SLOVENSKI STANDARD
oSIST prEN 14511-3:2021

01-april-2021

Klimatske naprave, enote za hlajenje kapljevine, toplotne črpalke za ogrevanje in hlajenje prostora ter procesne hladilne naprave z električnimi kompresorji - 3. del: Preskusne metode

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

Luftkonditionierer, Flüssigkeitskühlsätze und Wärmepumpen für die Raumbeheizung und -kühlung und Prozess-Kühler mit elektrisch angetriebenen Verdichtern - Teil 3: Prüfverfahren

Climatiseurs, groupes refroidisseurs de liquide et pompes à chaleur pour le chauffage et le refroidissement des locaux et refroidisseurs industriels avec compresseur entraîné par moteur électrique - Partie 3 : Méthodes d'essai

Ta slovenski standard je istoveten z: **prEN 14511-3**

ICS:

23.120	Zračniki. Vetrniki. Klimatske naprave	Ventilators. Fans. Air-conditioners
27.080	Toplotne črpalke	Heat pumps
91.140.30	Prezračevalni in klimatski sistemi	Ventilation and air-conditioning systems

oSIST prEN 14511-3:2021 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 14511-3

March 2021

ICS

Will supersede EN 14511-3:2018

English Version

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

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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.

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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: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (prEN 14511-3:2021) 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 Enquiry.

This document will supersede EN 14511-3:2018.

This document has been prepared in the frame of:

— the Commission Regulation (EU) No 206/2012 implementing Directive 2009/125/EC with regard to ecodesign requirements for air conditioners;

— the Commission Regulation (EU) n° 626/2011 supplementing Directive 2010/30/EU with regard to energy labelling for air conditioners;

— the Commission Regulation (EU) No 813/2013 implementing Directive 2009/125/EC with regard to ecodesign requirements for air-to-water and water-to-water heat pump space heaters;

— the Commission Regulation (EU) n° 811/2013 supplementing Directive 2010/30/EU with regard to energy labelling for air-to-water and water-to-water heat pump space heaters;

— the Commission Regulation (EU) n° 2015/1095 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for process chillers;

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

EN 14511, *Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors* currently comprises the following parts:

— *Part 1: Terms and definitions*

— *Part 2: Test conditions*

— *Part 3: Test methods*

— *Part 4: Requirements*

The main changes with respect to the previous edition are:

— update of the test procedure;

— addition of a new subclause on *COP* and *EER* calculation;

— update of the annexes on indoor air enthalpy test method and liquid enthalpy test method.

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, B, C or D, which is an integral part of this document.

1 Scope

1.1 The scope of prEN 14511-1:2021 is applicable.

1.2 This document specifies the test methods for the rating and performance of air conditioners, liquid chilling packages and heat pumps using either air, water or brine as heat transfer media, with electrically driven compressors when used for space heating and cooling. These test methods also apply for the rating and performance of process chillers.

It also specifies the method of testing and reporting for heat recovery capacities, system reduced capacities and the capacity of individual indoor units of multisplit systems, where applicable.

This document also makes possible to rate multisplit and modular heat recovery multisplit systems by rating separately the indoor and outdoor units.

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.

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*

EN 14825:2018, *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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN 14511-1:2021 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

4 Tests for determination of capacities

4.1 Basic principles and methods

4.1.1 Ait-to-air and water(brine)-to-air units

Heating and/or cooling capacity of air conditioners and of air-to-air or water(brine)-to-air units shall be determined from measurements in a calorimeter room (see Annex A) or by the air enthalpy method (see Annex B and Annex C).

The measured heating capacity Φ_{thi} shall be corrected for the heat from the indoor fan as specified in 4.1.3.2 or 4.1.3.3 to obtain the heating capacity P_H.

The measured cooling capacity Φ_{tci} shall be corrected for the heat from the indoor fan as specified in 4.1.3.2 or 4.1.3.3 to obtain the heating capacity PC.

4.1.2 Air-to-water(brine) and water(brine)-to-water(brine) units

The heating and/or cooling capacity of air-to-water(brine) and water(brine)-to-water(brine) units shall be determined in accordance with the liquid enthalpy test method at the liquid indoor heat exchanger (see Annex D and Annex E).

The measured heating capacity Φ_{thi} shall be corrected for the heat from the indoor liquid pump as specified in 4.1.3.4 to obtain the heating capacity P_H.

The measured cooling capacity Φ_{tci} shall be corrected for the heat from the indoor liquid as specified in 4.1.3.4 to obtain the heating capacity P_C.

The heat recovery capacity of air-to-water(brine) and water(brine)-to-water(brine) units shall be determined in accordance with the liquid enthalpy test method at the liquid heat recovery heat exchanger (see Annex D and Annex E).

The measured heat recovery capacity Φ_{hr} shall be corrected for the heat from the indoor liquid pump as specified in 4.1.3.4 to obtain the heating capacity P_{HR}.

4.1.3 Capacity correction

4.1.3.1 General

The capacity shall include the correction due to the heat output of the indoor fans or pumps, integrated into the unit or not as follows.

4.1.3.2 Capacity correction of fans for units without duct connection

In the case of units which are not designed for duct connection, i.e. which do not permit any external pressure difference, and which are equipped with an integral fan, no capacity correction due to heat provide by the fan shall apply.

4.1.3.3 Capacity correction due to indoor fan for ducted units

4.1.3.3.1 Units with integrated indoor fan

If the fan at the indoor heat exchanger is an integral part of the unit, the power input correction of the fan, as calculated with Formula (5) (see 4.1.4.3.1) shall be:

— subtracted from the measured heating capacity

— added to the measured cooling capacity

4.1.3.3.2 Units with non-integrated indoor fan

If the fan at the indoor heat exchanger is not an integral part of the unit, the power input correction as calculated with Formula (6) (see 4.1.4.3.2) shall be:

— added to the measured heating capacity

— subtracted from the measured cooling capacity

4.1.3.4 Capacity correction due to indoor liquid pump

4.1.3.4.1 Units with integrated liquid pump

If the liquid pump is an integrated part of the unit, the capacity correction as defined in 4.1.3.4.3 or 4.1.3.4.4 shall be:

— subtracted from the measured heating capacity.

— added to the measured cooling capacity

— subtracted from the measured heat recovery capacity

In case, the integrated liquid pump does not provide any available external static pressure difference, no capacity correction applies.

4.1.3.4.2 Units with non-integrated liquid pump

If the liquid pump is not an integral part of the unit, the capacity correction as defined in 4.1.3.4.5 shall be:

— added to the measured heating capacity.

— subtracted from the measured cooling capacity

— added to the measured heat recovery capacity

4.1.3.4.3 Capacity correction for integrated glandless circulators

If the unit is equipped with a glandless circulator, the capacity correction is calculated using Formula (1).

$$(q \times \Delta p_e) \times [(1-\eta)/\eta] \quad (1)$$

where

q is the measured liquid flow rate, expressed in m^3/s.

Δp_e is the measured available external static pressure difference, expressed in Pa, as defined in prEN 14511-1:2021, 3.58;

η is the global efficiency of the pump calculated according to Annex F.

4.1.3.4.4 Capacity correction for integrated dry motor pumps

If the unit is equipped with a dry-motor pump, the capacity correction shall be calculated using Formula (2).

$$(q \times \Delta p_e) \times [(IE - \eta)/\eta\ ] \quad (2)$$

where

q is the measured liquid volume flow rate, expressed in m^3/s;

Δp_e is the measured available external static pressure difference, expressed in Pa, as defined in prEN 14511-1:2021, 3.58;

IE is the motor efficiency as defined in the EC No 640/2009 regulation;

η is the global efficiency of the pump calculated according to Annex F.

4.1.3.4.5 Capacity correction for non-integrated liquid pumps

If the measured hydraulic power according to Annex F is ≤ 300 W, the liquid pump is considered as a glandless circulator. The capacity correction is calculated using Formula (3).

$$(q \times (-\Delta p_i)) \times [(1-\eta)/\eta] \quad (3)$$

where

q is the measured liquid flow rate, expressed in m^3/s;

Δp_i is the measured internal static pressure difference, expressed in Pa, as defined in prEN 14511-1:2021, 3.59;

η is the global efficiency of the pump calculated according to Annex F.

If the measured hydraulic power according to Annex F is > 300 W, the liquid pump is considered as a dry-motor pump. The capacity correction is calculated using Formula (4).

$$[q \times (-\Delta p_i)] \times [(IE - \eta) / \eta)] \quad (4)$$

where

q is the liquid volume flow rate, expressed in m^3/s;

Δp_i is the measured internal static pressure difference, expressed in Pascal, as defined in prEN 14511-1:2021, 3.59;

IE is equal to 0,88 (average the motor nominal efficiency defined in the EC No 640/2009 regulation for IE3 efficiency level);

η is the global efficiency of the pump calculated according to Annex F.

4.1.4 Effective power input

4.1.4.1 General

The effective power input shall include the correction due to power input of indoor and/or outdoor fans and/or pumps, integrated or no to the unit as follows.

4.1.4.2 Power input correction of fans for units without duct connection

In the case of units which are not designed for duct connection, i.e. which do not permit any external pressure differences, and which are equipped with an integral fan, the power absorbed by the fan shall be included in the effective power absorbed by the unit.

4.1.4.3 Power input correction of fans for units with duct connection

4.1.4.3.1 Power input correction for integrated fans

If a fan is an integral part of the unit, only a fraction of the power input of the fan motor shall be included in the effective power absorbed by the unit. The fraction that is to be excluded from the total power absorbed by the unit shall be calculated using Formula (5):

$$\frac{q \times \Delta p_{e(corr)}}{\eta} \quad (5)$$

where

q is the air volume flow rate, expressed in m^3/s and set according to 4.4.1.3 or 4.4.1.4;

$\Delta p_{e\ (corr)}$ is the available external static pressure difference, expressed in Pa, as defined in prEN 14511-1:2021, 3.58 and set according to 4.4.1.3 or 4.4.1.4;

η is equal to η_{target} as declared by the fan manufacturer according to the ecodesign regulation (EU) No 327/2011 for fans driven by motors between 125 W and 500 kW; otherwise is equal to 0,3 by convention.

4.1.4.3.2 Power input correction for non-integrated fans

If no fan is provided with the unit, the proportional power input which is to be included in the effective power absorbed by the unit shall be calculated using the Formula (6):

$$\frac{q \times \left(-\Delta p_i\right)}{\eta} \tag{6}$$

where

q is the air volume flow rate, expressed in m^3/s and set according to 4.4.1.3 or 4.4.1.4;

Δp_i is the measured internal static pressure difference, expressed in Pa, as defined in prEN 14511-1:2021, 3.59;

η is 0,3 by convention.

4.1.4.4 Power input correction of liquid pumps

4.1.4.4.1 Power input correction for integrated liquid pumps

When the liquid pump is integrated into the unit, it shall be connected for operation. When the liquid pump is delivered by the manufacturer apart from the unit, it shall be connected for operation according to the manufacturer's instructions and be then considered as an integral part of the unit.

For an integrated liquid pump, only a fraction of the input to the pump motor shall be included in the effective power absorbed by the unit. The fraction which is to be excluded from the total power absorbed by the unit shall be calculated using Formula (7):

$$\frac{q \times \Delta p_e}{\eta} \tag{7}$$

where

q is the measured liquid flow rate, expressed in m^3/s;

Δp_e is the measured available external static pressure difference, expressed in Pa, as defined in EN 14511-1:2018, 3.58;

η is the efficiency of the pump calculated according to Annex F.

In case the liquid pump is not able to provide any external static pressure difference, then this correction does not apply but the correction shall be made according to 4.1.4.4.2.

4.1.4.4.2 Power input correction for non-integrated liquid pumps

If no liquid pump is provided with the unit, the proportional power input which is to be included in the effective power absorbed by the unit shall be calculated using Formula (8):

$$\frac{q \times \left(-\Delta p_i\right)}{\eta} \tag{8}$$

where

q is the measured liquid flow rate, expressed in m^3/s;

Δp_i is the measured internal static pressure difference, expressed in Pa, as defined in prEN 14511-1:2021, 3.59;

η is the efficiency of the pump calculated according to Annex F.

4.1.5 Units on a distribution network of pressured water

In the case of appliances designed specially to operate on a distributing network of pressurized water without water-pump, no correction shall be applied to the power input.

4.1.6 Units for use with remote condenser

The power from the auxiliary liquid pump of the remote condenser shall not be taken into account in the effective power input.

4.2 Test apparatus

4.2.1 Arrangement of the test apparatus

4.2.1.1 General requirements

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

4.2.1.2 Test room for the air side

The size of the test room shall be selected such that any resistance to air flow at the air inlet and air outlet orifices of the test object is avoided. The air flow through the room shall not be capable of initiating any short circuit between these two orifices, and therefore the velocity of the air flows through the room at these two locations shall not exceed 1,5 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 or air outlet orifices shall be not less than 1 m distant from the surfaces of the test room.

Any direct heat radiation by heating units in the test room onto the unit or onto the temperature measuring points shall be avoided.

4.2.1.3 Appliances with duct connection

The connections of a ducted air unit to the test facility shall be sufficiently air tight to ensure that the measured results are not significantly influenced by exchange of air with the surroundings.

If defrost controls on the heat pump provide means for stopping the indoor air flow, provision shall be made to stop the test apparatus air flow to the equipment on both the indoor and outdoor-sides during such a defrost period.

4.2.1.4 Appliances with integrated pumps

For appliances with integrated and adjustable water or brine pumps, the pump speed shall be set at the same time as the temperature difference.

In case of a liquid pump with several fixed speeds or with variable speed, the manufacturer shall provide information on the settings of pump (speed or external static pressure to achieve).

If defrost controls on the heat pump provide means for stopping the indoor water flow rate, provision shall be made to stop the test apparatus water flow rate to the equipment during such a defrost period.

4.2.1.5 Liquid chilling package for use with remote condenser

Units for use with remote condenser are tested by using a water (brine)-cooled condenser, the characteristics of which shall enable the intended operating conditions to be achieved.

4.2.2 Installation and connection of the test object

4.2.2.1 General

The test object shall be installed and connected for the test as recommended by the manufacturer in the installation and operation manual. The accessories provided by option are not included in the test. If a back-up heater is provided in option or not, it shall be switched off or disconnected to be excluded from the testing.

For single ducts, regardless of the manufacturer's instructions, the discharge duct shall be as short and straight as possible compatibly with minimum distance between the unit and the wall for correct air inlet but not less than 50 cm. No accessory shall be connected to the discharge end of the duct.

For double duct units, the same requirements apply to both suction and discharge ducts, unless the appliance is designed to be installed directly on the wall.

For multisplit systems, the test shall be performed with the system operating at a capacity ratio of 1, or as close as possible.

As an option, Annex K provides recommendations to determine the capacity of an individual indoor unit, either operating on its own with the other indoor units disconnected, or with all indoor units operating.

When performing measures in heating mode, set the highest room temperature on the unit/system control device; when performing measures in cooling mode, set the lowest room temperature on the unit/system control device. If in the instructions, the manufacturer indicates a value for the temperature set on the control device for a given rating condition, then this value shall be used.

For unit with open-type compressor the electric motor shall be supplied or specified by the manufacturer. The compressor shall be operated at the rotational speed specified by the manufacturer.

For inverter type control units, the setting of the frequency shall be done for each rating condition. The manufacturer shall provide in the documentation information about how to obtain the necessary data to set the required frequencies.

If skilled personnel with knowledge of control software is required for the start of the system, the manufacturer or the nominated agent should be in attendance when the system is being installed and prepared for tests.

4.2.2.2 Installation of unit consisting of several parts

In the case of a unit consisting of several parts, the following installation conditions shall be complied for the test.

a) The refrigerant lines shall be installed in accordance with the manufacturer's instructions. The length of the refrigerant lines shall be 5 m except if the constraints of the test installation make 5 m not possible, in which case a greater length may be used, with a maximum of 7,5 m.

b) The refrigerant lines shall be installed so that the difference in elevation does not exceed 2,5 m.

c) The thermal insulation of the refrigerant lines shall be applied in accordance with the manufacturer's instructions.