

---

---

**Measurement of fluid flow by means  
of pressure-differential devices —  
Guidelines for the specification of  
orifice plates, nozzles and Venturi  
tubes beyond the scope of ISO 5167  
series**

*Mesurage du débit des fluides au moyen d'appareils déprimogènes —  
Lignes directrices pour la spécification des diaphragmes, des tuyères  
et des tubes de Venturi non couverts par la série de l'ISO 5167*



This document is a preview generated by EUS



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

Page

Foreword.....	iv
<b>1 Scope.....</b>	<b>1</b>
<b>2 Normative references.....</b>	<b>1</b>
<b>3 Terms and definitions.....</b>	<b>1</b>
<b>4 Symbols.....</b>	<b>1</b>
<b>5 Square-edged orifice plates and nozzles: with drain holes, in pipes below 50 mm diameter, and as inlet and outlet devices.....</b>	<b>3</b>
5.1 Drain holes through the upstream face of the square-edged orifice plate or nozzle.....	3
5.1.1 General.....	3
5.1.2 Square-edged orifice plates.....	3
5.1.3 ISA 1932 nozzles.....	5
5.1.4 Long radius nozzles.....	5
5.2 Square-edged orifice plates installed in pipes of diameter $25 \text{ mm} \leq D < 50 \text{ mm}$ .....	5
5.2.1 General.....	5
5.2.2 Limits of use.....	5
5.2.3 Discharge coefficients and corresponding uncertainties.....	6
5.3 No upstream or downstream pipeline.....	6
5.3.1 General.....	6
5.3.2 Flow from a large space (no upstream pipeline) into a pipeline or another large space.....	6
5.3.3 Flow into a large space (no downstream pipeline).....	8
<b>6 Orifice plates (except square-edged).....</b>	<b>9</b>
6.1 Conical entrance orifice plates.....	9
6.1.1 General.....	9
6.1.2 Limits of use.....	9
6.1.3 Description.....	10
6.1.4 Pressure tapplings.....	13
6.1.5 Coefficients and corresponding uncertainties.....	13
6.2 Quarter-circle orifice plates.....	14
6.2.1 General.....	14
6.2.2 Limits of use.....	14
6.2.3 Description.....	15
6.2.4 Pressure tapplings.....	18
6.2.5 Coefficients and corresponding uncertainties.....	18
6.3 Eccentric orifice plates.....	20
6.3.1 General.....	20
6.3.2 Limits of use.....	20
6.3.3 Description.....	20
6.3.4 Coefficients and corresponding uncertainties.....	23
<b>7 Venturi tubes with machined convergent of angle <math>10,5^\circ</math>.....</b>	<b>25</b>
7.1 General.....	25
7.2 Description.....	25
7.3 Limits of use.....	25
7.4 Discharge coefficient.....	26
7.5 Expansibility [expansion] factor.....	26
7.6 Pressure loss.....	26
7.7 Installation straight lengths.....	26
<b>Annex A (informative) An example of the calculations in <a href="#">5.1.2</a>.....</b>	<b>28</b>
<b>Bibliography.....</b>	<b>31</b>

## 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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at [www.iso.org/patents](http://www.iso.org/patents). ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

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

This fourth edition cancels and replaces the third edition (ISO/TR 15377:2018), which has been technically revised.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

# Measurement of fluid flow by means of pressure-differential devices — Guidelines for the specification of orifice plates, nozzles and Venturi tubes beyond the scope of ISO 5167 series

## 1 Scope

This document describes the geometry and method of use for conical-entrance orifice plates, quarter-circle orifice plates, eccentric orifice plates and Venturi tubes with 10,5° convergent angles. Information is also given for square-edged orifice plates and nozzles under conditions outside the scope of ISO 5167 series.

NOTE The data on which this document is based are limited in some cases.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *Measurement of fluid flow in closed conduits — Vocabulary and symbols*

ISO 5167-1, *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 and definitions

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

## 4 Symbols

For the purposes of this document, the symbols given in [Table 1](#) apply.

Table 1 — Symbols

Symbols	Represented quantity	Dimensions M: mass L: length T: time	SI unit
$a$	Orifice plate pressure-tapping hole diameter	L	m
$C$	Discharge coefficient	dimensionless	
$d$	Diameter of orifice (or throat) of primary device under working conditions <sup>a</sup>	L	m
$d_k$	Measured drain hole diameter	L	m

<sup>a</sup> In applications with drain holes,  $d$  is calculated from the measured values  $d_m$  and  $d_k$  [see [Formulae \(1\)](#) and [\(11\)](#)].

NOTE 1 Other symbols used in this document are defined at their place of use.

NOTE 2 Subscript 1 refers to the cross-section at the plane of the upstream pressure tapping. Subscript 2 refers to the cross-section at the plane of the downstream pressure tapping.