

SLOVENSKI STANDARD

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Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors - Heating mode - Testing and requirements for marking for domestic hot water units

Luftkonditionerer, Flüssigkeitskühlsätze und Wärmepumpen mit elektrisch angetriebenen Verdichtern - Heizen - Prüfungen und Anforderungen and die Kennzeichnung von Geräten zum Erwärmen von Brauchwarmwasser

Climatiseurs, groupes refroidisseurs de liquide et pompes à chaleur avec compresseur entraîné par moteur électrique - Mode chauffage - Essais et exigences pour le marquage pour les appareils pour eau chaude sanitaire

<http://standards.sist.si/standards/sist/2008/aaf-b6b0-467c-bea8-275d4ddda479/sist-en-16147-2011>

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**Air conditioners. liquid chilling packages and heat pumps with
electrically driven compressors - Heating mode - Testing and
requirements for marking for domestic hot water units**

Climatiseurs, groupes refroidisseurs de liquide et pompes à
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Mode chauffage - Essais et exigences pour le marquage
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Kennzeichnung von Geräten zum Erwärmen von
Brauchwarmwasser

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.

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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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Foreword

This document (prEN 255-3:2008) 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 CEN Enquiry.

This document will supersede EN 255-3:1997.

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1 Scope

This European Standard specifies methods for testing and reporting of the rating and it specifies requirements for marking of air/water and water/water heat pumps with electrically driven compressors when used for domestic hot water. When these units are used for space heating, then EN 14511, part 1 - 4 applies.

This European Standard applies to factory-made units which can be ducted.

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

Note:

Testing procedures for simultaneous operation for domestic hot water production and space heating are not treated in this standard.

In the case of units consisting of several parts, the standard applies only to those designed and supplied as a complete package.

This European Standard does not include any requirement about the quality of water.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

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

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

Mandate M/324, *Measurement standards for household appliances; water heaters, hot water storage appliances and water heating systems*.

3 Terms and definitions

For the purposes of this document, the following terms and definitions and those in EN 14511-1 apply.

3.1

Heat pump for heating domestic water

Heat pump as defined in EN 14511-1 connected to a domestic hot water storage tank

3.2

Domestic hot water

Water heated for household or similar purposes

3.3**Nominal volume (V_n)**

Volume of water that is assigned to the storage tank by the manufacturer and marked on it

3.4**Indoor ambient air**

In this standard, indoor ambient air is indicated as the heat source for a heat pump which absorbs heat by an outdoor heat exchanger in direct contact with the air inside a building without any duct

3.5**Outside air**

Air from the free atmosphere

3.6**Coefficient of performance for tapping domestic hot water (COPT)**

Coefficient of performance determined by the use of EU reference tapping cycles. This value includes the heat losses from the storage tank

3.7**Reference hot water temperature (T'_{wr})**

Temperature determined as the mean value of the average temperatures during one tapping which ends when the hot water temperature is below 40 °C

3.8**Maximum volume of usable hot water (V_{max})**

Total of a volume of hot water with a temperature not less than 40 °C together with the volume of cold water at 10°C needed to produce an overall temperature of 40 °C (see chapter 5.6)

4 Symbols and abbreviations

Symbol	Description	Units
T	Temperature	°C or K
t	Time	s
t _h	Heating up time	s
t _s	Duration of one on-off-cycle of the heat pump to determine the standby power input	s
t _{TTC}	Time length of test cycle in hours	s
t _{TAP}	Time length of one tapping	s
n _{TAP}	Number of tappings during a tapping cycle	-
T _{WH}	Temperature hot water	°C
T _{WC}	Temperature cold water	°C
c _p	Specific heat capacity of water	kJ/(kg*K)
ρ (T)	Density of the hot water depending on the temperature at the flow meter	Kg/m ³
W _{eh}	Heating up energy input	kWh
W _{es}	Energy input during the last on-off-cycle to determine the standby power input	kWh
P _{es}	Standby power input	kW
Q _{HP-Tap}	Useful energy recovered by the water during one tapping	kWh
Q _{EL-Tap}	Calculated heat energy produced by electricity to reach the required tapping temperatures	kWh

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Q_{Tap}	Total heat recovery during a tapping	kWh
$Q_{\text{HP-TC}}$	Heat recovery produced by the heat pump during the whole tapping cycle	kWh
$Q_{\text{EL-TC}}$	Calculated heat recovery produced by electricity during the whole tapping cycle	kWh
Q_{TC}	Total heat recovery during the tapping cycle	kWh
$W_{\text{EL-M}}$	Measured electrical energy consumption during the tapping cycle	kWh
$W_{\text{EL-Corr}}$	Electrical energy consumption of fans or liquid pumps	kWh
$W_{\text{EL-HP}}$	Total electrical energy consumption of the heat pump during a tapping cycle	kWh
$W_{\text{EL-TC}}$	Total electrical energy consumption during a tapping cycle	kWh
COP_{TC}	Coefficient of performance determined by using tapping cycles	-

5 General test requirements**5.1 Test apparatus, limits on uncertainties**

The test apparatus shall be designed in such a way that all requirements for adjustment of set values, stability criteria and accuracy of measurement according to this European Standard can be fulfilled.

Water systems or other heat transfer liquid systems shall be sufficiently free of entrained gas as to ensure that the measured results are not significantly influenced.

Ducted air systems shall be sufficiently airtight to ensure that the measured results are not significantly influenced by exchange of air with the surroundings.

Limits on uncertainties of measurement are described in EN 14511-3 (see 4.3).

The inlet and outlet temperatures of the domestic water are measured in the centre of the flow and as close as possible to the appliance.

The hot water temperature is measured with a rapid response thermometer to fulfil the following requirements.

The useful energy recovered Q_{Tap} at each individual tapping is set against the values given in Tables 3, 4, 5, 6 and 7. For each individual delivery, the accuracy of the value shall be $\pm 10 \text{ Wh}$ or $\pm 5 \%$ with a tolerance on the total energy content of the tapping cycle of $\pm 5 \%$.

5.2 Test room for the outdoor heat exchanger of air source heat pumps

The size of the test room shall be selected to avoid any resistance to air flow at the air inlet and air outlet orifices of the test object. The air flow through the room shall not be capable of initiating any short circuit between the two orifices, and therefore the velocity of air flow at these two locations shall not exceed $1,5 \text{ m/s}$ when the test object is switched off. The air velocity in the room shall also not be greater than the mean velocity through the unit inlet. Unless otherwise stated by the manufacturer, the air inlet and air outlet orifices shall not be less than 1 m from the surfaces of the test room; this also applies to any measuring ducts.

Any direct heat radiation (p. ex. solar radiation) from heating units in the test room onto the heat pump or onto the temperature measuring points shall be avoided.

5.3 Setting the external static pressure difference on the air side for heat pumps with duct connection

The setting is described in EN 14511-3 (see 4.4.1.1 - 4.4.1.3).

5.4 Setting the external pressure difference on the liquid side of heat pumps with integral liquid pumps

For heat pumps separated from the tank, the liquid flow rate has to be set on the liquid outlet side of the heat pump to the nominal flow rate specified by the manufacturer.

5.5 Installation and connection of the heat pump

The heat pump shall be installed and connected for the test as recommended by the manufacturer in his installation and operation manual.

Temperature and pressure measuring points shall be arranged in order to obtain significant mean values.

Set points for internal control equipment of the unit such as thermostats, pressure switches or mixing valves should be set to the values stated by the manufacturer.

Air and entrained gases shall be carefully removed from all water and other heat transfer liquid systems.

5.6 Installation of heat pumps consisting of several parts

In the case of heat pumps consisting of several refrigeration parts (split heat pumps) the following installation conditions shall be complied with for the tests:

- a) each refrigerant line shall be installed in accordance with the manufacturer's instructions. The length of each line must be between 5 m and 7,5 m;
- b) the lines shall be installed so that the difference in elevation does not exceed 1 m;
- c) thermal insulation shall be applied to the lines in accordance with the manufacturer's instructions;
- d) unless constrained by the design at least half of the interconnecting lines shall be exposed to the outdoor conditions with the rest of the lines exposed to the indoor conditions.

For indirect systems each water line shall be installed in accordance with the manufacturer's instructions to the maximum stated length or 5 m whichever is shorter. Thermal insulation shall be applied to the lines in accordance with the manufacturer's instructions.

5.7 Test conditions

Permissible deviations from set values are described in EN 14511-3 and table 1. The tests shall be carried out at the test conditions specified in tables 1 and 2 as appropriate.

Table 1 - Test conditions applicable to all systems

Measured variable	Set value
Power supply voltage	Rated voltage
Power supply frequency	Rated frequency
Air flowrate on the heat source side	Nominal, as indicated by the manufacturer. When only a range is given, tests are to be carried out at the minimum value.
Temperature of the incoming cold water (°C)	10
Hot water flowrate (l/min)	4 or 10 (see table 3 and 5.6)

Table 2 - Test conditions for particular types of systems

Type of heat source	Heat source temperature °C	Range of ambient temperature of heat pump °C	Ambient temperature of storage tank °C
Outside air (heat pump indoor) with air duct	7 (6)	from 15 to 30	20
Outside air (heat pump outdoor)	7 (6)	heat source temperature	20
Indoor ambient air	15 (12)	15 *	15
Exhaust air	20 (12)	from 15 to 30	20
Water	10 / 7	from 15 to 30	20
Brine	0 / -3	from 15 to 30	20
Direct evaporation	4	from 15 to 30	20

*) In this case the ambient temperature of the heat pump is the same than the temperature of the heat source.

Note 1: All heat source temperatures are inlet temperatures in degrees Celsius.

Note 2: All air temperatures in brackets are wet bulb temperatures in degrees Celsius.

Note 3: Permissible external pressure difference and associated internal pressure difference at the outdoor heat exchanger shall be indicated by the manufacturer in Pa for appliances with duct connection.

6 Performance test and determination of the energy consumption

6.1 General

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The methods of the tests described in this clause are designed to determine the energy consumption and the performance of heat pumps for heating domestic water.

The appliance shall be installed and adjusted in the initial state conditions and in the initial adjustment conditions defined in 4.1.

6.2 Basic principles, scope of the tests

The tests consist of the following 6 principal stages (see figure 1):

- A heating up period (see 5.3)
- B determination of standby power input (see 5.4)
- C determination of the energy consumption and the coefficient of performance for heating domestic water by using the reference tapping cycles (see 5.5)
- D determination of a reference hot water temperature and the maximum quantity of usable hot water in a single tapping (see 5.6)
- E test to determine the temperature operating range
- F security tests