidity	0 % to 100 % (exceptions)
Working Pressure Range (meters w/dia. < 500 mm)	0.03 MPa to at least 1 MPa
Working Pressure Range (meters w/dia. ≥ 500 mm)	0.03 MPa to at least 0.6 MPa

OIML R 49-1
Technical Requirements

5.5 Pressure Loss

- Pressure Loss through the water meter shall not be greater than 0.063 MPa between Q1 and Q3
- Value includes pressure loss if water meter has an integral strainer
- Pressure loss may exceed 0.063 MPa at flow rates > Q3
- Note: Maximum Pressure loss on combination meters may be found at Qx1 or Qx2

OIML R 49-1
Technical Requirements

5.6 Marks and Inscriptions

- The water meter shall contain information that is:
- Clearly and indelibly marked
- Either grouped or distributed
- Can be located:
  - on the casing
  - on the indicating device dial
  - on an identification plate
  - on the meter cover if it is not detachable

OIML R 49-1
Technical Requirements

5.6 Marks and Inscriptions

- The water meter shall be marked with the following information:

(a) Unit of measurement: cubic metre (see 5.7.1.2);

(b) Accuracy class, where it differs from accuracy class 2;

(c) Numerical value of $Q3$, the ratio $Q1/Q3$, and the ratio $Q2/Q1$ where it differs from 1.6;

(d) Type approval sign according to national regulations;

(e) Name or trademark of the manufacturer;

(f) Year of manufacture and serial number (as near as possible to the indicating device);

OIML R 49-1
Technical Requirements

5.6 Marks and Inscriptions (cont.)

- The water meter shall be marked with the following information:

(g) 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);

(h) Maximum admissible pressure (MAP) if it exceeds 1 MPa

(i) Letter V or H, if the meter can only be operated in the vertical or horizontal position;

(j) The temperature class in table 1 when it differs from T30; and

(k) The manufacturer may indicate the maximum pressure loss.

OIML R 49-1
Technical Requirements

5.7 Indicating Devices

- Shall provide an indication of the indicated volume
  - Easily read
  - Reliable
  - Unambiguous
- Shall include visual means of testing and calibration
- May include additional elements for testing or calibration
- Indicated volume shall be expressed in cubic metres

OIML R 49-1
Technical Requirements

5.7 Indicating Devices

- Shall be able to record the indicated volume in cubic metres corresponding to at least 1 600 hours (rounded value) of operation at Q3 without passing through zero.

*Q*3m3/h	Indicating range (minimum values) m3
$Q3 \leq 6.3$	9,999
$6.3 < Q3 \leq 63$	99,999
$63 < Q3 \leq 630$	999,999
$630 < Q3 \leq 6{,}300$	9,999,999

OIML R 49-1
Technical Requirements

5.7 Indicating Devices

- Black used to indicate the cubic metre and its multiples
- Red used to indicate sub-multiples of a cubic metre
- Applied to either pointers, indexes, numbers, wheels, discs, dials or to the aperture frames
- Other means may be used for electronic water meters, provided there is no ambiguity in distinguishing between the primary indication and alternative displays, e.g. sub-multiples for verification and testing

OIML R 49-1
Technical Requirements

5.7 Indicating Devices

- Rotational movement of the pointers or circular scales shall be clockwise
- Linear movement of pointers or scales shall be left to right
- Movement of numbered roller indicators (drums) shall be upwards
- The apparent height of the digits shall be at least 4 mm

OIML R 49-1
Technical Requirements

5.7 Indicating Devices

- A water meter may include supplementary devices
  - Which may be permanently incorporated or added temporarily
  - Used to detect movement of the flow sensor before this is clearly visible on the indicating device
  - Where national regulations permit, the device may be used for testing and verification and for remote reading of the water meter, provided that other means guarantee the satisfactory operation of the water meter

OIML R 49-1
Technical Requirements

5.7 Indicating Devices

- Resolution of the indicating device
  - The sub-divisions of the verification scale shall be small enough to ensure that the resolution error of the indicating device does not exceed 0.25 % for accuracy class 1 meters, and 0.5 % for accuracy class 2 meters, of the actual volume passed during 1 hour 30 minutes at the minimum flowrate Q1.

OIML R 49-1
Technical Requirements

5.7 Indicating Devices

- Resolution of the indicating device

Example #1: Class 2 meter, Q3 = 4 m^3/h, Q3/Q1 = 200

Q1 = Q3/200 = 4/200 = 0.02 m^3/h
Volume required = 0.02 m^3/h x 1.5 h (90 min) = 0.03 m^3
Max Resolution = 0.03 x 0.5% = 0.00015 m^3

Need to use 0.0001 m^3 (only 1, 2 or 5 X 10^n is permitted)

OIML R 49-1
Technical Requirements

5.7 Indicating Devices

- Resolution of the indicating device

Example #2: Class 2 meter, Q3 = 4 m^3/h, Q3/Q1 = 100

Q1 = Q3/100 = 4/100 = 0.04 m^3/h
Volume required = 0.04 m^3/h x 1.5 h (90 min) = 0.06 m^3
Max Resolution = 0.06 x 0.5% = 0.0003 m^3

Can use 0.0002 m^3 (only 1, 2 or 5 X 10^n is permitted)

OIML R 49-1
Technical Requirements

5.7 Indicating Devices

- Resolution of the indicating device

Example #3: Class 2 meter, Q3 = 2.5 m^3/h, Q3/Q1 = 100

Q1 = Q3/100 = 2.5/100 = 0.025 m^3/h
Volume required = 0.025 m^3/h x 1.5 h (90 min) = 0.0375 m^3
Max Resolution = 0.03 x 0.5% = 0.0001875 m^3

Need to use 0.0001 m^3 (only 1, 2 or 5 X 10^n is permitted)

OIML R 49-1
Technical Requirements

5.7 Indicating Devices

- Resolution of the indicating device

Example #	Q3 m^3/h	Q3/Q1	Maximum Resolution
1	4 m^3/h	200	0.1 litre
2	4 m^3/h	100	0.2 litre
3	2.5 m^3/h	100	0.1 litre

OIML R 49-1
Technical Requirements

5.8 Verification Marks and Protection Devices

- A place shall be provided for affixing the main verification mark
- Shall be visible without dismantling the meter

OIML R 49-1
Technical Requirements

5.8 Verification Marks and Protection Devices

- Water Meters shall include protections devices
  - Sealable
  - Prevent dismantling or modifications of the meter
  - Prevent adjustments to calibration or corrections devices
  - Sealing can be before or after correct installation of the water meter

OIML R 49-1
Metrological Controls (6.0)

- Reference conditions
- Type Approval
- Initial Verifications

OIML R 49-1
Reference Conditions

6.1 Reference Conditions

- All influence quantities, except for the influence quantity being tested, shall be held to the following values during type evaluation tests on a water meter:

Flowrate:	0.7 x (Q2 + Q3) ± 0.03 x (Q2 + Q3);
Water temperature:	Within ± 5 ° C of reference value(s) of Table 1
Ambient temperature:	(20 ± 5) ° C
Ambient relative humidity	(60 ± 15) %;
Ambient atmospheric pressure	86 kPa to 106 kPa [0.86 to 1.06 bar].

OIML R 49-1
Type Approval

6.2 Type Approval

- External Evaluation
- Sample Size
- Accuracy Tests – flowrates
- Pass/Fail Criteria
- Angle of Orientation (if applicable)
- Static Pressure Test

OIML R 49-1
Type Approval

6.2 Type Approval (cont.)

- Pressure Loss
- Endurance Tests
- Static Magnetic Field Test
- Documentation
- Type Approval Certificates
- Modifications of an Approved Type
- Special Tests for Electronic Devices

OIML R 49-1
Initial Verification

6.3 Initial Verification

- May be tested in series
- Accuracy Test - flowrates
- Pass/Fail Criteria

OIML R 49-1
Test Method and
Test Report Format (7.0)

7.1 Test Method

- The methods of examination and testing described in OIML R 49-2 shall apply to type approval and verification of a water meter.

"Water meters intended for the metering of cold potable water and hot water, Part 2: Test methods"

OIML R 49-1
Test Method and
Test Report Format (7.0)

7.1 Test Method

- Annex A shall apply to water meters with electronic devices
- Expanded uncertainty:
  - shall not exceed 1/5 of mpe for Type Approvals
  - shall not exceed 1/3 of mpe for Initial Verifications
  - estimated according to *Guide to the Expression of Measurement (GUM)* with a coverage factor, K=2
  - Error due to resolution of meter under test shall not exceed the values given in 5.7.4.2.3

OIML R 49-1
Test Method and
Test Report Format (7.0)

7.2 Test Report

- The results of type approval and initial verification examinations should be presented in the format given according to OIML R 49-3.

"water meters intended for the metering of cold potable water and hot water, Part 3: Test Report Format'

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OIML R 49-1

Water meters intended for the metering of cold potable water and hot water meters

ORGANISATION INTERNATIONALE
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INTERNATIONAL ORGANIZATION
OF LEGAL METROLOGY

Questions or Comments