BRITISH STANDARD

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814-2 : 1997

Air conditioners and heat pumps with electrically driven compressors — Cooling mode

Part 2. Testing and requirements for marking

The European Standard EN 814-2 : 1997 has the status of a British Standard

ICS 23.120; 27.080

Committees responsible for this British Standard

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British Gas plc
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Building Services Research and Information Association
Chartered Institution of Building Services Engineers
Department of the Environment – Building Research Establishment
Electricity Association
Heating and Ventilating Contractors' Association
Hevac Association
Institute of Refrigeration
Institution of Mechanical Engineers

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Contents

National foreword

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Cross-references

Publication referred to	Corresponding British Standard
	BS EN 255 *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors — Heating mode*
EN 255-2 : 1988	Part 2: *Testing and requirements for marking for space heating*
	BS EN 814 *Air conditioners and heat pumps with electrically driven compressors — Cooling mode*
EN 814-1 : 1996	Part 1: *Terms, definitions and designations*

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 10, an inside back cover and a back cover.

EUROPEAN STANDARD
NORME EUROPÉENNE
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EN 814-2

February 1997

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Descriptors: Air conditioning equipment, air conditioners, tests, testing conditions, installation, measurements, calorific power, marking

English version

Air conditioners and heat pumps with electrically driven compressors — Cooling mode — Part 2: Testing and requirements for marking

Climatiseurs et pompes à chaleur avec compresseur entrainé par moteur électrique — Mode réfrigération — Partie 2: Essais et exigences de marquage

Luftkonditionierer und Wärmepumpen mit elektrisch angetrieben Verdichtern — Kühlen — Teil 2: Prüfungen und Anforderungen an die Kennzeichung

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CEN
European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 113, Heat pumps and air conditioners, of which the secretariat is held by AFNOR.

This standard consists of the following parts:

EN 814-1 *Air conditioners and heat pumps with electrically driven compressors — Cooling mode — Part 1: Terms, definitions and designations*

EN 814-2 *Air conditioners and heat pumps with electrically driven compressors — Cooling mode — Part 2: Testing and requirements for marking*

EN 814-3 *Air conditioners and heat pumps with electrically driven compressors — Cooling mode — Part 3: Requirements*

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 August 1997, and conflicting national standards shall be withdrawn at the latest by August 1997.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Contents

1 Scope

This part of EN 814 specifies methods for testing and reporting of the rating and specifies requirements for marking of air and water cooled air conditioners, air/air and water/air heat pumps with electrically driven compressors when used in cooling mode. When these units are used in heating mode by reversing the refrigerating cycle, then EN 255-2 applies.

This standard applies to factory-made units which can be ducted. The units can be of the following specific types: comfort air conditioner or heat pump, spot air conditioner, single duct air conditioner, control cabinet air conditioner, close control air conditioner.

In the case of units consisting of several parts, the standard applies only to those designed and supplied as a complete package.

Units having two or more indoor sections connected to a single outdoor unit (multiple split system air conditioners or heat pumps) are excluded from this standard.

This standard does not apply to continuously variable capacity control units.

This standard does not apply to liquid chilling packages/units.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 255-2 *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors — Heating mode — Part 2: Testing and requirements for marking for space heating units*

EN 814-1 *Air conditioners and heat pumps with electrically driven compressors — Cooling mode — Part 1: Terms, definitions and designations*

3 Definitions

For the purposes of this standard, the definitions given in EN 814-1 apply.

4 Performance test

4.1 Basic principles

4.1.1 *General*

All measured parameters, with the exception of time measurement, shall be understood to be average values over the duration of the test period.

4.1.2 *Cooling capacity*

The cooling capacity of the unit is determined by measurements in a calorimeter room or by the air enthalpy method.

The cooling capacity shall be corrected for the heat from the fan:

– If the fan at the evaporator is an integral part of the unit, the heat from this should not affect the cooling capacity greater than the declared value of uncertainty. If the heat is greater, then the same power (calculated in **4.1.4.1**) which is excluded from the input is also added to the cooling capacity.

– If the fan at the evaporator is not an integral part of the unit the heat from this should also not affect the cooling capacity greater than the declared value of uncertainty. If the heat is greater, then the same power (calculated in **4.1.4.2**) which is included in the input is also subtracted from the cooling capacity.

4.1.3 *Power input of fans for units without duct connection*

In the case of units which are not designed for duct connection, i.e. which do not permit any external pressure difference, and which are equipped with an integral fan, the power absorbed by the fan shall be included in the effective power absorbed by the unit.

4.1.4 *Power input of fans for units with duct connection*

4.1.4.1 If a fan is an integral part of the unit, only a fraction of the input of the fan motor shall be included in the effective power absorbed by the unit. The fraction which is to be excluded from the total power absorbed by the unit shall be calculated using the following formula:

$$\frac{q\,\Delta p_e}{\eta} \text{ in watts}$$

where

η is 0,3 by convention;

Δp_e is the available external static pressure difference, in pascals;

q is the nominal air flow rate, in cubic meters per second.

4.1.4.2 If no fan is provided with the unit, the proportional power input which is to be included in the effective power absorbed by the unit, shall be calculated using the following formula:

$\frac{q\Delta p_i}{\eta}$ in watts

where

η is 0,3 by convention;

Δp_i is the measured internal static pressure difference, in pascals;

q is the nominal air flow rate, in cubic meters per second.

4.1.5 Power input of water pump

4.1.5.1 If a water pump is an integral part of the unit, only a fraction of the input to the pump motor shall be included in the effective power absorbed by the unit. The fraction which is to be excluded from the total power absorbed by the unit shall be calculated using the following formula:

$\frac{q\Delta p_e}{\eta}$ in watts

where

η is 0,3 by convention;

Δp_e is the available external static pressure difference, in pascals;

q is the nominal water flow rate, in cubic meters per second.

4.1.5.2 If no water pump is provided with the unit, the proportional power input which is to be included in the effective power absorbed by the unit, shall be calculated using the following formula:

$\frac{q\Delta p_i}{\eta}$ in watts

where

η is 0,3 by convention;

Δp_i is the measured internal static pressure difference, in pascals;

q is the nominal water flow rate, in cubic meters per second.

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

4.2 Test apparatus

4.2.1 *Arrangement of the test apparatus*

4.2.1.1 *General requirements*

The test apparatus shall be designed in such a way that all requirements on adjustment of set values, stability criteria and uncertainties of measurement according to this European Standard can be fulfilled.

Ducted air systems shall be sufficiently air tight to ensure that the measured results are not significantly influenced by exhange of air with the surroundings.

4.2.1.2 *Test room for the evaporator*

The size of the test room shall be selected such that any resistance to air flow at the air inlet and air outlet orifices of the test object is avoided. The air flow through the room shall not be capable of initiating any short circuit between these two orifices, and therefore the velocity of the air flows through the room at these two locations shall not exceed 1,5 m/s when the test object is switched off. The air velocity in the room shall also not be greater than the mean velocity through the unit inlet. Unless otherwise stated by the manufacturer, the air inlet or air outlet orifices shall be not less than 1 m distant from the surfaces of the test room; this also applies to any measuring ducts.

Any direct heat radiation by heating devices in the test room onto the unit or onto the temperature measuring points shall be avoided.

4.2.1.3 *Setting of the external static pressure difference on the air side for appliances with duct connection*

For appliances with duct connection, the maximum external static pressure difference available at the nominal flow rate specified by the manufacturer is preferably set on the air outlet side of the unit when the refrigerating system does not operate. The nominal air flow shall then be verified.

4.2.1.4 *Setting of the external static pressure difference on the water side for appliances with integral water pumps*

For appliances with integral water pumps, the maximum external static pressure difference available at the nominal flow rate specified by the manufacturer is preferably set on the water outlet side of the unit, this also sets the water flows.

4.2.2 *Installation and connection of the test object*

The test object shall be installed and connected for the test as recommended by the manufacturer in his installation and operation manual. The accessories provided by option (for example heating device) are not included in the test.

Temperature and pressure measuring points shall be arranged in order to obtain mean significant values. For control cabinet air conditioners, the inlet temperature at the evaporator is measured instead of the temperature inside the control cabinet.

4.2.3 *Installation of unit consisting of several parts*

In the case of unit consisting of several parts, the following installation conditions shall be complied with for the test:

a) each refrigerant line shall be installed in accordance with the manufacturer's instructions with the maximum stated length or 8 m, whichever is shorter;

b) the lines shall be installed so that the difference in elevation does not exceed 1 m;

c) the thermal insulation of the lines shall be applied in accordance with the manufacturer's instructions;

d) unless constrained by the design, at least half of the connecting lines shall be exposed to the outside conditions, with the rest of the lines exposed to the inside conditions.

4.3 Uncertainties of measurement

The uncertainties of measurement shall not exceed the values specified in table 1. The cooling capacity shall be determined within a maximum uncertainty of 5 % independent of the individual uncertainties of measurement including the uncertainties on the properties of fluids.

4.4 Test conditions

4.4.1 *Environmental conditions and electrical power supply requirements*

The tests shall be carried out under the environmental conditions and with the electrical power supply specified in table 2.

4.4.2 *Rating test conditions*

For the rating test, the appropriate test conditions in accordance with tables 2, 3a and 3b shall be applied.

Table 1. Uncertainties of measurement for indicated values

Measured quantity	Unit	Uncertainty of measurement
Water		
– temperature	°C	± 0,1 K
– temperature difference	K	± 0,1 K
– (volume) flow	m^3/s	± 5 %
– static pressure difference	Pa	± 5 Pa ($\Delta p \leq 100$ Pa) ± 5 % ($\Delta p > 100$ Pa)
Air		
– dry bulb temperature	°C	± 0,2 K
– wet bulb temperature	°C	± 0,2 K
– (volume) flow	m^3/s	± 5 %
– static pressure difference	Pa	± 5 Pa ($\Delta p \leq 100$ Pa) ± 5 % ($\Delta p > 100$ Pa)
Electric power	W	± 1 %
Voltage	V	± 0,5 %
Current	A	± 0,5 %
Electrical energy	kW·h	± 1 %

Table 2. Environmental conditions and electrical power supply requirements

Type	Measured quantities	Rating test
Units or parts with duct connection on the air inlet and outlet side	Dry bulb temperature	15 °C to 30 °C
All other types	Dry bulb temperature	As inlet temperature see table 3
All devices	Voltage	Rated voltage
All devices	Frequency	Rated frequency

Table 3. Rating test conditions

Table 3a. Air cooled or air/air unit

Denomination / Test conditions	Comfort air conditioner or heat pump	Spot air conditioner	Single-duct air conditioner*)	Control cabinet air conditioner	Close control air conditioner
Mandatory					
(T1)**)	A35 (24)/ A27 (19)	A35 (24)/ A35 (24)	A27 (19)/ A27 (19)	A35 (24)/ A35 (24)	A35 (24)/ A24 (17)
(T2)*)	A27 (19)/ A21 (15)	— —	— —	A50 (30)/ A35 (24)	— —
Optional					
(T3)**)	A46 (24)/ A29 (19)	— —	A35 (24)/ A35 (24)	— —	A27 (19)/ A21 (15)

Table 3b. Water cooled or water/air units

Denomination / Test conditions	Comfort air conditioner or heat pump	Control cabinet air conditioner	Close control air conditioner
Mandatory			
(T1)	W30/A27 (19)	W15/A35 (24)	W30/A24 (17)
Optional			
(T2)	W15/A27 (19)	—	W15/A21 (15)
(T3)	W45/A27 (19)	—	W45/A24 (17)

NOTE 1. All air and water temperatures are inlet temperatures in degrees Celsius.

NOTE 2. All air temperatures in brackets are wet bulb temperatures in degrees Celsius.

NOTE 3. All tests are carried out with nominal flow rates indicated by the manufacturer in cubic meters per second. Where no nominal flow rate is indicated by the manufacturer, and only a range of flow rates in given, tests shall be carried out at the minimum value.

NOTE 4. Permissible external pressure difference at the evaporator and condenser shall be indicated by the manufacturer in pascals for appliances with duct connection and for those discharging air into double floor, double ceiling and double wall. If the fan is not included, the internal pressure difference shall be indicated instead.

*) Single duct discharges to outside air leaving the condenser: in order to maintain atmospheric pressure in test room during the test, outside air at 35 °C (24 °C) will be introduced and measured by pressure equalizing device of calorimeter.

**) The wet bulb temperature condition on the condenser is not required when testing units which do not evaporate condensate.

4.5 Test procedure

4.5.1 *General*

For test conditions see **4.4**.

In the case of appliances with duct connection and fan with variable air flow, the test is carried out at the nominal flow rate with an external static pressure difference of 100 Pa or at the highest value declared by the manufacturer if the value is lower than 100 Pa. If the appliance can be used without duct connection, then (unless agreed otherwise) the measurement with duct connection is sufficient. The volume flows and the pressure difference shall be related to an air inlet temperature of 20 °C at the prevailing atmospheric pressure, the prevailing air humidity and with dry evaporator.

See table 4 for permissible deviations of the measured values from the test conditions.

Table 4. Permissible deviations from set values		
Measured quantity	**Permissible deviation of the arithmetic mean values from set values**	**Permissible deviations of individual measured values from set values**
Water		
— inlet temperature	± 0,2 K	± 0,5 K
— outlet temperature	± 0,3 K	± 0,6 K
— (volume) flow	± 2 %	± 5 %
— static pressure difference	—	± 10 %
Air		
— inlet temperature		
(dry bulb, wet bulb)	± 0,3 K	± 1 K
— (volume) flow	± 5 %	± 10 %
— static pressure difference	—	± 10 %
Voltage	± 4 %	± 4 %

4.5.2 *Output measurement*

4.5.2.1 *Steady state condition*

This condition is considered obtained and maintained when all the measured quantities remain constant without having to alter the set values. Periodic fluctuations of measured quantities caused by the operation of regulation and control devices are permissible, on condition the mean value of such fluctuations does not exceed the permissible deviations listed in table 4.

4.5.2.2 *Measurement of cooling capacity*

For the output measurement it is necessary to record all the meaningful data continuously. In the case of recording instruments which operate on a cyclic basis, the sequence shall be adjusted such that a complete recording is effected at least once every 2 min.

The output shall be measured in the steady state condition. The duration of measurement shall be not less than 30 min.

5 Test report

5.1 General information

The test report shall at least contain:

a) date;

b) test institute;

c) test place;

d) test method used (calorimeter or air enthalpy);

e) test supervisor;

f) test object denomination;

g) reference to this European Standard.

5.2 Additional information

Additional information given on the marking shall be noted.

5.3 Rating test

The values given in table 5 shall be the mean of values taken over the test period.

6 Marking

Each unit shall have a durable, permanently fixed marking that is easily readable or accessible when the unit is in position for use, bearing at least the following information in addition to information required by safety standards.

In the case of units consisting of several parts which can be made by different matching, only items a) and b) are to be indicated, where item b) applies to each part.

Items c) and d) depend on the considered matching and shall be indicated in the manufacturer's data sheet.

a) manufacturer or supplier;

b) manufacturer's model designation and serial number;

c) the *EER* to two significant figures and the test condition at which it is measured ((T1) according to table 3), except for spot air conditioner;

d) cooling capacity in kilowatts, with one digit after the decimal comma but not more than 3 significant figures at the test condition given in item c) of clause **6**, except for spot air conditioner;

e) for spot air conditioner, the flow rate and dry bulb temperature measured in test condition (T1) according to table 3;

f) for control cabinet air conditioner, the sensible cooling capacity in kilowatts, with one digit after the decimal comma but not more than 3 significant figures at the test condition given in item c) of clause **6**.

Further information may be provided; with regard to rating only the test conditions given in table 3 are to be used.

Table 5. Test results

Measured quantity or result	Unit	Calorimeter	Air enthalpy method	Test condition acc. to table 3
1) Ambient conditions				
– air temperature, dry bulb	°C	X	X	
2) Electrical quantities				
– voltage	V	X	X	
– total current	A	X	X	
– total power input, P_T	kW	X	X	
– effective power input, P_E	kW	X	X	
3) Thermodynamic quantities				
a) Condenser				
Air cooled				
– inlet temperature, dry bulb	°C	X	X	
– inlet temperature, wet bulb	°C	X	X	
– outlet temperature, dry bulb	°C		X	
For duct connection				
– external/internal static pressure difference, Δp	Pa		X	
– volume flow rate, q	m^3/s		X	
Water cooled				
– inlet temperature	°C	X	X	
– outlet temperature	°C	X	X	
– volume flow	m^3/s	X	X	
– pressure difference	kPa	X	X	
b) Evaporator				
– air inlet temperature, dry bulb	°C	X	X	
– air inlet temperature, wet bulb	°C	X	X	
– air outlet temperature, dry bulb	°C		X	
– air outlet temperature, wet bulb	°C		X	
For duct connection				
– external/internal static pressure difference, Δp	Pa		X	
– volume flow rate, q	m^3/s		X	
c) Calorimeter				
– heat input to calorimeter	kW	X		
– heat extracted from calorimeter	kW	X		
– ambient temperature around the calorimeter	°C	X		
– temperature of the water entering the humidifier	°C	X		
– condensate temperature	°C	X		
– rate of condensate collection	kg/s	X		
4) Cooling capacity				
– total cooling capacity (P_c)	kW	X		
– latent cooling capacity (P_L)	kW	X	X	
– sensible cooling capacity (P_s)	kW	X	X	
5) Ratios				
– *EER*	—	X	X	
– *SHR*	—	X	X	

Annex A (informative)
Bibliography

– *International vocabulary of basic and general terms in metrology.* ISO: GENEVA, 1993.

– *Guide to the expression of uncertainty in measurement.* ISO: GENEVA, 1993.

List of references

See national foreword.

BSI — British Standards Institution

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