SLOVENSKI STANDARD
SIST EN 12102-2:2019

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Klimatske naprave, enote za hlajenje kapljevine, toplotne črpalke, procesne hladilne naprave in razvlaževalniki z električnimi kompresorji - Ugotavljanje ravni zvočne moči - 2. del: Grelniki vode s toplotno črpalko

Air conditioners, liquid chilling packages, heat pumps, process chillers and dehumidifiers with electrically driven compressors - Determination of the sound power level - Part 2: Heat pump water heaters

Luftkonditionierer, Flüssigkeitskühlsätze, Wärmepumpen, Prozesskühler und Entfeuchter mit elektrisch angetriebenen Verdichtern - Bestimmung des Schallleistungspegels - Teil 2: Wärmepumpen-Wassererwärmer

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 2: Pompe à chaleur pour la production d'eau chaude sanitaire

Ta slovenski standard je istoveten z: **EN 12102-2:2019**

ICS:

17.140.20	Emisija hrupa naprav in opreme	Noise emitted by machines and equipment
27.080	Toplotne črpalke	Heat pumps
91.140.65	Oprema za ogrevanje vode	Water heating equipment

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EUROPEAN STANDARD
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English Version

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

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Contents

European foreword

This document (EN 12102-2:2019) 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of an identical text or by endorsement, at the latest by November 2019, and conflicting national standards shall be withdrawn at the latest by November 2019.

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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 Directive(s).

For relationship with EU Directive(s), see informative Annex ZA and Annex ZB, which are integral parts of this document.

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1 Scope

This document specifies methods for testing the sound power level of air/water, brine/water, water/water and direct exchange/water heat pump water heaters and heat pump combination heaters with electrically driven compressors and connected to or including a domestic hot water storage tank for domestic hot water production.

This European Standard comprises only the testing procedure for the domestic hot water production of the heat pump system.

NOTE 1 Testing procedures for simultaneous operation for domestic hot water production and space heating are not treated in this standard. Simultaneous operation means that domestic hot water production and space heating generation occur at the same time and may interact.

NOTE 2 For space heating function, the requirements are given in EN 12102-1:2017.

This European Standard only applies to water heaters which are supplied in a package of heat pump and storage tank. In the case of water heaters consisting of several parts with refrigerant connections, this European Standard applies only to those designed and supplied as a complete package.

This European Standard does not specify requirements for the quality of the used water.

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 12102-1:2017, *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*

EN 14511-1, *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*

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

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

EN 16147:2017, *Heat pumps with electrically driven compressors - Testing, performance rating and requirements for marking of domestic hot water units*

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, *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 3744, *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, *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 3747, *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 5801, *Fans - Performance testing using standardized airways (ISO 5801:2017)*

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

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 3741, EN ISO 3743-1, EN ISO 3744, EN ISO 3745, EN ISO 3747, EN ISO 9614 (all parts), EN 14511-1, EN 16147 and EN 12102-1 apply.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.2 Symbols, subscripts and units

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

Table 1 — Symbols, subscripts and units

Symbol/Subscript	Denomination	Unit
BC	Bend correction	mm
BR	Brine	—
c_o	Speed of sound in air	m/s
d	In duct	—
D	Diameter	mm
D_H	Total duration of heating	min
E	Duct end correction factor	dB
f	Centre frequency band	Hz
i	Indoor side of units	—
$\overline{L_{PA}}$	A-weighted average sound power level	dB(A)
L_W	Sound power level	dB
L_{WA}	A-weighted sound power level	dB(A)
L_{Wd}	Sound power level travelling into the duct	dB
o	Outdoor side of units	—
P_{rated} [a]	Rated heat output	kW
R	Refrigerant	—

Symbol/Subscript	Denomination	Unit
S	Area of the duct opening in the room	m^2
T	Dry bulb temperature	°C
T_{hw}	Target hot water temperature	°C
T_{iniw}	Initial water temperature in the tank	°C
$t_{MP\max}$	Maximum temperature measurement period	min
$t_{MP\min}$	Minimum temperature measurement period	min
T_{set}	Set point temperature for production of hot water	°C
T_{start}	Water temperature at the beginning of the test	°C
t_{Thw}	Theoretical time to reach T_{hw}	min
T_{wi}	Water inlet temperature	°C
T_{wo}	Water outlet temperature	°C
VPD	Volumic power density	W/l
V_{tank}	Declared volume of water tank	l
W/BR	Water/brine	—
Ω	Solid of the radiation path from the test opening	—
a As given in EN 16147.		

4 Acoustic characteristics

Table 2 lists the relevant acoustic characteristics, corrected for duct end and bend corrections where relevant, for the typical configurations of heat pump water heaters illustrated in Annex A.

Table 2 — Acoustic characteristics of typical configurations

Heat source / heat pump configuration	Outdoors	Indoors	Inlet duct	Outlet duct	Figure in Annex A
Non heated space air	—	②	—	—	A.1
Indoor air	—	②	—	—	A.2
Ground source	—	①	—	—	A.3
Outdoor air	②	—	—	—	A.4
Non heated space air ducted outlet	⑤	③	—	—	A.5
Outdoor air ducted inlet/outlet	④	①	—	—	A.6
Exhaust air – individual ventilation	⑤	①	⑥ + duct end correction + bend correction (if any)	—	A.7
Exhaust air – collective ventilation	—	①	⑥ + duct end correction + bend correction (if any)	⑦ + duct end correction + bend correction (if any)	A.8
Outdoor air split	②	⑧	—	—	A.9, A.10
Ambient air split	②	①	—	—	A.11
Roll bond panel	⑧	①	—	—	A.12

① noise radiated by the unit
② noise radiated by the unit + inlet + outlet
③ noise radiated by the unit + inlet
④ noise radiated by the openings of both inlet and outlet
⑤ noise radiated by the outlet opening
⑥ noise radiated by the unit inlet
⑦ noise radiated by the unit outlet
⑧ noise not to be measured

5 Measurement procedure

5.1 General approach

According to the capacity of the unit and the volume of its tank, defined by the volumic power density (*VPD*) in W/l, the heating time can dramatically change. The goal is to perform the acoustic measurement when the water tank temperature reaches the target hot water temperature T_{hw}. This temperature shall only be measured by small draw-offs.

Previous studies showed that the noise generated by units is unsteady compared to other HVAC devices. This is why a longer sound pressure averaging of 3 min is required.

For units with small *VPD*, the water tank temperature increases slowly and will not dramatically change during the time necessary to perform acoustic measurement. Fifteen minutes are given to perform this task, allowing some time-consuming processes of the standards (e.g. increase the number of microphone positions).

For units with large *VPD*, the water tank temperature increases quickly. The sound power level shall be continuously measured during the water tank heating, with several small draw-offs. Then the acoustic values corresponding to the target water tank temperature T_{hw} shall be deduced from the evolution of temperature versus time.

The measurement procedure for heat pump water heaters with a direct heat exchanger between the sanitary cold water and the refrigerant is given in Annex B.

5.2 Target hot water temperature T_{hw}

The target hot water temperatures T_{hw} at which the measurement shall be done are defined in Annex C.

Reaching T_{hw} is checked by small draw-offs, as specified in 5.5.

For units with *VPD* ≤ 10 W/l, the tolerance on T_{hw} is ± 1,5 K.

For units with *VPD* > 10 W/l, there is no tolerance on T_{hw}, because it is a target temperature used for time calculation.

5.3 Volumic power density (*VPD*)

The VPD is defined in Formula (1) and expressed in W/l.

$$VPD = \frac{P_{rated}}{V_{tank}} \times 1000 \quad (1)$$

where

*P*rated is the declared heating capacity (kW).

*V*tank is the declared volume of the water tank (l);

The measurement procedure depends on the *VPD* value:

— For units with a *VPD* ≤ 10 W/l, see 5.6;

— For units with a *VPD* > 10 W/l, see 5.7.

5.4 Water tank filling

The tank shall be fully filled with water at the temperature given in Table 3. The heat pump is then switched on.

Table 3 — Initial water temperature in the tank T_{iniw}

VPD W/l	***T*iniw** °C
≤ 10	T_{hw} – 5 K or 10 °C, whichever is higher
> 10 and ≤ 40	T_{hw} – 20 K or 10 °C, whichever is higher
> 40	T_{hw} – 35 K or 10 °C, whichever is higher

T_{iniw} has a tolerance of ± 2K.

If the measurement is performed at more than one target hot water temperature T_{hw} during a single heating-up, the initial temperature requirement only applies to the lowest target hot water temperature.

The tank is considered to be filled at the required temperature when the temperatures at the outlet and inlet fulfil the relation given in Formula (2).

$$\left|T_{wo} - T_{wi}\right| < 1\text{K} \tag{2}$$

5.5 Water outlet temperature measurement

The water outlet temperature T_{wo} is measured at the storage tank outlet, by doing small draw-offs of the water.

They shall be done according to the following procedure:

1) Tap water with a flow rate between 2,8 and 3,2 l/min during 25 to 35 s (in order to purge and to stabilize the temperature probe),

2) Then measure the temperature for 10 s with a flow rate between 2,8 and 3,2 l/min. The temperature measurement sampling shall be done with at least 1 value every 2 s. The temperature is the average of the measurements over these 10 s.

The water temperatures are measured in the centre of the flow, as close as possible to the appliance, as shown in Figure 1.