EESTI STANDARD EVS-EN 60534-8-4:2013

Industrial-process control valves -- Part 8-4: Noise considerations - Prediction of noise generated by hydrodynamic flow

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

EESTI STANDARDI EESSÕNA	NATIONAL FOREWORD
See Eesti standard EVS-EN 60534-8-4:2013 sisaldab Euroopa standardi EN 60534-8-4:2005 ingliskeelset teksti.	This Estonian standard EVS-EN 60534-8-4:2013 consists of the English text of the European standard EN 60534-8-4:2005.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 07.12.2005.	Date of Availability of the European standard is 07.12.2005.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 17.140.20, 23.060.40, 25.040.40

EUROPEAN STANDARD **EN 60534-8-4**

NORME EUROPÉENNE

EUROPÄISCHE NORM December 2005

ICS 23.060.40; 17.140.20; 25.040.40 Supersedes EN 60534-8-4:1994

English version

Industrial-process control valves
Part 8-4: Noise considerations - Prediction of noise generated by hydrodynamic flow
(IEC 60534-8-4:2005)

Vannes de régulation des processus industriels
Partie 8-4: Considérations sur le bruit - Prévision du bruit généré par un écoulement hydrodynamique
(CEI 60534-8-4:2005)

Stellventile für die Prozessregelung
Teil 8-4: Geräuschbetrachtungen - Vorausberechnung der Geräuschemission für flüssigkeitsdurchströmte Stellventile
(IEC 60534-8-4:2005)

This European Standard was approved by CENELEC on 2005-11-01. 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.

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

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

Ref. No. EN 60534-8-4:2005 E

Foreword

The text of document 65B/556/FDIS, future edition 2 of IEC 60534-8-4, 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 60534-8-4 on 2005-11-01.

This European Standard supersedes EN 60534-8-4:1994.

The noise prediction methods for hydrodynamic flow presented in this standard have been revised. The improvements are mainly in the acoustic efficiency factors for cavitating flow for single orifice, multi-stage and multi-hole trims and in the determination of transmission losses. This revised standard permits the prediction of the noise pressure levels by calculation without the need for coefficients determined by testing.

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)	2006-08-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2008-11-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60534-8-4:2005 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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.

NOTE Where an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60534-1	- [1]	Industrial-process control valves Part 1: Control valve terminology and general considerations	EN 60534-1	2005 [2]
IEC 60534-8-2	- [1]	Part 8: Noise considerations Section 2: Laboratory measurement of noise generated by hydrodynamic flow through control valves	EN 60534-8-2	1993 [2]
IEC 60534-8-3	- [1]	Part 8-3: Noise considerations - Control valve aerodynamic noise prediction method	EN 60534-8-3	2000 [2]

[1] Undated reference.

[2] Valid edition at date of issue.

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INDUSTRIAL-PROCESS CONTROL VALVES –

Part 8-4: Noise considerations – Prediction of noise generated by hydrodynamic flow

1 Scope

This part of IEC 60534 establishes a method to predict the noise generated in a control valve by liquid flow and the resulting noise level measured downstream of the valve and outside of the pipe. The noise may be generated both by normal turbulence and by liquid cavitation in the valve. Parts of the method are based on fundamental principles of acoustics, fluid mechanics, and mechanics. The method is validated by test data. Noise generated by flashing flow is not considered in this standard.

The transmission loss (TL) equations are based on analysis of the interaction between the sound waves inside the pipe and the coincidence frequencies in the wall of the pipe taking into account that commercial pipe tolerances allow a relatively wide variation in the thickness of the pipe wall. Ideal straight piping is assumed.

The method can be used with all conventional control valve styles including globe, butterfly, cage-type, eccentric rotary, and modified ball valves. Tests so far have only been conducted with water. The applicability of this method for fluids other than water is not known at this time.

This standard considers only noise generated by hydraulic turbulence and fluid cavitation. It does not consider any noise that might be generated by mechanical vibrations, unstable flow patterns, and unpredictable behaviour. In the typical installation, very little noise travels through the wall of the control valve body. The noise is measured at the standard measuring point of 1 m downstream of the valve and 1 m away from the outer surface of the pipe.

This prediction method has been validated with test results based on water covering more than 90 % of all known valve types at inlet pressures of up to 15 bar. This method is considered accurate within ± 5dB(A) except in the range of $x_F = x_{Fz} \pm 0,1$, when x_{Fz} is calculated using equations (3a) or (3b).

2 Normative references

The following referenced documents are indispensable for the application 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.

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

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

IEC 60534-8-3, *Industrial-process control valves – Part 8-3: Noise considerations – Control valve aerodynamic noise prediction method*

3 Symbols

Symbol	Description	Unit
$A(f)$	Frequency-dependent A-weighting value	dBA (ref P_o)
c_L	Speed of sound in liquid	m/s
c_o	Speed of sound in air = 343	m/s
c_p	Speed of sound in pipe (for steel pipe 5 000)	m/s
C	Flow coefficient (K_v and C_v)	Various (see IEC 60534-1)
C_R	Flow coefficient (K_v and C_v) at rated travel	Various (see IEC 60534-1)
C_1	Flow coefficent of first stage in a multistage valve (K_v and C_v)	Various (see IEC 60534-1)
C_n	Flow coefficent of last stage in a multistage valve (K_v and C_v)	Various (see IEC 60534-1)
D_i	Internal pipe diameter	m
D_j	Jet diameter	m
d	Valve inlet internal diameter	m
d_H	Multihole trim hole diameter	m
d_o	Seat or orifice diameter	m
F_{cav}	Frequency distribution function (cavitating)	Dimensionless
F_d	Valve style modifier	Dimensionless
F_L	Liquid pressure recovery factor of a valve without attached fittings	Dimensionless
F_{Ln}	Liquid pressure recovery factor of the last throttling stage	Dimensionless
F_{turb}	Frequency distribution function (turbulent)	Dimensionless
f	Frequency	Hz
f_{ji}	Octave band frequency	Hz
f_r	Ring frequency	Hz
$f_{p,turb}$	Internal peak sound frequency (turbulent)	Hz
$f_{p,cav}$	Internal peak sound frequency (cavitating)	Hz
$L_{pe,1m}$	Overall external sound pressure level 1 m from pipe wall	dB (ref P_o)
$L_{pAe,1m}$	A-weighted overall external sound pressure level 1 m from pipe wall	dBA (ref P_o)
$L_{pAe,1m,i}$	A-weighted external sound pressure level 1 m from pipe wall of stage i (number i from 1…n) in multistage valve with n stages	dBA (ref P_o)
L_{pi}	Overall internal sound pressure level at pipe wall	dB (ref P_o)
$L_{pi}(f_i)$	Frequency-dependent internal sound pressure level	dB (ref P_o)
$\dot{m}$	Mass flow rate	kg/s