ILNAS

Institut luxembourgeois de la normalisation
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ILNAS-EN 14511-3:2013

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

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

Climatiseurs, groupes refroidisseurs de liquide et pompes à chaleur avec compresseur entraîné par moteur électrique pour le chauffage et la

07/2013

National Foreword

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EUROPEAN STANDARD
NORME EUROPÉENNE
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EN 14511-3

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English Version

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

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

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

This European Standard was approved by CEN on 7 June 2013.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Foreword

This document (EN 14511-3:2013) has been prepared by Technical Committee CEN/TC 113 “Heat pumps and air conditioning units”, the secretariat of which is held by AENOR.

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of an identical text or by endorsement, at the latest by January 2014 and conflicting national standards shall be withdrawn at the latest by January 2014.

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

This document supersedes EN 14511-3:2011.

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

a) the addition of requirements related to the electrical consumption and the air flow rate measurement of ducted units;

b) the addition of a table template containing the test results of the ducted units;

c) the addition of two normative annexes related to indoor and outdoor units of multsplit and modular heat recovery multisplit systems and air flow rate measurement;

d) the addition of an Annex ZA relating to the Commission Regulation (EC) n°206/2012.

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, which is an integral part of this document.

Although 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 and comfort fans, it is also intended to support the essential requirements of the European Directive 2010/30/CE.

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

— *Part 1: Terms, definitions and classification*,

— *Part 2: Test conditions*,

— *Part 3: Test methods*,

— *Part 4: Operating requirements, marking and instructions.*

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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

1.1 The scope of EN 14511-1 is applicable.

1.2 This European Standard 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.

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 European Standard 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, 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 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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 14511-1:2013 apply.

4 Rating capacity test

4.1 Basic principles method of calculation for the determination of capacities

4.1.1 Heating capacity

The heating capacity of air conditioners and of air-to-air or water-to-air heat pumps shall be determined by measurements in a calorimeter room (see Annex A) or by the air enthalpy method (see Annex B).

However, the heating capacity of air conditioners and of air-to-air heat pumps having a cooling capacity below or equal to 12 kW shall be determined by measurements in a calorimeter room.

The heating capacity of air-to-water, water-to-water heat pumps and liquid chilling packages shall be determined in accordance with the direct method at the water or brine heat exchanger, by determination of the volume flow of the heat transfer medium, and the inlet and outlet temperatures, taking into consideration the specific heat capacity and density of the heat transfer medium.

For steady state operation, the heating capacity shall be determined using the following formula:

$$P_H = q \times \rho \times c_p \times \Delta t \quad (1)$$

where

P_H is the heat capacity, expressed in Watts;

q is the volume flow rate, expressed in cubic metres per second;

ρ is the density, expressed in kilograms per cubic metre;

c_p is the specific heat at constant pressure, expressed in joules per kilogram and Kelvin;

Δt is the difference between inlet and outlet temperatures, expressed in Kelvin.

NOTE 1 The mass flow rate can be determined directly instead of the term (q x ρ).

NOTE 2 The enthalpy change ΔH can be directly measured instead of the term (cp x Δt).

For the heating capacity calculation in transient operation, refer to 4.5.3.2.

The heating capacity shall be corrected for the heat from the fan or pump:

a) if the fan or pump at the indoor heat exchanger is an integral part of the unit, the same power (calculated in 4.1.5.2 or 4.1.6.3) which is excluded from the total power input shall be also subtracted from the heating capacity;

b) if the fan or pump at the indoor heat exchanger is not an integral part of the unit, the same power (calculated in 4.1.5.3 or 4.1.6.4) which is included in the effective power input shall be also added to the heating capacity.

4.1.2 Cooling capacity

The cooling capacity of air conditioners and of air-to-air or water-to-air heat pumps shall be determined by measurements in a calorimeter room (see Annex A) or by the air enthalpy method (see Annex B).

However, the cooling capacity of air conditioners and of air-to-air heat pumps having a cooling capacity below or equal to 12 kW shall be determined by measurements in a calorimeter room.

The cooling capacity of air-to-water, water-to-water heat pumps and liquid chilling packages shall be determined in accordance with the direct method at the water or brine heat exchanger, by determination of the volume flow of the heat transfer medium, and the inlet and outlet temperatures, taking into consideration the specific heat capacity and density of the heat transfer medium.

The cooling capacity shall be determined using the following formula:

$$P_C = q \times \rho \times c_p \times \Delta t \quad (2)$$

where

P_C is the cooling capacity, expressed in watts;

q is the volume flow rate, expressed in cubic metres per second;

ρ is the density, expressed in kilograms per cubic metre;

c_p is the specific heat at constant pressure, expressed in joules per kilogram and Kelvin;

Δt is the difference between inlet and outlet temperatures, expressed in Kelvin.

NOTE 1 The mass flow rate can be determined directly instead of the term (q x ρ).

NOTE 2 The enthalpy change ΔH can be directly measured instead of the term (c_p x Δt).

The cooling capacity shall be corrected for the heat from the fan or pump:

a) If the fan or pump at the evaporator is an integral part of the unit, the same power (calculated in 4.1.5.2 or 4.1.6.3) which is excluded from the total power input is also added to the cooling capacity.

b) If the fan or pump at the evaporator is not an integral part of the unit, the same power (calculated in 4.1.5.3 or 4.1.6.4) which is included in the effective power input is also subtracted from the cooling capacity.

4.1.3 Heat recovery capacity

The heat recovery capacity of air-to-water and water-to-water heat pumps and liquid chilling packages shall be determined in accordance with the direct method at the water or brine heat exchanger, by determination of the volume flow of the heat transfer medium, and the inlet and outlet temperatures, taking into consideration the specific heat capacity and density of the heat transfer medium.

The heat recovery capacity shall be determined using the following formula:

$$P_{HR} = q \times \rho \times c_p \times \Delta t \quad (3)$$

where

P_{HR} is the heat recovery capacity, expressed in Watts;

q is the volume flow rate, expressed in cubic metres per second;

ρ is the density, expressed in kilograms per cubic metre;

c_p is the specific heat at constant pressure, expressed in joules per kilogram and Kelvin;

Δt is the difference between inlet and outlet temperatures expressed in Kelvin.

NOTE The mass flow rate can be determined directly instead of the term (q x ρ). The enthalpy change ΔH can be directly measured instead of the term (c_p x Δt).

The heat recovery capacity shall be corrected for the heat of the pump:

a) if the pump at the heat recovery exchanger is an integral part of the unit, the power calculated according to 4.1.6.3 shall be subtracted from heat recovery capacity

b) if the pump at the heat recovery exchanger is not an integral part of the unit, the power calculated according to 4.1.6.4 shall be added to the heat recovery capacity.

4.1.4 Power input 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.

4.1.5 Power input of fans for units with duct connection

4.1.5.1 The following corrections of the power input of fans shall be made to both indoor and outdoor fans, where applicable.

4.1.5.2 If a fan is an integral part of the unit, only a fraction of the 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 the following formula:

$$\frac{q.(\Delta p_e - ESP_{\min})}{\eta} \quad (4)$$

where

η is equal to η_{target} ; as declared by the fan manufacturer according to the ecodesign regulation n°327/2011 for fans driven by motors between 125 W and 500 kW.

η is 0.3 by convention, for fans driven by motors below 125 W.

Δp_e is the measured available external static pressure difference, expressed in Pascal, as defined in 2.52 of EN 14511-1:2013.

ESP_{min} is the minimum external static pressure difference specified in Table 2 or Table 3, as applicable for an indoor unit, or 30 Pa for an outdoor unit.

q is the nominal air flow rate, expressed in cubic meters per second.

4.1.5.3 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 following formula:

(5)

$$\frac{-q.(\Delta p_i) + ESP_{\min}}{\eta}$$

where

η is 0,3 by convention.

Δp_i is the measured internal static pressure difference, expressed in Pascal, as defined in 2.53 of EN 14511-1:2013.

ESP_{min} is the minimum external static pressure difference given in Table 2 or Table 3, as applicable for an indoor unit, or 30 Pa for an outdoor unit.

q is the nominal air flow rate, expressed in cubic meters per second.

4.1.6 Power input of liquid pumps

4.1.6.1 The following corrections of the power input of liquid pumps shall be made to both indoor and outdoor (and heat recovery) liquid pumps, where applicable.

4.1.6.2 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.

4.1.6.3 If a liquid pump is an integral part of the unit, 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 the following formula:

$$\frac{q \times \Delta p_e}{\eta} \quad (6)$$

where

η is the efficiency of the pump calculated according to Annex H;