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Four-way electromagnetic reversing valve for heat pump

热泵用四通电磁换向阀

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Four-way electromagnetic reversing valve for heat pump

1 Scope

This Standard specifies the terms and definitions, model, basic parameters, requirements, test methods, inspection rules, marking, package and storage of heat pump four-way electromagnetic reversing valve for refrigeration equipment (hereinafter referred to as “reversing valve”).

This Standard is applicable the four-way electromagnetic reversing valve for the purposes of cooling and heating by changing the flow direction of the refrigerant in the refrigeration device with refrigerants of R22, R134a, R404A, R407C, R410A, and the valve’s nominal capacity of no more than 210kW.

2 Normative References

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) are applicable to this document.

GB/T 191 Packaging - Pictorial Marking for Handling of Goods

GB/T 2423.1 Environmental Testing - Part 2: Test Methods - Tests A: Cold

GB/T 2423.2 Environmental Testing - Part 2: Test Methods - Tests B: Dry Heat

GB/T 2423.3 Environmental Testing—Part 2: Testing Method - Test Cab: Damp Heat, Steady State

GB/T 2423.17 Environmental Testing for Electric and Electronic Products - Part 2: Test Method - Test Ka: Salt Mist

GB/T 2624 (all parts) Measurement of Fluid Flow by Means of Pressure Differential Devices Inserted in Circular Cross-Section Conduits Running Full

GB/T 6283 Chemical Products - Determination of Water Karl · Fischer Method (General Method)

--- Under normal temperature condition, the insulation resistance between the live parts and the non-live parts shall be greater than 100MΩ;

--- After the damp heat resistance test, the insulation resistance of the solenoid coil of reversing valve shall be no less than 1.5MΩ.

5.2.6.3 Under the specified test method of the solenoid coil of the reversing valve, the heating temperature requirements shall conform to the provisions of Table 6.

Table 6 – Heating Temperature

Heat resistance level	E	B	F	H	C
Temperature °C	≤120	≤130	≤155	≤180	>180

5.2.6.4 The solenoid coil of reversing valve shall meet the requirements of self-extinguishing within 60s.

5.2.6.5 The solenoid coil of the reversing valve, after the damp heat resistance test, shall meet the requirements of 5.2.6.1 and 5.2.6.2.

5.2.7 Low temperature resistance

After the low-temperature resistance test, the reversing valve shall meet the requirements of 5.2.2, 5.2.4, 5.2.5, 5.2.6.1, 5.2.6.2.

5.2.8 High temperature resistance

After the high-temperature resistance test, the reversing valve shall meet the requirements of 5.2.2, 5.2.4, 5.2.5, 5.2.6.1, 5.2.6.2.

5.2.9 Cold-thermal cycle resistance

After the cold-thermal cycle resistance test, the reversing valve shall meet the requirements of 5.2.2, 5.2.4, 5.2.5, 5.2.6.1, 5.2.6.2.

5.2.10 Vibration resistance

During the vibration test, there shall be no loosening of the solenoid coil of reversing valve and the falling-off and breaking of the weld-seam. After the test, the reversing valve shall meet the requirements of 5.2.2, 5.2.4, 5.2.5, 5.2.6.1, 5.2.6.2.

5.2.11 Durability

After the durability test, the reversing valve shall meet the requirements of 5.2.2, 5.2.4, 5.2.5, 5.2.6.1, 5.2.6.2.

5.2.12 Corrosion resistance

- The accuracy of the flowrate measuring instrument shall be ±2% reading value within the entire flowrate measuring range; the division value shall not exceed 2.5 times of the specified accuracy;

- The design, manufacture, installation and use of the flowrate measuring and throttling device shall be in accordance with provisions of GB/T 2624.

--- The electrical measuring instruments shall meet the following requirements:

- Voltmeter: depends on the voltage under test. When the voltage under test is greater than 150V~300V, the accuracy tolerance shall be ±1.50V; when it is greater than 300V~750V, the accuracy tolerance shall be ±3.75V;

- Ammeter: accuracy shall be ±1% of the indicated value of the ammeter;

- Resistance meter: accuracy shall be ±1% indicated value of the bridge type resistance meter;

- The division value of the electrical measuring instrument shall not exceed 2 times of the specified accuracy.

6.2 General requirement test

6.2.1 Check the interface and appearance size of the reversing valve by the plug gauge and Vernier caliper.

6.2.2 Check the materials entering the factory according to the corresponding standards; or check the material physical and chemical property test report, certificate of conformity and other relevant information.

6.2.3 Appearance quality inspection shall be carried out by visual examination.

6.3 Performance requirement test

6.3.1 Cleanliness test

The contents of the cleanliness test are as follows:

a) Impurity content test

Before use, the glass sand crucible shall be firstly washed by hydrochloric acid, then washed by the distilled water; place in the 120°C±2°C oven to bake for 30min; cool off to the room temperature; then use the one over ten-thousand analytical balance to weigh; repeat the operation till the weight difference between two times is within 0.2mg; record the reading; set it to be G_1. Pour the R141b cleaning agent into the inner cavity (the amount of the cleaning agent is two-thirds of the volume of the inner cavity of the measured object) of the sample;

shake for 1min; pour the cleaning agent into the No.3 glass sand crucible to filter (filtering accuracy is 15μm~35μm). Repeat to wash in such a way for 3 times, then place the glass sand crucible containing impurities into 120°C±2°C oven to bake for 1h; slightly cool off; place into the dryer to cool off to the room temperature and weigh it; then dry according to the above method; and cool off to the temperature and weigh it; repeat such operation till the weight difference between the two adjacent times is no more than 0.2mg; record the reading; set it to be G_2. The difference shall be the impurity content, and the result shall meet the requirements of 5.2.1.

b) Mineral oil content test

The filtered cleaning solution shall be evaporated into the 105°C±2°C thermostat till the cleaning agent remains constant weight; use the one over ten-thousand analytical balance to weigh it; measure the mineral oil content in it; the results shall meet the requirements of 5.2.1.

c) Internal moisture content test

The used reagent shall be analytically pure methanol. If the mass fraction of water in the reagent is greater than 0.05%, add 50g of 5A molecular sieve to 500mL of methanol; plug the stopper; stand overnight; take the supernatant to use; calculate the moisture content in the above methanol according to the Karl Fischer Method specified in GB/T 6283. Then take appropriate amount of reagent into the inner cavity of the valve to be tested; use the dry rubber stopper to plug the copper pipe mouth; shake the valve to be tested for 3min above; unplug the rubber stopper; use the same method to measure the moisture content in the methanol in the valve to be tested; then the difference of water content in the methanol before and after shaking is the moisture content in the inner cavity of the valve to be tested; the result shall meet the requirements of 5.2.1.

d) Chloride ion content test

Pour the eluent into the valve; conduct the oscillating elution; then take out the eluent and use the ion chromatograph to detect the content; the result shall meet the requirements of 5.2.1.

6.3.2 Sealing test

The sealing test of the reversing valve is as follows:

a) Water test: before solenoid coil is installed, install the reversing valve on the device shown in Figure 3; block the air pipes E, C, respectively; connect the air pipes D and S to the air source, respectively; immerse the entire valve in the water tank. Then slowly input the pressure to the maximum operating pressure,

and immediately conduct the performance test, it shall meet the requirements of 5.2.7.

6.3.8 High-temperature resistance test

According to the “Test Bd: high temperature test of test-rise of heat-dissipation test sample” method specified in GB/T 2423.2, place the reversing valve into the test chamber at 120°C±2°C for 72h; then place it under the atmospheric conditions for 2h; immediately retest; it shall meet the requirements of 5.2.8.

6.3.9 Cold-thermal cycle resistance test

Under the conditions of no electricity, no load and no pressure, it shall be one cycle for maintaining for 1h at 120°C±2°C; standing for 0.5h at the room temperature; and maintaining for 1h at -30°C±2°C. Conduct 5 times cycles. After that, stand for 2h under room temperature and humidity. It shall meet the requirements of 5.2.9.

6.3.10 Vibration resistance test

Fix the reversing valve onto the vibration test bench; carry out vibration up and down, left and right for 2h under the conditions of frequency 33Hz, amplitude 2mm; after the test, it shall meet the requirements of 5.2.10.

6.3.11 Durability test

Install the reversing valve on the device shown in Figure 5. Remove the rotameter. Block the pipes E, C; connect the pipe S to the atmosphere. Connect the solenoid coil, automatic counter and timer to the power supply; input 1.5MPa high-pressure gas from pipe D; reverse the slider back and forth at 6 times/min (lubricant shall be 10cm^3/h~15cm^3/h); the method is the same as the maximum reversing pressure difference test. After the test, it shall meet the requirements of 5.2.11.

6.3.12 Corrosion resistance test

6.3.12.1 Salt spray test: under the state of no electricity, no load and no pressure, the reversing valve test shall be continued for 72h as per GB/T 2423.17; it shall meet the requirements of 5.2.12.1.

6.3.12.2 Ammonia test: test shall be carried out as per the method specified in GB/T 10567.2. After the test, it shall meet the requirements of 5.2.12.2.

6.3.13 Actually-measured capacity test

The nominal capacity test and calculation method of reversing valve shall be conducted as per the provisions of Appendix B.

6.3.14 Noise test

Place the test piece at a distance of 30cm from the pickup head of the noise meter; the test voltage is 85% rated voltage with frequency of 50Hz. The result shall meet the requirements of 5.2.14 (except for the instantaneous action sound).

6.3.15 Protection level test

The reversing valve coil test shall be carried out as per the method specified in GB 14536.1; it shall meet the requirements of 5.2.15.

6.4 Destructive strength test

Before installing the solenoid coil, install the reversing valve on the device shown in Figure 3. Block the air pipes E, C totally; then slowly input water pressure from air pipe D; record the water pressure value when the valve body is broken and leaked; it shall meet the requirements of 5.3.1.

7 Inspection Rules

7.1 General requirements

Each reversing valve shall leave the factory after being inspected qualified by the manufacturer (company) quality inspection department according to this Standard and the technical documents.

7.2 Inspection classification

The reversing valve inspection can be divided into exit-factory inspection, sampling inspection and type inspection; the inspection items shall be in accordance with the provisions of Table 9.

diameter of the main pipe.

B.2.2 Measuring position of fluid temperature

The fluid temperature measuring point shall be set on a position on the downstream side of the outlet nozzle end face that does not exceed 12 times of the inner diameter of the main pipe.

B.2.3 Size of main pipe

The size of main pipe shall be the same as the size of the inlet and outlet connection pipes of the reversing valve.

B.3 Test procedures

B.3.1 Start the test bench of refrigeration system; so that it can gradually reach the nominal condition of the valve specified in 4.3.

B.3.2 Adjust the gas parameters on the exhaust side of the refrigeration system; so that the pressure of the gas refrigerant passing through the high-pressure inlet pipe (pipe D) of the reversing valve is maintained at a saturated vapor pressure corresponding to the condensation temperature of 40°C±0.5°C.

B.3.3 Adjust the gas parameters on the suction side of the refrigeration system; so that the pressure of the gas refrigerant passing through the low-temperature suction pipe (pipe S) of the reversing valve is maintained at a saturated vapor pressure corresponding to the evaporation temperature of 5°C±0.5°C; and the overheat suction temperature is maintained at 15°C±3°C. When the gas suction temperature deviates from the above specified temperature, it is allowed to be corrected by conversion.

B.3.4 Adjust the refrigerant flowrate passing through the suction channel of the reversing valve; so that the pressure drop between the air pipes E and S is increased from 0.005MPa to 0.035Mpa; the flowrate shall be measured each time 0.005MPa is increased.

B.3.5 The above measured data shall be plotted as the suction pressure drop-flowrate performance curve; then calculate the flowrate value, m_v, at the nominal condition point with pressure drop of 0.015MPa of the suction channel of the reversing valve specified in 4.3.

B.4 Calculation of nominal capacity

The nominal capacity of reversing valve shall be calculated as per the Formula (B.1):

$$Q_{rv}=m_v\,(h_2-h_1) \qquad \text{(B.1)}$$

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