SLOVENSKI STANDARD

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

ICS 23.060.40; 25.040.40

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ENGLISH VERSION

Industrial-process control valves
Part 2: Flow capacity - Section One: Sizing equations for incompressible fluid flow under installed conditions
(IEC 534-2-1:1978)

Vannes de régulation des processus industriels
Deuxième partie: Capacité d'écoulement - Section un: Equations de dimensionnement des vannes de régulation pour l'écoulement des fluides incompressibles dans les conditions d'installation
(CEI 534-2-1:1978)

Stellventile für die Prozeßregelung
Teil 2: Durchflußkapazität
Hauptabschnitt eins: Gleichungen für die Bemessung von Stellventilen für inkompressiblen Flüssigkeitsdurchfluß
(IEC 534-2-1:1978)

This European Standard was approved by CENELEC on 1992-12-09. 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.

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CENELEC

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

Central Secretariat: rue de Stassart 35, B-1050 Brussels

FOREWORD

The CENELEC questionnaire procedure, performed for finding out whether or not the International Standard IEC 534-2-1:1978 could be accepted without textual changes, has shown that no common modifications were necessary for the acceptance as European Standard.

The reference document was submitted to the CENELEC members for formal vote and was approved by CENELEC as EN 60534-2-1 on 9 December 1992.

The following dates were fixed:

- latest date of publication of an identical national standard	(dop)	1993-12-01
- latest date of withdrawal of conflicting national standards	(dow)	1993-12-01

For products which have complied with the relevant national standard before 1993-12-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1998-12-01.

ENDORSEMENT NOTICE

The text of the International Standard IEC 534-2-1:1978 was approved by CENELEC as a European Standard without any modification.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC STANDARD

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Vannes de régulation des processus industriels

Deuxième partie: Capacité d'écoulement

Section un — Equations de dimensionnement des vannes de régulation pour l'écoulement des fluides incompressibles dans les conditions d'installation

Industrial-process control valves

Part 2: Flow capacity

Section One — Sizing equations for incompressible fluid flow under installed conditions

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.

3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by Sub-Committee 65B, Elements of Systems, of IEC Technical Committee No. 65, Industrial-process Measurement and Control.

A first draft was discussed at the meeting held in Moscow in 1975. A revised draft, Document 65B(Central Office)10, was submitted to the National Committees for approval under the Six Months' Rule in February 1976.

The following countries voted explicitly in favour of publication:

Belgium
Bulgaria
Canada
Egypt
France
Germany
Hungary
Japan
Poland
Romania
South Africa (Republic of)
Switzerland
Turkey
United Kingdom
Yugoslavia

This standard is Part 2, Section One, of IEC Publication 534, Industrial-process Control Valves. Part 1, General Considerations, applies in general. Appropriate clauses of Part 2, Section Three, Control Valve Capacity Test Procedures for Incompressible and Compressible Fluids (under consideration) apply completely.

Part 1 is a general reference for this standard, except that Clause 3 of this standard supersedes Clause 5 of Part 1.

INDUSTRIAL-PROCESS CONTROL VALVES

Part 2: Flow capacity

SECTION ONE — SIZING EQUATIONS FOR INCOMPRESSIBLE FLUID FLOW UNDER INSTALLED CONDITIONS

1. Scope

The equations presented in this section of the standard are based on the Bernoulli equation for Newtonian incompressible fluids. They are not intended for use when non-Newtonian fluids, fluid mixtures, slurries, or liquid-solid conveyance systems are encountered.

2. Definitions

All of the definitions given in Clause 2 of IEC Publication 534-1 shall apply with the addition of the following:

2.1 *Choked flow*

A limiting, or maximum, flow condition that occurs as a result of vaporization of the liquid flowing within the valve.

Note. — With fixed inlet (upstream) conditions, it is manifested by the failure of increasing pressure differentials to produce further increases in the flow rate. Choked flow will be accompanied by either cavitation or flashing. If the downstream pressure is greater than the liquid vapour pressure, cavitation occurs. Flashing occurs if the downstream pressure is equal to or less than the liquid vapour pressure.

2.2 *Fitting*

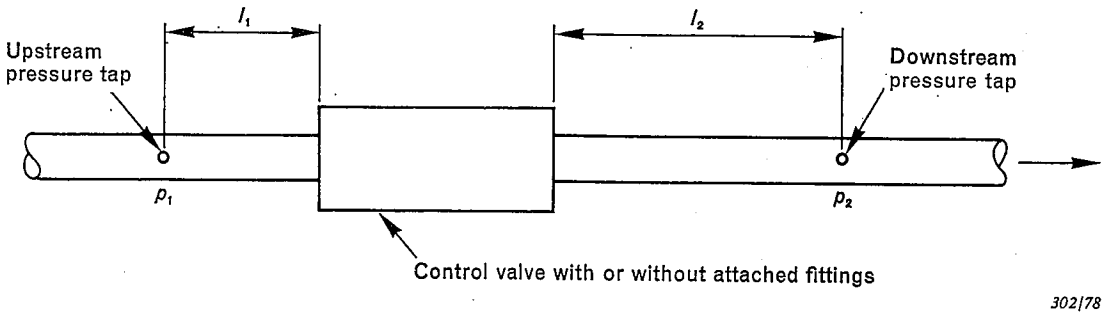
Any device such as a reducer, expander, elbow, T-piece, or bend, which is attached directly to a control valve.

3. Installation

In many industrial applications, reducers or other fittings are attached to the control valves. The effect of these types of fittings on the nominal flow coefficient of the control valve is usually not negligible. It is therefore necessary to introduce a correction factor. Additional factors are introduced to take account of the fluid property characteristics that influence the flow capacity of a control valve.

In sizing control valves, using the relationships presented herein, the flow coefficients calculated are assumed to include all head losses between pressure taps located as shown in Figure 1, page 9. It should be noted that the locations of the upstream and downstream pressure taps have been fixed at the outer limits shown in IEC Publication 534-1, Figure 3. These flow coefficients will normally be compared with those listed in valve manufacturers' literature which also includes all head losses from two pipe diameters upstream through six diameters downstream of the control valve.

For sizing purposes, a maximum allowable pressure differential has been introduced to identify choked flow (see Sub-clause 2.1).



l_1 = two nominal pipe diameters
l_2 = six nominal pipe diameters

FIG. 1. — Pressure tap locations.

4. Nomenclature

Symbols	*Description*	*Unit*
C	Flow coefficient (A_v, K_v, C_v)	Various (See Publication 534-1)
d	Nominal valve size	mm
D	Internal diameter of the piping	mm
F_d	Valve style modifier	Dimensionless
F_F	Liquid critical pressure ratio factor	Dimensionless
F_L	Liquid pressure recovery factor of a control valve without attached fittings	Dimensionless
F_{LP}	Combined liquid pressure recovery factor and piping geometry factor of a control valve with attached fittings	Dimensionless
F_P	Piping geometry factor	Dimensionless
F_R	Reynolds number factor	Dimensionless
N_1, N_2, N_4	Numerical constants	Various (See Note 1)
p_c	Absolute thermodynamic critical pressure	kPa or bar (See Note 2)
p_v	Absolute vapour pressure of the liquid at inlet temperature	kPa or bar
p_1	Inlet absolute pressure measured at the upstream pressure tap	kPa or bar
p_2	Outlet absolute pressure measured at the downstream pressure tap	kPa or bar
Δp	Differential pressure between upstream and downstream pressure taps ($p_1 - p_2$)	kPa or bar