QC

NATIONAL AUTOMOBILE STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

ICS 43.040.60

T 26

QC/T 945-2013

Passenger vehicle air conditioning unit

乘用车空调系统

Issued on: October 17, 2013 **Implemented on: March 1, 2014**

Issued by: Ministry of Industry and Information Technology of the People's Republic of China

Passenger vehicle air conditioning unit

1 Scope

This Standard specifies the requirements, test methods, inspection rules, marking, packaging, transportation and storage requirements for passenger vehicle air conditioning units using HFC-134a as refrigerant.

This Standard applies to the production, testing and inspection of passenger vehicle air conditioning units.

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 191-2008, *Packaging and storage marks*

GB 4706.32, *Safety of household and similar electrical appliances - Part 32: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers* (IEC 60335-2-40:1995, IDT)

GB 5226.1, *Electrical safety of machinery -- Electrical equipment of machines -- Part 1: General requirements* (IEC 60204-1:2000, IDT)

GB 8410, *Flammability of automotive interior materials*

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

GB 11555, *Motor vehicles-windshield demisting and defrosting systems -- Performance requirements and test methods*

GB/T 12782-2007, *Requirement and test method of heating performance for motor vehicle*

GB/T 21361-2008, *Motor vehicle air conditioning unit*

QC/T 657, *Automotive air conditioning and refrigeration unit test method*

QC/T 658, *Air conditioning refrigeration system performances road test method for motor vehicles*

QC/T 664, *Automotive air conditioning refrigerant hose*

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 21361-2008 as well as the followings apply.

3.1 heating, ventilation and air conditioning assembly

It is composed of a blower, evaporator, heater core and air door control mechanism. It regulates the temperature of the air delivered to the vehicle and controls the air intake, air supply mode and air volume.

3.2 air enthalpy difference

A method for determining the heat exchange capacity of an air conditioning unit. By measuring the air inlet parameters, air outlet parameters and air volume of the air conditioning unit, the heat exchange capacity of the air conditioning unit is determined by multiplying the specific melting difference between the inlet and outlet air by the air volume.

4 Requirements

4.1 General requirements

4.1.1 Manufacturing

Air conditioning units shall comply with the provisions of this Standard and be manufactured according to drawings and technical documents approved through prescribed procedures.

4.1.2 Appearance and installation dimensions

The appearance of the product shall be flat and smooth without dents or scratches. The installation dimensions shall comply with the requirements of the drawings.

4.1.3 Requirements for parts, components and materials

All parts, components and materials in the air conditioning unit shall comply with the relevant standards, meet the performance requirements and ensure safety. The combustion characteristics of interior materials shall meet the requirements of GB 8410. The selection and installation of electrical components shall comply with the requirements of GB 4706.32 and GB 5226.1.

4.1.4 Refrigerant filling

Refrigerant filling shall be carried out quantitatively on the automobile factory assembly line according to the design requirements. When filling, the system must be

evacuated to an absolute pressure of less than 500 Pa. The quantitative filling device shall pass the metrological verification. The accuracy of the device shall not be less than ± 15 g.

4.2 Thermal performance

4.2.1 Refrigeration performance

The cooling capacity and air volume of the air conditioning unit shall meet the design requirements. The energy efficiency ratio shall be greater than 2.1 W/W.

4.2.2 Heating performance

The heating capacity and air volume of the air conditioning unit shall meet the design requirements.

4.3 Environment simulation test

The air conditioning unit is installed on the vehicle according to the design requirements and subjected to environment simulation tests. The test results of its temperature rise and temperature drop performance shall meet the design requirements.

4.4 Defrosting and defogging performance

The defrosting and defogging performance shall comply with the requirements of standard GB 11555.

4.5 Heating, ventilation and air conditioning assembly

4.5.1 Power-on performance

4.5.1.1 For heating, ventilation and air conditioning assembly without speed regulating devices, the minimum starting voltage of the blower assembly shall meet the design requirements. After the assembly is powered on, it shall run smoothly without scratching or abnormal noise.

4.5.1.2 For heating, ventilation and air conditioning assembly with speed control devices, the blower assembly shall have clear gears after power is turned on. Each wind speed shall run smoothly without scratching or abnormal noise.

4.5.1.3 The blower assembly shall be able to operate normally at rated voltage. The current shall meet the design requirements.

4.5.1.4 The damper drive motor assembly shall run smoothly when the terminal voltage is 70% of the rated voltage. The damper shall not shake, make scraping sounds, creaking sounds or similar sounds, and shall be able to reach the designated position smoothly. The adjustment time shall meet the design requirements.

4.5.2 Impedance of thermistor

conditioning assembly shall be able to operate normally when powered on; the damper can operate normally; the assembly has no deformation or damage and meets the requirements of 4.5.7 of this Standard.

4.5.11 Water content

The total water content in the evaporator core shall not exceed 30 mg.

4.5.12 Residual impurities content

The total weight of residual impurities in the evaporator core shall not exceed 20 mg. The maximum particle diameter shall not exceed 0.2 mm.

4.5.13 Burst pressure

The minimum hydraulic bursting pressure of the evaporator core is 2.8 MPa (gauge pressure). No permanent deformation shall occur when the pressure reaches 1.4 MPa (gauge pressure).

4.6 Condenser assembly

4.6.1 Airtight performance

The leakage of HFC-134a of the condenser core assembly at 0.7 MPa shall not exceed 2 g/a.

4.6.2 Vibration resistance

After the product has completed the vibration resistance test as required, it shall comply with the requirements of 4.6.1 of this Standard.

4.6.3 Corrosion resistance

After the assembly is subjected to a 168h neutral salt spray test in accordance with standard GB/T 10125, there shall be no bubbling, paint peeling or surface pitting on the outer surface of the metal parts. Its air tightness shall still meet the requirements of 4.6.1 of this Standard.

4.6.4 Water content

The residual water content in the condenser core cavity shall not exceed 30 mg.

4.6.5 Residual impurities content

The residual impurity content in the inner cavity of the condenser core shall not exceed 20 mg. The maximum particle diameter shall not exceed 0.2 mm.

4.6.6 Burst pressure

The minimum hydraulic bursting pressure of the condenser core shall be able to reach 9 MPa (gauge pressure).

4.7 Pipeline assembly

4.7.1 Residual impurities content

The impurity content inside the pipeline assembly shall not exceed 250 mg/m^2. The maximum particle diameter shall not exceed 0.2 mm.

4.7.2 Airtight performance

The pipeline assembly shall be able to withstand an air pressure of 3.53 MPa (gauge pressure) and remain leak-free in water for 3 min.

4.7.3 Burst pressure

The minimum burst pressure of the pipeline is 12 MPa.

4.7.4 Pulse pressure cycle resistance

The pressure applied in the pipeline is (0～3.53) MPa. After 150000 cycles of testing, the pipeline shall be able to meet the requirements of 4.7.2 of this Standard.

4.7.5 Corrosion resistance

After the corrosion resistance test is completed, the pipeline shall be able to meet the requirements of 4.7.2 of this Standard.

4.7.6 Vibration resistance

After the vibration resistance test, the pipeline shall not have any abnormal deformation or breakage and meet the requirements of 4.7.2 of this Standard.

4.7.7 Hose assembly

Other properties of the hose assembly shall comply with the requirements of QC/T 664.

5 Test methods

5.1 Appearance, installation dimensions and materials

5.1.1 Appearance and installation dimensions

The appearance shall be visually inspected. The installation dimensions shall be measured using universal measuring tools. The results shall meet the requirements of 4.1.2 of this Standard.

e) Blower terminal voltage: rated voltage of the vehicle;

f) Air door conditions of heating, ventilation and air conditioning assembly: full heating, external circulation, foot blowing.

5.2.3 Tests

The air conditioning unit is installed on the air enthalpy difference automobile air conditioning special performance test device. Adjust the test bench parameters. Perform the measurement according to the requirements of QC/T 657. The results shall meet the requirements of 4.2 of this Standard.

5.3 Environment simulation test

The heating shall be carried out in accordance with the provisions of GB/T 12782-2007. The cooling shall be carried out in accordance with the provisions of QC/T 658. The results shall meet the requirements of 4.3 of this Standard.

5.4 Defrosting and defogging performance

Carry out in accordance with the provisions of GB 11555. The test results shall meet the requirements of 4.4 of this Standard.

5.5 Heating, ventilation and air conditioning assembly

5.5.1 Power-on performance

Connect the heating, ventilation and air conditioning assembly to the test device.

After all the circuits are connected, first provide the minimum starting voltage required by the design to the pins, and then provide the rated voltage. The blower impeller shall be able to start rotating at the minimum starting voltage. The assembly shall be able to operate normally at the rated voltage. Feel whether the air volume of each gear changes significantly. Listen carefully for any abnormal sound during operation. At the same time, use a stopwatch to record the adjustment time. The test results shall meet the requirements of 4.5.1 of this Standard.

5.5.2 Impedance of thermistor

After the heating, ventilation and air conditioning assembly is assembled, when the ambient temperature $t \geq 0°C$, use a multimeter to check the impedance at the current temperature. The result shall meet the requirements of 4.5.2 of this Standard.

5.5.3 Thermal insulation performance of the shell

5.5.3.1 Test phase 1: Fix the heating, ventilation and air conditioning assembly on the air enthalpy difference test bench according to the actual vehicle installation status. Test for 1 h under the following conditions. Visually check whether there are any water

droplets on the surface of the assembly:

a) Air dry bulb temperature at the blower inlet: 27°C±1°C, wet bulb temperature: 19.5°C±0.5°C;

b) Evaporator outlet pressure: 0.179 MPa (gauge pressure) ±0.01 MPa;

c) Expansion valve inlet pressure: 1.636 MPa (gauge pressure) ±0.02 MPa;

d) Refrigerant: HFC-134a; Subcooling: 5°C;

e) Blower terminal voltage: vehicle rated voltage;

f) Air door conditions: internal circulation, full cooling, blowing on face.

5.5.3.2 Test phase 2: Continue to adjust the air volume to the minimum setting required by the design. After running for 1 h, visually inspect whether there are water drops on the surface of the assembly. The results shall meet the requirements of 4.5.3 of this Standard.

5.5.4 Shell sealing performance

Fix the heating, ventilation and air conditioning assembly on the test stand according to the in-vehicle installation method. Connect the air inlet of the blower to the test device. Air door position: internal circulation, blowing face, full cooling. Make sure all air (face, face and defrost) are sealed intact. Maintain the specified pressure in the shell and record the amount of air that leaks out of the shell as displayed by the instrument. The results shall meet the requirements of 4.5.4 of this Standard.

5.5.5 Operating torque

5.5.5.1 Fix the air conditioning unit on the test stand in the same way as in the vehicle. Keep the traction on the cable to a minimum, i.e., keep the cable short and not twisted.

5.5.5.2 Supply rated voltage to the blower motor. Adjust the resistance of the air outlet to the same value as the resistance of the actual air grille or the actual air duct and nozzle in the vehicle. Adjust the damper to change the air conditioning working condition as required.

5.5.5.3 Use a torque measuring instrument with an accuracy of ±0.01 N • cm to measure the magnitude of the operating torque when the damper rotates. Repeat the above process twice. Calculate the average value.

5.5.5.4 While measuring the operating torque, listen to see if there is any abnormal sound during the operation of the damper. The result shall meet the requirements of 4.5.5 of this Standard.

5.5.6 Noise

5.5.9 Corrosion resistance

Place the assembly in a salt spray chamber. After conducting a 144h neutral salt spray test according to GB/T 10125, take out the assembly. Wash it with clean water at about 35°C. Dry it immediately. Observe whether there are bubbles and surface pitting on the outer surface of the metal parts. The results shall meet the requirements of 4.5.9 of this Standard.

5.5.10 Vibration resistance

The assembly is fixed on the vibration table by the vibration test fixture according to the actual installation state. The vibration measurement point shall be near the junction of the tested product and the test table. The vibration test in the up and down, front and back, left and right directions is carried out according to the following test conditions:

a) Product status: 50% volume of HFC-134a or CFC-113 is injected into the evaporator cavity;

b) Air door conditions: internal circulation, full cooling, blowing on face;

c) Blower voltage: rated voltage;

d) Test acceleration: 29.4 m/s^2;

e) Test frequency: 33.3 Hz;

f) Test time: 8 h, including 4 h of up and down vibration, 2 h of front and back vibration and 2 h of left and right vibration;

g) Test temperature: room temperature.

After the test, visually inspect the product for looseness or damage and conduct performance tests. The results shall meet the requirements of 4.5.10 of this Standard.

5.5.11 Water content

Place the evaporator core in an oven. The oven temperature is 120°C ± 2°C. The core inlet and outlet are connected with a three-way connection and connected to the measurement system. The end of the system is connected to a vacuum pump. The condenser of the moisture test device is placed in alcohol and dry ice at -60°C. Before the test, the mass of the condenser is weighed as g_1. Vacuum it to below 9.81×10^{-2} Pa and continue for 2 h. Then weigh the mass of the condenser as g_2. The difference (g_2-g_1) is the water content inside the evaporator core. The result shall meet the requirements of 4.5.11 of this Standard.

5.5.12 Residual impurities content

Pour 60% of the internal volume of isooctane or CFC-113 into the evaporator core.

Then place it on an oscillating table and vibrate at a frequency of 275 times/min for 3 min. Pour out the contents and filter and dry them. The weight is the internal impurity content. The result shall meet the requirements of 4.5.12 of this Standard.

5.5.13 Burst pressure

Block one end of the evaporator inlet and outlet. Feed water pressure at the other end at a rate of 241 kPa/min until the pressure reaches 1.4 MPa (gauge pressure). Observe whether the evaporator is deformed. Continue to increase the pressure until the product is severely deformed or leaks. Record the pressure at this time, which shall meet the requirements of 4.5.13 of this Standard.

5.6 Condenser assembly

5.6.1 Airtight performance

Any of the following methods can be used to test the air tightness of the condenser.

5.6.1.1 Helium test: Use a special helium leak detector for testing. The leak detection accuracy of the helium leak detector shall be ±0.2 g/a higher than the leakage of HFC-134a at 0.7 MPa.

5.6.1.2 Water test: Block one end of the condenser inlet and outlet, and pass nitrogen into the other end. Maintain the pressure at 3.53 MPa (gauge pressure). Place the product in water and keep it for 3 min. No bubbles shall be generated.

5.6.2 Vibration resistance

The assembly is fixed on the vibration table by the vibration test fixture according to the actual installation state. The vibration measurement point shall be near the junction of the tested product and the test table. The vibration test in all directions of up and down, front and back, left and right is carried out according to the following test conditions:

a) Product status: The inner cavity is injected with 50% volume of HFC-134a or CFC-113;

b) Test acceleration: 43.1 m/s^2;

c) Test frequency: 33.3 Hz;

d) Test time: 8 h, including 4 h of up and down vibration, 2 h of front and back vibration and 2 h of left and right vibration;

e) Test temperature: room temperature.

After the vibration test, visually inspect the product for looseness or damage. Perform an airtightness test in accordance with 5.6.1 of this Standard. The result shall meet the

5.7.3 Burst pressure

After injecting water or oil into the pipeline, increase the pressure linearly at a rate of 1 MPa/min until the test product bursts or leaks. Record the pressure value at this time. The result shall meet the requirements of 4.7.3 of this Standard.

5.7.4 Resistance to pulse pressure cycles

Inject hydraulic oil into the pipeline and apply pressure of (0~3.53) MPa to the pipeline alternately at a frequency of 1/3 Hz. Perform 150000 pressure cycles. The results shall meet the requirements of 4.7.4 of this Standard.

5.7.5 Corrosion resistance

The assembly is subjected to a 168-hour neutral salt spray test in accordance with GB/T 10125. After the test, it is cleaned with clean water at about 35°C and dried immediately. Visually inspect the metal parts for bubbling, paint peeling and surface pitting. The results shall meet the requirements of 4.7.5 of this Standard.

5.7.6 Vibration resistance

Install the pipeline on the vibration table according to the actual vehicle assembly state and conduct the test under the following conditions:

a) Internal pressure of pipeline: 3.53 MPa for liquid hard pipe and exhaust hard pipe, 1.08 MPa for air intake hard pipe;

b) Vibration acceleration: 29.4 m/s^2;

c) Vibration direction: up, down;

d) Vibration frequency: 33.3 Hz;

e) Vibration time: 100 h;

f) Ambient temperature: normal temperature.

After the test is completed, repeat test 5.7.2 and observe whether the pipeline has leakage, breakage or other damage. The result shall meet the requirements of 4.7.6 of this Standard.

5.7.7 Hose assembly

The test of hose assembly shall be carried out in accordance with the provisions of standard QC/T 664. The results shall meet the requirements of 4.7.7 of this Standard.

6 Inspection categories, inspection rules and inspection items

6.1 Inspection categories

The inspections specified in this Standard are divided into:

a) exit-factory inspection;

b) type inspection.

6.1.1 Exit-factory inspection

The exit-factory inspection items are shown in Table 1. The same product is allowed to participate in multiple tests that do not affect the purpose of the assessment.

6.1.2 Type inspection

Type inspection is carried out in the following cases:

a) When there are major changes in the product design, process, materials, etc.;

b) When the product is continuously produced for one year;

c) When the product is produced again after an interval of more than half a year;

d) When the quality inspection department or customers have doubts about the product quality.

Type inspection must be carried out on products that have passed the exit-factory inspection. The items for type inspection are shown in Table 1. Among them: environment simulation test and defrosting and defogging performance test are only carried out when the product is approved during the development stage.

The sample size for type inspection is 2 units. The same product is allowed to participate in multiple tests that do not affect the purpose of the assessment.

6.2 Inspection rules

6.2.1 The sampling method, sampling quantity and qualification judgment for exit-factory inspection shall be agreed upon by the supplier and the purchaser.

6.2.2 During type inspection, if the inspection results do not meet the requirements of this Standard, double the number of products shall be sampled from the same batch and the unqualified items shall be re-inspected. If they are still unqualified, the type test shall be judged as unqualified and product production shall be suspended until the cause is found, the fault is eliminated and it is confirmed to be qualified before production can be resumed.

This is an excerpt of the PDF (Some pages are marked off intentionally)

------ The End ------