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Meters for irrigation water —

Part 1: General requirements

Compteurs pour l'eau d'irrigation —

Partie 1: Exigences générales

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Foreword

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 16399 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 18, *Irrigation and drainage equipment and systems*.

Meters for Irrigation WaterMeters for Irrigation Water

1 Scope

This international standard applies to water meters intended for irrigation use (hereinafter referred to water meters), independently the water quality used for this purpose is, and specifies the requirements and certification procedures for water meters, irrespective of the design technologies used to meter the actual volume of cold water or heated water, flowing through a fully charged closed conduit. These water meters incorporate devices, which indicate the integrated volume.

This international standard also applies to water meters based on electrical or electronic principles and to water meters based on mechanical principles, incorporating electronic devices used to meter the actual volume flow of cold water. It provides metrological requirements for electronic ancillary devices when they are subject to metrological control. As a rule, the ancillary devices are optional. However national or international regulations make some ancillary devices mandatory in relation to the utilization of the water meter.

2 Normative references

ISO 4064, *Water meters intended for the metering of cold potable water and hot water*

ISO 9644, *Agricultural irrigation equipment — Pressure losses in irrigation valves — Test method*

ISO 286-2, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts*

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

3 Terms and definitions

3.1
water meter
instrument intended to measure continuously, memorize and display the volume of water passing through it

[OIML R49-1:2006]

NOTE A water meter includes at least a measurement transducer, a calculator (possibly including adjustment or correction devices) and an indicating device. These three devices may be in different housings.

3.2
indicating device
part of the meter that provides an indication corresponding to the volume of water passing through the meter

3.3
actual volume
Va
total volume of water passing through the meter, disregarding of the time taken

[OIML R49-1:2006]

NOTE 1 This is the measurand.

NOTE 2 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.

3.4
indicated volume
Vi
volume of water indicated by the meter, corresponding to the actual volume

[OIML R49-1:2006]

3.5
flow rate
Q
quotient of the actual volume and the time taken for this volume to pass through the meter

3.6
minimum flow rate
Q_1
lowest flow rate at which the meter is required to operate within the maximum permissible error

3.7
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 zone” and the “lower zone”, each characterized by its own maximum permissible error

3.8
permanent flow rate
Q_3
highest flow rate within the rated operating conditions at which the meter is required to operate in a satisfactory manner within the maximum permissible errors

3.9
overload flow rate
Q_4
highest flow rate at which the 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 under normal service conditions

3.10
test flow rate
mean flowrate during a test, calculated from the indications of a calibrated reference device

3.11
maximum permissible error
MPE
extreme value of error permitted by this Standard

3.12
error
measured quantity value minus a reference quantity value

NOTE In this standard the error is generally expressed as a percentage, and is equal to:

$$\frac{V_i - V_a}{V_a} \times 100 \ (\%)$$

3.13
working pressure
Pw
average water pressure in the pipe measured upstream of the meter

3.14
maximum admissible pressure
MAP
maximum internal pressure that the meter can withstand permanently, within its rate operating conditions, without deterioration of its metrological performance

NOTE MAP is equivalent to Nominal Pressure (PN).

3.15
working temperature
Tw
average water temperature in the pipe, measured upstream and downstream from a water meter

[OIML R49-1:2006]

3.16
minimum and maximum admissible temperature
mAT and MAT
minimum and maximum water temperatures that a meter can withstand permanently, within its rated operating conditions, without deterioration of its metrological performance

3.17
pressure loss
ΔP
decrease in pressure, at a given flow rate, caused by the presence of the water meter in the pipeline

[OIML R49-1:2006]

3.18
limiting condition
extreme condition that a meter is required to withstand without damage, and without degradation of specified metrological properties, when it is subsequently operated under its rated operating conditions

3.19
nominal diameter
DN
alphanumerical designation of size for components of a pipework system, which is used for reference purposes. It comprises 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 1 The number following the letters DN dos not represent a measurable value and should not be used for calculation purposes except where specified in the relevant standard.

NOTE 2 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.

3.21
influence parameter
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.

3.22
influence factor
influence parameter having a value within the rated operating conditions specified for a water meter

3.23
rated operating conditions
ROC
operating conditions that shall be fulfilled during measurement in order that a meter performs as design

[VIM:2007, 4.9]

NOTE The rated operating conditions specify intervals for the flow rate and for the influence parameters for which the errors are required to be within the maximum permissible errors.

3.24
reed contact unit
assembly containing contact blades, some or all of magnetic material, hermetically sealed in an envelope and controlled by means of externally generated magnetic field (e.g. a pulse generator)

3.25
make contact
means that a reed contact unit is open when there is no applied magnetic field. This is a normally open contact

3.26
break contact
means that a reed contact unit is closed when there is no applied magnetic field. This is a normally closed contact

3.27
operate position
position where the make contact is closed and the break contact is open

3.28
bounce
momentary re-opening of a contact after initial closing, or a momentary closing after initial opening

3.29
bounce time
interval of time between the instant of the first closing (or opening) and the instant of the final closing (or opening) of the reed contact unit

3.30
operate position time
T_{ON}
interval of time between the instant the reed contact unit is in the operate position and the instant of the removal of the applied magnetic field to the contact. It includes the closing bounce time in a normally open contact or the opening bounce time in a normally closed contact

4 Metrological characteristics

4.1 Maximum permissible error (MPE)

4.1.1 Formulation

The error is expressed as a percentage, and is equal to:

$$\varepsilon = \frac{(V_i - V_a)}{V_a} \times 100$$

4.1.2 Limits

The maximum permissible error, positive or negative, on volumes delivered at flow rates between the minimum flow rate (Q_1) (included) and the transitional flow rate (Q_2) (excluded) is 5 %.

The maximum permissible error, positive or negative, on volumes delivered at flow rates between the transitional flow rate (Q_2) (included) and the overload flow rate (Q_4) (included) is 2 %.

— $Q_1 \leq Q < Q_2$, MPE ≤ 5%

— $Q_2 \leq Q \leq Q_4$, MPE ≤ 2%

If all the errors within the measuring range of the water meter have the same sign, at least one of the errors shall be less than one half of the maximum permissible error.

When any accessory part is sold with the water meter, as for instance a control valve, the error shall be calculated for any position of the accessory, not altering the metrological characteristics of the water meter.

The indication error will be ensured by the manufacturer for any recommended installation configuration.

4.2 Metrological Characteristics

4.2.1 Permanent flow rate (Q_3)

The value of Q_3, in (m^3/h), shall be chosen from the following list:

1,0	1,6	2,5	4,0	6,3
10	16	25	40	63
100	160	250	400	630
1 000	1 600	2 500	4 000	6 300

This list may be extended to higher or lower values in the series.

4.2.2 Measuring range

The measuring range for the flow rate is defined by the ratio Q_3/Q_1. The values 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

This list may be extended to higher values in the series.

4.2.3 Relationship between permanent flow rate (Q_3) and overload flow rate (Q_4)

The overload flow rate is defined by:

$Q_4/Q_3 = 1,25$

4.2.4 Relationship between transitional flow rate (Q_2) and minimum flow rate (Q_1)

The transitional flow rate is defined by:

$Q_2/Q_1 = 1,6$

5 Technical characteristics

5.1 General specifications

The water meters shall be made so that they guarantee:

a) Their design lifetime and exclude fraud possibility.

b) Fulfilling the prescriptions of this International Standard, under rate operating conditions.

Other specifications are the following:

— A water meter measures continuously, records and displays the integrated volume of water passing through the measurement transducer.

NOTE A water meter includes at least a measurement transducer, a calculator and an indicating device.

— The manufacturer shall specify in his instruction manual the conditions in which the meter can operate in the event of reversal of the flow direction.

— Other ancillary functions of output and reception of information (remote reading, prepayment etc.) may be included provided they do not affect the performance of the meters as defined in this International Standard.

— The meter will preferably be designed in such a way as to present as little obstacle as possible to the water flow and any solid materials it may transport.

— The meter shall be designed such that its operation cannot be affected by a magnetic field as defined in ISO 4064-1, clause 7.2.7.

5.2 Rated operating conditions

The rated operating conditions for a water meter shall be as follow:

a) Ambient temperature range (T_{amb}): 0,1 ºC ≤ T_{amb} < 50 ºC.

b) Pressure (P): P < MAP (maximum admissible pressure).

c) Water temperature range (T_w): 0,1 ºC ≤ T_w < 30 ºC.

d) Flow rate range (Q): Q_1 (minimum flow rate) < Q ≤ Q_3 (permanent flow rate).

e) Power supply voltage (mains a.c.): Nominal voltage (Unom) ± 5 %.

f) Power supply frequency: Nominal frequency (fnom) ± 2 %.

g) Power supply voltage (battery): A voltage U in the range; Umin ≤ U ≤ Umax.

5.3 Materials

The water meter shall be made with materials with a resistance and stability suitable for its use.

The meter shall be fabricated using materials which are resistant to internal and external corrosion, and, if required, will be protected by the application of an appropriate surface treatment.

Water temperature variations within the working temperature range will not adversely affect the materials used.

5.4 Indicating device

5.4.1 Function

The indicating device shall always guarantee easy reading of volumes without ambiguity.

5.4.2 Unit of measurement

The indicated volume of water shall be expressed in cubic metres. The symbols m^3 shall appear on the dial or immediately adjacent to the numbered display.

5.4.3 Indicating range

This requirement is set in table 1:

Table 1 — Indicating Range

Q_3 m^3/h	Indicating range (minimum values) m^3
$Q_3 \leq 6,3$	9 999
$6,3 < Q_3 \leq 63$	99 999
$63 < Q_3 \leq 630$	999 999
$630 < Q_3 \leq 6\,300$	9 999 999

5.4.4 Colour coding for indicating devices

The colour black should be used to indicate the cubic metre and its multiples.

The colour red should be used to indicate sub-multiples of a cubic metre.

These colours should be applied to the pointers, indexes, numbers, wheels, discs, dials or aperture frames.

Other means of indicating the cubic metre, its multiples and its sub-multiples 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.

5.5 Reverse flow

For meters designed to measure reverse flow, the permanent flow rate and the measuring range may be different in each direction.

The manufacturer shall specify whether the meter is designed to measure reverse flow. If it is, the reverse flow volume shall either be subtracted from the indicated volume, or it shall be separately recorded. The maximum permissible error of clause 4.1.2 shall be met for forward and reverse flow.

Water meters not designed to measure reverse flow shall either prevent it or they shall be capable of withstanding an accidental reverse flow without any deterioration or change in their metrological properties for forward flow, and without modification of the cumulated volume.