SLOVENSKI STANDARD
oSIST prEN 12102-1:2021

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Klimatske naprave, enote za hlajenje kapljevine, toplotne črpalke, procesne hladilne naprave in razvlaževalniki z električnimi kompresorji - Določanje ravni zvočne moči - 1. del: Klimatske naprave, enote za hlajenje kapljevine, toplotne črpalke za ogrevanje in hlajenje prostora, razvlaževalniki in procesne hladilne naprave

Air conditioners, liquid chilling packages, heat pumps, process chillers and dehumidifiers with electrically driven compressors - Determination of the sound power level - Part 1: Air conditioners, liquid chilling packages, heat pumps for space heating and cooling, dehumidifiers and process chillers

Luftkonditionierer, Flüssigkeitskühlsätze, Wärmepumpen, Prozesskühler und Entfeuchter mit elektrisch angetriebenen Verdichtern - Bestimmung des Schallleistungspegels - Teil 1: Luftkonditionierer, Flüssigkeitskühlsätze, Wärmepumpen zur Raumbeheizung und -kühlung, Entfeuchter und Prozesskühler

Climatiseurs, groupes refroidisseurs de liquide, pompes à chaleur, refroidisseurs industriels et déshumidificateurs avec compresseur entraîné par moteur électrique - Détermination du niveau de puissance acoustique - Partie 1 : climatiseurs, groupes refroidisseurs de liquide, pompes à chaleur pour le chauffage et le refroidissement, déshumidificateurs et refroidisseurs industriels

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ICS:

17.140.20	Emisija hrupa naprav in opreme	Noise emitted by machines and equipment
27.080	Toplotne črpalke	Heat pumps

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 113.

If this draft becomes a European Standard, CEN 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.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 12102-1:2021) has been prepared by Technical Committee CEN/TC 113 “Heat pumps and air conditioning units”, the secretariat of which is held by UNE.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12102-1:2017.

The main changes with respect to the previous edition are listed below:

– addition of Annex C describing the sound power lever of indoor units of water-to-air and air-to-air heat pumps and air conditioners;

– update of Annex A regarding specific measurement for staged or variable capacity units;

– addition of Annex ZE relating to Commission Regulation (EU) No 2016/2281 aimed to be covered.

This document has been prepared under a standardization request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Regulation(s).

For relationship with EU Regulation(s), see informative Annex ZA, Annex ZB, Annex ZC, Annex ZD and Annex ZE, which are an integral part of this document.

Introduction

This document offers ways to determine the sound power level of air conditioners, liquid chilling packages, heat pumps, and dehumidifiers with electrically driven compressors. Some of them are specifically adapted to provide results with low uncertainties, by using laboratory class acoustic methods and highly controlled operating conditions. Those measurements are suitable for certification, labelling and marking purposes.

In some cases, the target and/or the environment of the measurements do not allow such precision-class methods. This document also offers ways to assess sound power levels with acceptable accuracy even though acoustic methods and/or operating conditions are not laboratory-type, e.g. *in situ* or quality control measurements.

This document gives two classes of measurements and results, according to the test environment:

— Class A measurements correspond to controlled operating conditions (standard or application rating conditions). It is defined by the respect to the tolerances of Table 2 and is intended to be used for the conformity to requirements of:

  — Commission Regulation (EC) No 206/2012 of 6 March 2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for air conditioners;

  — Commission Delegated Regulation (EU) No 811/2013 of 18 February 2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device;

  — Commission Regulation (EU) No 813/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters.

  — Commission Regulation (EU) 2016/2281 of 30 November 2016 implementing Directive 2009/125/EC of the European Parliament and of the Council establishing a framework for the setting of ecodesign requirements for energy-related products, with regard to ecodesign requirements for air heating products, cooling products, high temperature process chillers and fan coil units.

— Class B measurements correspond to the case where the range defined by the tolerances of Table 2 cannot be fulfilled.

In both classes, precision or engineering class acoustic methods need to be applied. The choice of the acoustic measurement method is done in accordance with EN ISO 3740 and the EN ISO 9614 series depending on the type of surrounding acoustic fields (diffuse or free field, enclosed or open space), and the available instrumentation. The reference of acoustic standard needs to be reported with explicit mention of its accuracy class, whatever the current operating conditions.

The use of EN ISO 3746 and EN ISO 3747 as survey grade methods is not recommended due to the high level of uncertainties. Their use is only allowed for non-controlled environments when they fulfil the engineering grade requirement.

Three methods for determining the sound power levels are specified in order to avoid unduly restricting existing facilities and experience:

— the first methodology is based on reverberation room measurement (see EN ISO 3741 and the EN ISO 3743 series);

— the second method is based on measurements in an essentially free field over a reflecting plane (see EN ISO 3744 and EN ISO 3745);

— the third method is based on sound intensity measurement (see the EN ISO 9614 series) preferably in a free field environment.

The necessity to maintain the test conditions obviously leads to recommend test methods implemented in acoustically designed (enclosed) spaces, such as EN ISO 3741, the EN ISO 3743 series, EN ISO 3745 and also the EN ISO 9614 series when implemented in an enclosed space.

The open spaces will be used only in specific cases, e.g. when the size or the capacity of the unit under test cannot be managed by standard test rooms. Suitable test methods are EN ISO 3744 and the EN ISO 9614 series.

NOTE Intensity measurement methods are quite robust and are well suited for tests to be done in environments without or with a light acoustic treatment (the better the acoustic treatment, the easier the implementation).

1 Scope

This document establishes requirements for determining, in accordance with a standardized procedure, the sound power level emitted into the surrounding air by air conditioners, heat pumps, liquid chilling packages with electrically driven compressors when used for space heating and/or cooling, and/or for process, as described in the prEN 14511 series, and dehumidifiers, as described in EN 810.

This document also covers the measurement of the sound power level of evaporatively cooled condenser air conditioners, as defined in EN 15218. However, the measurement will be done without external water feeding and these units will thus be considered as the other air conditioners covered by the prEN 14511 series.

It is emphasized that this measurement standard only refers to airborne noise.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 810:1997, *Dehumidifiers with electrically driven compressors - Rating tests, marking, operational requirements and technical data sheet*

prEN 14511-1:2021, *Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 1: Terms and definitions*

prEN 14511-2:2021, *Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 2: Test conditions*

prEN 14511-3:2021, *Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 3: Test methods*

prEN 14511-4:2021, *Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 4: Requirements*

prEN 14825:2020, *Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling - Testing and rating at part load conditions and calculation of seasonal performance*

EN 15218:2013, *Air conditioners and liquid chilling packages with evaporatively cooled condenser and with electrically driven compressors for space cooling - Terms, definitions, test conditions, test methods and requirements*

FprEN 16583:2021, *Heat exchangers - Hydronic room fan coils units - Determination of the sound power level*

EN ISO 3740:2019, *Acoustics - Determination of sound power levels of noise sources - Guidelines for the use of basic standards (ISO 3740:2019)*

EN 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 3741:2010)*

EN 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 a hard-walled test room (ISO 3743-1:2010)*

EN ISO 3743-2:2019, *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 3743-2:2018)*

EN ISO 3744:2010, *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane (ISO 3744:2010)*

EN ISO 3745:2012/A1:2017, *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Precision methods for anechoic rooms and hemi-anechoic rooms - Amendment 1 (ISO 3745:2012/Amd 1:2017)*

EN ISO 3746:2010, *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane (ISO 3746:2010)*

EN ISO 3747:2010, *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering/survey methods for use in situ in a reverberant environment (ISO 3747:2010)*

EN ISO 5136:2009, *Acoustics - Determination of sound power radiated into a duct by fans and other air-moving devices - In-duct method (ISO 5136:2003)*

EN ISO 9614-1:2009, *Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 1: Measurement at discrete points (ISO 9614-1:1993)*

EN ISO 9614-2:1996, *Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 2: Measurement by scanning (ISO 9614-2:1996)*

EN ISO 9614-3:2009, *Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 3: Precision method for measurement by scanning (ISO 9614-3:2002)*

3 Terms, definitions and symbols

For the purposes of this document, the terms, definitions and symbols given in prEN 14511-1:2021, prEN 14825:2020, EN 15218:2013, EN 810:1997, EN ISO 9614-1:2009, EN ISO 9614-2:1996, EN ISO 9614-3:2009, EN ISO 3740:2019, EN ISO 3741:2010, EN ISO 3743-1:2010, EN ISO 3743-2:2019, EN ISO 3744:2010, EN ISO 3745:2012/A1:2017, EN ISO 3746:2010 and EN ISO 3747:2010 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1 Terms and definitions

3.1.1
L_W
required value, sound power level, defined by Formula (1):

$$L_W = 10 \lg\left(\frac{P}{P_0}\right) dB \quad (1)$$

where

P is the sound power;

P_0 is the reference sound power = 1 pW

Note 1 to entry: This definition is technically in accordance with ISO 80000-8:2007.

3.1.2
L_{WA}
overall A-weighted sound power level indoors or outdoors

Note 1 to entry: Expressed in dB(A).

3.2 Symbols, subscripts and units

3.2.1 General

The symbols, subscripts and units are given in Table 1.

Table 1 — Symbols, subscripts and units

Symbol/Subscript	Denomination	Unit
L_W	sound power level	dB
L_{WA}	A-weighted sound power level	dB(A)
c_o	speed of sound in air	m/s
T	dry bulb temperature	°C
f	centre frequency band	Hz
S	area of the duct opening in the room	m^2
Ω	solid of the radiation path from the test opening	—
W	sound power	—
W_0	reference sound power	—
I	indoor side of units	—
O	outdoor side of units	—
d	in duct	—

3.2.2 Non ducted units

L_{Wi} sound power level radiated by the indoor side.

L_{Wo} sound power level radiated by the outdoor side.

3.2.3 Ducted units

For ducted unit, the required value is the sound power level travelling into the duct. It is assessed from the sound power level radiated by the air outlet opening of the duct, corrected by the "duct end correction" factor E (see 6.2.2).

L_{Wd} sound power level travelling into the (discharge or suction) duct.

For the case of a ducted indoor side of a split unit:

L_{Wdi} sound power level travelling into the (discharge or suction) duct of indoor unit.

For the case of a ducted unit on the outdoor side:

L_{Wdo} sound power travelling into the (discharge or suction) duct of outdoor unit.

The sound radiated by the casing does not require any specific suffix. Use the same symbols as in 3.2.1 to specify which unit is concerned, indoor or outdoor side.

4 Measuring instruments

The instruments used for measuring and evaluation shall comply with the requirements of the standards appropriate to the test method used, from acoustic and capacity points of view.

To comply with Class A measurements, the necessary instruments to control the operating conditions shall fulfil the requirements of Table 2.

Table 2 — Uncertainties of measurement for indicated values

Measured quantity	Unit	Uncertainty of measurement
Liquid		
- temperature inlet/outlet	°C	±0,3 K
- volume flow	m^3/s	±3 %
Air		
- dry bulb temperature	°C	±0,5 K
- wet bulb temperature	°C	±0,8 K
- static pressure difference	Pa	±8 Pa ($\Delta P \leq 100$ Pa) ±8 % ($\Delta P > 100$ Pa)
- volume flow	m^3/s	±10 %
Refrigerant		
- pressure at compressor outlet	kPa	±3 %
- temperature	°C	±1 K
Concentration		
- heat transfer medium	%vol	±4 %
Electrical quantities		
- voltage	V	±1 %
Rotation speed	min^{-1}	±1 %

Wet bulb temperature measurement involves the generation of air flow around a wet thermometer which may generate unwanted noise in the sound power measurement. It is then recommended to measure relative humidity or dew point instead of determining the wet bulb temperature.

Suitable windshields are recommended to be fitted on microphones if they have to be affected by air velocity (above about 2 m/s) which may be produced by the unit under test or by the laboratory facilities. Adjustment shall be made to the measured sound pressure levels to compensate for any alteration in the sensitivity of shielded microphones. Above 10 m/s, windshields are usually not efficient enough and care shall be taken to reduce the air velocity (by changing the location of microphones) or to change the type of windshields.

It is recommended to fit the intensity probes with windshields if they have to be affected by air velocity because they are much more sensitive to that parameter. For instance, the maximum air velocity admitted by EN ISO 9614-1:2009 is 2 m/s.