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# Water meters for cold potable water and hot water —

## Part 1: Metrological and technical requirements

*Compteurs d'eau potable froide et d'eau chaude —*

*Partie 1: Exigences métrologiques et techniques*



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# Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 30, *Measurement of fluid flow in closed conduits*, Subcommittee SC 7, *Volume methods including water meters* and OIML Technical Subcommittee TC 8/SC 5 *Water meters,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 92, *Test methods and equipment for cold water meters,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fifth edition of ISO 4064-1 cancels and replaces the fourth edition (ISO 4064-1:2014), which has been technically revised.

The main changes are as follows:

— a few editorial and technical changes were done throughout the document.

This edition of ISO 4064-1 is identical to the corresponding edition of OIML R 49-1, which has been issued concurrently. OIML R 49-1 was approved for final publication by the International Committee of Legal Metrology at its 59th meeting in October 2024. It will be submitted to the International Conference on Legal Metrology in XXX for formal sanction.

A list of all parts in the ISO 4064 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

# Water meters for cold potable water and hot water —

# Part 1:
# Metrological and technical requirements

## 1 Scope

This document specifies the metrological and technical requirements for water meters for cold potable water and hot water flowing through a fully charged, closed conduit. These water meters incorporate devices which indicate the accumulated volume.

In addition to water meters based on mechanical principles, this document applies to devices based on electrical or electronic principles, and mechanical principles incorporating electronic devices, used to measure the volume of cold potable water and hot water.

This document also applies to electronic ancillary devices. Ancillary devices are optional. However, it is possible for national or regional regulations to render some ancillary devices mandatory in relation to the utilization of water meters.

NOTE Any national regulations apply in the country of use.



## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4064-2:—OIML R 49-2:—, *Water meters for cold potable water and hot water — Part 2: Test methods*



## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

NOTE 1 This terminology conforms to that used in ISO/IEC Guide 99:2007|OIML V 2-200:2012[1], OIML V 1[8] and OIML D 11[9]. Modified versions of some terms defined in References [1], [8] and [9] are listed here.

NOTE 2 The following terms are referenced in the other parts of the ISO 4064| OIML R 49 series but are not cited within the main body of this document: *tariff control device* (3.1.9), *pre-setting device* (3.1.10), *meter for two constant partners* (3.1.12), *in-line meter* (3.1.13), *cartridge meter connection interface* (3.1.21), *meter with exchangeable metrological module* (3.1.22), *connection interface for meters with exchangeable metrological modules* (3.1.24), *non-adjustable water meter* (3.1.25), *adjustable water meter* (3.1.26), *initial intrinsic error* (3.2.7), *resolution of a displaying device* (3.2.14), *overload flow rate* (3.3.3), *transitional flow rate* (3.3.4), *combination meter changeover flow rate* (3.3.6), *minimum admissible temperature* (3.3.7), *maximum admissible temperature* (3.3.8), *working pressure* (3.3.11), *test flow rate* (3.3.13), *nominal diameter* (3.3.14), *temperature stability* (3.4.8), *preconditioning* (3.4.9), *recovery* (3.4.11), *automatic checking facility* (3.5.5), *permanent automatic checking facility type P automatic checking facility* (3.5.6), *intermittent automatic checking facility type I automatic checking facility* (3.5.7), *non-automatic checking facility type N checking facility* (3.5.8).

NOTE 3 Attention is drawn to the fact that the term "verification" or "initial verification" is equivalent to the term "conformity assessment" in the context of application of the European Measuring Instruments Directive.

## 3.1 Water meter and its constituents

**3.1.1**
**water meter**
instrument intended to measure, memorize, and display the volume of water passing through the *measurement transducer* (3.1.2) at *metering conditions* (3.2.11)

Note 1 to entry: A water meter includes at least a measurement transducer, a calculator (including adjustment or correction devices, if present) and an indicating device. These three devices can be in different housings.

Note 2 to entry: A water meter may be a combination meter (see 3.1.16).

Note 3 to entry: In this International Standard, a water meter is also referred to as a “meter”.

**3.1.2**
**measurement transducer**
part of the meter that transforms the *flow rate* (3.3.1) or volume of water to be measured into signals which are passed to the *calculator* (3.1.4) and includes the *sensor* (3.1.3)

Note 1 to entry: The measurement transducer may function autonomously or use an external power source and may be based on a mechanical, electrical or electronic principle.

**3.1.3**
**sensor**
element of a meter that is directly affected by a phenomenon, body or substance carrying a quantity to be measured



[SOURCE: ISO/IEC Guide 99:2007|OIML V 2-200:2012 (VIM), 3.8, modified — "meter" replaces "measuring system"; original note to entry removed; original examples removed, “Note 1 to entry” added.]

Note 1 to entry: For a water meter, the sensor may be a disc, piston, wheel or turbine element, the electrodes on an electromagnetic meter, or another element. The element senses the flow rate or volume of water passing through the meter and is referred to as a "flow sensor" or "volume sensor".



**3.1.4**
**calculator**
part of the meter that transforms the output signals from the *measurement transducer(s)* (3.1.2) and, possibly, from associated measuring instruments and stores the results in memory until they are used

Note 1 to entry: The gearing is considered to be the calculator in a mechanical meter.

Note 2 to entry: The calculator may be capable of communicating both ways with ancillary devices.

**3.1.5**
**indicating device**
part of the meter that provides an indication corresponding to the volume of water passing through the meter

Note 1 to entry: For the definition of the term “indication”, see ISO/IEC Guide 99:2007|OIML V 2-200:2012 (VIM), 4.1.

Note 2 to entry: In this International Standard, the volume of water passing through the meter refers to the accumulated volume.

**3.1.6**
**adjustment device**
part of the meter that allows an adjustment of the meter such that the error curve of the meter is generally shifted parallel to itself to fit in the envelope of the *maximum permissible error(s)* (3.2.5)

Note 1 to entry: For the definition of the term “adjustment of a measuring system”, see ISO/IEC Guide 99:2007|OIML V 2-200:2012 (VIM), 3.11.

**3.1.7**
**correction device**
device connected to or incorporated in the meter for automatic correction of the volume of water at *metering conditions* (3.2.11), by taking into account the *flow rate* (3.3.1) and/or the characteristics of the water to be measured and the pre-established calibration curves

Note 1 to entry: For the definition of the term "correction", see ISO/IEC Guide 99:2007|OIML V 2-200:2012 (VIM), 2.53.

**3.1.8**
**ancillary device**
device intended to perform a specific function, directly involved in elaborating, transmitting or displaying measured values

Note 1 to entry: For the definition of "measured value", see ISO/IEC Guide 99:2007|OIML V 2-200:2012 (VIM), 2.10.

Note 2 to entry: The main ancillary devices are:

a) zero-setting device;

b) price-indicating device;

c) repeating indicating device;

d) printing device;

e) memory device;

f) tariff control device;

g) pre-setting device;

h) self-service device;

i) flow sensor movement detector (for detecting movement of the flow sensor before this is clearly visible on the indicating device);

j) remote or automatic reading device (which may be incorporated permanently or added temporarily).

Note 3 to entry: Depending on national regulations, ancillary devices may be subject to legal metrological control.



**3.1.9**
**tariff control device**
device that allocates measured values into different registers depending on tariff or other criteria, each register having the possibility to be read individually

**3.1.10**
**pre-setting device**
device that permits the selection of the quantity of water to be measured and which automatically stops the flow of water after the selected quantity has been measured

**3.1.11**
**associated measuring instrument**
instrument connected to the *calculator* (3.1.4) or the *correction device* (3.1.7) for measuring a quantity, characteristic of water, with a view to making a correction and/or a conversion

**3.1.12**
**meter for two constant partners**
meter that is permanently installed and only used for deliveries from one supplier to one customer

**3.1.13**
**in-line meter**
type of meter that is fitted into a closed conduit by means of the meter end connections provided

Note 1 to entry: The end connections may be flanged or threaded.

**3.1.14**
**complete meter**
meter whose *measurement transducer* (3.1.2), *calculator* (3.1.4), and *indicating device* (3.1.5) are not separable

**3.1.15**
**combined meter**
meter whose *measurement transducer* (3.1.2), *calculator* (3.1.4), and *indicating device* (3.1.5) are separable

**3.1.16**
**combination meter**
meter comprising one large meter, one small meter, and a changeover device that, depending on the magnitude of the *flow rate* (3.3.1) passing through the meter, automatically directs the flow through either the small or the large meter, or both

Note 1 to entry: The meter reading is obtained from two independent totalizers, or from one totalizer which adds up the values from both meters.

**3.1.17**
**equipment under test**
**EUT**
*complete meter* (3.1.14), sub-assembly or *ancillary device* (3.1.8) that is subjected to a test

**3.1.18**
**concentric meter**
type of meter that is fitted into a closed conduit by means of a manifold

Note 1 to entry: The inlet and outlet passages of the meter and the manifold are coaxial at the interface between them.



**3.1.19**
**concentric meter manifold**
pipe fitting specific to the connection of a *concentric meter* (3.1.18)

**3.1.20**
**cartridge meter**
type of meter that is fitted into a closed conduit by means of an intermediate fitting called a connection interface



Note 1 to entry: The inlet and outlet passages of the meter and the connection interface are either concentric or axial as specified in ISO 4064-4[5].

**3.1.21**
**cartridge meter connection interface**
pipe fitting specific to the connection of an axial or concentric *cartridge meter* (3.1.20)

**3.1.22**
**meter with exchangeable metrological module**
meter comprising a connection interface and an *exchangeable metrological module* (3.1.23) from the same *type approval* (3.4.13)

**3.1.23**
**exchangeable metrological module**
self-contained module comprising a *measurement transducer* (3.1.2), a *calculator* (3.1.4) and an *indicating device* (3.1.5)

**3.1.24**
**connection interface for meters with exchangeable metrological modules**
pipe fitting specific to the connection of exchangeable metrological modules

**3.1.25**
**non-adjustable water meter**
*water meter* (3.1.1) whose indication cannot be altered in any way (e.g. without changing the internal dimensions and/or method of operation), and which has no *adjustment device* (3.1.6) or *correction device* (3.1.7).

Note 1 to entry: This category should also include mechanical meters with an internal adjustment device where the adjustment cannot be altered at initial verification stage as the meter would need to be dismantled.

Note 2 to entry: The meter should not have a correction device, *i.e.* the indicating device of the meter should either be purely mechanical or be electronic but with a constant multiplying factor applied to the indication and set to the same value for all meters (such as a device which counts the number of rotations of the shaft and multiplies by a fixed value to give total volume passed).

**3.1.26**
**adjustable water meter**
*water meter* (3.1.1) that is connected to or incorporates an adjustment and/or *correction device* (3.1.7)

**3.1.27**
**software-controlled water meter**
*water meter* (3.1.1) that incorporates and utilizes legally relevant software modules

## 3.2 Metrological characteristics

**3.2.1**
**actual volume**
$V_a$
total volume of water passing through the meter, disregarding the time taken

Note 1 to entry: This is the measurand.

Note 2 to entry: The actual volume is calculated from a reference volume as determined by a suitable measurement standard, taking into account differences in metering conditions, as appropriate.



**3.2.2**
**indicated volume**
$V_i$
volume of water indicated by the meter, corresponding to the actual volume

**3.2.3**
**primary indication**
indication which is subject to legal metrological control

**3.2.4**
**error**
measured quantity value minus a reference quantity value

[SOURCE: ISO/IEC Guide 99:2007|OIML V 2-200:2012 (VIM), 2.16, modified — “error” replaces “measurement error”; original notes to entry removed; “Note 1 to entry” added, “Note 2 to entry” added.]

Note 1 to entry: For the application of this part of ISO 4064|OIML R 49, the indicated volume is considered as the measured quantity value and the actual volume as the reference quantity value. The difference between indicated volume and actual volume is referred to as: error (of indication).

Note 2 to entry: In this International Standard, the error (of indication) is expressed as a percentage of the actual volume, and is equal to: $\frac{(V_i - V_a)}{V_a} \times 100\,\%$

**3.2.5**
**maximum permissible error**
**MPE**
extreme value of measurement *error* (3.2.4), with respect to a known reference quantity value, permitted by specifications or regulations for a given meter

[SOURCE: ISO/IEC Guide 99:2007|OIML V 2-200:2012 (VIM), 4.26, modified — "meter" replaces "measurement, measuring instrument, or measuring system"; original notes removed]

**3.2.6**
**intrinsic error**
*error* (3.2.4) of a meter determined under *reference condition(s)* (3.4.5)

[SOURCE: OIML D 11:2013, 3.8, modified — "a meter" replaces "indication"]

**3.2.7**
**initial intrinsic error**
*intrinsic error* (3.2.6) of a meter as determined prior to *performance test(s)* (3.4.6) and *durability* (3.2.10) evaluations

[SOURCE: OIML D 11:2013, 3.9, modified — "meter" replaces "measuring instrument"]

**3.2.8**
**fault**
difference between the *error* (3.2.4) (of indication) and the *intrinsic error* (3.2.6) of a meter

[SOURCE: OIML D 11:2013, 3.10, modified — "of indication" placed in parentheses; "meter" replaces "measuring instrument"; original notes removed]



**3.2.9**
**significant fault**
*fault* (3.2.8) greater than the value specified in this part of ISO 4064|OIML R 49

Note 1 to entry: See 5.1.2, which specifies the value of a significant fault.



**3.2.10**
**durability**
ability of a meter to maintain its performance characteristics over a period of use

[SOURCE: OIML D 11:2013, 3.18, modified — "meter" replaces "measuring instrument"]

**3.2.11**
**metering conditions**
conditions of the water, the volume of which is to be measured, at the point of measurement

EXAMPLE Water temperature, water pressure.

**3.2.12**
**first element of an indicating device**
element which, in an *indicating device* (3.1.5) comprising several elements, carries the graduated scale with the verification scale interval

**3.2.13**
**verification scale interval**
lowest value scale division of the *first element of an indicating device* (3.2.12)

**3.2.14**
**resolution of a displaying device**
smallest difference between displayed indications that can be meaningfully distinguished

[SOURCE: ISO/IEC Guide 99:2007|OIML V 2-200:2012 (VIM), 4.15, modified – "Note 1 to entry" added]

Note 1 to entry: For a digital indicating device, this is the change in the indication when the least significant digit changes by one step.

## 3.3 Operating conditions

**3.3.1**
**flow rate**
$Q$
$Q = \mathrm{d}V/\mathrm{d}t$ where $V$ is *actual volume* (3.2.1) and $t$ is the time taken for this volume to pass through the meter

Note 1 to entry: ISO 4006:1991[3], 4.1.2 prefers the use of the symbol $q_V$ for this quantity, but $Q$ is used in this International Standard as it is well established in the industry.

**3.3.2**
**permanent flow rate**
$Q_3$
highest *flow rate* (3.3.1) within the *rated operating condition(s)* (3.4.4) at which the meter is to operate within the *maximum permissible error(s)* (3.2.5)

Note 1 to entry: In this International Standard, flow rate is expressed in $m^3/h$. See 4.1.3.

**3.3.3**
**overload flow rate**
$Q_4$
highest *flow rate* (3.3.1) at which the meter is to operate for a short period of time, within the *maximum permissible error(s)* (3.2.5), while maintaining its metrological performance when it is subsequently operating within the *rated operating condition(s)* (3.4.4)



Note 1 to entry: the definition of short period of time can vary between economies and/or applications, but for example 2 hours in a 24 hours period.



**3.3.4**
**transitional flow rate**
$Q_2$
*flow rate* (3.3.1) between the *permanent flow rate* (3.3.2) and the *minimum flow rate* (3.3.5) that divides the flow rate range into two zones, the upper flow rate zone and the lower flow rate zone, each characterized by its own *maximum permissible error(s)* (3.2.5)

**3.3.5**
**minimum flow rate**
$Q_1$
lowest *flow rate* (3.3.1) at which the meter is to operate within the *maximum permissible error(s)* (3.2.5)

**3.3.6**
**combination meter changeover flow rate**
$Q_x$
*flow rate* (3.3.1) at which the flow in the larger meter stops with decreasing flow rate ($Q_{x1}$) or starts with increasing flow rate ($Q_{x2}$)

**3.3.7**
**minimum admissible temperature**
**mAT**
minimum water temperature that a meter can withstand permanently, within its *rated operating condition(s)* (3.4.4), without deterioration of its metrological performance

Note 1 to entry: mAT is the lower of the rated operating conditions for temperature.

**3.3.8**
**maximum admissible temperature**
**MAT**
maximum water temperature that a meter can withstand permanently, within its *rated operating condition(s)* (3.4.4), without deterioration of its metrological performance

Note 1 to entry: MAT is the upper of the rated operating conditions for temperature.

**3.3.9**
**maximum admissible pressure**
**MAP**
maximum internal pressure that a meter can withstand permanently, within its *rated operating condition(s)* (3.4.4), without deterioration of its metrological performance

**3.3.10**
**working temperature**
$T_w$
water temperature in the pipe measured upstream of the meter

**3.3.11**
**working pressure**
$p_w$
average water pressure (gauge) in the pipe measured upstream and downstream of the meter

**3.3.12**
**pressure loss**
$\Delta p$
irrecoverable decrease in pressure, at a given *flow rate* (3.3.1), caused by the presence of the meter in the pipeline

**3.3.13**
**test flow rate**
mean *flow rate* (3.3.1) during a test, calculated from the indications of a calibrated reference device



**3.3.14**
**nominal diameter**
**DN**
alphanumeric designation of size for components of a pipework system, which is used for reference purposes

Note 1 to entry: The nominal diameter is expressed by the letters DN followed by a dimensionless whole number which is indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections.

Note 2 to entry: The number following the letters DN does not represent a measurable value and should not be used for calculation purposes except where specified in the relevant standard.

Note 3 to entry: In those standards which use the DN designation system, any relationship between DN and component dimensions should be given, e.g. DN/OD or DN/ID.

## 3.4 Test conditions

**3.4.1**
**influence quantity**
quantity that, in a direct measurement, does not affect the quantity that is actually measured, but affects the relation between the indication and the measurement result

[SOURCE: ISO/IEC Guide 99:2007|OIML V 2-200:2012 (VIM) 2.52, modified – original examples and notes removed; “EXAMPLE” added]

EXAMPLE The ambient temperature of the meter is an influence quantity, whereas the temperature of the water passing through the meter affects the measurand.