SLOVENSKI STANDARD

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SIST EN ISO 5167-1:1997
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Merjenje pretoka fluida na osnovi tlaļne razlike, povzroļene z napravo, vstavljeno v polno zapolnjen vod s kroġnim prerezom ï 2. del: Zaslonke (ISO 5167-2:2003)

Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 2: Orifice plates (ISO 5167-2:2003)

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Durchflussmessung von Fluiden mit Drosselgeräten in voll durchströmten Leitungen mit Kreisquerschnitt - Teil 2: Blenden (ISO 5167-2:2003)

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Mesure de débit des fluides au moyen d'appareils déprimogènes insérés dans des conduites en charge de section circulaire - Partie 2: Diaphragmes (ISO 5167-2:2003)

Ta slovenski standard je istoveten z: **EN ISO 5167-2:2003**

ICS:

17.120.10	Pretok v zaprtih vodih	Flow in closed conduits

SIST EN ISO 5167-2:2004 **en**

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

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EUROPEAN STANDARD

NORME EUROPÉENNE

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EN ISO 5167-2

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Together with EN ISO 5167-1:2003, EN ISO 5167-3:2003 and EN ISO 5167-4:2003, supersedes EN ISO 5167-1:1995

English version

Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 2: Orifice plates (ISO 5167-2:2003)

Mesure de débit des fluides au moyen d'appareils déprimogènes insérés dans des conduites en charge de section circulaire - Partie 2: Diaphragmes (ISO 5167-2:2003)

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This European Standard was approved by CEN on 20 February 2003.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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CORRECTED 2003-09-03

Foreword

This document (EN ISO 5167-2:2003) has been prepared by Technical Committee ISO/TC 30 "Measurement of fluid flow in closed conduits" in collaboration with CMC.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2003, and conflicting national standards shall be withdrawn at the latest by September 2003.

This document, together with EN ISO 5167-1:2003, EN ISO 5167-3:2003 and EN ISO 5167-4:2003, supersedes EN ISO 5167-1:1995.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

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Endorsement notice

The text of ISO 5167-2:2003 has been approved by CEN as EN ISO 5167-2:2003 without any modifications.

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NOTE Normative references to International Standards are listed in Annex ZA (normative).

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Annex ZA
(normative)

Normative references to international publications with their relevant European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE Where an International Publication has been modified by common modifications, indicated by (mod.), the relevant EN/HD applies.

Publication	Year	Title	EN	Year
ISO 4006	1991	Measurement of fluid flow in closed conduits - Vocabulary and symbols	EN 24006	1993
ISO 5167-1	1991	Measurement of fluid flow by means of pressure differential devices - Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full	EN ISO 5167-1	1995

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INTERNATIONAL STANDARD

ISO 5167-2

First edition
2003-03-01

Measurement of fluid flow by means of pressure differential devices inserted in circular-cross section conduits running full —

Part 2: **Orifice plates**

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Mesure de débit des fluides au moyen d'appareils déprimogènes insérés dans des conduites en charge de section circulaire —

Partie 2: Diaphragmes

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 5167-2 was prepared by Technical Committee ISO/TC 30, *Measurement of fluid flow in closed conduits*, Subcommittee SC 2, *Pressure differential devices*.

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This first edition of ISO 5167-2, together with the second edition of ISO 5167-1 and the first editions of ISO 5167-3 and ISO 5167-4, cancels and replaces the first edition of ISO 5167-1:1991, which has been technically revised, and ISO 5167-1:1991/Amd.1:1998.

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ISO 5167 consists of the following parts, under the general title *Measurement of fluid flow by means of pressure differential devices inserted in circular-cross section conduits running full*:

— *Part 1: General principles and requirements*

— *Part 2: Orifice plates*

— *Part 3: Nozzles and Venturi nozzles*

— *Part 4:Venturi tubes*

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Introduction

ISO 5167, consisting of four parts, covers the geometry and method of use (installation and operating conditions) of orifice plates, nozzles and Venturi tubes when they are inserted in a conduit running full to determine the flowrate of the fluid flowing in the conduit. It also gives necessary information for calculating the flowrate and its associated uncertainty.

ISO 5167 (all parts) is applicable only to pressure differential devices in which the flow remains subsonic throughout the measuring section and where the fluid can be considered as single-phase, but is not applicable to the measurement of pulsating flow. Furthermore, each of these devices can only be used within specified limits of pipe size and Reynolds number.

ISO 5167 (all parts) deals with devices for which direct calibration experiments have been made, sufficient in number, spread and quality to enable coherent systems of application to be based on their results and coefficients to be given with certain predictable limits of uncertainty.

The devices introduced into the pipe are called “primary devices”. The term primary device also includes the pressure tappings. All other instruments or devices required for the measurement are known as “secondary devices”. ISO 5167 (all parts) covers primary devices; secondary devices[1] will be mentioned only occasionally.

ISO 5167 consists of the following four parts.

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a) ISO 5167-1 gives general terms and definitions, symbols, principles and requirements as well as methods of measurement and uncertainty that are to be used in conjunction with ISO 5167-2, ISO 5167-3 and ISO 5167-4.

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b) ISO 5167-2 specifies orifice plates, which can be used with corner pressure tappings, D and $D/2$ pressure tappings[2], and flange pressure tappings.

c) ISO 5167-3 specifies ISA 1932 nozzles[3], long radius nozzles and Venturi nozzles, which differ in shape and in the position of the pressure tappings.

d) ISO 5167-4 specifies classical Venturi tubes[4].

Aspects of safety are not dealt with in Parts 1 to 4 of ISO 5167. It is the responsibility of the user to ensure that the system meets applicable safety regulations.

1) See ISO 2186:1973, *Fluid flow in closed conduits — Connections for pressure signal transmissions between primary and secondary elements*.

2) Orifice plates with “vena contracta” pressure tappings are not considered in ISO 5167.

3) ISA is the abbreviation for the International Federation of the National Standardizing Associations, which was succeeded by ISO in 1946.

4) In the USA, the classical Venturi tube is sometimes called the Herschel Venturi tube.

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Measurement of fluid flow by means of pressure differential devices inserted in circular-cross section conduits running full —

Part 2: Orifice plates

1 Scope

This part of ISO 5167 specifies the geometry and method of use (installation and operating conditions) of orifice plates when they are inserted in a conduit running full to determine the flowrate of the fluid flowing in the conduit.

This part of ISO 5167 also provides background information for calculating the flowrate and is applicable in conjunction with the requirements given in ISO 5167-1.

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This part of ISO 5167 is applicable to primary devices having an orifice plate used with flange pressure tappings, or with corner pressure tappings, or with D and $D/2$ pressure tappings. Other pressure tappings such as "vena contracta" and pipe tappings have been used with orifice plates but are not covered by this part of ISO 5167. This part of ISO 5167 is applicable only to a flow which remains subsonic throughout the measuring section and where the fluid can be considered as single phase. It is not applicable to the measurement of pulsating flow. It does not cover the use of orifice plates in pipe sizes less than 50 mm or more than 1 000 mm, or for pipe Reynolds numbers below 5 000.

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2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4006:1991, *Measurement of fluid flow in closed conduits — Vocabulary and symbols*

ISO 5167-1:2003, *Measurement of fluid flow by means of pressure differential devices inserted in circular-cross section conduits running full — Part 1: General principles and requirements*

3 Terms, definitions and symbols

For the purposes of this document, the terms, definitions and symbols given in ISO 4006 and ISO 5167-1 apply.

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4 Principles of the method of measurement and computation

The principle of the method of measurement is based on the installation of an orifice plate into a pipeline in which a fluid is running full. The presence of the orifice plate causes a static pressure difference between the upstream and downstream sides of the plate. The mass flowrate, q_m, can be determined using Equation (1):

$$q_m = \frac{C}{\sqrt{1-\beta^4}} \varepsilon \frac{\pi}{4} d^2 \sqrt{2 \Delta p \rho_1} \quad (1)$$

The uncertainty limits can be calculated using the procedure given in Clause 8 of ISO 5167-1:2003.

Computation of the mass flowrate, which is a purely arithmetic process, can be performed by replacing the different terms on the right hand side of the basic Equation (1) by their numerical values.

Similarly, the value of volume flowrate, q_V, is calculated from:

$$q_V = \frac{q_m}{\rho} \quad (2)$$

where ρ is the fluid density at the temperature and pressure for which the volume is stated.

As will be seen later in this part of ISO 5167, the coefficient of discharge, C, is dependent on the Reynolds number, Re, which is itself dependent on q_m, and has to be obtained by iteration (see Annex A of ISO 5167-1:2003 for guidance regarding the choice of the iteration procedure and initial estimates).

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The diameters d and D mentioned in the formula are the values of the diameters at working conditions. Measurements taken at any other conditions should be corrected for any possible expansion or contraction of the orifice plate and the pipe due to the values of the temperature and pressure of the fluid during the measurement.

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It is necessary to know the density and the viscosity of the fluid at the working conditions. In the case of a compressible fluid, it is also necessary to know the isentropic exponent of the fluid at working conditions.

5 Orifice plates

NOTE 1 The various types of standard orifice meters are similar and therefore only a single description is needed. Each type of standard orifice meter is characterized by the arrangement of the pressure tappings.

NOTE 2 Limits of use are given in 5.3.1.

5.1 Description

5.1.1 General

The axial plane cross-section of a standard orifice plate is shown in Figure 1.

The letters given in the following text refer to the corresponding references in Figure 1.

5.1.2 General shape

5.1.2.1 The part of the plate inside the pipe shall be circular and concentric with the pipe centreline. The faces of the plate shall always be flat and parallel.

5.1.2.2 Unless otherwise stated, the following requirements apply only to that part of the plate located within the pipe.

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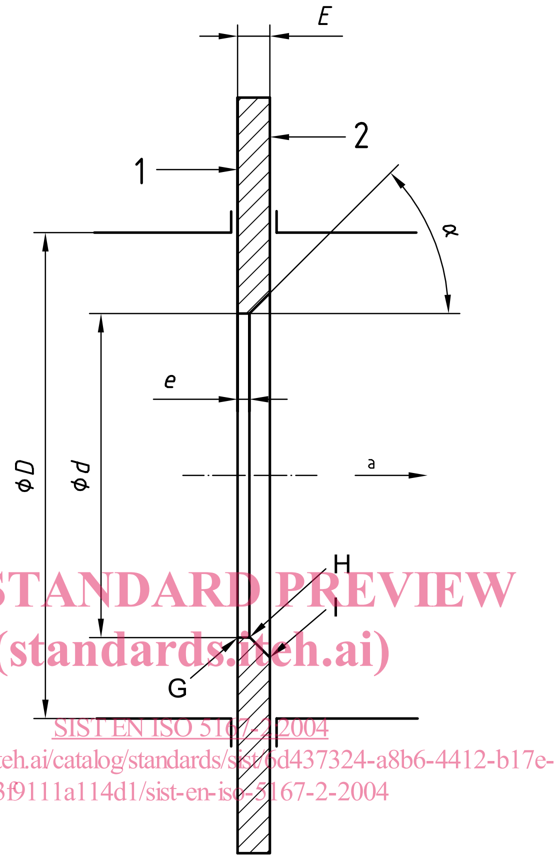
5.1.2.3 Care shall be taken in the design of the orifice plate and its installation to ensure that plastic buckling and elastic deformation of the plate, due to the magnitude of the differential pressure or of any other stress, do not cause the slope of the straight line defined in 5.1.3.1 to exceed 1 % under working conditions.

NOTE Further information is given in 8.1.1.3 of ISO/TR 9464:1998.



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Key

1 upstream face A

2 downstream face B

a Direction of flow.

Figure 1 — Standard orifice plate

5.1.3 Upstream face A

5.1.3.1 The upstream face A of the plate shall be flat when the plate is installed in the pipe with zero differential pressure across it. Provided that it can be shown that the method of mounting does not distort the plate, this flatness may be measured with the plate removed from the pipe. Under these circumstances, the plate may be considered to be flat when the maximum gap between the plate and a straight edge of length D laid across any diameter of the plate (see Figure 2) is less than $0{,}005(D - d)/2$, i.e. the slope is less than 0,5 % when the orifice plate is examined prior to insertion into the meter line. As can be seen from Figure 2, the critical area is in the vicinity of the orifice bore. The uncertainty requirements for this dimension can be met using feeler gauges.

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