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Evaporator for automotive air conditioning

汽车空调用蒸发器

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Evaporator for automotive air conditioning

1 Scope

This document specifies the technical requirements, test methods, inspection rules as well as marking, packaging, transportation and storage of evaporator for automotive air conditioning (referred to as the evaporator).

This document is applicable to the evaporator for automotive air conditioning that uses HFC-134a and HFO-1234yf as refrigerants.

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 191, *Packaging and storage marks*

GB/T 10125, *Corrosion tests in artificial atmospheres - Salt spray tests*

GB/T 21361, *Motor vehicle air-conditioning unit*

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 21361 as well as the followings apply.

3.1 evaporator

A heat exchanger that cools the air by vaporization of the refrigerant.

3.2 stable state

During the test, the state that the fluctuation range of the relevant test parameters is less than the specified value.

3.3 refrigerating capacity

Operating under the specified test conditions, the heat in the air that is absorbed by the evaporator per unit time.

3.4 air pressure drop

Operating under the specified test conditions, the pressure difference¹ between the air inlet surface and the air outlet surface of the evaporator.

3.5 refrigerant pressure drop

Operating under the specified test conditions, the pressure difference between the refrigerant inlet and outlet in the evaporator.

4 Technical requirements

4.1 Dimensional tolerance and appearance requirements

Inspect according to 5.1. The dimensional tolerance and appearance requirements of the product shall comply with the agreement between the supplier and the purchaser.

4.2 Refrigerating capacity, air pressure drop and refrigerant pressure drop

Test according to 5.2. The refrigerating capacity of the evaporator, the air pressure drop and the refrigerant pressure drop shall meet the requirements negotiated and determined by both parties.

4.3 Airtight performance

4.3.1 Airtight performance of helium test

Carry out airtight performance test of helium test according to 5.3.1. The helium leakage rate of the product shall not be greater than 1×10^{-3} Pa·L/s (refrigerant equivalent leakage rate is 2 g/y).

4.3.2 Airtight performance of water test

Carry out airtight performance test of water test according to 5.3.2. The product shall be free of air bubbles.

4.4 Residual impurities in the inner cavity

Carry out the test according to 5.4. The mass of residual impurities in the product cavity shall not exceed 20 mg/m². The diagonal outer diameter of particles shall not be greater than 0.5mm.

4.5 Residual water amount in the inner cavity

Carry out the test according to 5.5. The residual water amount in the inner cavity of the product shall not exceed 40 mg/m².

4.6 Pressure resistance

¹ Pressures in this document are gauge pressures unless otherwise specified.

Carry out the test according to 5.6. The product shall be free from damage and abnormal deformation and meet the requirements of 4.3.2.

4.7 Burst pressure

Carry out the test according to 5.7. The product shall not break under the pressure of 2.8 MPa.

4.8 Vacuum resistance

Carry out the test according to 5.8. The product shall be free from leakage, damage and abnormal deformation. The pressure rise rate after the test shall not exceed 0.5 kPa/min.

4.9 Pressure alternating performance

Carry out the test according to 5.9. The product shall have no abnormal deformation or crack and meet the requirements of 4.3.2.

4.10 Vibration resistance

Carry out the test according to 5.10. The product shall be free from looseness, damage and leakage and meet the requirements of 4.3.2.

4.11 Corrosion resistance

Carry out the test according to 5.11. The outer surface of the product shall be free of air bubbles or peeling off and meet the requirements of 4.3.2.

4.12 High temperature storage

Carry out the test according to 5.12. The appearance of the product shall be free from abnormal deformation or damage and meet the requirements of 4.3.2.

4.13 Low temperature storage

Carry out the test according to 5.13. The appearance of the product shall be free from abnormal deformation or damage and meet the requirements of 4.3.2.

4.14 Temperature cycle

Carry out the test according to 5.14. The appearance of the product shall be free from abnormal deformation or damage and meet the requirements of 4.3.2.

5 Test methods

5.1 Dimensional tolerance and appearance

Dimensional tolerances are checked with measuring tools. The appearance is detected

5.3.1 Air tightness test of helium test

Use vacuum box type helium leak detection equipment. Fill the cavity with helium at a pressure of $0.5\text{ MPa} \pm 0.05\text{ MPa}$. The pressure holding time is 1 min.

5.3.2 Air tightness test of water test

Seal one end of the evaporator inlet and outlet pipe. The other end is fed with dry air or nitrogen. Place in water. The pressure reaches $1.5\text{ MPa} \pm 0.05\text{ MPa}$. Hold the pressure for 3 min.

5.4 Mass test of residual impurities in the inner cavity

Inject about 60% of the volume of isooctane into the inner cavity of the tested product. Shake up and down, left and right, and back and forth 4~5 times. Then recover the dissolved matter in a special container. Filter and dry with $8\mu\text{m}$ filter paper. Determine the mass of residual material. Use industrial analytical tools to measure. The measurement accuracy is $\pm 0.1\text{ mg}$. Particle size is measured microscopically.

5.5 Cavity residual water test

Connect the evaporator inlet to the nitrogen tank. The outlet is connected to the inlet of the trace moisture meter. Introduce nitrogen into the evaporator at a rate of $70\text{ mL/min} \pm 20\text{ mL/min}$. When the fluctuation of the test value does not exceed 0.1 mg and lasts for more than 3 min, read the residual water amount as the test result. The accuracy of the trace moisture meter is $\pm 0.05\text{ mg}$.

5.6 Pressure resistance test

One end of the inlet and outlet pipe of the evaporator is sealed. The other end is passed into water or hydraulic oil to pressurize. Pressurize at a rate of $1\text{ MPa/min} \pm 0.5\text{ MPa/min}$ to $2.21\text{ MPa} \pm 0.05\text{ MPa}$. Hold the pressure for 3 min.

5.7 Burst pressure test

Evacuate the evaporator first. Seal one end of the inlet and outlet pipe. The other end is introduced to water or hydraulic oil. Pressurize at a rate of $1\text{ MPa/min} \pm 0.05\text{ MPa/min}$ to $2.8\text{ MPa} \pm 0.05\text{ MPa}$. Maintain 3 min. Then boost the pressure until it explodes. Record the pressure value before the evaporator burst.

5.8 Vacuum resistance test

Seal one end of the evaporator's inlet and outlet pipe. The other end is evacuated to 2 kPa. Conduct 3 consecutive times. Maintain 5 min each time.

5.9 Pressure alternating performance test

Carry out alternating pressure test according to the requirements of Table 3. The test

Each evaporator shall be exit-factory inspected. The inspection items, technical requirements and test methods shall be carried out according to Table 5.

6.1.2 Type inspection

6.1.2.1 Type inspection conditions

Type inspection shall be carried out under the following conditions. The inspection items are carried out according to Table 5:

- a) When product development is approved;
- b) When there are major changes in the design, process, materials of the product;
- c) When the production that has been discontinued for one year is resumed;
- d) When the quality is unstable, and it is deemed necessary;
- e) When it is required by the quality supervision department;
- f) After normal mass production, when the time interval from the previous type inspection exceeds 1 year.

6.1.2.2 Type inspection method

Samples are randomly selected from the products that have passed the exit-factory inspection. The same product is allowed to participate in multiple tests that do not affect its technical requirements.

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