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Replacing GB/T 19490-2003

Water source (ground-source) heat pumps

水（地）源热泵机组

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Foreword

This standard is drafted according to rules given by GB/T 1.1-2009.

This standard replaces GB/T 19049-2003 *Water-source heat pumps.* The main technical changes are as follows, compared with GB/T 19049-2003:

- Add the “surface water type” in type;
- Change the name of underground loop type into “buried pipe type”;
- Change the “inlet-outlet water temperature difference 5°C at heat-source side under working condition of hot-cold water models” to “the combination of outlet water temperature and water flow”;
- Change the heat pump from 8-gears to 2-gears, according to cold classification;
- Modify the working condition; the working condition of centrifugal units and volumetric units are determined separately;
- Add the annual coefficient of performance (ACOP) as the energy efficiency index of heat pump unit.

This standard was proposed by China Machinery Industry Federation.

This standard shall be under the jurisdiction of China technical standardization committee of cooling and air conditioning equipment (SAC/TC 238).

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Water source (ground-source) heat pumps

1 Scope

This standard specifies the terms and definitions, types and basic parameters, requirements, test methods, inspection rules, marking, packaging, transport and storage of water source (ground-source) heat pumps (hereinafter referred to as “UNIT”).

This standard applies to water source heat pumps that use electromechanical compression cooling system and takes the water circulating in buried pipes or water in wells, lakes, rivers, oceans, sewage, industrial waste, or water in common pipelines as cold (hot) source.

2 Normative references

The following documents are indispensable for application of this document. For the dated documents so quoted, only dated versions apply to this document. For the undated documents so quoted, the latest versions (including all modification sheets) apply to this document.

GB/T 191 Packaging - Pictorial marking for handling of goods

GB/T 3785-1983 Electric, sonic properties and measuring methods for sound level meters

GB 4706.32 Safety of household and similar electrical appliances - Particular requirements for heat pumps, air-conditioner and dehumidifier

GB/T 5226.1 Electrical equipment of industrial machines. Part 1: General requirements

GB/T 6388 Transport package shipping mark

GB/T 10870-2001 The methods of performance test for positive displacement and centrifugal water-chilling units and heat pump

GB/T 13306 Plates

GB/T 18430.1-2007 Water chilling (heat pump) packages using the vapor compression cycle - Household and similar water chilling (heat pump) packages

GB/T 17758-2010 Unitary air conditioners

GB/T 18836-2002 Ducted air-conditioning (heat pump) units

3.1.5

Ground-loop heat pumps

The UNIT that uses water circulating in underground coil as cold (hot) source.

3.1.6

Surface-water heat pump

The UNIT that uses water in lakes, rivers, oceans, sewage, industrial waste, or other surface water as cold (hot) source.

3.2

(ACOP) Annual Coefficient of Performance; ACOP

The annual coefficient of performance obtained by comprehensively WEIGHTING the efficiency for water-source (ground-source) heat pumps when operating at full-load under nominal cooling conditions and nominal heating conditions WITH several office buildings in typical cities according to the ratio of cooling and heating time.

Annual coefficient of performance ACOP = 0.56EER+0.44COP

Note 1: EER is the energy efficiency of water (ground) heat pump when the UNIT runs at full capacity under rated cooling condition.

Note 2: COP the energy efficiency of water (ground) heat pump when the UNIT runs at full capacity under rated heating condition.

Note 3: The weighting coefficients, 0.56 and 0.44, are the proportion of cooling and heating time of office buildings in Beijing, Harbin, Wuhan, Nanjing and Guangzhou that accounts for the total air-conditioned time of office buildings.

4 Types and basic parameters

4.1 The types of water-to-air heat pump [Translator: hereafter abbreviated as “heat-pump”]

4.1.1 The UNITs are divided into the following according to functions;

a) Heat-pump type;

b) Single-cold type;

c) Single-hot type.

4.1.2 The UNITs are divided into the following according to structure types;

a) Monolithic type;

b) Separated type.

4.1.3 The UNITs are divided into the following according to fan supply types;

a) Direct blowing type;

b) Compressed air type.

4.1.4 The UNITs are divided into the following according to the type of cold (hot) source types;

a) Water-loop type;

b) Ground-water type;

c) Ground-loop type;

d) Surface-water type.

4.2 The types of water-to-water heat-pump

4.2.1 The UNITs are divided into the following according to function;

a) Heat-pump type;

b) Single-cold type;

c) Single-hot type.

4.2.2 The UNITs are divided into the following according to structure types;

a) Integral type;

b) Separated type.

4.2.3 The UNITs are divided into the following according to the type of cold (hot) source types;

a) Water-loop type;

b) Ground-water type;

c) Ground-loop type;

d) Surface-water type.

4.3 Basic parameters

5.2.5 The water quality of the UNIT heat-source shall comply with requirements in Annex D of GB/T 18430.1-2007. The water that cannot meet the quality requirements shall be treated specially, or the appropriate heat exchanging equipment shall be used.

5.3 Performance requirements

5.3.1 Sealing of cooling system

There shall be no leakage of refrigerant in all parts of cooling system of the UNIT.

5.3.2 Running

The running test shall be done for the UNIT before the UNIT leaves the factory; there shall be no abnormal situation of the UNIT after test. If the test condition is not complete or the UNIT has a rated voltage being more than 3000 V, the UNIT can be run on-site.

5.3.3 Cooling capacity

The actual measured cooling capacity of the UNIT shall not be less than 95% of the nominal cooling capacity.

5.3.4 Power of cooling system

The actual measured power of cooling system shall not be larger than 110% of the nominal power of cooling system.

5.3.5 Heat capacity of heat-pump

The actual measured heat capacity of heat-pump shall not less than 95% of the nominal heat capacity of heat-pump.

5.3.6 Heating power consumption of heat-pump

The actual measured heating power consumption of heat-pump shall not be larger than 110% of the nominal heating power consumption of heat-pump.

5.3.7 Static pressure and air flow

5.3.7.1 The actual measured minimum external static pressure of outdoor UNIT of air pipe shall not be less than 95% of nominal statistic pressure value.

5.3.7.2 The actual measured air flow of water-to-air heat-pump shall not be less than 95% of nominal air flow.

5.3.8 The maximum operating cooling

When the UNIT is under working condition of maximum operating cooling, it shall meet the following conditions:

manufacturer, and the installation shall be done by using provided or recommended accessories and tools.

6.2.2.2 In addition to the prescribed manner required to connect the test apparatus and instruments, the UNIT shall not be changed and adjusted.

6.2.2.3 When necessary, the test UNIT can be evacuated or be charged with refrigerant in accordance with the manufacturer's guidance.

6.2.2.4 Requirements for the installation of split UNIT

6.2.2.4.1 The refrigerant connecting pipe of indoor UNIT and outdoor UNIT shall take the maximum designed length or 7.5 m as the test pipe length. Take the greater value of the two; if the connecting pipe dose not required to be cut as a whole of the UNIT, the test shall be done for the full length of installed connecting pipe. In addition, the diameter, insulation, evacuation and filled refrigerant shall be consistent with the manufacturer's requirements.

6.2.2.4.2 The installation height difference between connecting pipes shall be less than 2m.

6.2.3 Test fluid

6.2.3.1 The test fluid of heat-source side of water-loop heat-pump, ground-water heat-pump, round-loop heat-pump and surface-water heat-pump shall use local living water.

6.2.3.2 The use-side of water-to-water heat-pump shall use local living water.

6.2.3.3 The air in test fluid shall be fully discharged to ensure that the test result shall not be affected by the existing air.

6.3 Performance test

6.3.1 Sealing performance test of cooling system

Refrigerant leak detector with the following sensitivity can be used to detect the refrigerant system of the UNIT when the refrigerant system is filled with refrigerator normally and fully: for the UNITs with nominal cooling capacity (it is nominal heating capacity, for single-hot unit) of less than or equal to 150 kW, the sensitivity is $1X10^{-6}$ Pa•m^3/s; for the UNIT with nominal cooling capacity (it is nominal heating capacity, for single-hot unit) of greater than 150 kW, the sensitivity is $1X10^{-5}$ Pa•m^3/s.

6.3.2 Running test

When the UNIT is running, check whether the running status, the sensitivity and reliability of protection devices, the test temperature, electric appliance and other control components of the UNIT are normal.

6.3.3 Cooling capacity test

The test shall be done for water-to-air heat-pump under the nominal cooling working condition as specified in table 4 according to the test method specified in annex A of GB/T 17758-2010. The air enthalpy method shall be taken as calibration test method; the test shall be done for water-to-water heat-pump under the nominal cooling working condition as specified in table 5 according to the test method specified in GB/T 10870. The secondary refrigerant method shall be taken as calibration test method;

6.3.4 Power consumed by cooling

When it is in the cooling capacity test, measure the input power and current of UNIT.

6.3.5 Heating capacity test

The test shall be done for water-to-air heat-pump under the nominal heating working condition as specified in table 4 according to the test method specified in annex A of GB/T 17758-2010. The air enthalpy method shall be taken as calibration test method; the test shall be done for water-to-water heat-pump under the nominal heating working condition as specified in table 5 according to the test method specified in GB/T 10870. The secondary refrigerant method shall be taken as calibration test method;

6.3.6 Heating power consumption of heat-pumps

When it is in the heating capacity test, measure the input power and current of UNIT.

6.3.7 Air flow test of water-to-air heat-pump

The nominal airflow of the UNIT is determined by the measurement condition of airflow specified in table 4.

Measure the airflow of the UNIT with air pipe under nominal static pressure when the UNIT is in use.

Test the UNIT without air pipe under the condition that the external static pressure is 0 Pa, when the UNIT is in use.

6.3.8 The maximum running cooling test

6.3.8.1 The maximum running cooling test for water-to-air heat-pump

The test voltage shall be the rated voltage. Run the UNIT for 1 hour after the UNIT runs steadily under the maximum cooling working condition as specified in table 4; stop it for 3 minutes (the raised voltage shall not exceed 3% during this time); then start it to run for 1 hour.

6.3.5.2 The maximum running cooling test for water-to-water heat-pump

The test voltage shall be the rated voltage. The running time of the UNIT, after the UNIT runs steadily under the maximum cooling working condition as specified in table 5, shall not be less than 1 hour.

6.3.9 The maximum running heating test

6.3.9.1 The maximum running heating test for water-to-air heat-pump

The test voltage shall be the rated voltage. Run the UNIT for 1 hour, after the UNIT runs steadily under the maximum heating working condition as specified in table 4; stop it for 3 minutes (the raised voltage shall not exceed 3% during this time); then start it to run for 1 hour.

6.3.9.2 The maximum running heating test for water-to-water heat-pump

The test voltage shall be the rated voltage. The UNIT runs for 1 hour, after the UNIT runs steadily under the maximum heating working condition as specified in table 5.

6.3.10 The minimum running cooling test

The test voltage shall be the rated voltage. Run the water-to-air heat-pump under the minimum cooling working condition as specified in table 4; run the water-to-water heat-pump under the minimum cooling working condition as specified in table 5; and run them for at least 30 minutes after they runs steadily.

6.3.11 The minimum running heating test for heat-pump

The test voltage shall be the rated voltage. Use fluid with specified temperature to flow by the coil and soak the coil for 10 minutes, then run the water-to-air heat-pump under the minimum heating working condition as specified in table 4; and run the water-to-water heat-pump under the minimum heating working condition as specified in table 5. The UNIT shall be able to continue to run for at least 30 minutes.

6.3.12 Condensation test

The test voltage shall be the rated voltage. The UNIT is running in cooling condition under the condensation condition as specified in table 4.

Condensation running shall be done for all controllers, fans, dampers and grill when they has been lowered to the easiest condensed state without violating the manufacturer’s provisions for the user. And continue to run the UNIT for 4 hours after the running of the UNIT has reached the specified working condition.

6.3.13 Discharge capability test of condensation water for water-to-air heat-pump

Adjust the temperature controller, fan speed, throttle and guide grille of the UNIT to the easiest condensate state and do cooling running under the condensation working condition as specified in table 4 after the water pan has been filled with water fully enough to drain water; continue to run the UNIT for 1 hour after the water level of water pan is stable.

6.3.14 Noise test

The UNIT is running in cooling condition (for single-hot heat-pump: it is in nominal heating working condition) under the rated voltage, rated frequency and proximity nominal cooling working condition (for single-hot heat-pump: it is the nominal heating working condition). For UNIT with water pump, the water pump shall run under the flow and pump-lift closing to the specified values on nameplate; the test method is shown in Annex A.

6.3.15 The pressure loss of water system

The measure of pressure loss of water system shall be done in accordance with

8.1.1 The permanent nameplate shall be set on a prominent position for each UNIT; the nameplate shall comply with provisions of GB/T 13306. There shall be the following content on the nameplate:

a) Manufacturer's name and trademark;

b) The product name and model number;

c) Main technical performance parameters (nominal cooling capacity, nominal heating capacity, refrigerant type and amount of charge, rated voltage, rated frequency and phase, total input power, quality etc. For water-to-air heat-pump, it needs additional static pressure and air flow of the UNIT);

d) The product serial number;

e) The manufacturing date.

8.1.2 There shall be mark indicating the operational status on the UNIT, such as marks on indicating instrument and control button.

8.1.3 The number of implementation standard shall be marked on corresponding location (such as nameplates, product brochures, etc.).

8.1.4 The following factory documents shall be accompanied with each UNIT:

a) Product qualification certificate; the content includes:

- Product type and name;

- Product serial number;

- Conclusions of the examination;

- Signature or stamp of inspector;

- Inspection date.

b) Product description; the content includes:

- Product type and name, applicable scope, implementation standard, noise and pressure loss of water system;

- Structure diagram, electrical schematics and wiring diagrams of the product;

- Installation instructions and requirements;

- Use instructions, precautions of repair and maintenance,

c) Packing list.

8.2 Packaging

8.2.1 Cleaning shall be done for the UNIT before packaging; each component shall be clean and dry; the part vulnerable to rust shall be painted with rust inhibitor.

8.2.2 The plastic bag or waterproof paper shall be wrapped on the UNIT; they shall be fixed in the box to prevent moisture and mechanical damage in transportation.

8.2.3 The packaging box of the UNIT shall be equipped with the following marks:

Annex A

(Normative Annex)
Noise test method for water source (ground source) heat-pump

A.1 Applicable scope

This annex specified the noise test method for water source (ground source) heat-pump.

A.2 Determination location

The determination location shall be semi-free field on reflection plane; the difference between the measured unit noise and the background noise shall be more than 8 dB.

A.3 Measuring instrument

The measuring instrument shall be type I sound level meter or sound level meter above type I as specified in GB/T 3785 1983, and other test equipment with equivalent accuracy.

A.4 installation and operating conditions

Installation and operating conditions of the machine refer to corresponding provisions of JB/T 4330.

A.5 Measuring points arrangement and test method

A.5.1 Water-to-air heat-pump

A.5.1.1 Integrated UNIT

a) For UNIT with air pipe, the noise test shall refer to corresponding provisions of Annex B in GB/T 18836-2002.

b) For UNIT without air pipe, the noise test shall refer to corresponding provisions of Annex D in JB/T 4330-1999.

A.5.1.2 Split UNIT

a) Indoor unit

- For UNIT with air pipe, the noise test shall refer to corresponding provisions of Annex B in GB/T 18836-2002.
- For UNIT without air pipe, the noise test shall refer to corresponding provisions of Annex D in JB/T 4330-1999.

b) Outdoor unit

Arrange 4 measuring points at 4 sides of the UNIT - the height is 1/2 of the total height that is consisted of the height of the unit and 1 meter; the distance is 1 meter away from the unit. The test result is the average sound pressure level according to equation (A.1). Measure at the location as shown in figure A.1; the unit shall be adjusted to the nominal cooling working condition; run it stably when the noise test is done.

$$\overline{L}_p = 10\lg(1/4)\left(\sum_{i=1}^{4} 10^{0.1L_{pi}}\right) \qquad \cdots\cdots(A.1)$$

Where:

$\overline{L}_p$ – A-weighted average of the measurement surface or octave sound pressure level, dB (reference value is 20 μPa);

L_{pi} - The A-weighting measured at the i-th measuring point, or octave sound pressure level that is corrected according to 8.1.1 of JB/T 4330-1999, dB (reference value is 20 μPa).

A.5.2 Water-to-water (including spilt and integrated UNIT)

A.5.2.1 Floor mount

Arrange 4 measuring points at the 4 sides of the UNIT - the height is 1/2 of the total height that is consisted of the height of the UNIT and 1 meter; the distance is 1 meter away from the UNIT. The test result is the average sound pressure level according to equation (A.1). Measure at the location as shown in figure A.1; the UNIT shall be adjusted to the nominal cooling working condition; and run it stably when the noise test is done.

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