

Industrial-process control valves —

Part 2-3: Flow capacity — Test procedures

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British Standard

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National foreword

This British Standard is the English language version of EN 60534-2-3:1998. It is identical with IEC 60534-2-3:1997. It supersedes BS EN 60534-2-3:1993 which will be withdrawn on 1998-10-01.

The UK participation in its preparation was entrusted by Technical Committee GEL/65, Measurement and control, to Subcommittee GEL/65/2, Elements of systems, which has the responsibility to:

- aid enquirers to understand the text;
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From 1 January 1997, all IEC publications have the number 60000 added to the old number. For instance, IEC 27-1 has been renumbered as IEC 60027-1. For a period of time during the change over from one numbering system to the other, publications may contain identifiers from both systems.

Cross-references

Attention is drawn to the fact that CEN and CENELEC standards normally include an annex which lists normative references to international publications with their corresponding European publications. The British Standards which implement these international or European publications may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 20 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Amendments issued since publication

Amd. No.	Date	Comments

This British Standard, having been prepared under the direction of the Electrotechnical Sector Board, was published under the authority of the Standards Board and comes into effect on 15 June 1998

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English version

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

(IEC 60534-2-3:1997)

Vannes de régulation des processus industriels
Partie 2-3: Capacité d'écoulement —
Procédures d'essais
(CEI 60534-2-3:1997)

Stellventile für die Prozeßregelung
Teil 2-3: Durchflußkapazität —
Prüfverfahren
(IEC 60534-2-3:1997)

This European Standard was approved by CENELEC on 1998-01-01. 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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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CENELEC

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

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Foreword

The text of document 65B/319/FDIS, future edition 2 of IEC 60534-2-3, prepared by SC 65B, Devices, of IEC TC 65, Industrial-process measurement and control, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60534-2-3 on 1998-01-01.

This European Standard supersedes EN 60534-2-3:1993.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1998-10-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1998-10-01

Annexes designated “normative” are part of the body of the standard.

In this standard, Annex A and Annex ZA are normative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60534-2-3:1997 was approved by CENELEC as a European Standard without any modification.

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1 Scope

This section of IEC 60534-2 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 and IEC 60534-2-2:

- 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 normative documents contain provisions which, through reference in this text, constitute provisions of this section of IEC 60534-2. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this section of IEC 60534-2 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60534-1:1987, *Industrial-process control valves — Part 1: Control valve terminology and general considerations*.

IEC 60534-2:1978, *Industrial-process control valves — Part 2: Flow capacity — Section 1: Sizing equations for incompressible fluid flow under installed conditions*.

IEC 60534-2-2:1980, *Industrial-process control valves — Part 2: Flow capacity — Section 2: Sizing equations for compressible fluid flow under installed conditions*.

IEC 60534-8-2:1991, *Industrial-process control valves — Part 8: Noise considerations — Section 2: Laboratory measurement of noise generated by hydrodynamic flow through control valves*.

IEC 61298-1:1995, *Process measurement and control devices — General methods and procedures for evaluating performance — Part 1: General considerations*.

IEC 61298-2:1995, *Process measurement and control devices — General methods and procedures for evaluating performance — Part 2: Tests under reference conditions*.

3 Definitions

For the purpose of this section of IEC 60534-2, the definitions given in IEC 60534-1, IEC 60534-2, IEC 60534-2-2, IEC 61298-1, and IEC 61298-2 apply.

4 Symbols

Symbol	Description	Unit
C	Flow coefficient (K_v , C_v)	Various (see IEC 60534-1)
C_R	Flow coefficient at rated travel	Various (see IEC 60534-1)
d	Nominal valve size (DN)	mm
F_d	Valve style modifier	1
F_F	Liquid critical pressure ratio factor	1
F_L	Liquid pressure recovery factor of a control valve without attached fittings	1
F_{LP}	Combined liquid pressure recovery factor and piping geometry factor of a control valve with attached fittings	1
F_p	Piping geometry factor	1
F_R	Reynolds number factor	1
F_Y	Specific heat ratio factor	1
M	Molecular mass of flowing fluid	kg/kmol
N	Numerical constants (see Table 3)	Various (see note 1)
p_c	Thermodynamic critical pressure	kPa or bar (see note 2)
p_v	Vapour pressure of liquid at inlet temperature	kPa or bar
p_1	Inlet absolute static pressure measured at the upstream pressure tap	kPa or bar
p_2	Outlet absolute static pressure measured at the downstream pressure tap	kPa or bar
Δp	Differential pressure ($p_1 - p_2$) between upstream and downstream pressure taps	kPa or bar
$\Delta p_{\max}$	Maximum pressure differential	kPa or bar
$\Delta p_{\max(L)}$	Maximum effective Δp without attached fittings	kPa or bar
$\Delta p_{\max(LP)}$	Maximum effective Δp with attached fittings	kPa or bar
Q	Volumetric flow rate	m ³ /h (see note 3)
$Q_{\max}$	Maximum volumetric flow rate (choked flow conditions)	m ³ /h
$Q_{\max(L)}$	Maximum volumetric flow rate for incompressible fluids (choked flow conditions without attached fittings)	m ³ /h
$Q_{\max(LP)}$	Maximum volumetric flow rate for incompressible fluids (choked flow conditions with attached fittings)	m ³ /h
$Q_{\max(T)}$	Maximum volumetric flow rate for compressible fluids (choked flow conditions without attached fittings)	m ³ /h
$Q_{\max(TP)}$	Maximum volumetric flow rate for compressible fluids (choked flow conditions with attached fittings)	m ³ /h
Re_v	Valve Reynolds number	1
T_1	Inlet absolute temperature	K
t_s	Reference temperature for standard conditions	°C
x	Ratio of pressure differential to inlet absolute pressure ($\Delta p/p_1$)	1
x_T	Pressure differential ratio factor of a control valve without attached fittings for choked flow	1
x_{TP}	Pressure differential ratio factor of a control valve with attached fittings for choked flow	1
Y	Expansion factor	1
Z	Compressibility factor ($Z = 1$ for gases that exhibit ideal gas behaviour)	1
γ	Specific heat ratio	1
ν	Kinematic viscosity	m ² /s (see note 4)
ζ	Velocity head loss coefficient of a reducer, expander or other fitting attached to a control valve	1
ρ_1/ρ_0	Relative density ($\rho_1/\rho_0 = 1$ for water at 15,5 °C)	1

NOTE 1 To determine the units for the numerical constants, dimensional analysis may be performed on the appropriate equations using the units given in Table 3.

NOTE 2 1 bar = 10² kPa = 10⁵ pa.

NOTE 3 For compressible fluid volumetric flow rates in m³/h, identified by the symbol Q , refer to standard conditions which are an absolute pressure of 101,325 kPa (1,013 25 bar) and a temperature of either 0 °C or 15 °C (see Table 3).

NOTE 4 1 centistoke = 10⁻⁶ m²/s.