SLOVENSKI STANDARD
SIST EN 12309-4:2015

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SIST EN 12309-2:2001

Absorpcijske in adsorpcijske plinske naprave za gretje in/ali hlajenje z grelno močjo do vključno 70 kW - 4. del: Preskusne metode

Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW - Part 4: Test methods

Gasbefeuerte Sorptions-Geräte für Heizung und/oder Kühlung mit einer Nennwärmebelastung nicht über 70 kW - Teil 4: Prüfverfahren

Appareils à sorption à chauffage direct au gaz pour chauffage et/ou refroidissement d'un débit calorifique sur PCI inférieur à 70 kW - Partie 4: Méthodes d'essais

Ta slovenski standard je istoveten z: **EN 12309-4:2014**

ICS:

27.080	Toplotne črpalke	Heat pumps
91.140.30	Prezračevalni in klimatski sistemi	Ventilation and air-conditioning

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EUROPEAN STANDARD

NORME EUROPÉENNE

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EN 12309-4

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ICS 27.080; 91.140.30

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English Version

Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW - Part 4: Test methods

Appareils à sorption fonctionnant au gaz pour le chauffage et/ou le refroidissement de débit calorifique sur PCI inférieur ou égal à 70 kW - Partie 4 : Méthodes d'essai

Gasbefeuerte Sorptions-Geräte für Heizung und/oder Kühlung mit einer Nennwärmebelastung nicht über 70 kW - Teil 4: Prüfverfahren

This European Standard was approved by CEN on 18 October 2014.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 12309-4:2014) has been prepared by Technical Committee CEN/TC 299 “Gas-fired sorption appliances, indirect fired sorption appliances, gas-fired endothermic engine heat pumps and domestic gas-fired washing and drying appliances”, the secretariat of which is held by UNI.

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 June 2015, and conflicting national standards shall be withdrawn at the latest by June 2015.

This document supersedes EN 12309-2:2000.

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 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.

This European Standard comprises the following parts under the general title, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW*:

— *Part 1: Terms and definitions*;

— *Part 2: Safety*;

— *Part 3: Test conditions*;

— *Part 4: Test methods*;

— *Part 5: Requirements*;

— *Part 6: Calculation of seasonal performances*;

— *Part 7: Specific provisions for hybrid appliances*;

— *Part 8: Environmental aspects*.

EN 12309-1 and EN 12309-2 supersede EN 12309-1:1999, whereas EN 12309-1, EN 12309-3, EN 12309-4, EN 12309-5, EN 12309-6, and EN 12309-7 supersede EN 12309-2:2000.

EN 12309-1, EN 12309-2, EN 12309-3, EN 12309-4, EN 12309-5, EN 12309-6, and EN 12309-7 have been prepared to address the essential requirements of the European Directive 2009/142/EC relating to appliances burning gaseous fuels (see Annex ZA of prEN 12309-2:2013 for safety aspects and Annex ZA of EN 12309-5:2014 for rational use of energy aspects).

These documents are linked to the Energy Related Products Directive (2009/125/EC) in terms of tests conditions, tests methods and seasonal performances calculation methods under Mandate M/495 (see EN 12309-3:2014, Annex ZA; EN 12309-4:2014, Annex ZA; EN 12309-6:2014, Annex ZA and EN 12309-7:2014, Annex ZA and prEN 12309-2:2013, Annex ZB and EN 12309-5:2014, Annex ZB).

These documents will be reviewed whenever new mandates could apply.

EN 12309-8 (“Environmental aspects”) deals with the incorporation of the Resolution BT 27/2008 regarding CEN approach on addressing environmental issues in product and service standards.

According to the CEN-CENELEC Internal Regulations, the national standards organizations 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 Scope of EN 12309

Appliances covered by this European Standard include one or a combination of the following:

— gas-fired sorption chiller;

— gas-fired sorption chiller/heater;

— gas-fired sorption heat pump.

This European Standard applies to appliances designed to be used for space heating or cooling or refrigeration with or without heat recovery.

This European Standard applies to appliances having flue gas systems of type B and type C (according to CEN/TR 1749) and to appliances designed for outdoor installations. EN 12309 does not apply to air conditioners, it only applies to appliances having:

— integral burners under the control of fully automatic burner control systems,

— closed system refrigerant circuits in which the refrigerant does not come into direct contact with the water or air to be cooled or heated,

— mechanical means to assist transportation of the combustion air and/or the flue gas.

The above appliances can have one or more primary or secondary functions (i.e. heat recovery - see definitions in EN 12309-1:2014).

In the case of packaged units (consisting of several parts), this European Standard applies only to those designed and supplied as a complete package.

The appliances having their condenser cooled by air and by the evaporation of external additional water are not covered by EN 12309.

Installations used for heating and/or cooling of industrial processes are not within the scope of EN 12309.

All the symbols given in this text should be used regardless of the language used.

1.2 Scope of this Part 4 of EN 12309

This part of EN 12309 specifies the test methods for gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW.

This part of EN 12309 deals particularly with test protocols and tools to calculate the capacity, the gas utilization efficiency and the electrical power input of the appliance. This data can be used in particular to calculate the seasonal efficiency of the appliance.

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 437, *Test gases — Test pressures — Appliance categories*

EN 12309-1:2014, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW — Part 1: Terms and definitions*

prEN 12309-2:2013, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW —Part 2: Safety*

EN 12309-3:2014, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW — Part 3: Test conditions*

EN 12309-7:2014, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW — Part 7: Specific provisions for hybrid appliances*

EN 12102, *Air conditioners, liquid chilling packages, heat pumps and dehumidifiers with electrically driven compressors for space heating and cooling - Measurement of airborne noise - Determination of the sound power level*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12309-1:2014 apply.

4 Test methods

4.1 General

A steady-state, transient or cyclical operation test could be applied for full capacity tests or for reduced capacity tests.

The sound power level is measured in the standard rating conditions as given in EN 12309-3:2014 for monovalent and EN 12309-7:2014 for hybrids and bivalent with the corresponding test methods according to EN 12102. It is considered that this European Standard, dedicated to determination of the sound power level could be used with appliances covered in the scope of EN 12309.

4.2 Basic principles

4.2.1 Heating capacity

4.2.1.1 General

The heating capacity of air-to-water(brine), water(brine)-to-water(brine) chiller/heater or heat pumps shall be determined in accordance with the direct method at the water or brine (indoor) heat exchanger(s), by determination of the volume or mass flow rate of the heat transfer medium, and the inlet and outlet temperatures, taking into consideration the specific heat capacity and density, or the enthalpy change, of the heat transfer medium (see 4.2.1.2, 4.2.1.3, 4.2.1.4).

4.2.1.2 Measured heating capacity

The measured heating capacity shall be determined using the following formula:

$$Q_{\mathrm{h}} = \frac{\sum_{j=1}^{n} (Vm_{\mathrm{j}} \times \delta_{\mathrm{j}} \times Cp_{\mathrm{j}} \times \Delta t_{\mathrm{j}})}{n} \quad (1)$$

where

j is the scan number;

n is the number of scan of the data collection period;

Q_{h} is the measured heating capacity, in kilowatts;

Vm_{j} is the volume flow rate of the heat transfer medium at the considered scan, in cubic meters per second;

δ_{j} is the density of the heat transfer medium at flow meter temperature at the considered scan, in kilograms per cubic meter;

Cp_{j} is the specific heat of the heat transfer medium at constant pressure at mean temperature of the heat transfer medium at the considered scan, in kilojoules per kilogram and kelvin;

Δt_{j} is the difference between inlet and outlet temperatures of the heat transfer medium at the considered scan, in kelvin.

NOTE 1 The mass flow can be determined directly instead of the term $(Vm_{\mathrm{j}} * \delta_{\mathrm{j}})$.

NOTE 2 The enthalpy change ΔH_{j} can be determined directly instead of the term $(Cp_{\mathrm{j}} * \Delta t_{\mathrm{j}})$.

4.2.1.3 Effective heating capacity

The effective heating capacity is the measured heating capacity corrected for the heat from the pump(s):

a) if the pump(s) is (are) an integral part of the appliance, the capacity correction due to the pump(s), c_{pump}, calculated according to 4.2.5.4.2, which is excluded from the total electrical power input shall also be subtracted from the heating capacity (the correction is negative);

b) if the pump(s) is (are) not an integral part of the appliance, the capacity correction due to the pump(s), c_{pump}, calculated according to 4.2.5.4.3, which is added to the total electrical power input shall be also added to the heating capacity (the correction is positive).

The effective heating capacity shall be determined using the following formula:

$$Q_{\mathrm{Eh}} = Q_{\mathrm{h}} + c_{\mathrm{pump}} \quad (2)$$

where

Q_{Eh} is the effective heating capacity, in kilowatts;

Q_{h} is the measured heating capacity, in kilowatts;

c_{pump} is the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the indoor heat exchanger, in kilowatts.

4.2.1.4 Rated and nominal heating capacities

The rated heating capacity (at full load) shall be determined using the following formula:

$$Q_{Rh} = Q_h \times \frac{Q_{grh}}{Q_{gmh}} + c_{pump} \quad (3)$$

where

Q_{Rh} is the rated heating capacity, in kilowatts;

Q_h is the measured heating capacity, in kilowatts;

Q_{grh} is the rated heating heat input, in kilowatts;

Q_{gmh} is the measured heating heat input, in kilowatts;

c_{pump} is the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the indoor heat exchanger, in kilowatts.

NOTE 1 The rated heating heat input and the rated cooling heat input could be equal.

The nominal heating capacity (at full load) is an unique rated heating capacity (at full load) and shall be determined using the following formula:

$$Q_{Nh} = Q_h \times \frac{Q_{gNh}}{Q_{gmh}} + c_{pump} \quad (4)$$

where

Q_{Nh} is the nominal heating capacity, in kilowatts;

Q_h is the measured heating capacity, in kilowatts;

Q_{gNh} is the nominal heating heat input, in kilowatts;

Q_{gmh} is the measured heating heat input, in kilowatts;

c_{pump} is the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the indoor heat exchanger, in kilowatts.

NOTE 2 For more explanation about the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the indoor heat exchanger, see 4.2.1.3.

4.2.2 Cooling capacity

4.2.2.1 General

The cooling capacity of air-to-water(brine), water(brine)-to-water(brine) reversible heat pumps, chillers and chillers/heaters shall be determined in accordance with the direct method at the water or brine indoor heat exchanger(s), by determination of the volume or mass flow rate of the heat transfer medium, and the inlet and outlet temperatures, taking into consideration the specific heat capacity and density, or the enthalpy change of the heat transfer medium (see 4.2.2.2, 4.2.2.3, 4.2.2.4).

4.2.2.2 Measured cooling capacity

The measured cooling capacity shall be determined using the following formula:

$$Q_c = \frac{\sum_{j=1}^{n} (Vm_j \times \delta_j \times Cp_j \times \Delta t_j)}{n} \quad (5)$$

where

j *is the scan number;*

n is the number of scan of the data collection period;

Q_c is the measured cooling capacity, in kilowatts;

Vm_j is the volume flow rate of the heat transfer medium at the considered scan, in cubic meters per second;

δ_j is the density of the heat transfer medium at flow meter temperature at the considered scan, in kilograms per cubic meter;

Cp_j is the specific heat of the heat transfer medium at constant pressure at mean temperature of the heat transfer medium at the considered scan, in kilojoules per kilogram and kelvin;

Δt_j is the difference between inlet and outlet temperatures of the heat transfer medium at the considered scan, in kelvin.

NOTE 1 The mass flow can be determined directly instead of the term $(Vm_j * \delta_j)$.

NOTE 2 The enthalpy change ΔH_j can be determined directly instead of the term $(Cp_j * \Delta t_j)$.

4.2.2.3 Effective cooling capacity

The effective cooling capacity is the measured cooling capacity corrected for the heat from the pump(s):

a) if the pump(s) is (are) an integral part of the appliance, the capacity correction due to the pump(s), c_{pump}, calculated according to 4.2.5.4.2, which is excluded from the total power input shall be added to the cooling capacity (the correction is positive).

b) if the pump(s) is (are) not an integral part of the appliance, the capacity correction due to the pump(s), c_{pump}, calculated according to 4.2.5.4.3, which is added to the total electrical power input shall be subtracted from the cooling capacity (the correction is negative).

The effective cooling capacity shall be determined using the following formula:

$$Q_{Ec} = Q_c + c_{pump} \quad (6)$$

where

Q_{Ec} is the effective cooling capacity, in kilowatts;

Q_c is the measured cooling capacity, in kilowatts;

c_{pump} is the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the indoor heat exchanger, in kilowatts.

4.2.2.4 Rated and nominal cooling capacities

The rated cooling capacity (at full load) shall be determined using the following formula:

$$Q_{Rc} = Q_c \times \frac{Q_{grc}}{Q_{gmc}} + c_{pump} \quad (7)$$

where

Q_{Rc} is the rated cooling capacity, in kilowatts;

Q_c is the measured cooling capacity, in kilowatts;

Q_{grc} is the rated cooling heat input, in kilowatts;

Q_{gmc} is the measured heat input, in kilowatts;

c_{pump} is the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the indoor heat exchanger, in kilowatts.

NOTE 1 The rated cooling heat input and the rated heating heat input could be equal.

NOTE 2 The nominal cooling heat input and the nominal cooling heat input could be equal.

The nominal cooling capacity (at full load) is an unique rated cooling capacity (at full load) and shall be determined using the following formula:

$$Q_{Nc} = Q_c \times \frac{Q_{gNc}}{Q_{gmc}} + c_{pump} \quad (8)$$

where

Q_{Nc} is the nominal cooling capacity, in kilowatts;

Q_c is the measured cooling capacity, in kilowatts;

Q_{gNc} is the nominal cooling heat input, in kilowatts;

Q_{gmc} is the measured cooling heat input, in kilowatts;

c_{pump} is the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the indoor heat exchanger, in kilowatts.

NOTE 3 For more explanation about the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the indoor heat exchanger, see 4.2.2.3.

4.2.3 Heat recovery capacity

4.2.3.1 General

The heat recovery capacity of air-to-water(brine) and water(brine)-to-water(brine) chillers or chillers/heaters shall be determined in accordance with the direct method at the water or brine heat recovery heat exchanger(s), by determination of the volume or mass flow rate of the heat transfer medium, and the inlet and outlet temperatures, taking into consideration the specific heat capacity and density, or the enthalpy change of the heat transfer medium (see 4.2.3.2, 4.2.3.3, 4.2.3.4).

4.2.3.2 Measured heat recovery capacity

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

$$Q_{hr} = \frac{\sum_{j=1}^{n} (Vm_j \times \delta_j \times Cp_j \times \Delta t_j)}{n} \quad (9)$$

where

j is the scan number;

n is the number of scan of the data collection period;

Q_{hr} is the measured heat recovery capacity, in kilowatts;

Vm_j is the volume flow rate of the heat transfer medium at the considered scan, in cubic meters per second;

δ_j is the density of the heat transfer medium at flow meter temperature at the considered scan, in kilograms per cubic meter;

Cp_j is the specific heat of the heat transfer medium at constant pressure at mean temperature of the heat transfer medium at the considered scan, in kilojoules per kilogram and kelvin;

Δt_j is the difference between inlet and outlet temperatures of the heat transfer medium at the considered scan, in kelvin.

NOTE 1 The mass flow can be determined directly instead of the term ($Vm_j \cdot \delta_j$).

NOTE 2 The enthalpy change ΔHj can be determined directly instead of the term ($Cp_j \cdot \Delta t_j$).

4.2.3.3 Effective heat recovery capacity

The effective heat recovery capacity is the measured heat recovery capacity corrected for the heat from the pump(s):

a) if the pump(s) is (are) an integral part of the appliance, the capacity correction due to the pump(s), c_{pump}, calculated according to 4.2.5.4.2 which is excluded from the total electrical power input shall be also subtracted from the heat recovery capacity (the correction is negative).

b) if the pump(s) is (are) not an integral part of the appliance, capacity correction due to the pump(s), c_{pump}, calculated according to 4.2.5.4.3, which is added to the total electrical power input shall be also added to the heat recovery capacity (the correction is positive).

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

$$Q_{Ehr} = Q_{hr} + c_{pump} \quad (10)$$

where

Q_{Ehr} is the effective heat recovery capacity, in kilowatts;

Q_{hr} is the measured heat recovery capacity, in kilowatts;

c_{pump} is the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the heat recovery exchanger, in kilowatts.

4.2.3.4 Rated and nominal heat recovery capacities

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

$$Q_{Rhr} = Q_{hr} \times \frac{Q_{grhr}}{Q_{gmhr}} + c_{pump} \quad (11)$$

where

Q_{Rhr} is the rated heat recovery capacity, in kilowatts;

Q_{hr} is the measured heat recovery capacity, in kilowatts;

Q_{grhr} is the rated heat recovery heat input, in kilowatts;

Q_{gmhr} is the measured heat input, in kilowatts;

c_{pump} is the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the indoor heat exchanger, in kilowatts.

NOTE 1 Normally, the rated heat recovery heat input is the rated cooling heat input.

The nominal heat recovery capacity is an unique rated cooling capacity (at full load) and shall be determined using the following formula:

$$Q_{Nhr} = Q_{hr} \times \frac{Q_{gNhr}}{Q_{gmhr}} + c_{pump} \quad (12)$$

where

Q_{Nhr} is the nominal heat recovery capacity, in kilowatts;

Q_{hr} is the measured heat recovery capacity, in kilowatts;

Q_{gNhr} is the nominal heat recovery heat input, in kilowatts;

Q_{gmhr} is the measured heat recovery heat input, in kilowatts;

c_{pump} is the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the heat recovery exchanger, in kilowatts.

NOTE 2 Normally, the nominal heat recovery heat input is the nominal cooling heat input.

NOTE 3 For more explanation about the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the indoor heat exchanger, see 4.2.3.3.

4.2.4 Heat input

4.2.4.1 General conditions for operation of the gas-fired part of the appliance

Tests are carried out with the appropriate references gas(es) for the category to which the appliance belongs (see EN 437), supplied at the corresponding normal pressure indicated in EN 437.

Prior to carrying out any tests, the heat input of the burner(s) at full capacity is adjusted, if this is necessary, in order that it is within ± 5 % of the nominal heat input. This nominal heat input is determined when the appliance is operating at the appropriate standard rating conditions given in EN 12309-3:2014.