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ISO 7858-3

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Measurement of water flow in closed conduits — Meters for cold potable water — Combination meters —

Part 3:
Test methods

Mesurage de débit d'eau dans les conduites fermées — Compteurs d'eau potable froide — Compteurs combinés —

Partie 3: Méthodes d'essai

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Contents

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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.

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.

International Standard ISO 7858-3 was prepared by Technical Committee ISO/TC 30, *Measurement of fluid flow in closed conduits*, Sub-Committee SC 7, *Water meters*.

ISO 7858 consists of the following parts, under the general title *Measurement of water flow in closed conduits — Meters for cold potable water — Combination meters*:

— *Part 1: Specifications*

— *Part 2: Installation requirements*

— *Part 3: Test methods*

Introduction

This part of ISO 7858 is applicable to combination meters, such as they are defined in ISO 7858-1.

ISO 7858-1 deals with terminology, technical characteristics and dimensions, with metrological characteristics and loss of pressure. ISO 7858-2 deals with installation conditions.

Measurement of water flow in closed conduits — Meters for cold potable water — Combination meters —

Part 3:
Test methods

1 Scope

The purpose of this part of ISO 7858 is to define a number of tests for specific inspection of combination meters for cold potable water. It is applicable as a complement to ISO 4064-3 for component meters and specifies additional requirements for combination meters.

Legal requirements, if any, will always take precedence over the specifications of this part of ISO 7858. In particular it should be noted that in countries where legal regulations specify that tests shall be carried out in conformity with the rules of the International Organization of Legal Metrology (OIML), for example for pattern approval and initial verification of meters, OIML Recommendation No. 49 should be followed.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 7858. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 7858 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4064-3:1983, *Measurement of water flow in closed conduits — Meters for cold potable water — Part 3: Test methods and equipment.*

ISO 7858-1:1985, *Measurement of water flow in closed conduits — Meters for cold potable water — Combination meters — Part 1: Specifications.*

ISO 7858-2:1987, *Measurement of water flow in closed conduits — Meters for cold potable water — Combination meters — Part 2: Installation requirements.*

OIML, International Recommendation No. 49, *Water meters for the measurement of cold water* (1977).

3 Requirements common to all tests

The requirements applicable to all tests are those given in ISO 4064-3:1983, clause 4 (Preliminary conditions, water quality, general test installation requirements and their location). However meters are tested individually.

4 Measurement error tests

The test for assessing measurement errors as described in ISO 4064-3 employs the "collection" method, in which the quantity of water passed through the combination meter is collected in one or more collecting vessels and the quantity determined volumetrically or by weighing. Other methods may be used, provided accuracy levels given in this part of ISO 7858 for the "collection" method are attained. Test equipment shall permit error measurement for both increasing and decreasing flow-rates.

These tests shall be carried out in accordance with ISO 4064-3.

NOTE 1 The test method described in ISO 4064-3:1983, 5.3.5.2, in which readings of the combination meter are taken at rest, does not allow the determination of measurement errors after regulating the test flow-rate for decreasing flow-rates. The test method described in ISO 4064-3:1983, 5.3.5.3 in which readings of the combination meter are taken at an established flow-rate, ensures that the change-over device is functioning correctly for both increasing and decreasing flow-rates.

4.1 Change-over flow-rate, Q_c

Change-over flow-rate Q_{c1} is obtained at decreasing flow-rates when the pressure drop in the combination meter increases suddenly in parallel with a cessation of the larger meter and with a visible increase in the flow-rate in the smaller meter (see figure 1).

Change-over flowrate Q_{c2} is obtained at increasing flow-rates when the pressure drop in the combination meter decreases suddenly in parallel with a starting up of the larger meter and with a visible reduction in the flow-rate in the smaller meter (see figure 1).

NOTE 2 The test flow-rate is taken to be the mean flow-rate calculated from the indications of the calibrated reference device.

4.2 Test method for the determination of change-over flow-rates

Starting from a flow-rate less than case f) in 9.1.3.3 or a flow-rate greater than case h) in 9.1.3.3 for the change-over flow-rate, the flow-rate is increased or decreased in successive steps of 5 % until the flow-rate as defined in 4.1 is achieved. The last value taken before change-over occurs is taken as the value of the change-over flow-rate (Q_{c1} and Q_{c2}).

5 Pressure tests

Pressure tests shall be in accordance with the specifications given in ISO 4064-3.

6 Pressure-loss tests

Pressure-loss tests shall be in accordance with the specifications given in ISO 4064-3.

7 Accelerated wear tests

Accelerated wear tests shall be in accordance with the specifications given in ISO 4064-3.

8 Test report

The test report shall be in accordance with the specifications given in ISO 4064-3.

9 Examples of test programmes

From among the different test programmes to which combination meters may be submitted, this clause gives two examples: a pattern approval test programme and an initial verification test programme.

9.1 Pattern approval

9.1.1 Definition

Pattern approval means verifying that characteristics of the model of the meter conform with the standards and regulations in force.

This approval consequently requires that samples of the model shall fulfil the requirements of the test programme.

The pattern approval test programme is described in 9.1.2 and 9.1.3.

9.1.2 Number of meters to be tested

The pattern approval tests shall be carried out on a minimum number of combination meters of each model as specified in table 1 as a function of the permanent flow-rate of the model submitted.

Table 1

Permanent flow-rate, Q_p m^3/h	Minimum number of meters
$Q_p \leqslant 100$	3
$100 < Q_p \leqslant 250$	2

The number of combination meters in table 1 may be regarded as the minimum to be tested, however the authority responsible for pattern approval may request further combination meters.

9.1.3 Programme of approval

The two component meters shall have been pattern approval tested in accordance with ISO 4064-3.

9.1.3.1 Tests to be carried out

Tests of a combination meter shall consist of the following, carried out in the following order:

a) pressure tests;

b) determination of the error curves as a function of flow-rate;

c) pressure-loss tests;

d) accelerated wear tests.

9.1.3.2 Pressure tests

The combination meter shall withstand, without leakage or seepage through the walls and without damage, a pressure equal to:

— 16 bar[1] or 1,6 times the maximum permissible pressure if this is greater than 10 bar, applied for 15 min, and

— 20 bar or twice the maximum permissible pressure applied for 1 min.

9.1.3.3 Determination of the error curve as a function of the flow-rate

Test methods and equipment used to determine the error of the meter at a given flow-rate shall be as specified in clause 4.

It is recommended that the characteristic curve of each combination meter be plotted in terms of the error as a function of flow-rate so that the general performance of the combination meter over the flow-rate range and in particular in the change-over zone and its approaches (by the use of increasing then decreasing flow-rates) can be evaluated.

The effect of pressure shall be investigated.

The indication errors of the combination meter (in the measurement of volume flow) shall be determined as a minimum at the following flow-rates:

a) between Q_{min} and 1,1 Q_{min};

b) between Q_t and 1,1 Q_t;

c) between 0,45 Q_p and 0,5 Q_p;

d) between 0,9 Q_p and Q_p;

e) between 0,9 Q_s and Q_s;

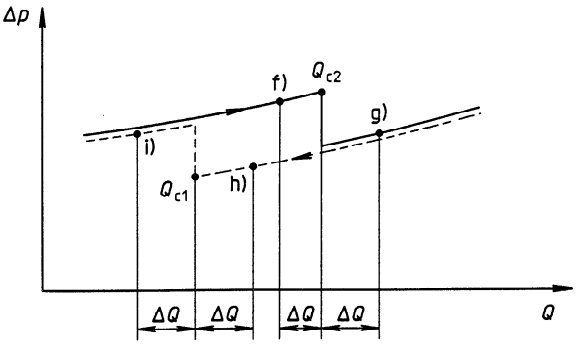
f) at a flow-rate f) before the change-over flow-rate, using increasing flow-rates;

g) at a flow-rate g) after the change-over flow-rate, using increasing flow-rates;

h) at a flow-rate h) before the change-over flow-rate, using decreasing flow-rates;

i) at a flow-rate i) after the change-over flow-rate, using decreasing flow-rates.

Test points f) to i) shall be less than 10 % apart and less than 600 l/h away from the change-over flow-rate Q_c, unless note 2 of figure 1 applies.



$\Delta Q < 0{,}1\, Q_c$ and $\Delta Q < 600$ l/h

Key

——— increasing flow-rates

------ decreasing flow-rates

NOTES

1 Flow-rate shall be kept constant in accordance with ISO 4064-3.

2 If, during tests g) and i), the test flow-rate cannot be obtained after change-over within the specified limits due to limitations in the supply pressure, testing shall take place at the nearest possible flow-rate after change-over.

Figure 1 — Illustration of paragraphs f), g), h) and i)

For pattern approval tests the test is declared satisfactory if the error determined at each flow-rate does not exceed the limits of permissible error.

If the error determined exceeds the limits of permissible error, the test shall be carried out a further two times. If the arithmetical mean of the three tests does not exceed the limits of permissible error the test is declared satisfactory.

9.1.3.4 Pressure-loss tests

Test methods and equipment used to determine pressure loss shall be as specified in clause 6.

The values of the pressure loss shall be determined at a sufficient number of flow-rates, in particular in the change-over zone and its approaches by the use of increasing then decreasing flow-rates, so that the combination meter can be classified in accordance with the requirements of ISO 7858-1.

9.1.3.5 Accelerated wear tests

The combination meter shall undergo an endurance test simulating service conditions, for example under the following conditions:

1) 1 bar = 10^5 Pa

a) test flow-rate: at least twice the change-over flow-rate, determined using increasing flow-rates;

b) type of test: discontinuous;

c) number of interruptions: 50 000;

d) duration of stop: 15 s;

e) duration of running at the test flow-rate: 15 s;

f) duration of acceleration and deceleration:

— minimum 3 s,

— maximum 6 s.

After the accelerated wear tests

a) the shift in the error curve shall not exceed 1,5 % between Q_t and Q_s or 3 % between Q_{min} and Q_t;

b) the maximum error of the meter after wear shall not exceed ± 6 % between Q_{min} and Q_t and ± 2,5 % between Q_t and Q_s.

The test methods and equipment shall be as specified in clause 7.

9.2 Initial verification

9.2.1 Definition

Initial verification means verifying that all the combination meters submitted conform to the approved model and to the standards and regulations in force.

The initial verification programme may authorize total or partial statistical control procedures.

The initial verification test programme and an alternative to this programme are described in 9.2.2.

9.2.2 Initial verification programme

The component meters shall have been submitted to initial verification tests conforming to the requirements of ISO 4064-3 unless the alternative programme as described in 9.2.2.5 is applied.

9.2.2.1 Tests to be carried out

Initial verification consists of (as a minimum):

a) in principle on all combination meters:

— pressure tests,

— determination of the measurement errors;

b) normally by sampling, as required by the inspector:

— a check that the combination meter conforms to the approved pattern,

— pressure-loss measurement.

9.2.2.2 Conformity with the approved model

Combination meters shall have the same technical characteristics (dimensions of the constituent parts, materials, surface finish etc.) as the approved model.

This check is normally carried out by sampling.

9.2.2.3 Pressure tests

Every combination meter shall withstand, without leakage or seepage through the walls, a pressure equal to 16 bar or 1,6 times the maximum permissible pressure.

9.2.2.4 Determination of the measurement errors

Test methods and equipment shall be as specified in clause 4.

The measurement errors of each combination meter shall be determined at not less than two flow-rates, of which one shall be within the change-over zone.

The flow-rates are chosen as a function of the characteristics of the measurement error curve of the model of the meter, in such a manner that it can be established with certainty that the maximum permissible errors are not exceeded.

The following tests in particular shall be carried out:

a) test for accuracy with increasing flow-rates before the change-over close to Q_{c2};

b) for accuracy with decreasing flow-rates according to 1) or 2):

1) at q_{t1} of the larger meter by using decreasing flow-rates if the transitional flow-rate Q_t of the combination meter is equal to the transitional flow-rate, q_{t2}, of the smaller meter (see ISO 7858-1) (see figure 2),

2) at q_{min1} of the larger meter by using decreasing flow-rates if the transitional flow-rate Q_t of the combination meter is equal to the transitional flow-rate, q_{t1}, of the larger meter (see ISO 7858-1) (see figure 3).

Test 1) or 2) shall be carried out to check that change-over has occurred:

above q_{t1} in the case of 1),

above q_{min1} in the case of 2),

and to inspect the leak-tightness of the change-over device.

The error shall be measured for the smaller meter only.

The requirements concerning the maximum permissible errors, the definition of the error, and the test flow-rate given in 9.1.3.3 shall apply.

Initial verification tests shall not be repeated. The meter is only declared satisfactory if, for each test flow-rate, the error determined does not exceed or is equal to the maximum permissible error.

9.2.2.5 Variant of the test programme described in 9.2.2.4

This variant is applicable when the larger component meter of the combination meter has not been submitted to the initial verification tests in accordance with ISO 4064-3. The following tests shall therefore be carried out in addition to the tests specified in 9.2.2.4 a) and b):

c) tests for accuracy at a flow-rate between Q_t and 1,1 Q_t (such a test is not required for combination meters having a transitional flow-rate Q_t equal to q_{t2} of the smaller meter);

d) test for accuracy at a flow-rate between 0,9 Q_s and Q_s;

e) test for accuracy at a flow-rate immediately greater than the change-over flow-rate, the latter being approached by using decreasing flow-rates.

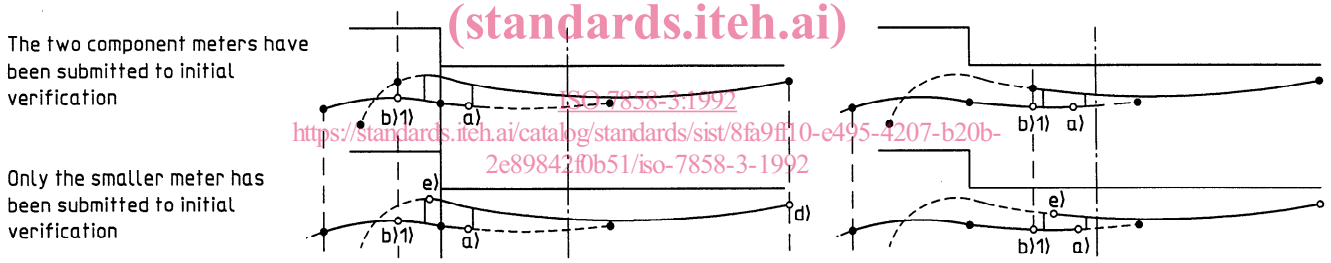
9.2.2.6 Pressure-loss tests

Test methods and equipment for the measurement of pressure loss shall be as specified in clause 6.

The value of the pressure loss shall be measured over the whole of the flow-rate range.

The value of the pressure loss shall conform to the pressure loss group of the approved model (see ISO 7858-1).

This check is normally carried out by sampling.



NOTES

1 Q_t is equal to the transitional flow-rate q_{t2} of the smaller meter. In this case change-over shall take place in such a way that the larger meter is never submitted to a flow-rate smaller than its transitional flow-rate q_{t1}.

2 The letters on the curves refer to 9.2.2.4 and 9.2.2.5; the meanings of the symbols and curves are as follows:

- O tests (flow-rates) described and specified in this part of ISO 7858;
- • tests (flow-rates) carried out previously on the component meters (see ISO 4064-3);
- —— error curves of the combination meter;
- - - - unused portions of the error curves of the component meters.

Figure 2 — Measurement error curves in the case where $Q_t = q_{t2}$