SLOVENSKI STANDARD
oSIST prEN 12102-2:2018

01-januar-2018

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

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

Klimageräte, Flüssigkeitskühlsätze, Wärmepumpen und Entfeuchter mit elektrisch angetriebenen Verdichtern - Bestimmung des Schallleistungspegels - Teil 2: Wassererhitzer mit Wärmepumpen

Climatiseurs, groupes refroidisseurs de liquide, pompes à chaleur avec compresseur entraîné par moteur électrique - Détermination du niveau de puissance acoustique - Partie 2 : Chauffe-eau à pompe à chaleur

Ta slovenski standard je istoveten z: **prEN 12102-2**

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

oSIST prEN 12102-2:2018 **en,fr,de**

EUROPEAN STANDARD

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English Version

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

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 : Chauffe-eau à pompe à chaleur

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This draft European Standard is submitted to CEN members for second 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.

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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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

This document (prEN 12102-2:2017) has been prepared by Technical Committee CEN/TC 113 “Heat pumps and air conditioning units”, the secretariat of which is held by AENOR.

This document is currently submitted to the second CEN Enquiry.

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 or ZB, which is an integral part of this document.

1 Scope

This European Standard 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 prEN 12102-1:2015.

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 of the quality of the used water.

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.

prEN 12102-1:2016, *Air conditioners, liquid chilling packages, heat pumps 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 14511-1:2013, *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 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 3744:2010, *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 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, *Industrial fans - Performance testing using standardized airways (ISO 5801:2007 including Cor 1:2008)*

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

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 are given in Table 1.

Table 1 — Symbols, subscripts and units

Symbol/Subscript	Denomination	Unit
B	Brine	—
c_o	Speed of sound in air	m/s
d	In duct	—
D_H	Total duration of heating	—
f	Centre frequency band	Hz
i	Indoor side of units	—
L_W	Sound power level	dB
L_{WA}	A-weighted sound power level	dB(A)
o	Outdoor side of units	—
P_{rated} [a]	Rated heat output	kW
R	Refrigerant	—
S	Area of the duct opening in the room	m^2
T	Dry bulb temperature	°C
T_{hw}	Target water temperature	°C
T_{set}	Set point temperature for production of hot water	°C
VPD	Volumic power density	W/l
V_{tank}	Declared volume of water tank	l
W	Sound power	—
W/B	Water/brine	—
W_0	Reference sound power	—
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 of typical configurations of heat pump water heaters which are described in Annex A.

Table 2 — Acoustic characteristics of typical configurations

Heat pump configuration	Outdoors	Indoors	Inlet duct	Outlet duct
A1/ Ambient air	—	② Unit + inlet + outlet	—	—
A2/ Ground source	—	② Unit + inlet + outlet	—	—
A3/ Outdoor air	② Unit + inlet + outlet	—	—	—
B/ Ambient air – ducted outlet	⑤ Outlet opening	③ Unit + inlet	—	—
C/ Outdoor air Ducted inlet/outlet	④ Openings of both inlet and outlet	① Unit	—	—
D/ Exhaust air with integrated fan	⑤ Outlet opening	① Unit	⑥ Unit inlet	—
E/ Exhaust air without fan	—	① Unit	⑥ Unit inlet	⑦ Unit outlet
F1/ Outdoor air split	② Unit + inlet + outlet	⑧ Not to be measured	—	—
F2/ Outdoor air split	② Unit + inlet + outlet	⑧ Not to be measured	—	—
G/ Ambient air split	② Unit + inlet + outlet	① Unit	—	—
H/ Roll bond panel	⑧ Not to be measured	① Unit	—	—

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 power 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 water temperature T_{hw}, usually 45°. But this temperature shall only be measured by small draw-offs, thus preventing its continuous monitoring.

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 low 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 higher 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 water tank temperature of T_{hw} (usually 45 °C) 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 water temperature

The target water temperature T_{hw} is the temperature of the water in the top of the tank, at which the sound power level value has to be declared.

The target water temperature T_{hw} is 45 °C for units with a set point > 50 °C, or [set point - 5] °C otherwise.

For units with VPD ≤ 10, the target water temperature T_{hw} has a tolerance of ± 1K.

For units with VPD > 10, the target water temperature T_{hw} has no tolerance 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.

$$VPD = P_{rated} * 1000 / V_{tank} \quad (1)$$

where

V_{tank} is the declared volume of water tank (litres);

P_{rated} is the declared heating capacity (kW).

The measurement procedure depends on the *VPD* value:

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

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

5.4 Water tank filling

The unit being stopped, the tank shall be fully filled with water at the temperature given in Table 3.

Table 3 — Initial water temperature in the water tank

VPD (W/l)	T° fill in (°C)
≤ 10	T_{hw} – 5 K
> 10 and ≤ 40	T_{hw} – 20 K
> 40	T_{hw} – 35 K

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

$$|T_{outlet} - T_{inlet}| < 1K \quad (2)$$

5.5 Water outlet temperature measurement

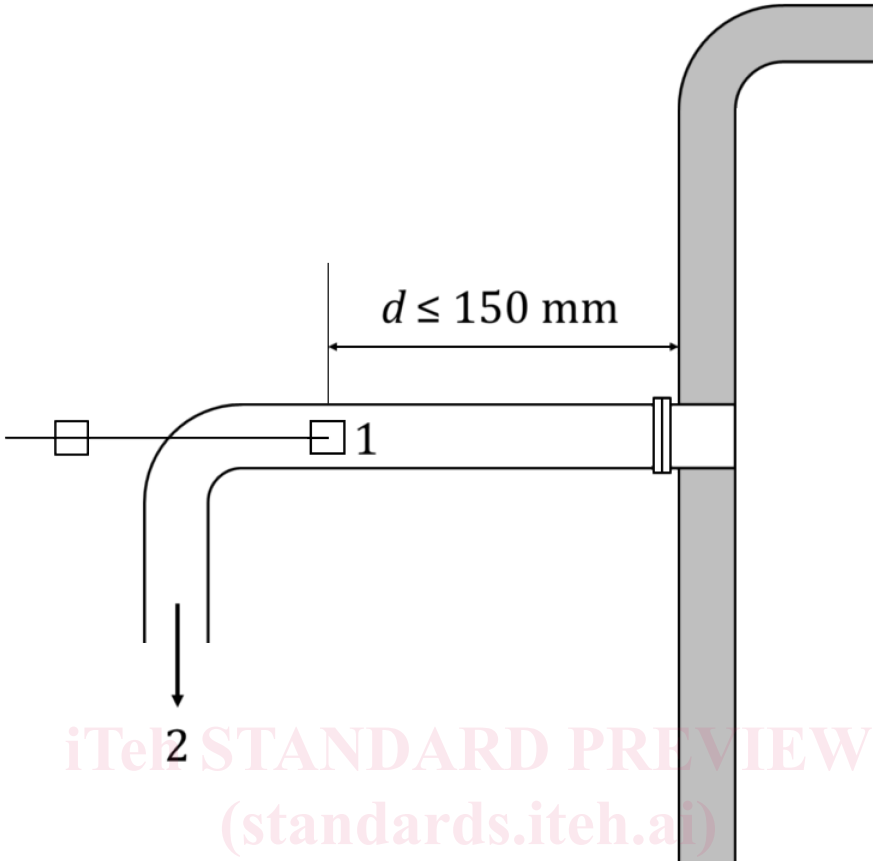
The water outlet temperature T_{wo} is measured at the storage tank outlet by using small draw-offs of the water.

They shall be done according to the following procedure:

1) Tap water with a flow 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 during 10 s with a flow 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.



Key

1 temperature probe

2 draw-off

Figure 1 — Distance for the temperature measurement

The difference between lowest and highest temperature shall not exceed 0,15 K.

In order to compensate the draw-offs, the tank shall be filled with water at temperature as defined in 5.4.

NOTE For practical reasons, it is possible to use another way to follow the water tank inner temperature. In this case, only draw off measurements are considered.

5.6 Method for units with *VPD* ≤ 10

5.6.1 Heat pump operation

When the storage tank is full of water at the temperature, as defined in Table 3, the acoustic measurement shall begin as soon as both following conditions are achieved:

— water outlet temperature T_{wo} is within the target water temperature range outlet T_{hw};

— continuous run of the compressor for a minimum of 30 min immediately before the acoustic measurement; otherwise, circulate a volume of V_{tank} at the temperature defined in Table 3, while the unit is still running and start the measurement when the target temperature is reached.