AMERICAN NATIONAL STANDARD

ANSI/ISA-75.01.01 (IEC 60534-2-1 Mod)-2007

**Flow Equations for
Sizing Control Valves**

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Flow Equations for Sizing Control Valves

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The standards referenced within this document may contain provisions which, through reference in this text, constitute requirements of this document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this document are encouraged to investigate the possibility of applying the most recent editions of the standards indicated within this document. Members of IEC and ISO maintain registers of currently valid International Standards. ANSI maintains registers of currently valid U.S. National Standards.

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FOREWORD

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International Standard IEC 60534-2-1 has been prepared by subcommittee 65B: Devices, of IEC technical committee 65: Industrial-process measurement and control.

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

FDIS	Report on voting
65B/347/FDIS	65B/357/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.

The current edition of IEC 60534-2-1 cancels and replaces the first edition of both IEC 60534-2 published in 1978, and IEC 60534-2-2 published in 1980, which cover incompressible and compressible fluid flow, respectively.

IEC 60534-2-1 covers sizing equations for both incompressible and compressible fluid flow.

Annexes A, B, C, D, E, F, and G are for information only.

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

1 Scope

ANSI/ISA-75.01.01 (IEC 60534-2-1 Mod)-2007 includes equations for predicting the flow coefficient of compressible and incompressible fluids through control valves.

The equations for incompressible flow are based on standard hydrodynamic equations for Newtonian incompressible fluids. They are not intended for use when non-Newtonian fluids, fluid mixtures, slurries, or liquid-solid conveyance systems are encountered.

At very low ratios of pressure differential to absolute inlet pressure ($\Delta P/P_1$), compressible fluids behave similarly to incompressible fluids. Under such conditions, the sizing equations for compressible flow can be traced to the standard hydrodynamic equations for Newtonian incompressible fluids. However, increasing values of $\Delta P/P_1$ result in compressibility effects that require that the basic equations be modified by appropriate correction factors. The equations for compressible fluids are for use with gas or vapor and are not intended for use with multiphase streams such as gas-liquid, vapor-liquid or gas-solid mixtures.

For compressible fluid applications, this part of ISA-75.01.01-2007 is valid for all valves. However, manufacturers of some valves with $x_T \geq 0.84$ have reported minor inaccuracies (see Annex G). Caution must also be exercised when applying the equations for compressible fluids to gaseous mixtures of compounds, particularly near phase boundaries.

The accuracy of results computed with the equations in this standard will be governed by the accuracy of the constituent coefficients and the process data supplied. Methods of evaluating the coefficients used in the equations presented herein are given in ANSI/ISA-75.02-1996. The stated accuracy associated with the coefficients in that document is $\pm$ 5% when $C_v/d^2 < 0.047\, N_{18}$. Reasonable accuracy can only be maintained for control valves if $C_v/d^2 < 0.047\, N_{18}$.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISA-75.01.01-2007. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of ISA-75.01.01-2007 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 60534-1:2005, *Industrial-process control valves – Part 1: Control valve terminology and general considerations*

IEC 60534-2-3:1997, *Industrial-process control valves – Part 2-3: Flow capacity – Test procedures*

ANSI/ISA-75.02-1996, Control Valve Capacity Test Procedures

ANSI/ISA-75.05.01-2000 (R2005), Control Valve Terminology

3 Definitions

For the purpose of ANSI/ISA-75.01.01 (IEC 60534-2-1 Mod)-2007, definitions given in IEC 60534-2-1 apply with the addition of the following: