INTERNATIONAL STANDARD ISO 4064/I

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Measurement of water flow in closed conduits – Meters for cold potable water – Part I : Specification

Mesurage de débit d'eau dans les conduites fermées – Compteurs d'eau potable froide – Partie I : Spécifications

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4064/I was developed by Technical Committee ISO/TC 30, *Measurement of fluid flow in closed conduits*, and was circulated to the member bodies in September 1976.

It has been approved by the member bodies of the following countries :

Belgium	India	Turkey
Czechoslovakia	Korea, Rep. of	United Kingdom
Egypt, Arab Rep. of	Mexico	U.S.S.R.
Finland	Netherlands	Yugoslavia
France	Portugal	
Germany	Romania	

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Austria
Japan
U.S.A.

Measurement of water flow in closed conduits – Meters for cold potable water – Part I : Specification

1 SCOPE AND FIELD OF APPLICATION

This International Standard is the first part of an International Standard applying to meters for the measurement of cold potable water and which is to comprise three parts.

This first part deals with terminology, technical characteristics, metrological characteristics and pressure loss.

The second part[1] will deal with installation conditions and the third[2] with test methods.

This International Standard applies to water meters of various metrological classes (see clause 5) having nominal flow rates which lie in the range 0,6 to 4 000 m^3/h, with a nominal pressure of 10 bar[3] and a working temperature up to 30 °C.

The recommendations of this International Standard apply, except for the connecting flange dimensions, to water meters subject to nominal pressures of 10 to 16 bar. The recommendations of this International Standard apply to water meters defined as follows : self-contained integrating measuring instruments continuously determining the volume of water flowing through them, employing a direct mechanical process involving the use of volumetric chambers with mobile walls or the action of the velocity of the water on the rotation rate of a moving part (turbine, impeller).

Legal requirements take precedence over the recommendations of this International Standard.

2 REFERENCES

ISO 228, *Pipe threads where pressure-tight joints are not made on the threads – Part I : Designation, dimensions and tolerances.*[4]

ISO 2084, *Pipeline flanges for general use – Metric series – Mating dimensions.*

ISO 4006, *Measurement of fluid flow in closed conduits – Vocabulary and symbols.*

OIML, *Vocabulary of legal metrology,* 1969.

3 DEFINITIONS

For the purpose of this International Standard, the following definitions apply :

3.1 nominal pressure : The internal pressure, expressed in bars, corresponding to the maximum permissible working pressure. It is designated by the letters PN followed by the appropriate figure.

3.2 flow rate : The quotient of the volume of water passing through the water meter by the time taken for this volume to pass through the meter.

3.3 volume-flow : The volume of water passing through the water meter.

3.4 maximum flow rate, q_{max} : The highest flow rate at which the meter is required to operate in a satisfactory manner for a short period of time without deteriorating.

3.5 nominal flow rate, q_n : Half the maximum flow rate, q_{max}.

Expressed in cubic metres per hour, the nominal flow rate is used for the purpose of designating the water meter.

At the nominal flow rate, q_n, a water meter is expected to operate in a satisfactory manner under normal conditions of use, i.e. under steady or intermittent flow conditions.

3.6 minimum flow rate, q_{min} : The lowest flow rate at which the meter is required to give indications within the maximum permissible error tolerance. It is determined in terms of q_n.

3.7 transitional flow rate, q_t : The flow rate at which the maximum permissible error of the water meter changes in value.

1) At present at the stage of draft.

2) In preparation.

3) 1 bar = 10^5 Pa

4) At present at the stage of draft. (Revision of ISO/R 228-1961.)

3.8 flow-rate range : The range limited by the maximum and the minimum flow rates (q_{max} and q_{min}).

This range is divided into two zones called upper and lower zones, separated by the transitional flow rate.

3.9 pressure loss : The pressure loss caused by the presence of the water meter.

4 TECHNICAL CHARACTERISTICS

4.1 Meter size and overall dimensions

Meter size is designated either by thread size of the end connections or by the nominal diameter of the flange. For each meter size designation there is a corresponding fixed set of overall dimensions (see figure 1). The dimensions are given in tables 1 and 2.

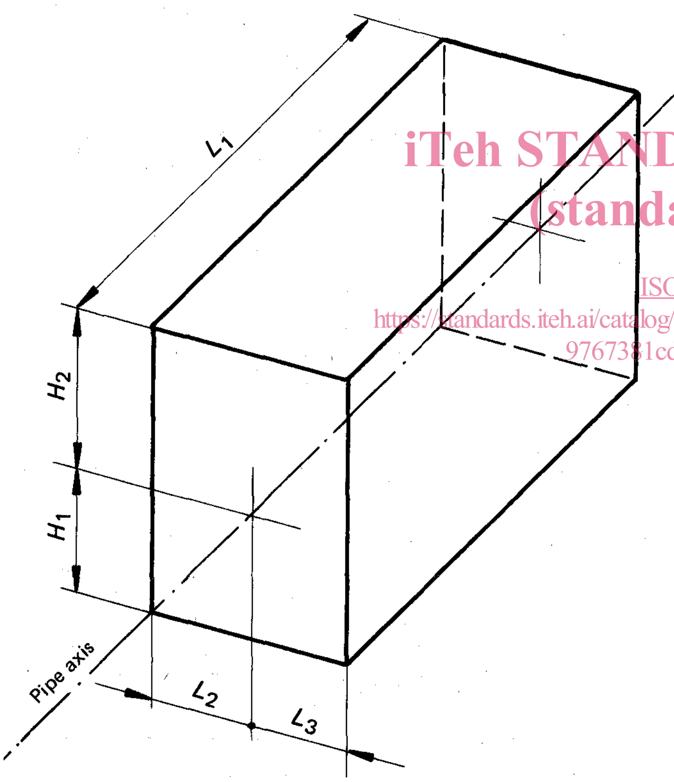

FIGURE 1

$H_1 + H_2$; L_1; $L_2 + L_3$ define the height, length and width respectively of a cuboid within which the water meter can be contained (the cover being at right angles to its closed position).

H_1, H_2, L_2, L_3 are maximum dimensions.

L_1 is a fixed value with specified tolerances.

For threaded end connections, two minimum dimensions, *a* and *b*, are specified (see 4.1.2).

4.1.1 *Relationship between meter size and nominal flow rate*

Meter size and hence overall dimensions are in principle linked to the nominal flow rate (q_n) of the water meter as specified in tables 1 and 2.

It is, however, permitted to adopt a meter size one step smaller or larger than the relationship shown in the tables, provided that the metrological requirements are met. In such a case the meter shall be designated not only by the numerical value of its nominal flow rate but also by the nominal diameter of its end connections. End connections shall be the same at the water meter inlet and outlet.

4.1.2 *Threaded connection*

Values are given in table 1. Threads shall comply with ISO/R 228. Figure 2 defines dimensions *a* and *b*.

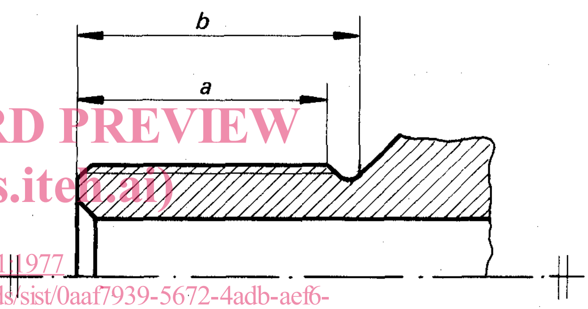

FIGURE 2

4.1.3 *Flanged connection*

Flanged end connections shall comply with ISO 2084 for a nominal pressure corresponding to that of the water meter, i.e. normally 10 bar. Dimensions are given in table 2.

The manufacturer shall provide a reasonable clearance behind the rear face of the flange to allow access for installation and removal.

4.2 Indicating device

The indicator must allow, by simple juxtaposition of its various constituent elements, a reliable, easy and unambiguous reading of the volume of water measured, expressed in cubic metres.

The volume is indicated by one of the following systems :

- the position of one or more pointers on circular scales – type 1;
- reading of a row of in-line consecutive digits in one or more apertures – type 2;
- a combination of these two systems – type 3.

The cubic metre and its multiples shall be indicated in black, and sub-multiples of the cubic metre in red. This colour coding applies to the pointers on circular scale type indicating devices and to the drums in in-line digit indicating devices.

The actual or apparent height of the digits on the drums shall not be less than 4 mm.

On digital indicators (types 2 and 3) visible displacement of all digits shall be upwards.

The advance of any given digital unit shall be completed while the digit of the immediately next lower value describes the last tenth of its travel; the drum showing the digits of lowest value may move continuously in the case of type 3.

Indicators with pointers (type 1 and 3) shall rotate in a clockwise direction. The value in cubic metres for each scale division shall be expressed as 10^n, where n is a positive or negative whole number or zero, thereby establishing a system of consecutive decades. Each scale shall be :

- either graduated in values expressed in cubic metres;
- or accompanied by a multiplying factor (× 0,001 – × 0,01 – × 0,1 – × 1 – × 10 – × 100 – × 1 000, etc.)

In both cases (dial and digital indicators) :

- the unit symbol m^3 shall appear either on the dial or in the immediate vicinity of the digital indication;
- the fastest-moving visible graduated element, the control element, the scale interval of which is known as the "verification scale interval", shall move continuously.

The length of the verification scale interval shall be not less than 1 mm and not more than 5 mm. The scale shall consist :

- either of lines of equal thickness not exceeding one-quarter of the distance between the axes of two consecutive lines and differing only in length;
- or of contrasting bands of a constant width equal to the length of the scale division.

The width of the pointer index tip shall not exceed one-quarter of the distance between two scale divisions, and in no case shall it be greater than 0,5 mm.

4.3 Number of decades and value of the verification scale division

It shall be possible for the indicating device to record volume, expressed in cubic metres, corresponding to at least 1 999 h of operation at the nominal flow rate, without returning to zero.

The value of the verification scale interval, expressed in cubic metres, shall be based on the formula 1×10^n or 2×10^n or 5×10^n.

For type 2, the verification scale interval may be formed from the division into 20, 50 or 100 equal parts of a supplementary scale of markings engraved on the drum bearing the figures of the lowest decade. Numbering shall not be applied to the said divisions.

TABLE 1 – **Water meters with threaded end connections – Nominal flow rates, meter sizes and dimensions**

Dimensions in millimetres

Nominal flow rate q_n (All types) m^3/h	Meter size (Nominal diameter of threaded end connection)	Thread	a min.	b min.	Overall dimensions: L_1 tolerance $^{0}_{-2}$ Preferred value	L_1 Alternatives		L_2 max.	L_3 max.	H_1 max.	H_2 max.
0,6	G 1/2 B	G 1/2 B	10	12	110	85	130	50	50	50	180
1	G 1/2 B	G 1/2 B	10	12	110	85	130	50	50	55	200
1,5	G 3/4 B	G 3/4 B	10	12	165	110	130	65	65	60	220
2,5	G 1 B	G 1 B	12	14	190	165		65	65	60	240
3,5	G 1 1/4 B	G 1 1/4 B	12	16	260			85	85	65	260
6,0	G 1 1/2 B	G 1 1/2 B	13	18	260			85	85	70	280
10	G 2 B	G 2 B	13	20	300			105	105	75	300

TABLE 2 – **Water meters with flanged end connections – Nominal flow rates, meter sizes and dimensions**

Nominal flow rate q_n m^3/h		Meter size (Nominal diameter of flange end connections)
Volumetric and turbine meters	Woltman meters	
15	15	50
20	25	65
30	40	80
50	60	100
100	100 and 150	150
	250	200
	400	250
	600	300
	1 000	400
	1 500	500
	2 500	600
	4 000	800

Dimensions in millimetres

Nominal diameter flange	Overall dimensions										
	L_1, tolerances $200 \leqslant L_1 \leqslant 400$ $^{0}_{-3}$; $400 < L_1 \leqslant 1\,200$ $^{0}_{-5}$			L_2 max.		L_3 max.		H_1 max.		H_2 max.	
	Volume meters	Turbine and removable element Woltman meters	Non-removable element Woltman meters	Volume and turbine meters	Woltman meters	Volume and turbine meters	Woltman meters	Volume and turbine meters	Woltman meters	Volume and turbine meters	Woltman meters
50	350	300	200	135	135	135	135	115	100	300	390
65	450	300	200	150	135	150	135	130	110	320	390
80	500	350	200 or 225*	180	135	180	135	150	120	320	410
100	650	350 or 400*	250	225	135	225	135	215	140	320	440
150	1 000	500	300	350	175	350	175	250	180	400	500
200		500	350		190		190		200		500
250		600	450		210		210		220		500
300		800	500		240		240		250		500
400		800	600		290		290		320		500
500		1 000	800		365		365		380		520
600		1 200	1 000		390		390		450		600
800		1 200	1 200		510		510		550		700

* For a transitional period.

For types 1 and 3, the verification scale interval may be formed from the sub-division into 2, 5 or 10 equal parts of the main interval of the circular scale of the lowest-value indicator. Numbering shall not be applied to the said sub-divisions. The only numbering permitted shall be that set against the 10 markings making up the basic divisions of the circular scale of the indicator in question.

The sub-divisions of the verification scale shall be small enough to ensure a measurement inaccuracy during the verification of not more than 0,5 % (allowing for a possible reading error in each reading of not more than half the length of the smallest scale division) and small enough so that at the minimum flow rate the test does not take more than 1 h 30 min (until 20 July 1981 a maximum duration of 7 h is permitted).

These concepts are summarized in tables 3 and 4.

TABLE 3

q_n m³/h	Minimum number of positive decades
$0,6 < q_n \leqslant 5$	4
$5 < q_n \leqslant 50$	5
$50 < q_n \leqslant 500$	6
$500 < q_n \leqslant 4\,000$	7

TABLE 4

q_{min} m³/h	Maximum value of verification scale interval m³*
$0,002\,66 \leqslant q_{min} < 0,006\,66$	0,000 02
$0,006\,66 \leqslant q_{min} < 0,013\,3$	0,000 05
$0,013\,3 \leqslant q_{min} < 0,026\,6$	0,000 1
$0,026\,6 \leqslant q_{min} < 0,066\,6$	0,000 2
$0,066\,6 \leqslant q_{min} < 0,133$	0,000 5
$0,133 \leqslant q_{min} < 0,266$	0,001
$0,266 \leqslant q_{min} < 0,666$	0,002
$0,666 \leqslant q_{min} < 1,330$	0,005
$1,330 \leqslant q_{min} < 2,660$	0,01
$2,660 \leqslant q_{min} < 6,660$	0,02
$6,660 \leqslant q_{min} < 13,300$	0,05
$13,300 \leqslant q_{min} < 26,600$	0,1
$26,600 \leqslant q_{min} < 66,600$	0,2
$66,600 \leqslant q_{min} < 133$	0,5
$133 \leqslant q_{min} < 266$	1*
$266 \leqslant q_{min} < 666$	2*

* Theoretical values obtained by application of the reference formula. In practice, when calibration is carried out by comparison with the volume discharged in a tank, generally of a capacity not exceeding 100 m³, the scale value 0,5 m³ is to be applied to any meter with q_{min} greater than or equal to 66,600 m³/h.

An additional element (star, disk with a mark, etc.) may be added to detect any movement of the measuring device before this is clearly perceptible on the indicating device.

4.4 Adjustment device

Meters may be fitted with an adjustment device with which it is possible to correct the relationship between the volume indicated and the volume actually passed. This device is obligatory for meters which make use of the action of the velocity of the water on the rotation of a moving part.

4.5 Accelerating device

The use of an accelerating device for increasing the speed of the meter below q_{min} is prohibited.

4.6 Materials

Water temperature variations, within the working temperature range, shall not adversely affect the materials used in the construction of the water meter. All materials of the water meter which are in contact with the water flowing through the water meter shall be non-toxic and non-tainting. They shall be in conformity with operative national regulations.

The water meter shall be constructed throughout of materials which are resistant to normal internal and external corrosion or which are protected by some suitable surface treatment.

The water meter shall be made of materials of adequate strength for the purpose for which it is to be used.

The indicating device of the water meter shall be protected by a transparent window (glass or other material). Further protection may be provided by a suitable cover.

The water meter shall be provided with means for the removal of condensation if the latter can occur on the underside of the window of the indicating device of the water meter.

4.7 Strainers

All volumetric chamber and turbine water meters shall be provided with an internal strainer or filter placed upstream of the measuring element.

4.8 Behaviour in case of flow back

Where meters may be subjected to an accidental reversal of flow, they shall be capable of withstanding the reversal without any deterioration or change in their metrological characteristics and at the same time shall record such a reversal.

4.9 Sealing

Water meters shall have protective devices which can be sealed in such a way that after sealing, both before and after the water meter has been correctly installed, there is no possibility of dismantling or altering the water meter or its adjustment device without damaging the protective devices.

4.10 Marking

It is obligatory that all water meters be clearly and indelibly marked with the following information, either grouped or distributed on the casing, the indicating device dial or an identification plate. The water meter cover, being detachable, shall never be used for this purpose.

a) name or trade mark of the manufacturer;

b) metrological class, nominal flow rate q_n, in cubic metres per hour and pressure loss in bars;

c) year of manufacture and serial number;

d) one or two arrows indicating the direction of flow;

e) mark of type approval;

f) maximum working pressure, in bars, if exceeding 10 bar;

g) the letter V or H, if the meter can only be operational in the vertical or horizontal position.

5 METROLOGICAL CHARACTERISTICS

5.1 Maximum permissible errors

The maximum permissible error in the lower zone from q_{min} inclusive up to but excluding q_t is ± 5 %.

The maximum permissible error in the upper zone from q_t inclusive up to and including q_{max} is ± 2 %.

5.2 Metrological classes

Water meters are divided into three metrological classes according to the values of q_{min} and q_t as defined in clause 3, as shown in table 5.

TABLE 5

Classes	q_n type meters	
	< 15 m³/h	⩾ 15 m³/h
Class A		
Value of q_{min}	0,04 q_n	0,08 q_n
Value of q_t	0,10 q_n	0,30 q_n
Class B		
Value of q_{min}	0,02 q_n	0,03 q_n
Value of q_t	0,08 q_n	0,20 q_n
Class C		
Value of q_{min}	0,01 q_n	0,006 q_n
Value of q_t	0,015 q_n	0,015 q_n

6 PRESSURE LOSS

From the results of tests, water meters are divided into four groups on the basis that the pressure loss corresponds to one of the following maximum values : 1 – 0,6 – 0,3 and 0,1 bar on the flow-rate range.