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Fans — Air curtain units —

Part 2: Laboratory methods of testing for sound power

Ventilateurs — Rideaux d'air —

Partie 2: Méthodes d'essai en laboratoire des niveaux de puissance acoustique

[Revision of first edition (ISO 13347-1:2004, ISO 13347-1:2004/Cor.1:2006, ISO 13347-2:2004 and ISO 13347-2:2004/Cor.1:2006)]

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Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 27327-2 was prepared by Technical Committee ISO/TC 117, *Fans*, Subcommittee SC , .

ISO 27327 consists of the following parts, under the general title *Fans — Air Curtain Units:*

Part 1: Laboratory methods of testing for aerodynamic performance rating

Part 2: Determination of air curtain unit sound power levels under standardized laboratory conditions - reverberant room method

Introduction

The need for this new International Standard, ISO 27327-2, has been evident for some time. Whilst a number of national standards exist for the measurement of fan noise, none addressed the particular considerations required for the noise testing of air curtain units.

Forming part of the ISO/TC 117 series of fan standards, this part of ISO 27327 deals with the determination of the air curtain unit sound power level appropriate to a particular application. In describing the test and rating procedures, numerous references are made to ISO 5801 and ISO 13347 as well as to other ISO standards.

The test procedures described in this part of ISO 27327 relate to laboratory conditions. The measurement of performance under site conditions is not included. Acoustic system effects can be considerable where the airflow into and out of the air curtain unit is not free from swirl, nor fully developed.

This part of ISO 27327 describes methods for determining sound power levels of air curtain units in one-third-octave bandwidths and one-octave bandwidths.

Data obtained in accordance with this part of ISO 27327 may be used for the following purposes amongst others:

a) comparison of air curtain units which are similar in size and type;

b) comparison of air curtain units which are different in size, type, design, speed, etc.;

c) determining whether an air curtain unit is suitable for a specified upper limit of sound emission;

d) scaling air curtain unit noise from one size and speed to another size and speed of the same type of air curtain unit

e) prediction of sound pressure level in application of the air curtain unit;

f) engineering work to assist in developing machinery and equipment with lower sound emissions.

Fans — Air Curtain Units - Determination of air curtain unit sound power levels under standardized laboratory conditions - reverberant room method

1 Scope

This part of ISO 27327 deals with the determination of the acoustic performance of air curtain units. In addition, it may be used to determine the acoustic performance of air curtain units combined with an ancillary device.

2 Normative References

The following referenced documents are indispensible 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.

ISO 266:1997, Acoustics – Preferred frequencies

ISO 3740:2000, Acoustics – Determination of sound power levels of noise sources – Guidelines for the use of basic standards

ISO 3741:2010, Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Precision methods for reverberation test rooms

ISO 3743-1:2010, Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for small movable sources in reverberant fields – Part 1: Comparison method for hard-walled test room

ISO 3743-2:1994, Acoustics – Determination of sound power levels of noise sources using sound pressure – Engineering methods for small, movable sources in reverberant fields – Part 2: Methods for special reverberation test rooms

ISO 5801:2007, Industrial fans – Performance testing using standardized airways

ISO 6926:1999, Acoustics – Requirements for the performance and calibration of reference sound sources used for the determination of sound power levels

ISO 10302-1:2011, Acoustics –Measurement of airborne noise emitted and structure-borne vibration induced by small air-moving devices – Part 1: Airborne noise measurement

ISO 13347-1:2004, Industrial Fans – Determination of fan sound power levels under standardized laboratory conditions – Part 1: General overview

ISO 13347-2:2004, Industrial Fans – Determination of fan sound power levels under standardized laboratory conditions – Part 2: Reverberant room method

ISO 13349:2010, Fans – Vocabulary and definitions of categories

ISO 27327-1:2009, Fans – Air curtain units – Part 1: Laboratory methods of testing for aerodynamic performance rating

ISO 80000-1:2009, Quantities and units – Part 1: General

3 Terms, definitions, symbols and units

3.1 Terms and definitions

For the purposes of this document, the non-acoustical terms and units defined in ISO 5801, ISO 13349, ISO 27327-1, and ISO 1000 apply. The following definitions also apply, and are taken from ISO 3740 to 3747, ISO 13347-1, and ISO 13347-2 wherever possible. Some definitions have been expanded to fit the specific needs of this document.

3.1.1
inlet sound power level
sound power level of an air curtain unit determined at the air curtain unit inlet in test installation type A.

3.1.2
outlet sound power level
sound power level of an air curtain unit determined at the air curtain outlet in test installation type A.

3.1.3
total sound power level
sound power level of an air curtain unit in test installation type E.

3.1.4
casing sound power level
sound power level radiated from an air curtain unit casing.

NOTE If the air curtain unit drive is external to the air curtain unit casing, the casing sound power shall include the sound power generated by and radiated from the air curtain unit drive

3.1.5
frequency range of interest
frequency range including octave bands with centre frequencies between 63 Hz and 8 000 Hz and one-third octave bands with centre frequencies between 50 Hz and 10 000 Hz.

NOTE For special purposes, the frequency range may be extended at either end, provided that the test environment and instrument accuracy are satisfactory for use over the extended frequency range. For air curtain units which radiate sound at predominantly high (or low) frequency, the frequency range of interest may be limited in order to optimise the test facility and procedures.

3.1.6
blade passage frequency (BPF)
frequency of air curtain unit impeller blades passing a single fixed object.

NOTE The blade passage frequency is calculated by the following formula:

$$\mathrm{BPF} = \frac{x \times n}{60}\ \mathrm{Hz}$$

where

x is the number of blades;

n is the fan speed, expressed in revolutions per minute.

3.1.7
chamber
enclosure used to regulate flow and absorb sound; it may also conform to air test chamber conditions outlined in ISO 5801.

3.1.8
air curtain unit inlet area
A_1
summation of open areas (slots, holes, louvres, openings, etc.) through which air will flow into the air curtain unit; normally a grille and/or air inlet opening

3.1.9
air curtain unit outlet area
A_2
summation of open areas through which air will discharge out of the air curtain; normally a grille and/or air outlet opening.

3.1.10
reverberant room
enclosure meeting the requirements of Annex A and/or Annex B of ISO 13347-2:2004

3.1.11
standard air
air with a density of 1,2 kg/m^3

NOTE 1 Standard air has a ratio of specific heats of 1,4 and a viscosity of 1,815 E-03 kg/m • s

NOTE 2 Air at 16 °C dry bulb temperature, 50 % relative humidity, and 100 kPa barometric pressure has these properties, but this is not part of the definition.

NOTE 3 Air at 20 °C dry bulb temperature, 50 % relative humidity, and 101.325 kPa barometric pressure has these properties, but this is not part of the definition.

3.2 Air curtain unit sound power levels

Considering all possible combinations for installation conditions specified in Clause 4, five different sound power level (L_W) descriptions are defined in Table 1; e.g., L_W (A,in).

Table 1 — Sound power levels

Number	Suffix	Description
1	(A,in)	free-inlet sound power level, type A installation.
2	(A,out)	free-outlet sound power level; type A installation.
3	(E,tot)	total sound power level; type E installation (includes the contributions from the inlet, outlet, casing, and drive).
4	(A,in+cas)	free-inlet sound power level plus casing-radiated noise; type A installation
5	(A,out+cas)	free-outlet sound power level plus casing-radiated noise; type A installation

NOTE 1 All of these symbols may be used to indicate levels in one-third octave or octave frequency bands as well as overall sound power levels and A-weighted sound power levels, provided that the sound power to which the symbols relate is clearly defined.

Where noise from the drive may contribute to the noise radiated from a casing, then this should be clearly stated by the

addition of +dr e.g., L_W (E,cas + dr).

NOTE 2 Not all of the above levels need to be measured for a particular air curtain unit.

NOTE 3 Where some portion of inlet noise is included in the measurement of outlet noise, this shall be clearly stated by the addition of "+ in" or other similar notation; e.g., L_W (A,out+in).

3.3 Other Symbols

For consistency and mutual understanding, it is recommended that the symbols and units shown in Table 2 be used in reporting and calculation. Unless otherwise noted, the subscript number refers to the mid-frequency of the octave band or one-third octave band number.

Table 2 — Symbols, units

Symbol	Term	SI unit
A_1	air curtain unit inlet area	m^2
A_2	air curtain unit outlet area	m^2
c	speed of sound	m/s
D_{min}	minimum distance between equipment under test and reverberant room measurement surface	m
f	frequency	Hz
L_p	sound pressure level, re 20 μpa (2×10^{-5} Pa)	dB
L_{pc}	corrected sound pressure level of the air curtain unit	dB
L_{pb}	recorded sound pressure level of room background as measured over the normal microphone path	dB
$\overline{L_{pb}}$	background sound pressure level	dB
L_{pm}	recorded sound pressure level of fan and room background as measured over the normal microphone path	dB
L_{pq}	corrected sound pressure level of the RSS	dB
L_{pqm}	recorded sound pressure level of the RSS and room background as measured over the normal microphone path	dB
L_{ps}	recorded sound pressure level of pure tone noise source	dB
L_W	sound power level, re 1 pW (1×10^{-12} W)	dB
L_{Wr}	sound power level of RSS	dB
λ	wavelength	m
M	Mach number	dimensionless
p	sound pressure	Pa
p_{ref}	reference sound pressure, 20 μpa (2×10^{-5} Pa)	-
s	standard deviation	dB
θ	air temperature	K
W	sound power	W
W_{ref}	reference sound power, re 1 pW (1×10^{-12} W)	dB