

# SLOVENSKI STANDARD

## SIST EN 12102-1:2018

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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

[SIST EN 12102-1:2018](https://standards.iteh.ai/catalog/standards/sist/f179497f-be6d-421a-9b9a-4b1e2541095/sist-en-12102-1-2018)

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

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27.080	Toplotne črpalke	Heat pumps

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EUROPEAN STANDARD

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**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**

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 la réfrigération, déshumidificateurs et refroidisseurs industriels

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

This European Standard was approved by CEN on 1 October 2017. 2018

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
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**EN 12102-1:2017 (E)****European foreword**

This document (EN 12102-1:2017) has been prepared by Technical Committee CEN/TC 113 “Heat pumps and air conditioning units”, the secretariat of which is held by UNE.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2018, and conflicting national standards shall be withdrawn at the latest by May 2018.

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

This document supersedes EN 12102:2013.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directives.

For relationship with EU Directives, see informative Annexes ZA, ZB, ZC or ZD, which are integral parts of this document.

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

- a) addition of Annex ZB relating to the Commission Regulation EU n°626/2012;
- b) addition of Annex ZC relating to the Commission Regulation EU n°813/2013;
- c) addition of Annex ZD relating to the Commission Regulation EU n°811/2013.

EN 12102 comprises the following parts under the general title *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*
- *Part 2: Heat pump water heaters*

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Introduction

This European Standard 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 European Standard 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 European Standard 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 will be used for the conformity to requirements of:
  - The Commission Regulation (EU) 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;
  - The 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;
  - The Commission Delegated Regulation (EU) No 626/2011 of 4 May 2011 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of air conditioners.
- 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 are 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);

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- 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).

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## 1 Scope

This European Standard 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 EN 14511 series and dehumidifiers as described in EN 810.

This European Standard 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 EN 14511 series.

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

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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*

EN 14511-1:2013, *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling - Part 1: Terms, definitions and classification*

EN 14511-2:2013, *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling - Part 2: Test conditions*

EN 14511-3:2013, *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling - Part 3: Test methods*

EN 14511-4:2013, *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling - Part 4: Operating requirements, marking and instructions*

EN 14825:2016, *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*

EN ISO 3740:2000, *Acoustics - Determination of sound power levels of noise sources - Guidelines for the use of basic standards (ISO 3740:2000)*

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 (all parts), *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 (ISO 3743, all parts)*

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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, *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 (ISO 3745:2012)*

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 5801:2008, *Industrial fans - Performance testing using standardized airways (ISO 5801:2007 including Cor 1:2008)*

EN ISO 9614 (all parts), *Acoustics - Determination of sound power levels of noise sources using sound intensity (ISO 9614, all parts)*

### 3 Terms, definitions and symbols

For the purposes of this document, the terms, definitions and symbols given in EN 14511-1:2013, EN 14825:2016, EN 15218:2013, EN 810:1997, EN ISO 9614, EN ISO 3740:2000 to EN ISO 3747:2010 and the following apply.

#### 3.1 Terms and definitions

##### 3.1.1

**L<sub>w</sub>**

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

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

where

P is the sound power;

P<sub>0</sub> 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<sub>WA</sub>**

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 <sup>2</sup>
$\Omega$	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 <sup>3</sup> /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 <sup>3</sup> /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 <sup>-1</sup>	±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 is 2 m/s.