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Toplotna črpalka s plinsko gnanim motorjem z notranjim zgorevanjem - 2. del: Varnost

Gas-fired endothermic engine driven heat pumps - Part 2: Safety

Gasbefeuerte endothermische Motor-Wärmepumpen - Teil 2: Sicherheit

Pompes à chaleur à moteur endothermique alimenté au gaz - Partie 2: Sécurité

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27.080	Toplotne črpalke	Heat pumps

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Gas-fired endothermic engine driven heat pumps - Part 2: Safety

Pompes à chaleur à moteur endothermique alimenté au gaz - Partie 2: Sécurité

Gasbefeuerte endothermische Motor-Wärmepumpen - Teil 2: Sicherheit

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 16905-2:2021) 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 16905-2:2020.

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 and ZC, which are an integral part of this document.

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 and ZC in order to align the text to the Ecodesign Requirements stated in Commission Regulation (EU) No 2016/426.

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.*

Introduction

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

Single split and multisplit systems are covered by this European Standard.

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

This European Standard 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 16905-2:2020 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 EN 16905-2:2020, Annex ZA).

EN 16905-1:2017, EN 16905-2:2020, EN 16905-3:2017, EN 16905-4:2017 and EN 16905-5:2017 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, EN 16905-4:2017, Annex ZA, EN 16905-5:2017, Annex ZA and EN 16905-2:2020, Annexes ZB and ZC).

These documents will be reviewed whenever new mandates could apply.

1 Scope

This part of prEN 16905 specifies the safety requirements, the safety test conditions and the safety test methods of gas-fired endothermic engine driven heat pumps for heating and/or cooling mode including the engine heat recovery, to be used outdoors.

This document specifies minimum operating requirements which ensure that the products are fit for the use designated by the manufacturer when used for space heating and/or cooling.

This document is to be used in conjunction with:

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

b) the test conditions, EN 16905-3:2017;

c) the test methods, EN 16905-4:2017;

d) the calculation of seasonal performances in heating and cooling mode, EN 16905-5:2017;

e) the heat pump, prEN 14511-4:2021, EN 378-1:2016+A1:2020, EN 378-2:2016, EN 378-3:2016+A1:2020, EN 378-4:2016+A1:2019 and EN 14825:2018;

f) electrical safety, EN 60335-1:2012, EN 60335-2-102:2016, EN 60335-2-40:2003[2] and EN 60204-1:2018.

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

This document only applies to GEHP appliances under categories I2H, I2E, I2Er, I2R, I2E(S)B, I2L, I2LL, I2ELL, I2E(R)B, I2ESi, I2E(R), I3P, I3B, I3B/P, II2H3+, II2Er3+, II2H3B/P, II2L3B/P, II2E3B/P, II2ELL3B/P, II2L3P, II2H3P, II2E3P and II2Er3P according to EN 437:2021.

This document only applies to GEHP appliances:

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

b) that have 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 161:2011+A3:2013, *Automatic shut-off valves for gas burners and gas appliances*

EN 378-2:2016, *Refrigerating systems and heat pumps - Safety and environmental requirements - Part 2: Design, construction, testing, marking and documentation*

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

EN 549:2019, *Rubber materials for seals and diaphragms for gas appliances and gas equipment*

CR 1404:1994, *Determination of emissions from appliances burning gaseous fuels during type-testing*

EN 1561:2011, *Founding - Grey cast irons*

EN 10029:2010, *Hot-rolled steel plates 3 mm thick or above - Tolerances on dimensions and shape*

EN 10226-1:2004, *Pipe threads where pressure tight joints are made on the threads - Part 1: Taper external threads and parallel internal threads - Dimensions, tolerances and designation*

EN 10226-2:2005, *Pipe threads where pressure tight joints are made on the threads - Part 2: Taper external threads and taper internal threads - Dimensions, tolerances and designation*

EN 12102-1:2017, *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*

EN 12102-2:2019, *Air conditioners, liquid chilling packages, heat pumps, process chillers and dehumidifiers with electrically driven compressors - Determination of the sound power level - Part 2: Heat pump water heaters*

EN 14800:2007, *Corrugated safety metal hose assemblies for the connection of domestic appliances using gaseous fuels*

EN 16436-1:2014+A3:2020, *Rubber and plastics hoses, tubing and assemblies for use with propane and butane and their mixtures in the vapour phase - Part 1: Hoses and tubings*

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

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

EN 16905-4:2017, *Gas-fired endothermic engine driven heat pumps - Part 4: Test methods*

EN 16905-5:2017, *Gas-fired endothermic engine driven heat pumps - Part 5: Calculation of seasonal performances in heating and cooling mode*

EN IEC 55014-1:2021, *Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission*

EN IEC 55014-2:2021, *Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 2: Immunity - Product family standard*

EN 60335-1:2012[1], *Household and similar electrical appliances – Safety – Part 1: General requirements*

EN 60335-2-40:2003[2], *Household and similar electrical appliances - Safety - Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers*

EN 60335-2-102:2016, *Household and similar electrical appliances - Safety - Part 2-102: Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections*

EN 60529:1991[3], *Degrees of protection provided by enclosures (IP Code)*

EN 61000-3-2:2014, *Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*

EN 61000-3-3:2013, *Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection*

EN IEC 61000-3-11:2019, *Electromagnetic compatibility (EMC) - Part 3-11: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems - Equipment with rated current ≤ 75 A and subject to conditional connection*

EN 61000-3-12:2011, *Electromagnetic compatibility (EMC) - Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and <= 75 A per phase*

EN IEC 61000-6-1:2019, *Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity standard for residential, commercial and light-industrial environments*

EN 61000-6-3:2007, *Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments*

EN ISO 2553:2019, *Welding and allied processes - Symbolic representation on drawings - Welded joints (ISO 2553:2019, Corrected version 2021-09)*

EN ISO 3166-1:2020, *Codes for the representation of names of countries and their subdivisions - Part 1: Country code (ISO 3166-1:2020)*

EN ISO 4063:2010, *Welding and allied processes - Nomenclature of processes and reference numbers (ISO 4063:2009, Corrected version 2010-03-01)*

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[1] As impacted by EN 60335-1:2012/A11:2014, EN 60335-1:2012/AC:2014, EN 60335-1:2012/A13:2017, EN 60335-1:2012/A1:2019, EN 60335-1:2012/A2:2019, EN 60335-1:2012/A14:2019 and EN 60335-1:2012/A15:2021.

[2] As impacted by EN 60335-2-40:2003/A11:2004, EN 60335-2-40:2003/A12:2005, EN 60335-2-40:2003/A1:2006, EN 60335-2-40:2003/Cor.:2006, EN 60335-2-40:2003/A2:2009, EN 60335-2-40:2003/Cor.:2010, EN 60335-2-40:2003/A13:2012 and EN 60335-2-40:2003/A13:2012/AC:2013.

[3] As impacted by EN 60529:1991/A1:2000 and EN 60529:1991/A2:2013.

EN ISO 7010:2020, *Graphical symbols - Safety colours and safety signs - Registered safety signs (ISO 7010:2019, Corrected version 2020-06)*

ISO 857-2:2005, *Welding and allied processes - Vocabulary - Part 2: Soldering and brazing processes and related terms*

3 Terms and definitions

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

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

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

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

3.1
maximun water operating pressure
PMS
maximum water operating pressure at which the GEHP appliance can be used, in bars given by the symbol “PMS”, followed by the equals sign, the numerical value and the unit “bar

3.2
Ignition Safety Time
TSA
time elapsing between the start and the stop of the gas supply to internal combustion engine in the event of ignition not taking place

3.3
Maximum Ignition Safety Time
TSA max
ignition safety time measured under the least favourable conditions of ambient temperature and variation in supply voltage

4 Classification

4.1 General

GEHP appliances can be classified according to:

— the gases they use;

— the unit structure;

— air blowing system.

4.2 Classification of GEHP appliances

4.2.1 Classification of gases

Gases are classified into three families, possibly divided into groups according to the value of the Wobbe index. Families and groups of gas used in this standard are in accordance with those of the EN 437:2021. This standard is for GEHP appliances working with 2nd and 3rd gas family only.

4.2.2 Classification according to the unit structure

4.2.2.1 Single split

Single GEHP appliance in combination with single heating/cooling device to form a discrete matched functional unit.

4.2.2.2 Multi split

Single GEHP appliance with a single refrigerant circuit in combination with multiple heating/cooling devices.

4.2.3 Classification according to the air blowing system

4.2.3.1 Non ducted type

Air introduced from the space containing the unit and discharged within the same space.

4.2.3.2 Ducted type

Air introduced from the space containing the unit and discharged outside this space.

4.3 GEHP appliance classification according to the maximum water side operating pressure (PMS):

— pressure class 1: PMS = 1 bar

— pressure class 2: PMS = 3 bar

— pressure class 3: 3 bar < PMS ≤ 6 bar

NOTE Internal cooling circuits in GEHP appliances are not considered under this classification, e.g. internal cooling circuits for internal combustion engine in GEHP appliances.

5 Design requirements

5.1 Structure

5.1.1 General

The structure of the equipment shall satisfy the following requirements in consideration of safety and durability:

a) The edge of the part which people touch with hands in service or in the case of maintenance and checking shall be sufficiently smooth.

b) The control section and electric section shall not be influenced by the weather condition.

c) The thermal insulation material, etc. shall not produce detachment or omission in normal use.

d) The movable parts of the blower, etc. shall not easily come into contact with a human body in normal use.

e) The thermal insulation material, etc. used near (less than 50 mm) the electric component section shall be fire-resistant, except in cases where there is no possibility that danger such as electric shock, fire arises if the thermal insulation material, etc. burns.

f) The confirmation of drain of the condensed water can be easily performed.

g) The connecting port, etc. for refrigerant collection shall be provided.

h) The refrigerant circuit shall be safe for an abnormal pressure rise.

i) The GEHP appliance shall be equipped with control and safety devices for start, operation and control of the gas supply.

j) These devices shall ensure the automatic start and the automatic monitoring for the operating functions of the engine and the GEHP appliance as well as the gas supply.

k) In case of failure of the normal operating functions (malfunctions), the gas supply shall be cut off, if need be, with lock-out in accordance with the operating programme.

l) The functional safety specification for control and supervision as well as for the automatic restart shall be part of the design documents.

m) The design of the control and safety system shall be such that it is not possible to perform two or more actions which are unacceptable in combination. The order of the actions shall be fixed in such a manner that it is not possible to change it.

n) Any parts of a GEHP appliance which are not intended to be altered by the user or the installer shall be protected in an appropriate manner. Paint may be used for this purpose provided that it withstands the temperature to which it is subjected during normal operation of the GEHP appliance.

o) GEHP appliances shall be so designed and constructed that gas release at any state of operation is limited in order to avoid a dangerous accumulation of unburned gas in the GEHP appliance.

5.1.2 Structure of each part

5.1.2.1 Gas inlet connection

The gas inlet connection shall be as follows:

a) The gas inlet connection portshall be exposed to the outside or shall be located so that it is able to be easily identified visually.

b) For the screw threads of the gas connecting port, those specified in EN 10226-1:2004 or EN 10226-2:2005 shall be used.

5.1.2.2 Automatic shut-off valve

The automatic shut-off valve shall be as follows.

a) The gas passage to an engine shall be closed by two or more automatic shut-off valves provided in series at the time of engine stop.

b) Each automatic shut-off valve shall have the independent function.

c) Each automatic shut-off valve shall comply with the requirement of EN 161:2011+A3:2013.

d) Composition of the automatic shut-off valves shall be, at least, C+C or B+J.

e) For non-volatile lockout two or more valves shall be closed simultaneously.

In response to a control device, if the delay between the signals to close the two valves is not greater than 1 s, the signals are considered to be simultaneous.

5.1.2.3 Gas carrying circuit

The gas carrying circuit shall be as follows:

a) The gas carrying circuit used for the part which becomes negative pressure shall have sufficient strength to negative pressure. Under the normal operation condition, each part of the gas carrying circuit shall be free from abnormalities such as deformation during the period from the close of the gas shut off valve in the gas inlet side to the stop of the engine.

b) The surface treatment such as a tinning shall be given to the inner surface of the copper pipe of 2 mm or less in inner diameter used for a gas carrying circuit.

c) The gas carrying circuit used for the part which becomes positive pressure shall have sufficient strength to positive pressure.

d) When there is leakage of fuel gas from the gas carrying circuit used for the part which becomes positive pressure, the GEHP appliance shall be structured so that the leaked fuel gas shall comply with the requirements of the soundness gas carrying circuit specified in 6.2.1.

e) Gas carrying circuit shall be sound so that at any state of operation unburned gas in the GEHP appliance does not accumulate.

5.1.2.4 Soundness of the engine

Soundness of the engine shall be ensured according to the following items:

The leakage of the engine shall

a) be ignited immediately with the mixture designed to be burned in the engine, or

b) be contained by the entire engine being surrounded by combustion air or cooling water, or

c) be released easily outside into atmosphere, or

d) lead to non-operation of the engine under such leakage conditions.

5.1.2.5 Combustion products circuit

The combustion products circuit shall be as follows:

a) The combustion products circuit shall have the structure to endure the temperature of combustion products and vibration of an engine;

b) The ducts, bends, if any, and the terminal or fitting piece shall fit together correctly and shall form a stable assembly. Parts intended to be dismantled for periodic servicing shall be designed and arranged so that soundness is assured after reassembly. Any fitting piece shall allow a sound connection to be made to the system intended for the evacuation of combustion products and supply of air;

c) The opening of combustion products exhaust outlet shall be structured so that a steel ball of 16 mm in diameter by applying a force of 5 N in every possible position cannot enter or birds, etc. cannot invade;

d) Condensation shall not affect the operational safety, then the combustion products circuit shall have the structure which is capable of discharging condensation drain without blocking the combustion products;

e) All parts of the heat exchanger(s) and other parts of the GEHP appliance likely to come into contact with condensate shall be constructed of corrosion resistant materials or materials protected by a suitable coating and maintained in accordance with the manufacturer's instructions;

f) If the technical documentation states the chemical composition of the condensate, the composition shall be verified at the end of the test under rating conditions in cooling mode according to EN 16905-3:2017, 4.2.

5.1.2.6 Casing

The casing shall be as follows:

a) The opening of casing to intake air for combustion shall be structured so that a steel ball of 16 mm in diameter when applied with a force of 5 N cannot enter.

b) The panel for checking and maintenance shall have the structure to endure the intended use of attachment and detachment.

5.1.2.7 Motor for engine startup

The motor for engine startup shall have protection device (for example, fuse) to prevent overheat.

5.1.2.8 Engine ignition device

The engine ignition device shall be structured so that the noise radiation (radio noise) generated by the engine ignition device gives no interference to other equipment.

5.1.2.9 Engine protective device

The engine protective device shall be as follows:

a) When the number of rotations of an engine exceeds that designated by the design documentation, the engine protective device shall have the function in which the engine stops and the gas carrying circuit is automatically closed.

b) When the engine oil decreases to the degree indicated in the design documentation, the engine protective device shall have the function in which the engine stops and the gas carrying circuit is automatically closed.

c) When the engine cooling water (anti-freeze solution) exceeds the temperature indicated in the design documentation, the engine protective device shall have the function in which the engine stops and the gas carrying circuit is automatically closed.

5.1.3 Refrigerant circuit

The strength of each part of refrigerant circuit shall conform to the specification of EN 378-2:2016 and have the structure to endure vibration of an engine, etc. sufficiently.

5.1.4 Engine lubricant oil circuit

In case of leakage from the lubricant oil circuit, there shall be no escape of oil to outside of GEHP appliance.

5.2 Material

5.2.1 Domestic hot water circuit

The materials of the parts containing domestic water shall not affect the quality of the domestic water in respect of either health or taste.