BS EN 14511-4:2013

BSI Standards Publication

Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling

Part 4: Operating requirements, marking and instructions

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National foreword

This British Standard is the UK implementation of EN 14511-4:2013. It supersedes BS EN 14511-4:2011 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RHE/17, Testing of air conditioning units.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Luftkonditionierer, Flüssigkeitskühlsätze und Wärmepumpen mit elektrisch angetriebenen Verdichtern für die Raumbeheizung und -kühlung - Teil 4: Betriebsanforderungen, Kennzeichnung und Anleitung

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Foreword

This document (EN 14511-4:2013) has been prepared by Technical Committee CEN/TC 113 “Heat pumps and air conditioning units”, the secretariat of which is held by AENOR.

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of an identical text or by endorsement, at the latest by February 2014 and conflicting national standards shall be withdrawn at the latest by February 2014.

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 supersedes EN 14511-4:2011.

The main changes with respect to the previous edition are listed below:

a) the updating of the normative references.

EN 14511 comprises the following parts under the general title *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling*:

— *Part 1: Terms, definitions and classification*,

— *Part 2: Test conditions*,

— *Part 3: Test methods*,

— *Part 4: Operating requirements*, *marking and instructions*

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1 Scope

1.1 The scope of EN 14511-1 is applicable.

1.2 This European Standard specifies minimum operating requirements which ensure that air conditioners, heat pumps and liquid chilling packages using either air, water or brine as heat transfer media, with electrical driven compressors are fit for the use designated by the manufacturer when used for space heating and/or cooling.

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 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*

EN 14511-1:2013, *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling — Part 1: Terms, definitions and classification*

EN 14511-2:2013, *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling — Part 2: Test conditions*

EN 14511-3:2013, *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling — Part 3: Test methods*

EN 60204-1, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1, modified)*

EN 60335-2-40, *Household and similar electrical appliances—- Safety — Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers (IEC 60335-2-40, modified)*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 14511-1:2013 apply.

4 Operating requirements

4.1 General

Except where otherwise stated, tests shall be conducted as described in EN 14511-1 and EN 14511-3.

4.2 Temperature operating range

4.2.1 Starting test

The unit shall be capable of operating within the limit of use (temperatures and flows) indicated by the manufacturer in the technical documentation (see 6.4).

For every condition stated in Table 1, and for both cooling and heating mode where applicable, the unit shall start up and operate for at least 30 min, without being stopped by the safety devices.

Table 1 — Operational requirements conditions

Type	**Inlet temperature at outdoor heat exchanger** °C	**Outlet temperature at indoor heat exchanger** °C	**Water flow rate of air-to-water and water-to-water units**	**Voltage** V
All types	Upper limit of use	Upper limit of use	Maximum	Rated voltage
All types	Lower limit of use	Lower limit of use	Minimum	Rated voltage

The temperatures are set at the beginning of the test and maintained constant during the test.

Test voltage shall be as specified in Table 1. It is set at the beginning of the test and maintained constant during the test.

The environmental conditions during the test shall be as specified in Tables 1 and 2 of EN 14511-2:2013.

Air flow rates shall be the same as that used for the rating capacity test, as specified in EN 14511-2:2013.

Deviation between individual values and set values shall be between:

— zero and minus twice the permissible deviation according to Table 2 of EN 14511-3:2013, for the upper limit of use;

— zero and plus twice the permissible deviation according to Table 2 of EN 14511-3:2013, for the lower limit of use.

Uncertainty of measurement shall be as specified in Table 1 of EN 14511-3:2013.

4.2.2 Test at maximum operating conditions (cooling mode)

When operated at conditions stated in Table 2 during 1 h, then switch off for 5 min, and then switched on again for 1 h, the unit shall meet the following requirements:

— the unit motor shall operate continuously for the first hour without tripping of the motor overload protective devices;

— after the shut-down period of 5 min, the unit shall restart automatically no more than 5 min after restarting of the compressor;

— the unit motor shall operate again continuously for the rest of the second hour without tripping of the motor overload protective devices.

NOTE When possible, switching off the unit is done through the control panel of the unit.

Table 2 — Maximum operating conditions

Type	Inlet temperature at outdoor heat exchanger ºC	Outlet temperature at indoor heat exchanger ºC	Voltage V
Control cabinet air conditioner	Upper limit of use	35	Rated voltage
All other types	Upper limit of use	Upper limit of use	Rated voltage

This test can be combined with the corresponding starting test, except for control cabinet air conditioners where the inlet temperature at the indoor heat exchanger is lowered to 35 °C after the starting time.

4.2.3 Freeze-up test

4.2.3.1 Air-cooled unit

After the unit has operated for 6 h at the conditions stated in Table 3, and after the last freeze up cycle has completed, the following requirements shall be fulfilled:

— no ice shall have accumulated on the evaporator;

— no ice shall drip from the unit;

— no water shall drip or be blown off the unit into the room.

4.2.3.2 Water-cooled units

After the unit has operated for 6 h at the conditions stated in Table 3 the following requirements shall be fulfilled:

— air flow through the unit shall not have dropped by more than 5 %;

NOTE Ensure that air flow through the unit is not adjusted during the test by some automatic control device.

— the water temperature difference through the unit shall not have dropped by more than 30 %;

— the saturated temperature corresponding to the pressure measured at the suction of the compressor shall not have decreased by more than 2 K.

Table 3 — Freeze up test conditions

Unit type	Temperature at outdoor heat exchanger	Temperature at indoor heat exchanger ºC			Air flow rate
		Air		Water	
		Dry bulb	Wet bulb		
All types	Lowest limit of use	21	15	Lowest entering temperature	Minimum setting as allowed by the manufacturer

For all units, electrical power voltage and frequency shall be given by the manufacturer.

4.3 Outside the operating range

If operating outside the temperature range can cause damage to the unit, it shall be provided with safety devices which ensure that the unit suffers no damage when the operating limits of use indicated by the manufacturer are exceeded and remains capable of operating when coming back within these limits. A safety device that does not automatically reset may trip provided that a warning device is fitted.

The manufacturer shall indicate any safety devices provided and their operating conditions according to 7.2.3.

4.4 Shutting off the heat transfer medium flows

To check the correct operating of the safety devices on the unit, the following faults shall be simulated consecutively. The unit shall have attained steady state in the standard rating conditions according to Tables 3 to 23 of EN 14511-2:2013 for 30 min before every fault is simulated. Each fault simulated shall be maintained for at least 1 h.

NOTE In case the unit is provided without flow switch but it is required by the manufacturer instructions, the unit is tested with an additional flow switch.

a) Shutting off the heat transfer medium flow at the outdoor heat exchanger.

b) Shutting off the heat transfer medium flow at the indoor heat exchanger.

c) Shutting off the heat transfer medium flow at the heat recovery heat exchanger where applicable.

The unit is checked for any damage sustained during the test and if any safety devices have operated during the test. The unit shall suffer no damage and shall remain capable of operating after restoration of the flow rates. A safety device that does not automatically reset may trip provided that a warning device is fitted.

For units with defrosting system, an additional test shall be conducted at the test conditions specified in Table 4 by shutting off the heat transfer medium flow at the indoor heat exchanger, at the beginning of the defrosting phase.

Table 4 — Shutting off the heat transfer medium flows

Type of unit	Outdoor heat exchanger		Indoor heat exchanger			
	Inlet dry bulb temperature °C	Inlet wet bulb temperature °C	Inlet dry bulb temperature °C	Inlet wet bulb temperature °C	Inlet water temperature °C	Outlet water temperature °C
Air-to-air units	2	1	20	15 max.		
Air-to-water units	2	1			[a]	45
Air-to-water units (for floor heating or similar application)	2	1			[a]	35
[a] The test is performed at the flow rate obtained during the test at the corresponding standard rating conditions.						

4.5 Complete power supply failure

Complete power supply failure lasting approximately 5 s shall be simulated. The unit shall have attained steady state conditions before the fault simulation, at the standard rating condition according to Tables 3 to 23 of EN 14511-2:2013.

The unit has to restart automatically within 30 min. When the manufacturer states that the unit does not automatically restart, fault detection is necessary.

The unit is checked for any damage sustained during the test and if any safety devices have operated during the test.

4.6 Condensate draining and enclosure sweat test

In heating mode, draining of condensate, including that formed on the enclosure, shall be made correctly when operating at the standard rating conditions given in Tables 3 to 23 of EN 14511-2:2013.

In cooling mode, draining of condensate, including that formed on the enclosure, shall be made correctly when operating at conditions given in Table 5.

During the test of 4 h, no condensed water shall drip, run or blow off the unit except through the drain.

For indoor units, drain holes shall be provided with suitable pipe connection, the minimum diameter of which shall be 12 mm.

Table 5 — Condensate draining and enclosure sweat test. Cooling mode

	Indoor heat exchanger temperatures				**Outdoor heat exchanger temperatures**			
	Inlet dry bulb °C	Inlet wet bulb °C	Inlet water °C	Outlet water °C	Inlet dry bulb °C	Inlet wet bulb °C	Inlet water °C	Outlet water °C
Air-to-air	27	24	-	-	27	24	-	-
Water-to-air	-	-	27	[a]	27	24	-	-
Close control, air cooled	27	[b]	-	-	27	[b]	-	-
Close control, water cooled	-	-	27	[a]	27	[b]	-	-
Control cabinet, air cooled	27	24	-	-	27	24[c]	-	-
Control cabinet, water cooled	-	-	27	[a]	27	24[c]	-	-

[a] Same water flow rate as for the rating capacity test at the standard rating conditions.

[b] With the highest relative humidity stated by the manufacturer.

NOTE If not possible, make the test at the lowest dry bulb temperature (greater than 27 ºC) with 80 % relative humidity.

4.7 Defrosting

For air-to-air and air-to-water units, the functioning of any defrosting system shall be verified under any one of the application rating conditions with an outdoor air temperature of 2(1) °C (see Table 3, Tables 12 to 15 and Table 19 of EN 14511-2:2013), where frosting occurs.

At least three successive frosting/defrosting cycles shall be repeated without running in progressively deteriorating average performances.

There shall not be growth of ice in and around the drip tray.

4.8 Other requirements

Components in air handling systems, such as fans, filters, heat exchangers, etc., shall be easily accessible and resistant for cleaning purposes recommended by the manufacturer.

5 Marking

Each unit shall have a durable, permanently fixed rating plate 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 COP and/or EER to three significant figures and the standard rating condition at which it is measured according to Tables 3 to 23 of EN 14511-2:2013;

d) heating/cooling capacity in kilowatts, with two digits after the decimal comma but not more than 3 significant figures at the test condition given in item c) of Clause 5;

e) for control cabinet air conditioners, 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 5.

Further information may be provided; with regard to rating only the other rating conditions given in Tables 3 to 23 of EN 14511-2:2013 are to be used.

6 Technical data sheet

6.1 General description

The manufacturer shall provide the following information:

— trade mark, model designation;

— power supply (voltage, frequency);

— denomination of the unit (e.g.: air-to-water);

— intended use of the unit (e.g.: control cabinet air conditioner);

— number of separate component units;

— type and mass of refrigerant charge;

— overall dimensions and weight of each separate component unit.

6.2 Performance characteristics

6.2.1 Rating characteristics

The manufacturer shall provide in a table or as a graph the rating characteristics according to EN 14511-2 and EN 14511-3.

Rating characteristics include:

— the cooling capacity, the effective power input, the EER and the SHR (where applicable);

— the heating capacity, the effective power input and the COP (where applicable);

— the heat recovery capacity and the type of liquid (where applicable).

The manufacturer shall state that the characteristics apply to a new unit with clean heat exchangers.

6.2.2 Additional characteristics

In addition, the manufacturer shall provide the following characteristics for the rated point(s):

— non ducted air-to-air units: flow rates or rotational speeds of fans;

— non ducted air-to-water units: air flow rate or rotational speed of fan; water flow rate and pressure difference;

— unit intended to discharge into double floor: nominal flow rate and external static pressure difference;

— other types of units: nominal flow rates and external static pressure differences for air and water.

6.2.3 Sound characteristics

The manufacturer shall provide the sound power level measured in the standard rating conditions as given in EN 14511-2 with the corresponding test method according to EN 12102.

6.3 Electrical characteristics

The manufacturer shall specify the electrical characteristics in accordance with EN 60335-2-40 or EN 60204-1 as applicable and:

— maximum starting current of the unit, as defined in EN 61000-3-11;

— total power input and current at the rated point, excluding the starting period;

— reactive power or power factor at the rated point, for units with a total power input greater than 10 kW;

— power input of fan and pump if included in the units.

6.4 Operating range

The manufacturer shall specify:

— limits of use (temperatures and flows);

— whether there are devices fitted which do not allow the unit to operate when these limits are exceeded.

7 Instructions

7.1 General

If not already required by other standards, the manufacturer shall provide the information as described.

7.2 Physical description

7.2.1 Refrigerant, air and/or liquid circuits

The manufacturer shall:

— specify the refrigerant, air and liquid circuits preferably providing circuit diagrams, showing every functional unit, control and safety device and specifying their type;

— if the unit uses water in the heat exchangers, specify the water capacity contained in the unit, and specify either the constructional materials of the heat exchangers or the water quality;

— if used, specify the type of brine and the concentration into any other liquid;

— specify the type of oil to be used in the compressor.

7.2.2 Additional heating devices, when integral to the unit

The manufacturer shall specify the type and location of additional heating devices and their control and safety devices.

7.2.3 Control and safety

The manufacturer shall:

— state the functions achieved by the control and safety devices provided with the unit and specify when applicable their provision for adjustment and the method by which the safety devices are reset;

— provide specifications for any control or safety devices necessary to ensure correct operation of the unit but which are not provided with the unit;

— specify any limitation to the use of the rest of the installation.

7.3 Instructions for installation

The manufacturer shall specify where applicable:

a) the required location conditions (whether units are to be installed outside or in a weather proof enclosure, or in a heated space);

b) requirements of physical layout, access and clearance;

c) requirements for the electrical, liquid, air and refrigerant connections, to be made on site;

d) the location of warning and tripping devices;

e) the installation precautions to be taken to ensure, in particular:

   1) correct circulation of the heat transfer media;

2) water draining;

3) cleanliness of heat exchange surfaces;

4) to minimise noise, vibration or other adverse effects.

Special indications for units using soil, seawater, ground water or surface water: specify any materials which are in contact with the water or with the brine.

7.4 Instruction for maintenance

The manufacturer shall state:

— content and frequency of routine maintenance operations to be performed by the user;

— content and frequency of maintenance and inspection operations which shall be performed by a specialist.

7.5 Instructions to test houses

For rating inverter type control units, the manufacturer shall provide information on how to obtain data to set the required frequencies for the different tests.

Bibliography

[1] EN 14825, *Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors for space heating and cooling — Testing and rating at part load conditions and calculation of seasonal performance*

[2] Commission Directive 2002/31/EC – Implementation of Council Directive 92/75/EEC with regard to energy labelling of household air-conditioners

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