



BSI Standards Publication

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

Part 4: Test methods

National foreword

This British Standard is the UK implementation of EN 12309-4:2014. Together with BS EN 12309-1:2014, BS EN 12309-3:2014, BS EN 12309-5:2014, BS EN 12309-6:2014 and BS EN 12309-7:2014, it supersedes BS EN 12309-2:2000, which is withdrawn.

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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

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Contents	Page
Foreword.....	4
1 Scope	6
1.1 Scope of EN 12309.....	6
1.2 Scope of this Part 4 of EN 12309.....	6
2 Normative references	7
3 Terms and definitions	7
4 Test methods.....	7
4.1 General.....	7
4.2 Basic principles	7
4.2.1 Heating capacity	7
4.2.2 Cooling capacity	9
4.2.3 Heat recovery capacity.....	11
4.2.4 Heat input	13
4.2.5 Electrical power input	15
4.2.6 Gas utilization efficiency.....	18
4.2.7 Auxiliary energy factor.....	18
4.3 Test apparatus	19
4.3.1 Arrangement of the test apparatus	19
4.3.2 Installation and connection of the appliance.....	20
4.4 Uncertainties of measurement	21
4.5 Test procedure	22
4.5.1 General.....	22
4.5.2 Non-cyclical operation	23
4.5.3 Cyclical operation	31
4.6 Test methods for electric power consumption during thermostat off mode, standby mode and off mode	35
4.6.1 Measurement of electrical power consumption during thermostat off mode	35
4.6.2 Measurement of the electrical power consumption during standby mode	35
4.6.3 Measurement of the electric power consumption during off mode	35
4.7 Test results	35
Annex A (normative) Determination of the pump efficiency	38
A.1 General.....	38
A.2 Hydraulic power of the pump	38
A.3 Efficiency of the pump	39
Annex B (normative) “Individual” corrections to include in the “global” electrical power input correction depending on the appliance	40
Annex C (informative) Primary energy efficiency - Calculation at a single operating point.....	41
C.1 General.....	41
C.2 Primary energy ratio in heating mode	41
C.3 Primary energy ratio in cooling mode	42
Annex D (informative) Heating capacity tests - Flow chart and examples of different test sequences	43
D.1 Flow chart.....	43

D.2	Examples of test profiles	44
Annex E (informative)	Direct method for air-to-water (brine) and water (brine) to water (brine) appliances	50
E.1	General	50
E.2	Compensation system air to water appliances	50
E.3	Compensation system for water/brine to water appliances	51
Annex F (informative)	Measurement control criteria for water (brine) to water (brine) appliances	52
F.1	General	52
F.2	Water (brine)-to-water (brine) heat pump in heating mode	52
F.3	Water (brine)-to-water (brine) chiller or chiller/heater in cooling mode	53
Annex G (normative)	Measurement in ON/OFF cycling mode	55
G.1	General	55
G.2	Test Procedure for measurement in ON/OFF cycling	55
Annex H (informative)	Test report	57
H.1	General information	57
H.2	Additional information	57
H.3	Rating test results	58
Annex ZA (informative)	Relationship between this European Standard and the requirements of Commission Regulation (EC) No 813/2013	59
Annex ZB (informative)	Relationship between this European Standard and the requirements of Commission Regulation (EC) No 811/2013	60
Bibliography		61

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:

$$Q_h = \frac{\sum_{j=1}^n (V_{m_j} \times \delta_j \times C_{p_j} \times \Delta t_j)}{n} \quad (1)$$

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;
- V_{m_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;
- C_{p_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 $(V_{m_j} \times \delta_j)$.

NOTE 2 The enthalpy change ΔH_j can be determined directly instead of the term $(C_{p_j} \times \Delta t_j)$.

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:

$$Q_{\text{Eh}} = Q_h + c_{\text{pump}} \quad (2)$$

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:

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

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:

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

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:

$$Q_c = \frac{\sum_{j=1}^n (V_{mj} \times \delta_j \times C_{pj} \times \Delta t_j)}{n} \quad (5)$$

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;
- V_{mj} 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;
- C_{pj} 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 $(V_{mj} \times \delta_j)$.

NOTE 2 The enthalpy change ΔH_j can be determined directly instead of the term $(C_{pj} \times \Delta t_j)$.

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:

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

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 ΔH_j 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 reference 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 $\pm 5\%$ 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.

4.2.4.2 Measurement of heat inputs under test conditions

The appliance is installed as describe in prEN 12309-2:2013, 7.1.6, and adjusted as described in 4.2.4.1 and then operated at the heat input imposed by the control system of the appliance. The heat input measurement is carried out when thermal “equilibrium” conditions have been achieved under the particular test conditions.

NOTE 1 It is important to note that the nominal or rated heating, cooling or heat recovery heat input is determined in accordance with the method given in prEN 12309-2:2013, but that the measured heat input achieved under particular test conditions is different and determined in a different way. This is described below.

The heat input under the test conditions (Q_{gm}) in kilowatts is given by the formula:

$$Q_{gm} = 0,278 \times \frac{\sum_{j=1}^n (MC_j \times H_{iM(T)j})}{n} \quad (13)$$

or

$$Q_{gm} = 0,278 \times \frac{\sum_{j=1}^n (VC_j \times H_{iV(T)j})}{n} \quad (14)$$

where

- j is the scan number;
- n is the number of scan of the data collection period;
- Q_{gm} is the measured heat input, in kilowatts;
- $H_{iM(T)j}$ is the net calorific value of the test gas at the considered scan, in megajoules per kilogram;
- MC_j is the mass flow rate of dry test gas at the considered scan, in kilograms per hour;
- $H_{iV(T)j}$ is the net calorific value of the test gas at the considered scan, in megajoules per cubic meter (dry gas, 15 °C, 1013,25 mbar);
- VC_j is the volumetric flow rate of dry test gas corrected to 1013,25 mbar and 15 °C at the considered scan, in cubic meters per hour and derived from the following formula:

$$VC_j = V_{mj} \times \frac{p_{aj} + p_j - p_{wj}}{1013,25} \times \frac{288,15}{273,15 + t_{gj}} \quad (15)$$

where

- V_{mj} is the measured gas flow rate at the considered scan, in cubic meters per hour;
- p_{aj} is the atmospheric pressure at the considered scan, in millibars;
- p_j is the gas static pressure at the gas meter at the considered scan, in millibars;
- p_{wj} is the saturated (water) vapour pressure in the gas used at the considered scan, in millibars;
- t_{gj} is the gas temperature at the gas meter at the considered scan, in degrees Celsius.

NOTE 2 It is important to note that gas static pressure at the gas meter could be different from gas static pressure of the appliance.

NOTE 3 p_{wj} covers the use of wet gas meters (equal zero if dry gas meter is used).

NOTE 4 Alternative expression of heat inputs: the use of the gross calorific value is becoming increasingly common. The alternative calculation and publication of heat input (Q_g) on the basis of the gross calorific value is allowed only when the reference (GCV) is explicitly stated beside the value.

EXAMPLE $Q_g : 23 \text{ kW}_{\text{GCV}}$

Elsewhere, the heat input (Q_g) is always to be understood as based on net calorific value (NCV) as per 4.2.4.2.

4.2.5 Electrical power input

4.2.5.1 General condition for operation of the electrical part of the appliance

Tests are carried out with the nominal voltage.

The “global” electrical power input correction depends on the design of each appliance. Its “global” correction is the sum of appropriate “individual” corrections (See Annex B).

4.2.5.2 Effective electrical power input

The effective electrical power input shall be determined using the following formula:

$$P_E = \frac{\sum_{j=1}^n (P_{Tj})}{n} + C_{\text{pump}} + C_{\text{outdoor}} \quad (16)$$

where

- j is the scan number;
- n is the number of scan of the data collection period;
- P_E is the effective electrical power input, in kilowatts;
- P_{Tj} is measured (total) electrical power input at the considered scan, 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 and/or heat recovery heat exchanger, in kilowatts;
- C_{outdoor} is the electrical power input correction due to the fan(s) or pump(s) responsible for circulating the heat transfer medium through the outdoor heat exchanger, in kilowatts.

4.2.5.3 Electrical power input of fans

4.2.5.3.1 General

The following corrections of the electrical power input of fan(s) shall be made for fan(s) providing the air to the outdoor heat exchanger, where applicable.

4.2.5.3.2 Electrical power input of fan(s) for appliances without duct connection

In the case of appliances which are not designed for duct connection, i.e. which do not permit any external pressure differences, and which are equipped with integral fan(s), the electrical power absorbed by the fan(s) shall be included in the effective electrical power absorbed by the appliance (no correction).

4.2.5.3.3 Electrical power input of fan(s) for appliances with duct connection

4.2.5.3.3.1 If the fan(s) is (are) an integral part of the appliance, only a part of the electrical power input of the fan motor(s) shall be included in the effective electrical power absorbed by the appliance. The part that is to be excluded (subtracted) from the total electrical power absorbed by the appliance shall be calculated using the following formula (the correction is negative):

$$c_{\text{outdoor}} = \frac{q \times \Delta p_e}{\eta \times 1000} \quad (17)$$

where

- c_{outdoor} is the electrical correction due to fan(s), in kilowatts;
- η is equal to η target; as declared according to the Ecodesign regulation n°327/2011 for fans driven by motors between 125 W and 500 kW;
- η is 0,3 by convention for fans driven by motors below 125 W;
- Δp_e is the measured external static pressure difference, in pascals;
- q is the measured air flow rate at standard air conditions, in cubic meters per second.

4.2.5.3.3.2 If no fan is provided with the appliance, the part of the electrical power input which is to be included in the effective electrical power absorbed by the appliance, shall be calculated using the following formula (the correction is positive):

$$c_{\text{outdoor}} = \frac{q \times (-\Delta p_i)}{\eta \times 1000} \quad (18)$$

where

- c_{outdoor} is the electrical correction due to fan(s), in kilowatts;
- η is equal to η target; as declared according to the Ecodesign regulation n° 327/2011 for fans driven by motors between 125 W and 500 kW;
- η is 0,3 by convention for fans driven by motors below 125 W;
- Δp_i is the measured internal static pressure difference, in pascals;
- q is the measured air flow rate at standard air conditions, in cubic meters per second.

4.2.5.4 Electrical power input of pumps

4.2.5.4.1 General

The following correction of the electrical power input of pump(s) shall be made to both the pump responsible for circulating the heat transfer medium through the indoor heat exchanger (c_{pump}) and circulating the heat transfer medium through the outdoor heat exchanger (c_{outdoor}) where applicable. When the pump is integrated, it shall be connected for operation; when the pump is delivered separately, it shall be connected for operation according to the appliance's instructions and be considered as an integral part of the appliance.

4.2.5.4.2 Electrical power input for appliances with at least one internal pump

If the pump(s) is (are) an integral part of the appliance, only a part of the electrical power input to the pump motor(s) shall be included in the effective electrical power absorbed by the appliance. The part which is to be excluded (subtracted) from the total electrical power absorbed by the appliance shall be calculated using the following formula (the correction is negative):

$$C_{\text{pump}} \text{ OR } C_{\text{outdoor}} = \frac{q \times \Delta p_e}{\eta \times 1000} \quad (19)$$

where

- C_{pump} is the electrical correction due to pump(s) responsible for circulating the heat transfer medium through the indoor heat exchanger, in kilowatts;
- C_{outdoor} is the electrical correction due to pump(s) responsible for circulating the heat transfer medium through the outdoor heat exchanger, in kilowatts;
- η is the efficiency of the pump calculated according to Annex A in kilowatts per kilowatt;
- Δp_e is the measured external static pressure difference, in pascals;
- q is the measured water flow rate, in cubic meters per second.

If the pump presents negative external static pressure due to a mismatch with the appliance, correction shall be calculated according to 4.2.5.4.3.

4.2.5.4.3 Electrical power input for appliances without internal pump

If no pump is provided with the appliance, the part of the electrical power input which is to be included in the effective electrical power absorbed by the appliance, shall be calculated using the following formula (the correction is positive):

$$C_{\text{pump}} \text{ OR } C_{\text{outdoor}} = \frac{q \times (-\Delta p_i)}{\eta \times 1000} \quad (20)$$

where

- C_{pump} is the electrical correction due to no pump(s) responsible for circulating the heat transfer medium through the indoor heat exchanger, in kilowatts;
- C_{outdoor} is the electrical correction due to pump(s) responsible for circulating the heat transfer medium through the outdoor heat exchanger, in kilowatts;
- η is the efficiency of the pump calculated according to Annex A in kilowatts per kilowatt;
- Δp_i is the measured internal static pressure difference, in pascals;
- Q is the measured water flow rate, in cubic meters per second.

4.2.5.4.4 Specific cases

In the case of appliances designed especially to operate on a distributing network of heating/cooling water without water-pump, no correction is to be applied to the electrical power input.

4.2.6 Gas utilization efficiency

4.2.6.1 Heating mode

The gas utilization efficiency in heating mode shall be determined using the following formula:

$$GUEh = \frac{Q_{Eh}}{Q_{gmh}} \quad (21)$$

where

$GUEh$ is the heating gas utilization efficiency, in kilowatts per kilowatt;

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

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

4.2.6.2 Cooling mode

The gas utilization efficiency in cooling mode shall be determined using the following formula:

$$GUEc = \frac{Q_{Ec}}{Q_{gmc}} \quad (22)$$

where

$GUEc$ is the cooling gas utilization efficiency, in kilowatts per kilowatt;

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

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

4.2.7 Auxiliary energy factor

4.2.7.1 Heating mode

The auxiliary energy factor in the heating mode is determined using the following formula:

$$AEFh = \frac{Q_{Eh}}{P_{Eh}} \quad (23)$$

where

$AEFh$ is the heating auxiliary energy factor, in kilowatts per kilowatt;

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

P_{Eh} is the effective heating electrical power input, in kilowatts.