
Absorpcijske in adsorpcijske plinske naprave za gretje in/ali hlajenje z grelno močjo do vključno 70 kW - 7. del: Posebne zahteve za hibridne naprave

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

Gasbefeuerte Sorptions-Geräte für Heizung und/oder Kühlung mit einer Nennwärmebelastung nicht über 70 kW - Teil 7: Spezifische Bestimmungen für Hybridanlagen

Appareils à sorption à chauffage direct au gaz pour chauffage et/ou refroidissement d'un débit calorifique sur PCI inférieur à 70 kW - Partie 7: Dispositions spécifiques pour les appareils hybrides

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net heat input not exceeding 70 kW - Part 7: Specific provisions
for hybrid appliances**

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Kühlung mit einer Nennwärmebelastung nicht über 70 kW -
Teil 7: Spezifische Bestimmungen für Hybridanlagen

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

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Contents

Page

Foreword	3
1 Scope	4
1.1 Scope of EN 12309 series	4
1.2 Scope of this Part 7 to EN 12309.....	4
2 Normative references	5
3 Terms and definitions	5
4 Test conditions	5
4.1 General.....	5
4.2 Inlet and outlet temperatures into/from the indoor heat exchanger	7
4.3 Inlet temperatures into the outdoor heat exchanger	9
4.3.1 Air to water hybrid heating appliances	9
4.3.2 Ground water sourced hybrid heating appliances.....	10
4.3.3 Ground heat sourced hybrid heating appliances.....	10
4.3.4 Solar collector sourced hybrid heating appliances	10
5 Calculation of the seasonal performance in the heating mode	11
6 Standard rating conditions of gas driven sorption heat pump based hybrid heating appliances	12
Annex A (informative) Estimation of the heating fluid inlet and outlet temperature into/out of the indoor heat exchanger	14
Annex B (informative) Inlet temperature into the outdoor heat exchanger for ground sourced sorption heat pump based hybrid heating appliances	15
Annex C (informative) Inlet temperature into the outdoor heat exchanger for solar collector sourced sorption heat pump based hybrid heating appliances	17
Annex D (informative) Inlet temperature into the outdoor heat exchanger for solar collector assisted sorption heat pump based hybrid heating appliances	19
D.1 Introduction	19
D.2 Solar-assisted ground sourced gas-driven sorption heat pumps.....	19
D.3 Solar-assisted air sourced gas-driven sorption heat pumps.....	19
Annex E (informative) Calculation of the seasonal gas utilization efficiency with partial heat demand coverage by the applied solar collectors	20
Annex F (informative) Estimation of the seasonal performance of hybrid heating appliances at building design loads deviating from the appliance's nominal heating capacity	21
Bibliography	22

Foreword

This document (prEN 12309-7:2012) 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 12309-2:2000.

EN 12309 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.

Parts 1 and 2 to EN 12309 will supersede EN 12309-1:1999, whereas Part 1 and Parts 3 to 7 of EN 12309 will supersede EN 12309-2:2000. Parts 1 to 7 have been prepared to address the essential requirements of the European Directive 2009/142/EC relating to appliances burning gaseous fuels (see informative Annex ZA of EN 12309-2:20xx for safety aspects and Annex ZA of prEN 12309-5:2012 for rational use of energy aspects).

These documents are linked to the following European Directives:

- Energy Related Products Directive (2009/125/EC) in terms of tests conditions, tests methods and seasonal performances calculation methods under Mandate M/495 (see Annex ZB of prEN 12309-5:2012);
- Promotion of the Use of Renewable Energy Directive (2009/28/EC – Annex VII) (see Annex A of prEN 12309-5:2012).

For the relationship with EU Directive(s), see informative Annexes ZA and ZB in EN 12309-2:20xx and in prEN 12309-5:2012, which are an integral part of this document. These documents will be reviewed whenever new mandates could apply.

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

1 Scope

1.1 Scope of EN 12309 series

Appliances covered by EN 12309 include one or a combination of the following:

- gas-fired sorption chiller;
- gas-fired sorption chiller/heater;
- gas-fired sorption heat pump.

EN 12309 applies to appliances only when used for space heating and cooling with or without heat recovery. Appliances can be monovalent, bivalent or hybrid types.

EN 12309 applies to appliances having flue gas systems of type B and C (according to CEN/TR 1749) and to appliances designed for outdoor installations. EN 12309 applies to appliances that can be single ducted or double ducted.

EN 12309 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 prEN 12309-1:2012) and EN 12309 applies to all such functions providing that the function concerned is dependent on circulation of fluid (refrigerant and/or solution) within the absorption, adsorption or refrigerant circuit(s).

NOTE 1 Any appliance function that is not dependent on circulation of the fluid within the absorption, adsorption, or refrigerant circuit(s) should be assessed separately.

EN 12309 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), EN 12309 applies only to those designed and supplied as a complete package.

EN 12309 does not apply to air conditioners.

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.

NOTE 2 All the symbols given in this text should be used regardless of the language used.

1.2 Scope of this Part 7 to EN 12309

This part of EN 12309 specifies specific provisions for hybrid appliances 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 the specific provisions of the newly introduced hybrid heating appliances based on gas-driven sorption heat pumps as defined in Part 1 and comprehensively described in 4.1 of this document.

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 12309-1:2012, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW – Part 1: Terms and definitions*

EN 12309-2:20xx, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW – Part 2: Safety*

prEN 12309-3:2012, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW – Part 3: Test conditions*

prEN 12309-4:2012, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW – Part 4: Test methods*

prEN 12309-6:2012, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW – Part 6: Calculation of seasonal performances*

EN 14511-2, *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 prEN 12309-1:2012 apply.

4 Test conditions

4.1 General

As indicated in the scope of this European Standard, the heating appliances covered by this European Standard are of hybrid type and include a direct or indirect-fired sorption heat pump for base load and a peak load condensing boiler in one housing with only one gas input pipe, one flue line, one electrical supply cable and one human machine interface to the end user. The direct- or indirect-fired sorption heat pump integrated in the considered hybrid appliances in this European Standard could be

- an intermittent or continuously operating absorption heat pump or
- an intermittent or continuously operating adsorption heat pump.

The energy manager of those recently introduced hybrid heating appliances decides on the transition between the heat pump operation mode to/from the mixed operation mode (heating by both sorption heat pump as well as the peak boiler) and the direct heating mode (only peak boiler) depending on the heating fluid inlet or return temperature, temperature of brine entering the indoor heat exchanger (evaporator) of the heat pump, the required outlet or supply temperature dependent on the outdoor temperature as well as the target value of the indoor or room temperature. Upon transition from the heat pump operation mode to the mixed operation mode, the energy manager decides also on the degree of mixing based on the above mentioned parameters. On the metal specification plate of the heating appliance, the nominal heating capacity (NC) for the heating mode should be clearly given among other parameters by the manufacturer.

The considered hybrid heating appliances in this European Standard are of variable capacity type delivering a variable heating fluid outlet temperature depending on the outdoor (ambient air) and the target indoor (room) temperatures as well as the selected heat sink conditions.

prEN 12309-7:2012 (E)

Table 1 presents the design temperatures for heating (the dry bulb outdoor coldest temperature) for each reference heating season, the design room (indoor) temperature as well as the balance point or heating limit temperature (TBP) for the considered three reference heating seasons (climatic conditions) in prEN 12309-6:2012; namely average (A), colder (C) and warmer (W). The heating season “Average” corresponds to the weather conditions of Strasburg, while “Warmer” and “Colder” correspond to the weather conditions of Athens and Helsinki, respectively.

Table 1 — Design temperature, indoor temperature and balance point temperatures for the different reference heating seasons

Reference Heating Season	Dry bulb temperature conditions		
	$T_{\text{design-h}}$	T_R	T_{BP}
Average (A)	-10 °C	20 °C	16 °C
Colder (C)	-22 °C	20 °C	16 °C
Warmer (W)	+2 °C	20 °C	16 °C

In Table 2, the design outlet (supply) and inlet (return) temperatures to and from the building heating network (heating fluid temperatures from the heating appliance to the heating network and backwards, respectively) are listed as defined in prEN 12309-3:2012

Table 2 — Design outlet and inlet temperatures for the different heat sink conditions considered in this European Standard

Reference Heat Sink condition	Dry bulb temperature conditions	
	$T_{\text{out-d}}$ °C	$T_{\text{in-d}}$ °C
Low temperature application	35	28
Medium temperature application	45	35
High temperature application	55	43
Very high temperature application	65	48

Each manufacturer can choose at least one of the given heat sink conditions in Table 2, upon which the seasonal performance can be evaluated by a certified laboratory or institute according to this document.

The calculation of the seasonal performance of the hybrid heating appliances follows from the application of the bin method, exactly like in prEN 12309-6:2012, where the part load gas utilization efficiency (GUE) and auxiliary energy factor (AEF) at each bin temperature are determined via linear interpolation of the their respective part load values measured at the reference part load conditions defined in this document for each reference heating season (climatic zone conditions) and heat sink design condition.

The part load ratio at any outdoor temperature can be defined for the building as the ratio between the building part load at any outdoor temperature and the building design heat load. In the same way, the heating appliance part load ratio can be defined as the appliance heating capacity to be delivered at any outdoor temperature divided by the appliance’s nominal capacity declared by the manufacturer.

Based on the definition of the part load ratio ($PLR(T_{outdoor})$) given in prEN 12309-6:2012, the outdoor temperatures corresponding to each of the above mentioned reference part load ratios can be estimated from Formula (1).

$$T_{outdoor} = 16 + PLR(T_{outdoor}) \cdot (T_{design-h} - 16) \quad (1)$$

Recalling that the appliances covered by this part are of hybrid type and include a direct or indirect-fired sorption heat pump for base load and a peak load condensing boiler in one housing, it becomes necessary to emphasize on the fact that the accuracy of estimating the seasonal performance of such hybrid appliances are highly dependent on the uniformity of distributing the reference part load conditions over the building heat demand curve. The reference part load conditions A, B, C and D given in prEN 12309-6:2012 are based on fixed reference outdoor temperatures -7°C , 2°C , 7°C and 12°C , respectively. This results in shifting the distribution of the part load ratios towards lower values for the heating season (C); namely between 11 % and 61 % and towards higher values for the heating season (W); namely between 29 % and 100 %. For the heating season (A), the reference part load ratio varies between 15 % and 88 %. In addition, prEN 12309-6:2012 allows the manufacturers to define two optional points E and F at the operating limit and the bivalent outdoor temperature conditions.

In order to guarantee a uniform distribution of the reference part load conditions for the hybrid heating appliances, the reference part load ratios of 100 %, 75 %, 60 %, 45 %, 30 % and 15% have been chosen. Because of the applied 1 K step in the outdoor temperature in the prEN 12309-6:2012, the estimated part load ratios deviate from those values. Accordingly, the closest part load value is allocated as a pivot part load ratio for the estimation of the seasonal performance as given in Table 3.

Table 3 — Reference and pivot part load ratios for the considered reference heating seasons

Reference test condition	Reference PLR %	Pivot PLR for the Reference Heating Seasons		
		(C)	(A)	(W)
A	100	100	100	100
B	75	74	73	71
C	60	61	58	57
D	45	45	46	43
E	30	29	31	29
F	15	16	15	14

If deems necessary, the manufacturer can add at most one more reference test point G between two successive reference test points from A to F. The test conditions should then be linearly interpolated between the two successive standard test conditions given in 4.2 and 4.3.

The declared nominal capacity of the hybrid heating appliance shall be always higher than the building design load for heating.

NOTE The measured gas utilization efficiencies at the reference part load conditions are only allowed to be considered in estimating the seasonal performance, if the heating capacity at each reference part load condition is measured within the given deviation limits in prEN 12309-4:2012.

4.2 Inlet and outlet temperatures into/from the indoor heat exchanger

Fixing the reference test conditions to part load ratios results in same inlet and outlet temperatures into/from the indoor heat exchanger for every part load ratio over the considered reference heating seasons. Annex A represents a detailed approach on how to estimate the inlet and outlet temperature into/from the indoor heat exchanger for any part load ratio and reference heating season. Following Formulae (A.5) and (A.6), the inlet

and outlet temperatures have been estimated for the reference test part load ratios defined in 4.1 and presented in Table 4 for both low and medium as well as in Table 5 for both high and very high temperature heat sink conditions, respectively.

Table 4 — Inlet and outlet temperatures for the reference part load test conditions of the low and medium temperature heat sink applications

Reference test condition	Low temperature application		Medium temperature application	
	Outlet temperature °C	Inlet temperature °C	Outlet temperature °C	Inlet temperature °C
A	35,0	28,0	45,0	35,0
B	31,4	26,2	39,4	31,9
C	29,3	25,1	36,1	30,1
D	27,1	24,0	32,4	28,0
E	24,9	22,8	28,8	25,8
F	22,5	21,5	24,8	23,3

Table 5 — Inlet and outlet temperatures for the reference part load test conditions of the high and very high temperature heat sink applications

Reference test condition	High temperature application		Very high temperature application	
	Outlet temperature °C	Inlet temperature °C	Outlet temperature °C	Inlet temperature °C
A	55,0	43,0	65,0	48,0
B	47,6	38,7	56,0	43,3
C	43,2	36,0	50,4	40,2
D	38,3	32,9	44,3	36,7
E	33,3	29,7	38,0	32,9
F	27,5	25,7	30,5	28,0

Each reference part load test condition is strictly defined by both part load and the inlet temperatures to both indoor and outdoor heat exchangers. The inlet temperatures to the indoor heat exchangers shall be taken from Tables 4 and 5, while the inlet temperature to the outdoor heat exchanger is defined in 4.3 for the different environmental heat sources.

The part load measurements at the reference test conditions shall follow the inlet temperature method of the prEN 12309-4:2012.

As the integrated gas-driven sorption heat pump can be of intermittent type and even for a continuously operating heat pump a certain kind of time share between the heat pump and the peak boiler is required at higher heating capacities, the heating capacity should be averaged either over a very long time period (e.g. 24 h) or over a number of **complete** operation cycles not less than two. A typical operation cycle of a hybrid appliance can be counted between two successive normal burner operations.

For burners with constant air to fuel ratio control, a burner calibration shall not be counted as a normal burner operation. The test laboratory shall then wait for two successive operation cycles without any automatic burner calibration operations in between. The manufacturer has to explain the cyclic operation of its hybrid appliance in his operation manual and may suppress the automatic burner calibration mode within a test operation mode, in order for the test laboratory to carry out the tests precisely.

The listed outlet temperatures in Tables 4 and 5 shall be the cycle average outlet temperatures. They are given to guide the measurements only in case the nominal (design) heating fluid flow rate is kept constant over all part load conditions. Specially, for the low part load ratios (reference test conditions D, E and F), the heating fluid flow rate can be decreased to enhance the outlet temperature, in order to increase the measurement accuracy and to reduce the auxiliary electrical power consumption. This is only allowed under the condition that the temperature gradient between outlet and inlet temperatures at any part load condition shall not be higher than the temperature gradient at the corresponding design load condition; namely 7 K for the low temperature heat sink as well as 10 K, 12 K and 17 K for the medium, high and very high temperature heat sink applications, respectively.

The recommendations of the hybrid appliance manufacturers concerning the allowed deviation(s) in the temperature gradients at each reference part load test condition, as described before, shall be followed by the measuring laboratories.

4.3 Inlet temperatures into the outdoor heat exchanger

4.3.1 Air to water hybrid heating appliances

The dry bulb air temperatures upon entering the outdoor heat exchanger of air to water hybrid heating appliances have been estimated for the reference part load test conditions given in Table 1 by Formula (1) and listed in Table 6. In accordance with EN 14511-2, when air/water heat pumps are measured in an appropriate climatic chamber, the wet bulb temperature at the inlet to the air heat exchanger is to be 1 K below the dry bulb temperature.

Table 6 — Inlet dry (wet) bulb temperatures of air into the outdoor heat exchangers

Reference test condition	Reference Heating Season °C		
	(W)	(A)	(C)
A	2 (1)	-10 (-11)	-22 (-23)
B	6 (5)	-3 (-4)	-12 (-13)
C	8 (7)	1 (0)	-7 (-8)
D	10 (9)	4 (3)	-1 (-2)
E	12 (11)	8 (7)	5 (4)
F	14 (13)	12 (11)	10 (9)

For air to water hybrid heating appliances working with exhaust air as an environmental heat source an inlet air dry(wet) bulb temperature of 20(12) °C shall be considered for all reference test conditions according to the prEN 12309-3:2012.

If defrosting of the air heat exchanger under any of the specified test conditions of this subclause takes place, then the defrosting process should be considered in accordance with prEN 12309-4:2012.

The installation of the appliance in the climatic chamber of the test laboratory shall follow the installation instructions of the manufacturer in accordance with EN 12309-2:20xx and prEN 12309-4:2012.