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Toplotna črpalka s plinsko gnanim motorjem z notranjim zgorevanjem - 4. del: Preskusne metode

Gas-fired endothermic engine driven heat pumps - Part 4: Test methods

Gasbefeuerte endothermische Motor-Wärmepumpen - Teil 4: Prüfverfahren

Pompes à chaleur à moteur endothermique alimenté au gaz - Partie 4 : Méthodes d'essai

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Gas-fired endothermic engine driven heat pumps - Part 4: Test methods

Pompes à chaleur à moteur endothermique alimenté au gaz - Partie 4 : Méthodes d'essai

Gasbefeuerte endothermische Motor-Wärmepumpen - Teil 4: Prüfverfahren

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 299.

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

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European foreword

This document (prEN 16905-4:2022) 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 document is currently submitted to the CEN Enquiry.

This document will supersede EN 16905-4:2017.

In comparison with the previous edition, the following technical modifications have been made:

— Editorial and technical changes throughout the draft and in Annex ZA, ZB in order to align the text to the Ecodesign Requirements of Commission Regulation (EU) No 813/2013;

— Addition of Annex ZC in order to align the text to the Ecodesign Requirements of Commission Regulation (EU) No 2016/2281.

This document has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) / Regulation(s).

For relationship with EU Directive(s) / Regulation(s), see informative Annex ZA, ZB or ZC, which is an integral part of this document.

Introduction

The GEHP appliances having their condenser cooled by air and by the evaporation of external additional water are not covered by this document.

Single split and multisplit systems are covered by this document.

The GEHP appliances can have one or more primary or secondary functions.

This document specifies the requirements, test methods and test conditions concerning, in particular, the construction, safety, fitness for purpose, and rational use of energy, for the rating and performance calculation of air conditioners and heat pumps using either air, water or brine as heat transfer media, with gas-fired endothermic engine driven compressors when used for space heating, cooling and refrigeration, hereafter referred to as “GEHP appliance”.

EN 16905 comprises the following parts under the general title, Gas-fired endothermic engine driven heat pumps:

— Part 1: Terms and definitions;

— Part 2: Safety;

— Part 3: Tests conditions;

— Part 4: Tests methods;

— Part 5: Calculation of seasonal performances in heating and cooling mode.

prEN 16905-4:2022 has been prepared to address the essential requirements of the European Regulation (EU) 2016/426 relating to appliances burning gaseous fuels and repealing Directive 2009/142/EC (see prEN 16905-4:2022, Annex ZA).

EN 16905-1:2017, prEN 16905-2:2021, EN 16905-3:2017, prEN 16905-4:2022 and prEN 16905-5:2021 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/535; (see EN 16905- 3:2017, Annex ZA, prEN 16905-4:2022, Annex ZA, prEN 16905-5:2021, Annex ZA and prEN 16905-2:2021, Annexes ZB and ZC).

These documents will be reviewed whenever new mandates could apply.

1 Scope

This document specifies the requirements, test methods and test conditions for the rating and performance calculation of gas-fired endothermic engine driven heat pumps for heating and/or cooling mode including the engine heat recovery, to be used outdoor.

This document specifies the test conditions tests methods and seasonal performances calculation methods.

This document is to be used in conjunction with:

a) the terms and conditions, EN 16905-1:2017

b) the safety, prEN 16905-2:2021

c) the test conditions, EN 16905-3:2017

d) the calculation of seasonal performances in heating and cooling mode, prEN 16905-5:2021

e) the heat pump standards, EN 14511-2:2018, EN 14511-3:2018 and EN 14825:2022.

This document only applies to appliances with a maximum heat input (based on net calorific value) not exceeding 70 kW at standard rating conditions.

This document only applies to appliances under categories I_{2H}, I_{2E}, I_{2Er}, I_{2R}, $I_{2E(S)B}$, I_{2L}, I_{2LL}, I_{2ELL}, $I_{2E(R)B}$, I_{2ESi}, $I_{2E(R)}$, I_{3P}, I_{3B}, $I_{3B/P,}$ II_{2H3}+, II_{2Er3}+, $II_{2H3B/P}$, $II_{2L3B/P}$, $II_{2E3B/P}$, $II_{2ELL3B/P}$, II_{2L3P}, II_{2H3P}, II_{2E3P} and II_{2Er3P} according to EN 437:2021.

This document only applies to appliances having:

a) gas fired endothermic engines under the control of fully automatic control systems;

b) closed system refrigerant circuits in which the refrigerant does not come into direct contact with the fluid to be cooled or heated;

c) where the temperature of the heat transfer fluid of the heating system (heating water circuit) does not exceed 105 °C during normal operation;

d) where the maximum operating pressure in the:

   1) heating water circuit (if installed) does not exceed 6 bar;

   2) domestic hot water circuit (if installed) does not exceed 10 bar.

This document applies to GEHP appliances only when used for space heating or space cooling or for refrigeration, with or without heat recovery.

This document is applicable to GEHP appliances that are intended to be type tested. Requirements for GEHP appliances that are not type tested would need to be subject to further consideration.

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.

EN 437:2021, *Test gases - Test pressures - Appliance categories*

EN 14511-3:2018, *Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 3: Test methods*

EN 16905-1:2017, *Gas-fired endothermic engine driven heat pumps - Part 1: Terms and definitions*

prEN 16905-2:2021,[1] *Gas-fired endothermic engine driven heat pumps — Part 2: Safety*

EN 16905-3:2017, *Gas-fired endothermic engine driven heat pumps - Part 3: Test conditions*

prEN 16905-5:2021,[2] *Gas-fired endothermic engine driven heat pumps — Part 5: Calculation of seasonal performances in heating and cooling mode*

FprEN 12102-1:2022,[3] *Air conditioners, liquid chilling packages, heat pumps, process chillers 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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16905-1:2017 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Test methods

4.1 General

A steady-state or transient or cyclical operation test could be applied for 100 % load tests or for reduced load tests.

The sound power level is measured in the standard rating conditions as given in EN 16905-3:2017 with the corresponding test methods according to FprEN 12102-1:2022 considering that this standard, dedicated to determination of the sound power level could be used with appliances covered in the scope of EN 16905-1:2017; prEN 16905-2:2021; EN 16905-3:2017 and prEN 16905-5:2021.

[1] Currently in preparation.

[2] Currently in preparation.

[3] Currently in preparation.

4.2 Basic principles method of calculation for the determination of capacities

4.2.1 Capacity

4.2.1.1 Measured capacity

The measured cooling or heating capacity of air-to-air or water (brine)-to-air GEHP shall be determined by measurements in a calorimeter room (see Annex A) or by the air enthalpy method (see Annex B).

The measured cooling or heating capacity of air-to-water (brine) or water (brine)-to-water (brine) GEHP shall be determined in accordance with the water enthalpy method (see Annex D).

The measured heat recovery capacity of all GEHP shall be determined in accordance with the water enthalpy method (see Annex D).

4.2.1.2 Effective capacity

4.2.1.2.1 Effective cooling capacity

The effective cooling capacity is the measured cooling capacity corrected for the heat from the device (pump(s) or fan(s)) responsible for circulating the heat transfer medium through the indoor heat exchanger:

a) if the fan(s) or pump(s) is (are) an integral part of the appliance, the capacity correction due to the device, $C_{device\text{-}indoor}$, calculated according to 4.2.4.3.3.1 or 4.2.4.4.2.1, which is excluded from the total power input shall be added to the cooling capacity (the correction is positive). The effective heating capacity shall be determined using the following formula:

$$Q_{Ec} = Q_c + Abs\left(C_{device\_indoor}\right) \quad (1)$$

b) if the fan(s) or pump(s) is (are) not an integral part of the appliance, the capacity correction due to the device, $C_{device\text{-}indoor}$, calculated according to 4.2.4.3.3.2 or 4.2.4.4.2.2, 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:

$$Q_{Ec} = Q_c - Abs\left(C_{device\_indoor}\right) \quad (2)$$

where:

Q_{EC} is the effective cooling capacity, in kilowatt;

Q_c is the measured cooling capacity, in kilowatt;

C_{device_indoor} is the capacity correction due to the device(s) (fan(s) or pump(s)) responsible for circulating the heat transfer medium through the indoor heat exchanger, in kilowatt.

4.2.1.2.2 Effective heating capacity

The effective heating capacity is the measured heating capacity corrected for the heat from the device (pump(s) or fan(s)) responsible for circulating the heat transfer medium through the indoor heat exchanger:

a) if the fan(s) or pump(s) is (are) an integral part of the appliance, the capacity correction due to the device, C_{device_indoor}, calculated according to 4.2.4.3.3.1 or 4.2.4.4.2.1, which is excluded from the total electrical power input shall also be subtracted from the heating capacity (the correction is negative). The effective heating capacity shall be determined using the following formula:

$$Q_{Eh} = Q_h - Abs\left(C_{device\_indoor}\right) \quad (3)$$

b) if the fan(s) or pump(s) is (are) not an integral part of the appliance, the capacity correction due to the device, C_{device_indoor}, calculated according to 4.2.4.3.3.2 or 4.2.4.4.2.2, 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:

$$Q_{Eh} = Q_h + Abs\left(C_{device\_indoor}\right) \quad (4)$$

where

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

Q_h is the measured heating capacity, in kilowatt;

C_{device_indoor} is the capacity correction due to the device(s) (fan(s) or pump(s)) responsible for circulating the heat transfer medium through the indoor heat exchanger, in kilowatt.

4.2.1.3 Rating capacity

4.2.1.3.1 Rating cooling capacity

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

$$Q_{Rc} = Q_c \times \frac{Q_{grc}}{Q_{gmc}} \pm Abs\left(C_{device\_indoor}\right) \quad (5)$$

where

Q_{Rc} is the rating cooling capacity, in kilowatt;

Q_c is the measured cooling capacity, in kilowatt;

Q_{grc} is the rating gas heat input in cooling mode, in kilowatt;

Q_{gmc} is the measured gas heat input in cooling mode, in kilowatt;

C_{device_indoor} is the capacity correction due to the device(s) (fan(s) or pump(s)) responsible for circulating the heat transfer medium through the indoor heat exchanger, in kilowatt.

NOTE For more explanation about the capacity correction due to the device responsible for circulating the heat transfer medium through the indoor heat exchanger, see 4.2.1.2.1.

4.2.1.3.2 Rating heating capacity

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

$$Q_{Rh} = Q_h \times \frac{Q_{grh}}{Q_{gmh}} \pm Abs\left(C_{device\_indoor}\right) \quad (6)$$

where

Q_{Rh} is the rating heating capacity, in kilowatt;

Q_h is the measured heating capacity, in kilowatt;

Q_{grh} is the rating gas heat input in heating mode, in kilowatt;

Q_{gmh} is the measured gas heat input in heating mode, in kilowatt;

C_{device_indoor} is the capacity correction due to the device(s) (fan(s) or pump(s)) responsible for circulating the heat transfer medium through the indoor heat exchanger, in kilowatt.

NOTE For more explanation about the capacity correction due to the device responsible for circulating the heat transfer medium through the indoor heat exchanger, see 4.2.1.2.2.

4.2.2 Engine heat recovery capacity

4.2.2.1 Effective engine heat recovery capacity

The effective engine heat recovery capacity is the measured engine heat recovery capacity corrected for the heat from the device (pump(s)) of the engine heat recovery circuit (measured in any condition):

a) if this (these) pump(s) is (are) an integral part of the appliance, the capacity correction due to the pump(s), c_{device_hr}, calculated according to 4.2.4.4.2.1 which is excluded from the total electrical power input shall be also subtracted from the engine heat recovery capacity (the correction is negative).

b) if this(these) pump(s) is (are) not an integral part of the appliance, capacity correction due to the pump(s), c_{device_hr}, calculated according to 4.2.4.4.2.2, which is added to the total electrical power input shall be also added to the engine heat recovery capacity (the correction is positive).

The effective engine heat recovery capacity shall be determined using the following formula, which is applicable to either heating or cooling mode:

$$Q_{Ehr} = Q_{hr} \pm Abs\left(C_{device\_hr}\right) \quad (7)$$

where

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

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

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

4.2.2.2 Rating engine heat recovery capacity in cooling mode

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

$$Q_{Rhrc} = Q_{hr} \times \frac{Q_{grhrc}}{Q_{gmhr}} \pm Abs\left(C_{device\_hr}\right) \quad (8)$$

where

Q_{Rhrc} is the rating engine heat recovery capacity in cooling mode, in kilowatt;

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

Q_{grhrc} is the rating engine heat recovery gas heat input in cooling mode, in kilowatt;

Q_{gmhr} is the measured engine heat recovery gas heat input, in kilowatt;

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

NOTE 1 For more explanation about the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the engine heat recovery heat exchanger, see 4.2.2.1.

NOTE 2 The rating heat recovery heat input in cooling mode is equal to the rating heat recovery heat input in heating mode.

4.2.2.3 Rating engine heat recovery capacity in heating mode

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

$$Q_{Rhrh} = Q_{hr} \times \frac{Q_{grhrh}}{Q_{gmhr}} \pm Abs\left(C_{device\_hr}\right) \quad (9)$$

where

Q_{Rhrh} is the rating engine heat recovery capacity in heating mode, in kilowatt;

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

Q_{grhrh} is the rating engine heat recovery gas heat input in heating mode, in kilowatt;

Q_{gmhr} is the measured engine heat recovery gas heat input, in kilowatt;

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

NOTE For more explanation about the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the engine heat recovery heat exchanger, see 4.2.2.1.