SLOVENSKI STANDARD
oSIST prEN 16905-5:2015

01-november-2015

Plinske toplotne črpalke endotermnega motorja - 5. del: Izračun sezonske zmogljivosti za ogrevanje in hlajenje

Gas-fired endothermic engine heat pumps - Part 5: Calculation of seasonal performances in heating and Cooling mode

Gasbefeuerte endothermische Motor-Wärmepumpen - Teil 5: Berechnung der saisonalen Effizienzkennzahlen im Heiz- und Kühlmodus

Pompes à chaleur à moteur endothermique alimenté au gaz -Partie 5 : Calcul des performances saisonnières en modes chauffage et refroidissement

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Ta slovenski standard je istoveten z: **prEN 16905-5**

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ICS:

27.080	Toplotne črpalke	Heat pumps

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EUROPEAN STANDARD

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prEN 16905-5

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ICS

English Version

Gas-fired endothermic engine heat pumps - Part 5: Calculation of seasonal performances in heating and Cooling mode

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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COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (prEN 16905-5:2015) 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 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 standard 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*.

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prEN 16905-1, prEN 16905-2, prEN 16905-3, prEN 16905-4 and prEN 16905-5 have been prepared to address the essential requirements of the European Directive 2009/142/EC relating to appliances burning gaseous fuels (see prEN 16905-2, Annex ZA for safety aspects and prEN 16905-5:2015, Annex ZA of for rational use of energy aspects).

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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 prEN 16905-3:2015, Annex ZA, prEN 16905-4:2015, Annex ZA, prEN 16905-5:2015, Annex ZA and prEN 16905-2, Annex ZB).

These documents will be reviewed whenever new mandates could apply.

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1 Scope

1.1 Scope of prEN 16905

This European Standard specifies the requirements, test methods and test conditions 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”.

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

This European Standard 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.

This European Standard only applies to appliances having:

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

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

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

— where the maximum operating pressure in the

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

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

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

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

Packaged units, single split and multisplit systems are covered by this European Standard. Single duct and double duct units are covered by this European Standard.

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

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

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

NOTE All the symbols given in this text are used regardless of the language used.

1.2 Scope of prEN 16905-5

This part of prEN 16905 specifies the calculation of seasonal performance factor for heating and/or cooling mode including the engine heat recovery.

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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.

prEN 16905-1:2015, *Gas-fired endothermic engine heat pumps — Part 1: Terms and definitions*

prEN 16905-4:2015, *Gas-fired endothermic engine heat pumps — Part 4: Tests methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN 16905-1:2015 apply.

4 Part load conditions in cooling mode

4.1 General

For the purpose of calculation of application $SGUE_c$, $SAEF_c$, $SEHREgas_c$, $SEHREelec_c$ and reference $SGUE_c$, $SAEF_c$, $SEHREgas_c$, $SEHREelec_c$ as explained in Clauses 6 and 7, the part load ratios mentioned below shall be based on the part load ratio Formulae (1st column of Tables 1 to 2) and not on the rounded figures as mentioned in the 2nd column of these tables. The calculation of $SGUE_c$, $SAEF_c$, $SEHREgas_c$, $SEHREelec_c$ and reference $SGUE_c$, $SAEF_c$, $SEHREgas_c$, $SEHREelec_c$ is determined via linear interpolation of the respective part load values at the reference part load conditions mentioned below (A,B,C,D).

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4.2 Air-to-air units

The part load conditions for determining the reference $SGUE_c$ (Formula (2)), $SAEF_c$ (Formula (4)), $SEHREgas_c$ (Formula (7)), $SEHREelec_c$ (Formula (8)) are given in the following table:

Table 1 — Part load conditions of air to air units and air-cooled multisplit systems in cooling mode

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	Part load ratio	Part load ratio %	Outdoor air dry bulb temperature °C	Indoor air dry bulb (wet bulb) temperatures °C
A	(35–16)/(Tdesignc-16)	100	35	27(19)
B	(30–16)/(Tdesignc-16)	74	30	27(19)
C	(25–16)/(Tdesignc-16)	47	25	27(19)
D	(20–16)/(Tdesignc-16)	21	20	27(19)

4.3 Water-to-air and brine to air units

The part load conditions for determining the reference $SGUE_c$ (Formula (2)), $SAEF_c$ (Formula (4)), $SEHREgas_c$ (Formula (7)), $SEHREelec_c$ (Formula (8)) are given in the following table:

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Table 2 — Part load conditions of water-to-air and brine-to-air units in cooling mode

	Part load ratio	Part load ratio %	Outdoor heat exchanger			Indoor heat exchanger
			Cooling tower [b] or water loop application Inlet/outlet water temperatures °C	Ground coupled application (water or brine) Inlet/outlet water temperatures °C	Dry cooler application Inlet/outlet water temperatures °C	Air dry bulb (wet bulb) temperatures °C
A	(35–16)/(Tdesignc-16)	100	30/35	10/15	50/45	27(19)
B	(30–16)/(Tdesignc-16)	74	26/[a]	10/[a]	45/[a]	27(19)
C	(25–16)/(Tdesignc-16)	47	22/[a]	10/[a]	40/[a]	27(19)
D	(20–16)/(Tdesignc-16)	21	18/[a]	10/[a]	35/[a]	27(19)

[a] With the water flow rate as determined during the “A” test.

[b] If a cooling tower and a water-to-air unit are sold as a matched assembly, they shall be tested as an air-to-air unit.

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4.4 Air-to-water units

For each application, units either allowing or not allowing a variation of the outlet water temperature with the outdoor temperature are considered. The variable outlet temperature shall only be applied when the control provides a regulation of outlet water temperature that considers the outdoor temperature.

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The part load conditions for determining the reference $SGUE_c$ (Formula (2)), $SAEF_c$ (Formula (4)), $SEHREgas_c$ (Formula (7)), $SEHREelec_c$ (Formula (8)) are given in the following table:

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Table 3 — Part load conditions of air-to-water units in cooling mode

	Part load ratio	Part load ratio %	Outdoor heat exchanger	Indoor heat exchanger		
			Air dry bulb temperature °C	Fan coil application Inlet/outlet water temperatures		Cooling floor application Inlet/outlet water temperatures °C
				Fixed outlet °C	Variable outlet °C	
A	(35–16)/(Tdesignc-16)	100	35	12/7	12/7	23/18
B	(30–16)/(Tdesignc-16)	74	30	[a] /7	[a] /8,5	[a] /18
C	(25–16)/(Tdesignc-16)	47	25	[a] /7	[a] /10	[a] /18
D	(20–16)/(Tdesignc-16)	21	20	[a] /7	[a] /11,5	[a] /18

[a] With the water flow rate as determined during “A” test for units with a fixed water flow rate or with a fixed delta T of 5 K for units with a variable water flow rate.

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4.5 Water-to-water and brine-to-water units

For each application, units either allowing or not allowing a variation of the outlet water temperature with the outdoor temperature are considered. The variable outlet temperature shall only be applied when the control provides a regulation of outlet water temperature that considers the outdoor temperature.

The part load conditions for determining the reference $SGUE_c$ (Formula (2)), $SAEF_c$ (Formula (4)), $SEHREgas_c$ (Formula (7)), $SEHREelec_c$ (Formula (8)) are given in the following table:

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Table 4 — Part load conditions of water to-water units and brine to-water units in cooling mode

	Part load ratio	Part load ratio %	Outdoor heat exchanger			Indoor heat exchanger		
			Cooling tower[b] application Inlet/outlet water temperatures °C	Ground coupled application (water or brine) Inlet/outlet water temperatures °C	Dry cooler application Inlet/outlet water temperatures °C	Fan coil application Inlet/outlet water temperatures		Cooling floor application Inlet/outlet water temperatures °C
						Fixed outlet °C	Variable outlet °C	
A	(35–1 6) / (Tdesignc-16)	100	30/35	10/15	50/45	12/7	12/7	23/18
B	(30–1 6) / (Tdesignc-16)	74	26/[a]	10/[a]	45/[a]	[a] /7	[a] /8,5	[a] /18
C	(25–1 6) / (Tdesignc-16)	47	22/[a]	10/[a]	40/[a]	[a] /7	[a] /10	[a] /18
D	(20–1 6) / (Tdesignc-16)	21	18/[a]	10/[a]	35/[a]	[a] /7	[a] /11,5	[a] /18

[a] With the water flow rate as determined during “A” test for units with a fixed water flow rate or with a fixed delta T of 5 K for units with a variable water flow rate.

[b] If a cooling tower and water-to-air unit are sold as a matched assembly, they shall be tested as an air-to-air unit.

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5 Part load conditions in heating mode

5.1 General

For the purpose of calculation of application $SGUE_h$, $SAEF_h$, $SEHREgas_h$, $SEHREelec_h$ and reference $SGUE_h$, $SAEF_h$, $SEHREgas_h$, $SEHREelec_h$ the part load ratios mentioned below should be based on the part load ratio Formulae (1st column of Tables 4 to 22) and not on the rounded figures as mentioned in the 2nd column of these tables. The calculation of $SGUE_h$, $SAEF_h$, $SEHREgas_h$, $SEHREelec_h$ and reference $SGUE_h$, $SAEF_h$, $SEHREgas_h$, $SEHREelec_h$ is determined via linear interpolation of the respective part load values at the reference part load conditions mentioned below (A,B,C,D). For the purpose of reference $SGUE_h$, $SAEF_h$, $SEHREgas_h$, $SEHREelec_h$ there are three reference conditions: average(A), warmer (W) and colder (C).

The relevant $Tdesign_h$ values are defined as follows:

— Tdesign “average” dry bulb temperature conditions at − 10 °C (− 11 °C wet bulb) outdoor temperature and 20 °C indoor temperature;

— Tdesign “colder” dry bulb temperature conditions at − 22 °C (− 23 °C wet bulb) outdoor temperature and 20 °C indoor temperature

— Tdesign “warmer” dry bulb temperature conditions at + 2 °C (1 °C wet bulb) outdoor temperature and 20 °C indoor temperature

and the relevant Tbivalent is defined as follows:

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— for the average heating season, the dry bulb bivalent temperature is + 2 °C or lower;

— for the colder heating season, the dry bulb bivalent temperature is − 7 °C or lower;

— for the warmer heating season, the dry bulb bivalent temperature is + 7 °C or lower.

NOTE If the declared TOL is lower than the $Tdesign_h$ of the considered climate, then it is assumed that TOL is equal to $Tdesign_h$. For Tbivalent and TOL higher or equal to − 7 °C the wet bulb temperature equals the dry bulb temperature minus 1 °C. For Tbivalent and TOL below − 7 °C, the wet bulb temperature is not defined. At any other part load conditions, the declared capacity of the appliance is larger than the building load.

5.2 Air-to-air units

The part load conditions for determining the reference $SGUE_h$ (Formula (11)), $SAEF_h$ (Formula (13)), $SEHREgas_h$ (Formula (16)), $SEHREelec_h$ (Formula (17)) are given in the following tables:

Table 5 — Part load conditions of air-to-air units and air-cooled multisplit systems in heating mode for the reference heating season "A" = average

	A		Outdoor air dry bulb (wet bulb) temperatures °C	Indoor air dry bulb temperature °C
	Part load ratio	Part load ratio %		
A	(−7–16)/(Tdesignh-16)	88	−7(−8)	20
B	(+2–16)/(Tdesignh-16)	54	2(1)	20
C	(+7–16)/(Tdesignh-16)	35	7(6)	20
D	(+12–16)/(Tdesignh-16)	15	12(11)	20
E	(TOL-16)/(Tdesignh-16)		TOL	20
F	(Tbivalent-16)/(Tdesignh −16)		Tbivalent	20

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Table 6 — Part load conditions of air-to-air units and air-cooled multisplit systems in heating mode for the reference heating season "W" = warmer

	W		Outdoor air dry bulb (wet bulb) temperatures °C	Indoor air dry bulb temperature °C
	Part load ratio	Part load ratio %		
A	(not applicable)			
B	(+2–16)/(Tdesignh-16)	100	2(1)	20
C	(+7–16)/(Tdesignh-16)	64	7(6)	20
D	(+12–16)/(Tdesignh-16)	29	12(11)	20
E	(TOL-16)/(Tdesignh-16)		TOL	20
F	(Tbivalent-16)/(Tdesignh −16)		Tbivalent	20

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Table 7 — Part load conditions of air-to-air units and air-cooled multisplit systems in heating mode for the reference heating season "C" = colder

	C		Outdoor air dry bulb (wet bulb) temperatures °C	Indoor air dry bulb temperature °C
	Part load ratio	Part load ratio %		
A	(−7–16)/(Tdesignh-16)	61	−7(−8)	20
B	(+2–16)/(Tdesignh-16)	37	2(1)	20
C	(+7–16)/(Tdesignh-16)	24	7(6)	20
D	(+12–16)/(Tdesignh-16)	11	12(11)	20
E	(TOL-16)/(Tdesignh-16)		TOL	20
F	(Tbivalent-16)/(Tdesignh-16)		Tbivalent	20
G[a]	(−15–16)/(Tdesignh-16)	82	−15	20
a Condition G is performed in case TOL is below −20 C				

5.3 Water-to-air units and brine to air units

The part load conditions for determining the reference $SGUE_h$ (Formula (11)), $SAEF_h$ (Formula (13)), $SEHREgas_h$ (Formula (16)), $SEHREelec_h$ (Formula (17)) are given in the following tables:

Table 8 — Part load conditions of water-to-air and brine-to-air units in heating mode for the reference heating season "A" = average

	A		Outdoor heat exchanger		Indoor heat exchanger
	Part load ratio	Part load ratio %	Ground water	Brine	Indoor air
			Inlet/outlet temperatures°C	Inlet/outlet temperatures°C	Inlet dry bulb temperature °C
A	(−7–16)/(Tdesignh-16)	88	10/[a]	0/[a]	20
B	(+2–16)/(Tdesignh-16)	54	10/[a]	0/[a]	20
C	(+7–16)/(Tdesignh-16)	35	10/[a]	0/[a]	20
D	(+12–16)/(Tdesignh-16)	15	10/[a]	0/[a]	20
F	(Tbivalent-16)/(Tdesignh-16)		10/[a]	0/[a]	20
a The water flow rate as determined at the standard rating conditions.					

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Table 9 — Part load conditions of water-to-air and brine-to-air units in heating mode for the reference heating season "W" = warmer

	W		Outdoor heat exchanger		Indoor heat exchanger
	Part load ratio	Part load ratio %	Ground water	Brine	Indoor air
			Inlet/outlet temperatures °C	Inlet/outlet temperatures dry (wet) bulb° C	Indoor temperatures dry bulb °C
A	Not applicable				
B	(+2–16)/(Tdesignh-16)	100	10/[a]	0/[a]	20
C	(+7–16)/(Tdesignh-16)	64	10/[a]	0/[a]	20
D	(+12–16)/(Tdesignh-16)	29	10/[a]	0/[a]	20
F	(Tbivalent-16)/(Tdesignh-16)		10/[a]	0/[a]	20

[a] The water flow rate as determined at the standard rating conditions of fixed capacity heat pumps.

Table 10 — Part load conditions of water-to-air and brine-to-air units in heating mode or the reference heating season "C" = colder

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	C		Outdoor heat exchanger		Indoor heat exchanger
	Part load ratio	Part load ratio %	Ground water	Brine	Indoor air
			Inlet/outlet temperatures °C	Inlet/outlet dry (wet) bulb °C	Indoor temperatures dry bulb °C
A	(−7–16)/(Tdesignh-16)	61	10/[a]	0/[a]	20
B	(+2–16)/(Tdesignh-16)	37	10/[a]	0/[a]	20
C	(+7–16)/(Tdesignh-16)	24	10/[a]	0/[a]	20
D	(+12–16)/(Tdesignh-16)	11	10/[a]	0/[a]	20
F	(Tbivalent-16)/(Tdesignh-16)		10/[a]	0/[a]	20

[a] The water flow rate as determined at the standard rating conditions of fixed capacity heat pumps.

5.4 Air-to-water units

5.4.1 General

For each application, units either allowing or not allowing a variation of the outlet water temperature with the outdoor temperature are considered. The variable outlet temperature shall only be applied when the control provides a regulation of outlet water temperature that considers the outdoor temperature.

The part load conditions for determining the reference $SGUE_h$ (Formula (11)), $SAEF_h$ (Formula (13)), $SEHREgas_h$ (Formula (16)), $SEHREelec_h$ (Formula (17)) are given in the following tables.