
British Standard

Measurement of flow of cold potable water in closed conduits

Part 3. Methods for determining principal characteristics of meters

[ISO title : Measurement of water flow in closed conduits — Meters for cold potable water —
Part 3 : Test methods and equipment]

Mesurage de débit de l'eau potable froide dans les conduites fermées
Partie 3. Méthodes de détermination des caractéristiques principales des compteurs

Messung der Durchflußmenge von kaltem Trinkwasser in geschlossenen Leitungen
Teil 3. Verfahren zur Bestimmung der Haupteigenschaften von Wassermessern

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National foreword

This British Standard has been prepared under the direction of the Industrial-process Measurement and Control Standards Committee and is identical with ISO 4064/3-1983 'Measurement of water flow in closed conduits — Meters for cold potable water — Part 3 : Test methods and equipment', published by the International Organization for Standardization (ISO).

Terminology and conventions. The text of the international standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following.

The comma has been used as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Where the words 'International Standard' appear, referring to this standard, they should be read as 'British Standard'. Where the words 'this part of ISO 4064' appear, referring to this standard, they should be read as 'this Part of BS 5728'.

Cross-references

International standards	Corresponding British Standards
ISO 228/1 - 1978	BS 2779 : 1973 Pipe threads where pressure-tight joints are not made on the threads (Technically equivalent)
ISO 4006 - 1977	BS 5875 : 1980 Glossary of terms and symbols for measurement of fluid flow in closed circuits (Identical)
ISO 4064/2 - 1978	BS 5728 Measurement of flow of cold potable water in closed conduits Part 2 : 1980 Specification for installation requirements for meters (Identical)

The Technical Committee has reviewed the provisions of ISO 4064/1, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard. A related standard is BS 5728 'Measurement of flow of cold potable water in closed conduits' Part 1 'Specification for meters'.

At present there is no corresponding British Standard for ISO 2084, to which reference is made for information only.

The OIML Vocabulary of legal metrology has been published by BSI as PD 6461 : 1981 'Vocabulary of legal metrology. Fundamental terms'.

Documents OIML/SP5/SR16 79 and 91, which are in course of preparation, and OIML Recommendation 49 constitute informative matter only.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Amendment No. 1
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Measurement of flow of cold potable water
in closed conduits
Part 3. Methods for determining principal
characteristics of meters

Revised text

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Title

On the front cover and at the top of page 1 delete the Part title and substitute the following:
 'Part 3. Methods for determining principal characteristics of single meters (including test equipment)'.

Delete the existing French and German part titles and substitute the following:

'Partie 1. Methodes de détermination des caractéristiques principales des compteurs individuels (y compris appareils d'essai).

Teil 1. Verfahren zur Bestimmung der Haupteigenschaften von Einfachzählern (einschließlich Prüfgeräte)'.

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National foreword

In paragraph 5, headed 'Cross references', against ISO 4064/2--1978 delete the existing entry and substitute the following:

'BS 5728 Measurement of flow of cold potable water in closed conduits
 Part 2 : 1980 Specification for installation requirements for single meters
 (Identical)'

In paragraph 6, beginning 'The Technical Committee', delete sentence 2 entirely and substitute the following:

'A related standard is BS 5728 'Measurement of flow of cold potable water in closed conduits' Part 1 'Specification for single meters'.'

British Standard

Measurement of flow of cold potable water in closed conduits

Part 3. Methods for determining principal characteristics of meters

0 Introduction

This International Standard is applicable to meters for cold potable water, as defined in clause 1 of ISO 4064/1.

ISO 4064/1 deals with terminology, technical and dimensional characteristics, metrological characteristics and pressure loss.

ISO 4064/2 deals with installation requirements.

1 Scope

This part of ISO 4064 specifies the test methods and means to be employed in determining the principal characteristics of water meters.

2 Field of application

Legal requirements take precedence over the specifications of this part of ISO 4064. In particular, it should be noted that in countries where legal requirements specify that the tests are to be carried out in accordance with the rules of the International Organization of Legal Metrology, for example for pattern approval and initial verification of water meters, OIML Recommendation 49 shall be followed.

3 References

ISO 228/1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1 : Designation, dimensions and tolerances*.

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

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

ISO 4064/1, *Measurement of water flow in closed conduits — Meters for cold potable water — Part 1 : Specification*.

ISO 4064/2, *Measurement of water flow in closed conduits — Meters for cold potable water — Part 2 : Installation requirements*.

OIML, *Vocabulary of legal metrology*.

OIML/SP 5/SR 16 Doc. 79¹⁾, *Installation and storage conditions for cold water meters*.

OIML/SP 5/SR 16 Doc. 91¹⁾, *The evaluation of flow standards and facilities used for testing water meters*.

4 Requirements common to all tests

4.1 Preliminary requirements

Before starting testing, a written test programme shall be compiled, and shall include, for example, a description of the tests for the determination of measurement error, pressure loss and wear resistance. The programme may also define the necessary levels of acceptability and stipulate how the test results should be interpreted.

Two of the most common forms of test programme, that is pattern approval and initial verification, are given in clause 10 by way of example.

1) At present at the stage of draft.

4.2 Water quality

Water meter tests shall be made with water. The water shall be that of the public potable water supply or shall meet the same requirements. If water is being recycled, measures shall be taken to prevent residual water in the meter from becoming harmful to human beings.

The water shall not contain anything capable of damaging the meter or adversely affecting its operation.

It shall not contain air bubbles.

4.3 General rules concerning the test installation and its location

4.3.1 Freedom from spurious influences

Test rigs shall be so designed, constructed and used that the performance of the rig itself shall not contribute significantly to test error. To this end, high standards of rig maintenance and adequate supports and fittings, preventing vibration of the meter, the test rig and its accessories, are necessary.

It shall be possible to carry out test readings rapidly and easily.

4.3.2 Group testing of meters

Meters are tested individually or in groups. In the latter case the individual characteristics shall be precisely determined. Interaction between meters, and between test rigs, shall be eliminated.

When meters are tested in series, the pressure at the exit of each shall be sufficient to prevent cavitation.

4.3.3 Temperature of the water during the tests

The results of the tests are acceptable without temperature correction provided that the water temperature in the meter is between 0 and 30 °C during the tests.

In no part of the test rig shall the temperature fall below 0 °C.

4.3.4 Location

During the tests, the location chosen for them shall be isolated from any other activity (for example, manufacture, repairs etc.) or disturbing influences (for example, ambient temperature, vibration).

5 Measurement error tests

The method described in this part of ISO 4064 to determine measurement errors is the so-called "collection" method in which the quantity of water passed through the water meter is collected in one or more collecting vessels and the quantity determined volumetrically or by weighing. Other methods may be used, provided the accuracy levels stated in this part of ISO 4064 are attained.

5.1 Principle

5.1.1 Nature of checks

The checking of the measurement error consists in comparing the indications given by the meter under test against a calibrated reference device.

5.1.2 Definitions

For the purpose of this part of ISO 4064, the following definitions apply.

5.1.2.1 measurement errors : Conventionally expressed as relative errors, calculated as a percentage, and equal to

$$\frac{V_i - V_c}{V_c} \times 100$$

where

V_c is the value accepted as true of the volume passed;

V_i is the volume indicated by the water meter at the time of measurement of the same volume, both expressed in the same units.

NOTE — ISO 4064/1 gives the maximum permissible errors.

5.1.2.2 test flowrate : The mean flowrate calculated from the indication of the calibrated reference device.

5.2 Description of the test rig

The test rig consists of

- a water supply (mains, non-pressurized tank, pressurized tank, pump, etc.);
- pipework;
- a calibrated reference device (calibrated tank, reference meter, etc.);
- means for measuring the time of the test.

Devices for automating the testing of water meters are permissible.

5.3 Pipework

5.3.1 Description

Pipework shall include

- a test section in which the meter(s) is (are) placed;
- means to establish the desired flowrate;
- one or two isolating devices;
- means for determining the flowrate;

and if necessary

- e) one or more air bleeds;
- f) a non-return device;
- g) an air separator;
- h) a filter.

During the test, flow leakage, flow input and flow drainage shall be permitted neither between the meter(s) and the reference device nor from the reference device.

The pipework shall be such that in the upper part of the meter a positive pressure exists of at least 0,05 bar (5 kPa) even at zero flowrate.

5.3.2 Test section

The test section includes, in addition to the meter(s)

- a) one or more pressure tapings for the measurement of pressure, of which one pressure tapping is situated upstream of, and close to, the (first) meter;
- b) if necessary, means for measuring the temperature of the water at the entry to the (first) meter.

The different devices placed in the measuring section shall not cause cavitation or flow disturbances capable of altering the performance of the meters or causing measurement errors.

5.3.3 Precautions to be taken during tests

The operation of the test rig shall be such that the quantity of water which has flowed through the meter(s) equals that measured by the reference device.

It shall be checked that pipes (for example the swan neck in the outlet pipe) are filled to the same extent at the beginning and at the end of the test.

Air shall be bled from the interconnecting pipework and the meter(s).

All precautions shall be taken to avoid the effects of vibration and shock.

5.3.4 Special arrangements for the installation of certain types of meter

5.3.4.1 Principles

The following reminder of the most frequent causes of error and the necessary precautions for the installation of water meters on the test bench is prompted by the recommendations of OIML Document 79, which aims to help achieve a test installation where

- a) the hydrodynamic flow characteristics cause no discernible difference to the meter functioning when compared with hydrodynamic flow characteristics which are undisturbed;
- b) the overall error of the method employed does not exceed the stipulated value (see 5.4.1).

5.3.4.2 Need for straight lengths of pipe or a flow straightener

The accuracy of the water meter can be affected by upstream disturbance caused for example by the presence of bends, tees, valves or pumps.

In order to counteract these effects, the meter shall be installed for test in a straight length. The connecting pipework shall have the same internal diameter as the hole in the connection of the meter. It may, moreover, be necessary to put a flow straightener upstream of the straight length.

5.3.4.3 Common causes of flow disturbance

A flow can be subject to two types of disturbance : velocity profile distortion and swirl, both of which affect the accuracy of the water meter.

Velocity profile distortion is typically caused by an obstruction partially blocking the pipe, for instance the presence of a partly closed valve or a misaligned flange joint. This can easily be eliminated.

Swirl is caused mainly by two or more bends in different planes. This effect can be controlled either by ensuring an adequate length of straight pipe upstream of the water meter, or by installing a straightening device, or by a combination of the two.

5.3.4.4 Volumetric water meters

Volumetric water meters (that is, involving measuring chambers with mobile walls), such as oscillating piston meters, are considered insensitive to upstream installation conditions; hence no special recommendations are required.

5.3.4.5 Velocity type water meters

Certain velocity type water meters are sensitive to flow disturbance which can cause significant errors, but the way installation conditions affect their accuracy has not yet been clearly determined. It is simply recommended to avoid, as far as possible, the presence of bends, pumps, taper pieces and changes in the diameter of pipework immediately upstream and to position the meter to afford the maximum possible straight length of pipe upstream and downstream.

5.3.5 Test commencement and termination errors

5.3.5.1 Principles

Adequate precautions shall be taken to reduce the uncertainties resulting from the operation of the test rig components during the test.

Details of the precautions to be taken are given in 5.3.5.2 and 5.3.5.3 for two cases encountered in the "collection" method.

5.3.5.2 Tests with readings taken with the meter at rest

The flow is established by opening a valve preferably situated downstream of the meter, and it is stopped by the closure of this valve. The meter is read whilst completely stationary.