



NSAI
Standards

Irish Standard
I.S. EN 60534-2-3:2016

Industrial-process control valves - Part 2-3: Flow capacity - Test procedures

I.S. EN 60534-2-3:2016

Incorporating amendments/corrigenda/National Annexes issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on:

EN 60534-2-3:2016

Published:

2016-04-08

*This document was published
under the authority of the NSAI
and comes into effect on:*

2016-04-26

ICS number:

23.060.40

25.040.40

NOTE: If blank see CEN/CENELEC cover page

NSAI
1 Swift Square,
Northwood, Santry
Dublin 9

T +353 1 807 3800
F +353 1 807 3838
E standards@nsai.ie
W NSAI.ie

Sales:
T +353 1 857 6730
F +353 1 857 6729
W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

National Foreword

I.S. EN 60534-2-3:2016 is the adopted Irish version of the European Document EN 60534-2-3:2016, Industrial-process control valves - Part 2-3: Flow capacity - Test procedures

This document does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with this document does not of itself confer immunity from legal obligations.

In line with international standards practice the decimal point is shown as a comma (,) throughout this document.

This page is intentionally left blank

EUROPEAN STANDARD

EN 60534-2-3

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2016

ICS 23.060.40; 25.040.40

Supersedes EN 60534-2-3:1998

English Version

**Industrial-process control valves -
Part 2-3: Flow capacity - Test procedures
(IEC 60534-2-3:2015)**

Vannes de régulation des processus industriels -
Partie 2-3: Capacité d'écoulement - Procédures d'essais
(IEC 60534-2-3:2015)

Stellventile für die Prozessregelung -
Teil 2-3: Durchflusskapazität - Prüfverfahren
(IEC 60534-2-3:2015)

This European Standard was approved by CENELEC on 2016-01-20. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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 CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

EN 60534-2-3:2016

European foreword

The text of document 65B/1025/FDIS, future edition 3 of IEC 60534-2-3, prepared by SC 65B "Measurement and control devices" of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60534-2-3:2016.

The following dates are fixed:

- latest date by which the document has to be (dop) 2016-10-20
implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2019-01-20
standards conflicting with the
document have to be withdrawn

This document supersedes EN 60534-2-3:1998.

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

Endorsement notice

The text of the International Standard IEC 60534-2-3:2015 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 60751:2008 NOTE Harmonized as EN 60751:2008 (not modified).

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60534-1	-	Industrial-process control valves - Part 1: Control valve terminology and general considerations	EN 60534-1	-
IEC 60534-2-1	2011	Industrial-process control valves - Part 2-1: Flow capacity - Sizing equations for fluid flow under installed conditions	EN 60534-2-1	2011
IEC 60534-8-2	-	Industrial-process control valves - Part 8-2: Noise considerations - Laboratory measurement of noise generated by hydrodynamic flow through control valves	EN 60534-8-2	-
IEC 61298-1	-	Process measurement and control devices - General methods and procedures for evaluating performance - Part 1: General considerations	EN 61298-1	-
IEC 61298-2	-	Process measurement and control devices - General methods and procedures for evaluating performance - Part 2: Tests under reference conditions	EN 61298-2	-

This page is intentionally left blank



IEC 60534-2-3

Edition 3.0 2015-12

INTERNATIONAL STANDARD



**Industrial-process control valves –
Part 2-3: Flow capacity – Test procedures**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2015 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 60 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.



IEC 60534-2-3

Edition 3.0 2015-12

INTERNATIONAL STANDARD



Industrial-process control valves – Part 2-3: Flow capacity – Test procedures

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 23.060.40; 25.040.40

ISBN 978-2-8322-3055-8

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	4
1 Scope	6
2 Normative references	6
3 Terms and definitions	6
4 Symbols	7
5 Test system	8
5.1 Test specimen	8
5.2 Test section	8
5.3 Throttling valves	9
5.4 Flow measurement.....	10
5.5 Pressure taps	10
5.6 Pressure measurement	10
5.7 Temperature measurement	10
5.8 Valve travel.....	11
5.9 Installation of test specimen.....	11
6 Accuracy of tests	12
7 Test fluids.....	12
7.1 Incompressible fluids	12
7.2 Compressible fluids	12
8 Test procedure for incompressible fluids.....	12
8.1 Test procedure for flow coefficient C	12
8.2 Test procedure for liquid pressure recovery factor F_L and combined liquid pressure recovery factor and piping geometry factor F_{LP}	14
8.3 Test procedure for piping geometry factor F_P	15
8.4 Test procedure for liquid critical pressure ratio factor F_F	15
8.5 Test procedure for Reynolds number factor F_R for incompressible flow	15
8.6 Test procedure for valve style modifier F_d	15
9 Data evaluation procedure for incompressible fluids	16
9.1 Non-choked flow	16
9.2 Choked flow	16
9.3 Calculation of flow coefficient C	17
9.4 Calculation of liquid pressure recovery factor F_L and the combined liquid pressure recovery factor and piping geometry factor F_{LP}	17
9.5 Calculation of piping geometry factor F_P	18
9.6 Calculation of liquid critical pressure ratio factor F_F	18
9.7 Calculation of Reynolds number factor F_R	18
9.8 Calculation of valve style modifier F_d	18
10 Test procedure for compressible fluids	19
10.1 Test procedure for flow coefficient C	19
10.2 Test procedure for pressure differential ratio factors x_T and x_{TP}	20
10.3 Test procedure for piping geometry factor F_P	21
10.4 Test procedure for Reynolds number factor F_R	22
10.5 Test procedure for valve style modifier F_d	22
10.6 Test procedure for small flow trim	22
11 Data evaluation procedure for compressible fluids	23

11.1	Flow equation	23
11.2	Calculation of flow coefficient C	23
11.3	Calculation of pressure differential ratio factor x_T	23
11.4	Calculation of pressure differential ratio factor x_{TP}	24
11.5	Calculation of piping geometry factor F_P	24
11.6	Calculation of Reynolds number factor F_R for compressible fluids	24
11.7	Calculation of valve style modifier F_d	24
11.8	Calculation of flow coefficient C for small flow trim	24
Annex A (normative) Typical examples of test specimens showing appropriate pressure tap locations		26
Annex B (informative) Engineering data		28
Annex C (informative) Derivation of the valve style modifier, F_d		31
Annex D (informative) Laminar flow test discussion		35
Annex E (informative) Long form F_L test procedure		36
E.1	General	36
E.2	Test procedure	36
E.3	Graphical data reduction	36
Annex F (informative) Calculation of F_P to help determine if pipe/valve port diameters are adequately matched		39
Bibliography		41
Figure 1 – Basic flow test system		8
Figure 2 – Test section piping requirements		9
Figure 3 – Recommended pressure tap connection		11
Figure A.1 – Typical examples of test specimens showing appropriate pressure tap locations		27
Figure B.1 – Dynamic viscosity of water		28
Figure C.1 – Single seated, parabolic plug (flow tending to open)		34
Figure C.2 – Swing-through butterfly valve		34
Figure E.1 – Typical flow results		37
Table 1 – Test specimen alignment		11
Table 2 – Minimum inlet absolute test pressure in kPa (bar) as related to F_L and Δp		13
Table 3 – Numerical constants N		25
Table B.1 – Properties for water		28
Table B.2 – Properties of air		29
Table B.3 – Test section piping		30
Table C.1 – Numerical constant, N		34
Table F.1 – Tabulated values of F_P if upstream and downstream pipe the same size		40
Table F.2 – Tabulated values of F_P if downstream pipe larger than valve		40

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INDUSTRIAL-PROCESS CONTROL VALVES –

Part 2-3: Flow capacity – Test procedures

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60534-2-3 has been prepared by subcommittee 65B: Measurement and control devices, of IEC technical committee 65: Industrial-process measurement, control and automation.

The third edition cancels and replaces the second edition published in 1997, of which it constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Addition of informative Annexes B, C, D, E and F.
- b) Organizational and formatting changes were made to group technically related subject matter.

The text of this standard is based on the following documents:

FDIS	Report on voting
65B/1025/FDIS	65B/1028/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60534 series, published under the general title *Industrial-process control valves*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INDUSTRIAL-PROCESS CONTROL VALVES –

Part 2-3: Flow capacity – Test procedures

1 Scope

This part of IEC 60534 is applicable to industrial-process control valves and provides the flow capacity test procedures for determining the following variables used in the equations given in IEC 60534-2-1:

- a) flow coefficient C ;
- b) liquid pressure recovery factor without attached fittings F_L ;
- c) combined liquid pressure recovery factor and piping geometry factor of a control valve with attached fittings F_{LP} ;
- d) piping geometry factor F_P ;
- e) pressure differential ratio factors x_T and x_{TP} ;
- f) valve style modifier F_d ;
- g) Reynolds number factor F_R .

2 Normative references

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

IEC 60534-1, *Industrial-process control valves – Part 1: Control valve terminology and general considerations*

IEC 60534-2-1:2011, *Industrial-process control valves – Part 2-1: Flow capacity – Sizing equations for fluid flow under installed conditions*

IEC 60534-8-2, *Industrial-process control valves – Part 8-2: Noise considerations – Laboratory measurement of noise generated by hydrodynamic flow through control valves*

IEC 61298-1, *Process measurement and control devices – General methods and procedures for evaluating performance – Part 1: General considerations*

IEC 61298-2, *Process measurement and control devices – General methods and procedures for evaluating performance – Part 2: Tests under reference conditions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60534-1, IEC 60534-2-1, IEC 61298-1, and IEC 61298-2 apply.

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

-
- Looking for additional Standards? Visit Intertek Inform Infostore
 - Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation
-