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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

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2, www.iso.org/directives.

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The committees responsible for this document are 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*.

This fourth edition of ISO 4064-1 cancels and partially replaces the third edition (ISO 4064-1:2005), which has been technically revised. Some provisions of the third edition are addressed in ISO 4064-4:2014.

ISO 4064 consists of the following parts, under the general title *Water meters for cold potable water and hot water*:

— *Part 1: Metrological and technical requirements*

— *Part 2: Test methods*

— *Part 3: Test report format*

— *Part 4: Non-metrological requirements not covered in* ISO 4064-1

— *Part 5: Installation requirements*

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 48th meeting in Ho Chi Minh City, Vietnam in October 2013. It will be submitted to the International Conference on Legal Metrology in 2016 for formal sanction.

Water meters for cold potable water and hot water —

Part 1: Metrological and technical requirements

1 Scope

This part of ISO 4064|OIML R 49 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 integrated volume.

In addition to water meters based on mechanical principles, this part of ISO 4064|OIML R 49 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 part of ISO 4064|OIML R 49 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, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4064-2:2014|OIML R 49-2:2013, *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 definitions apply.

NOTE This terminology conforms to that used in ISO/IEC Guide 99:2007|OIML V 2-200:2012,[1] OIML V 1:2013[2] and OIML D 11.[3] Modified versions of some terms defined in References[1]–[3] are listed here.

3.1 Water meter and its constituents

3.1.1
water meter
instrument intended to measure continuously, memorize, and display the volume of water passing through the measurement transducer at metering conditions

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 or volume of water to be measured into signals which are passed to the calculator and includes the sensor

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".]

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) and, possibly, from associated measuring instruments and, if appropriate, 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.

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 errors

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, by taking into account the flow rate and/or the characteristics of the water to be measured and the pre-established calibration curves

Note 1 to entry: The characteristics of the water, e.g. temperature and pressure, may be either measured using associated measuring instruments or stored in a memory in the meter.

Note 2 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 reading device (which may be incorporated permanently or added temporarily).

Note 3 to entry: Depending on national legislation, 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 or the correction device 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, calculator, and indicating device are not separable

3.1.15
combined meter
meter whose measurement transducer, calculator, and indicating device 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 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 water meters.

3.1.17
equipment under test
EUT
complete meter, sub-assembly or ancillary device 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

3.1.20
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.

3.1.21
cartridge meter connection interface
pipe fitting specific to the connection of an axial or concentric cartridge meter

3.1.22
meter with exchangeable metrological module
meter with a permanent flow rate ≥16 m^3/h, comprising a connection interface and an exchangeable metrological module from the same type approval

3.1.23
exchangeable metrological module
self-contained module comprising a measurement transducer, a calculator and an indicating device

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

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, 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"]

3.2.6
intrinsic error
error of a meter determined under reference conditions

[SOURCE: OIML D 11:2013, 3.8, modified — "meter" replaces "measuring instrument,"]

3.2.7
initial intrinsic error
intrinsic error of a meter as determined prior to performance tests and durability evaluations

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

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

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

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

[SOURCE: OIML D 11:2013, 3.12, modified — "this part of ISO 4064|OIML R 49" replaces "the relevant Recommendation"]

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 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

3.2.14
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]

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 and t is time taken for this volume to pass through the meter

Note 1 to entry: ISO 4006:1991,[4]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 within the rated operating conditions at which the meter is to operate within the maximum permissible errors

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 at which the meter is to operate for a short period of time within the maximum permissible errors, while maintaining its metrological performance when it is subsequently operating within the rated operating conditions

3.3.4
transitional flow rate
Q_2
flow rate between the permanent flow rate and the minimum flow rate 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 errors

3.3.5
minimum flow rate
Q_1
lowest flow rate at which the meter is to operate within the maximum permissible errors

3.3.6
combination meter changeover flow rate
Q_x
flow rate 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 conditions, 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 conditions, 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 conditions, 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
Δp
irrecoverable decrease in pressure, at a given flow rate, caused by the presence of the meter in the pipeline

3.3.13
test flow rate
mean flow rate 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]

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

3.4.2
influence factor
influence quantity having a value within the rated operating conditions of a meter specified in this part of ISO 4064|OIML R 49

[SOURCE: OIML D 11:2013, 3.15.1, modified — “meter” replaces “measuring instrument”; “this part of ISO 4064|OIML R 49” replaces “the relevant Recommendation”]

3.4.3
disturbance
influence quantity having a value within the limits specified in this part of ISO 4064|OIML R 49, but outside the specified rated operating conditions of the meter

[SOURCE: OIML D 11:2004, 3.15.2, modified — “this part of ISO 4064|OIML R 49” replaces “the relevant Recommendation”; “meter” replaces “measuring instrument”]

Note 1 to entry: An influence quantity is a disturbance if the rated operating conditions for that influence quantity are not specified.

3.4.4
rated operating condition
ROC
operating condition requiring fulfilment during measurement in order that a meter perform as designed

[SOURCE: ISO/IEC Guide 99:2007|OIML V 2-200:2012 (VIM), 4.9, modified — "requiring fulfilment" replaces "that must be fulfilled"; "meter" replaces "measuring instrument or measuring system"]

Note 1 to entry: The rated operating conditions specify intervals for the flow rate and for the influence quantities for which the errors (of indication) are required to be within the maximum permissible errors.

3.4.5
reference condition
operating condition prescribed for evaluating the performance of a meter or for comparison of measurement results

[SOURCE: ISO/IEC Guide 99:2007|OIML V 2-200:2012 (VIM), 4.11, modified — "meter" replaces "measuring instrument or measuring system"]

3.4.6
performance test
test intended to verify whether the equipment under test is able to accomplish its intended functions

[SOURCE: OIML D 11:2013, 3.21.4]

3.4.7
durability test

test intended to verify whether the equipment under test is able to maintain its performance characteristics over a period of use

[SOURCE: OIML D 11:2013, 3.21.5]

3.4.8
temperature stability
condition in which all parts of the equipment under test have a temperature within 3 °C of each other, or as otherwise specified in the relevant specification of its final temperature

3.4.9
preconditioning
treatment of the equipment under test with the objective of eliminating or partially counteracting the effects of its previous history

Note 1 to entry: Where called for, this is the first process in a test procedure.

3.4.10
conditioning
exposure of the equipment under test to an environmental condition (influence factor or disturbance) in order to determine the effect of such a condition on it

3.4.11
recovery
treatment of the equipment under test, after conditioning, in order that its properties can be stabilized before measurement

3.4.12
type evaluation
pattern evaluation
systematic examination and testing of the performance of one or more specimens of an identified type or pattern of measuring instruments against documented requirements, the results of which are contained in the evaluation report, in order to determine whether the type may be approved

Note 1 to entry: "Pattern" is used in legal metrology with the same meaning as "type".