GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 27.010

CCS F 01

GB 19577-2024

Replacing GB 19577-2015, GB 29540-2013, GB 30721-2014, GB 37480-2019

Minimum allowable values of the energy efficiency and energy efficiency grades for heat pumps and water chillers

热泵和冷水机组能效限定值及能效等级

Issued on: April 29, 2024 **Implemented on: February 01, 2025**

Issued by: State Administration for Market Regulation;
Standardization Administration of the People's Republic of China.

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Minimum allowable values of the energy efficiency and energy efficiency grades for heat pumps and water chillers

1 Scope

This document specifies the technical requirements for the minimum allowable values of the energy efficiency and energy efficiency grades for heat pumps and water chillers, describes the corresponding test methods, and clarifies the implementation of this document.

The types of heat pumps and chillers to which this document applies include water chilling (heat pump) packages using the vapor compression, low ambient temperature air source heat pump (water chilling) packages, water-source (ground-source) heat pumps, lithium bromide absorption water chillers (heaters), water-source high temperature heat pumps using the vapor compression cycle, indirect evaporative cooling water chillers, and integrated water chilling (heat pump) packages.

2 Normative references

The following referenced documents are indispensable for the application 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.

GB/T 10870 The methods of performance test for water chilling (heat pump) packages using the vaper compression cycle

GB/T 18362 Direct-fired lithium bromide absorption water chiller (heater)

GB/T 18430.1 Water chilling (heat pump) packages using the vapor compression cycle - Part 1: Water chilling (heat pump) packages for industrial & commercial and similar application

GB/T 18430.2 Water chilling (heat pump) packages using the vapor compression cycle - Part 2: Water chilling (heat pump) packages for household and similar application

GB/T 18431 Steam and hot water type lithium bromide absorption water chiller

GB/T 19409 Water-source (ground-source) heat pumps

Under the specified standard operating conditions, the minimum allowable values of the nominal heating coefficient of performance (COP_h), low temperature heating coefficient of performance (COP_{dh}), heating seasonal performance factor (HSPF) and (or) annual performance factor (APF) of low ambient temperature air source heat pump (water chilling) packages.

NOTE: For fan-coil units, the annual performance factor (APF) is assessed for the seasonal performance factor; for floor-heating and radiator units, the heating seasonal performance factor (HSPF) is assessed for the seasonal performance factor.

3.3

minimum allowable values of energy efficiency for water-source (ground-source) heat pumps

Under the specified standard operating conditions, the minimum allowable values of the annual comprehensive coefficient of performance (ACOP) or heating coefficient of performance (COP) of water-source (ground-source) heat pumps.

NOTE: For heat-pump units, the annual comprehensive coefficient of performance (ACOP) is assessed; for single-heat units, the heating coefficient of performance (COP) is assessed.

3.4

minimum allowable values of energy efficiency for lithium bromide absorption water chillers (heaters)

Under the specified standard operating conditions, the minimum allowable values of the coefficient of performance (COP) or the maximum values of the heating source consumption per unit cooling capacity of lithium bromide absorption water chillers (heaters).

NOTE: For vapor units, the heating source consumption per unit cooling capacity is assessed; for direct-fired units, the coefficient of performance (COP) is assessed.

3.5

minimum allowable values of energy efficiency for water-source high temperature heat pumps using the vapor compression cycle

Under the specified standard operating conditions, the minimum allowable values of the heating coefficient of performance of water-source high temperature heat pumps using the vapor compression cycle.

NOTE: For water-source high temperature heat pumps, the heating coefficient of performance (COP_H) is assessed; for periodical feeding heat pump high temperature hot water units, the heating coefficient of performance (COP) is assessed.

3.6

minimum allowable values of energy efficiency for indirect evaporative cooling water chillers

Under specified standard operating conditions, the minimum allowable values of the annual energy efficiency ratio (AEER) or energy efficiency ratio (EER) of indirect evaporative cooling water chillers.

NOTE: For high-leaving water temperature chillers base on dew point indirect evaporative cooling used in data centers and similar places, the annual energy efficiency ratio (AEER) is assessed; for composite indirect evaporative cooling water chillers used in computer and data processing rooms, the energy efficiency ratio (EER) is assessed.

3.7

minimum allowable values of energy efficiency for integrated water chilling (heat pump) package

Under specified standard operating conditions, the minimum allowable values of the integrated part load value ($IPLV_I$) and nominal operating coefficient of performance (COP_I) of integrated water chilling (heat pump) packages.

NOTE: For vapor-cooled, cooling-tower and air-cooled units, the integrated part load value ($IPLV_I$) and nominal operating coefficient of performance (COP_I) are assessed.

4 Energy efficiency grades

4.1 The energy efficiency grades for heat pumps and water chillers are divided into 3 grades, among which grade 1 has the highest energy efficiency.

4.2 The measured values and nominal values of the energy efficiency indicators of various types of heat pumps and water chillers shall not be less than the specified values corresponding to the energy efficiency grades in Tables 1 to 8. Among them, the indicators of energy efficiency grades for water chilling (heat pump) packages using the vapor compression adopt dual-channel evaluation indicators, i.e., select the energy efficiency value of one of the indicator systems in the comprehensive part load value (IPLV) (see Table 1) or the coefficient of performance (COP_c) (see Table 2) to determine the energy efficiency grade.

NOTE: The specific product types of water chilling (heat pump) packages using the vapor compression, low ambient temperature air source heat pumps (chillers), low ambient temperature air source heat pump (water chilling) packages, water-source (ground-source) heat pumps, lithium bromide absorption water chillers (heaters), water-source high temperature heat pumps using the vapor compression cycle, indirect evaporative cooling water chillers, and integrated water chilling (heat pump) package mentioned in this document are the product types mentioned in Tables 1 to 8.

efficiency for low ambient temperature air source heat pump (water chilling) packages, the minimum allowable values of energy efficiency for water-source (ground-source) heat pumps, the minimum allowable values of energy efficiency for lithium bromide absorption water chillers (heaters), the minimum allowable values of energy efficiency for water-source high temperature heat pumps using the vapor compression cycle, the minimum allowable values of energy efficiency for indirect evaporative cooling water chillers, and the minimum allowable values of energy efficiency for integrated water chilling (heat pump) packages are the indicator values corresponding to energy efficiency grade 3 in Tables 1 to 8.

5.2 For low ambient temperature air source heat pump (water chilling) packages with electric auxiliary heating, the electric auxiliary heating system shall be manually turned on and off, and its working status shall be expressed in an obvious position.

5.3 The marked values of energy efficiency for heat pumps and water chillers shall be within the range of values corresponding to their rated energy efficiency grades, and the measured values of energy efficiency shall not be less than the provisions in the corresponding product standards in Tables 1 to 8.

NOTE: The marked values and measured values of energy efficiency for water chilling (heat pump) packages using the vapor compression, low ambient temperature air source heat pump (water chilling) packages, water-source (ground-source) heat pumps, lithium bromide absorption water chillers (heaters), water-source high temperature heat pumps using the vapor compression cycle, and indirect evaporative cooling water chillers are rounded off to multiples of 0.01, and the marked values and measured values of energy efficiency for integrated water chilling (heat pump) packages are rounded off to multiples of 0.1.

5.4 The marked values of the nominal cooling (heating) capacity of the unit shall be within the range of the nominal cooling (heating) capacity corresponding to its rated energy efficiency grade, and the measured value of the nominal cooling (heating) capacity shall not be less than the provisions in the corresponding product standards in Tables 1 to 8.

6 Tests and calculation methods

6.1 The energy efficiency test method for water chilling (heat pump) packages using the vapor compression shall be carried out in accordance with the relevant provisions of GB/T 18430.1 and GB/T 18430.2. The test and calculation of air-cooled comfort chillers with a nominal cooling capacity not exceeding 50 kW shall be carried out in accordance with the provisions of Annex A.

6.2 The energy efficiency test method for low ambient temperature air source heat pump (water chilling) packages shall be carried out in accordance with the relevant provisions of GB/T 25127.1 and GB/T 25127.2.

6.3 The energy efficiency test method for water-source (ground-source) heat pumps shall be carried out in accordance with the relevant provisions of GB/T 19409.

6.4 The energy efficiency test method of lithium bromide absorption water chillers (heaters) shall be carried out in accordance with the relevant provisions of GB/T 18431 and GB/T 18362.

6.5 The energy efficiency test method for water-source high temperature heat pumps using the vapor compression cycle shall be carried out in accordance with the relevant provisions of GB/T 25861 and JB/T 12840.

6.6 The energy efficiency test method for indirect evaporative cooling water chillers shall be carried out in accordance with the relevant provisions of JB/T 14642 and JB/T 14640. The dry-bulb and wet-bulb temperature distribution coefficients, used for the test conditions and calculation of the annual energy efficiency ratio (AEER) of high-leaving water temperature chillers base on dew point indirect evaporative cooling used in data centers and similar places, are tested and calculated according to the provisions for cold regions (refer to Beijing) in JB/T 14642 (referenced to Beijing).

6.7 The energy efficiency test method for integrated water chilling (heat pump) packages shall be carried out in accordance with the relevant provisions of JB/T 12839.

7 Implementation of the document

Products produced or imported on the date of implementation of this document shall comply with the requirements of this document.

The sales of products produced or imported before the implementation of this document shall only be delayed until the 24th month after the implementation of this document.

Key:
A - test point of 100 % load rate;
B - test point of 75 % load rate;
C - test point of 50 % load rate;
D - test point of 25 % load rate.

Figure A.1 -- Cooling load line

A.3 Test methods

Under the rated voltage and test conditions specified in Table A.1, according to the method specified in GB/T 10870, measure the cooling capacity and cooling power consumption of the unit at the test points of four operating conditions: A, B, C, and D respectively, and calculate the cooling coefficient of performance of the corresponding load point according to the method in A.4:

a) For units using a single fixed-frequency/fixed-speed compressor: test at rated voltage and rated frequency;

b) For units using multiple fixed-frequency/fixed-speed compressors: start the appropriate number of compressors according to the needs through the control system of the unit, so that the unit can stabilize at the load rate specified in Table A.1;

NOTE: If the control system of the unit does not set the compressor number start logic, test it as a fixed-frequency/fixed-speed unit.

c) For variable-frequency/variable-capacity units: the operating frequency or capacity of the compressor shall be adjusted to an appropriate value so that the unit can stably operate at the load rate specified in Table A.1.

A.4 Calculation methods

A.4.1 Cooling seasonal total load

The cooling seasonal total load CSTL is calculated according to formula (A.2).

$$CSTL = \sum_{j=1}^{n} Q_c(t_j) \times n_j \qquad \cdots\cdots (A.2)$$

where:

$Q_c(t_j)$ - the cooling capacity of each load of the unit, in kilowatts (kW);

n_j - the working time at each temperature of cooling in the cooling season, in hours (h).

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