



BSI Standards Publication

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

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Part 4: Requirements

## National foreword

This British Standard is the UK implementation of EN 14511-4:2022 and supersedes BS EN 14511-4:2018, which is withdrawn.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 committee manager.

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Date	Text affected
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EUROPEAN STANDARD

**EN 14511-4**

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EUROPÄISCHE NORM

September 2022

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Supersedes EN 14511-4:2018

English Version

## Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 4: Requirements

Climatiseurs, groupes refroidisseurs à liquide et pompes à chaleur pour le chauffage et le refroidissement des locaux et refroidisseurs industriels avec compresseur entraîné par moteur électrique -  
Partie 4 : Exigences

Luftkonditionierer, Flüssigkeitskühlsätze und Wärmepumpen für die Raumbeheizung und kühlung und Prozess-Kühler mit elektrisch angetriebenen Verdichtern - Teil 4: Anforderungen

This European Standard was approved by CEN on 10 July 2022.

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## European foreword

This document (EN 14511-4:2022) has been prepared by Technical Committee CEN/TC 113 “Heat pumps and air conditioning units”, the secretariat of which is held by UNE.

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of an identical text or by endorsement, at the latest by March 2023, and conflicting national standards shall be withdrawn at the latest by March 2023.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 14511-4:2018.

The main changes compared with EN 14511-4:2018 are as follows:

- update of normative references;
- deletion of Clause 5 “Marking”.

This document has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association.

This document has been prepared in the frame of:

- Commission Regulation (EU) No 206/2012 of 6 March 2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for air conditioners and comfort fans;
- Commission Delegated Regulation (EU) No 626/2011 of 4 May 2011 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of air conditioners;
- Commission Regulation (EU) No 813/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters;
- Commission Delegated Regulation (EU) No 811/2013 of 18 February 2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device;
- Commission Regulation (EU) 2015/1095 of 5 May 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for professional refrigerated storage cabinets, blast cabinets, condensing units and process chillers;
- Commission Regulation (EU) 2016/2281 of 30 November 2016 implementing Directive 2009/125/EC of the European Parliament and of the Council establishing a framework for the setting of ecodesign requirements for energy-related products, with regard to ecodesign requirements for air heating products, cooling products, high temperature process chillers and fan coil units.

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

- *Part 1: Terms and definitions;*
- *Part 2: Test conditions;*
- *Part 3: Test methods;*
- *Part 4: Requirements.*

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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## 1 Scope

1.1 The scope of EN 14511-1:2022 is applicable, with the exception of process chillers.

1.2 This document 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 are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 14511-1:2022, *Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors — Part 1: Terms and definitions*

EN 14511-2:2022, *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling and process chillers, with electrically driven compressors — Part 2: Test conditions*

EN 14511-3:2022, *Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors — Part 3: Test methods*

EN 12102-1:2017, *Air conditioners, liquid chilling packages, heat pumps, process chillers and dehumidifiers with electrically driven compressors — Determination of the sound power level — Part 1: Air conditioners, liquid chilling packages, heat pumps for space heating and cooling, dehumidifiers and process chillers*

EN 60204-1:2018, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2016)*

FprEN IEC 60335-2-40:2021, *Household and similar electrical appliances — Safety — Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers (IEC 60335-2-40:2018)*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 14511-1:2022 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

## 4 Operating requirements

### 4.1 General

Except where otherwise stated, tests shall be conducted as described in EN 14511-2:2022 and EN 14511-3:2022.

## 4.2 Temperature operating range

### 4.2.1 Starting and operating tests

#### 4.2.1.1 General

The unit shall be capable of starting and/or operating within the limit of use (temperatures and flows) specified by the manufacturer.

Rated voltage shall be set at the beginning of the test and maintained constant during the test.

The environmental conditions during the test shall be as specified in EN 14511-2:2022, Tables 1 and 2.

Air flow rates shall be the same as that used for the rating capacity test, as specified in EN 14511-2:2022.

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

For a given air dry bulb temperature, the relative humidity shall be determined accordingly to Table 1 and used for the calculation of the wet bulb temperature to be set.

**Table 1 — Determination of wet bulb temperature related to dry bulb temperature**

Dry bulb temperature $T_{DB}$ °C	Wet bulb temperature $T_{WB}$ °C
$T_{DB} < -10$	Not defined
$-10 \leq T_{DB} \leq 12$	$T_{WB} = T_{DB} - 1$
$12 < T_{DB} \leq 20$	$T_{WB} = 0,34 * T_{DB} + 6,95$
$T_{DB} > 20$	$T_{WB} = 0,6414 * T_{DB} + 1,5931$

Deviation between individual values and set values shall be between:

- zero and minus twice the permissible deviation according to EN 14511-3:2022, Table 5 for the upper limit of use;
- zero and plus twice the permissible deviation according to EN 14511-3:2022, Table 5 for the lower limit of use.

Uncertainty of measurement shall be as specified in EN 14511-3:2022, Table 2.

The tests shall be performed at every condition stated in Tables 2 to 9, accordingly to the type of unit and in both cooling and heating mode, where applicable.

For a starting test, the unit shall start and operate in the temperature conditions stated in Tables 2 to 9 during 15 min.

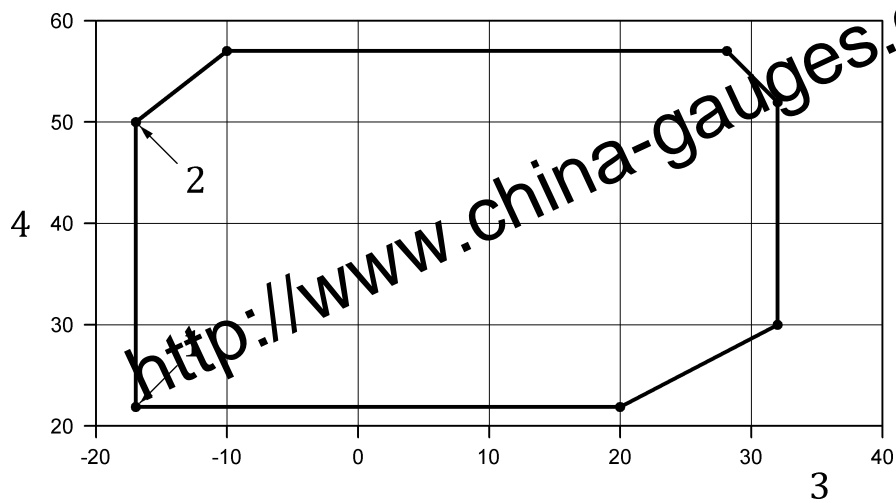
For an operating test, the unit shall be able to operate during 1h in the temperature conditions stated in Tables 2 to 5.

The unit motor shall operate without tripping of the motor overload protective devices.



#### 4.2.1.2 Heating mode

The following Figure 1 provides an example of the operating range as declared by the manufacturer. The temperature values are not necessarily relevant.



**Key**

- 1, 2 test points
- 3 inlet temperature at outdoor heat exchanger in °C
- 4 inlet temperature at indoor heat exchanger in °C

**Figure 1 — Example of operating range of a unit in heating mode**

**Table 2 — Operational requirements conditions for air-to-air units**

Test point	Test
1	Starting
2	Operating

**Table 3 — Operational requirements conditions for air-to-water units**

Test point	Water flow rate at indoor heat exchanger	Test
1	Minimum	Starting
2	Minimum	Operating

**Table 4 — Operational requirements conditions for water(brine)-to-water units**

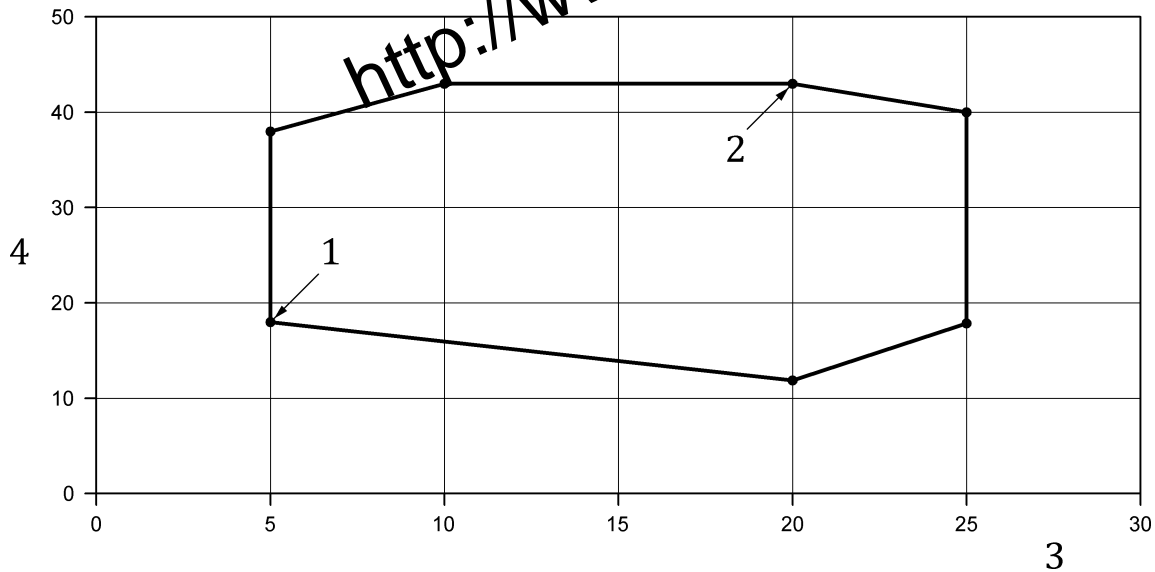
Test point	Water flow rate at indoor heat exchanger	Water flow rate at outdoor heat exchanger	Test
1	Minimum	Minimum	Starting
2	Minimum	Minimum	Operating

**Table 5 — Operational requirements conditions for water(brine)-to-air units**

Test point	Water flow rate at indoor heat exchanger	Test
1	Minimum	Starting
2	Minimum	Operating

**4.2.1.3 Cooling mode**

The following Figure 2 provides an example of the operating range as declared by the manufacturer. The temperature values are not necessarily relevant.



**Key**

- 1, 2 test points
- 3 inlet temperature at indoor heat exchanger in °C
- 4 inlet temperature at outdoor heat exchanger in °C

**Figure 2 — Example of operating range of a unit in cooling mode**

**Table 6 — Operational requirements conditions for air-to-air units**

Test point	Test
1	Starting
2	Starting

**Table 7 — Operational requirements conditions for air-to-water units**

Test point	Water flow rate at indoor heat exchanger	Test
1	Minimum	Starting
2	Maximum	Starting

**Table 8 — Operational requirements conditions for water(brine)-to-water units**

Test point	Water flow rate at indoor heat exchanger	Water flow rate at outdoor heat exchanger	Test
1	Maximum	Minimum	Starting
2	Maximum	Minimum	Starting

**Table 9 — Operational requirements conditions for water(brine)-to-air units**

Test point	Water flow rate at outdoor heat exchanger	Test
1	Maximum	Starting
2	Maximum	Starting

### 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 6.2.3.

### 4.4 Freeze-up test in cooling mode

The test shall be performed on air-to-air and water(brine)-to-air units in the cooling mode for checking the consequences of a possible freeze-up of the air on the indoor side.

After the unit has operated for 6 h at the conditions stated in Table 10, or after the last freeze up cycle has completed after these 6 h, 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.

**Table 10 — Freeze up test conditions**

Unit type	Temperature at outdoor heat exchanger	Indoor heat exchanger			
		Air temperatures		Air flow rate	Set point temperature
		Dry bulb °C	Wet bulb °C		
All types	Lowest condition of the operating range (see Figure 2)	21	15	Minimum setting as allowed by the manufacturer	Lowest set point

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

#### 4.5 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 for 30 min each.

- 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 shall have attained steady-state operation in one of the standard rating conditions according to EN 14511-2:2022, Tables 3 to 24 in both cooling and heating mode where applicable for 15 min before each fault is simulated.

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.

The unit is checked if any safety devices have operated during the test. The unit shall remain capable of operating after restoration of the flow rates for 30 min once the compressor has restarted. A safety device that does not automatically reset may trip provided that a warning device is fitted.

#### 4.6 Complete power supply failure

Complete power supply failure lasting approximately 5 s shall be simulated. The unit shall have attained steady-state conditions for 15 min before the fault simulation, at one of the standard rating condition according to EN 14511-2:2022, Tables 3 to 24 in cooling and heating mode where applicable.

The unit shall 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.

#### 4.7 Condensate draining and enclosure sweat test

The test applies to air-to-air and water (brine)-to-air units operating in cooling mode, for which condensation of air moisture may occur.

Draining of condensate, including that formed on the enclosure, shall be made correctly when operating at conditions given in Table 11.

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 11 — Condensate draining and enclosure sweat test. Cooling mode**

	Indoor heat exchanger temperatures				Outdoor heat exchanger temperatures	
	Inlet air dry bulb °C	Inlet air wet bulb °C	Inlet water °C	Outlet water °C	Inlet dry bulb °C	Inlet wet bulb °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 <sup>c</sup>
Control cabinet, water cooled	—	—	27	a	27	24 <sup>c</sup>

<sup>a</sup> Same water flow rate as for the rating capacity test at the standard rating conditions.  
<sup>b</sup> With the highest relative humidity stated by the manufacturer.  
<sup>c</sup> If not possible, make the test at the lowest dry bulb temperature (greater than 27 °C) with 80 % relative humidity.

#### 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 Technical data sheet

#### 5.1 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.

## 5.2 Performance characteristics

### 5.2.1 Rating characteristics

The manufacturer shall provide in a table or as a graph the rating characteristics according to EN 14511-2:2022 and EN 14511-3:2022.

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.

### 5.2.2 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.

### 5.2.3 Sound characteristics

The manufacturer shall provide the sound power level measured according to EN 12102-1:2017.

## 5.3 Electrical characteristics

The manufacturer shall specify the electrical characteristics in accordance with FprEN IEC 60335-2-40:2021 or EN 60204-1:2018, as applicable, and:

- maximum starting current of the unit;
- 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.

## 5.4 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.

## 6 Instructions

### 6.1 General

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

### 6.2 Physical description

#### 6.2.1 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 devices 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.

#### 6.2.2 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.

#### 6.2.3 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.

### 6.3 Instructions for installation

The manufacturer shall specify where applicable:

- a) the required location conditions (whether units shall 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 minimize 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.

#### **6.4 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.

#### **6.5 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.



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