QC

AUTOMOBILE INDUSTRY STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

ICS 43.080.20

CCS T 42

QC/T 1091-2023

Replacing QC/T 1091-2017

Air cleaner for bus

客车空气净化装置

Issued on: December 20, 2023 **Implemented on: July 01, 2024**

Issued by: Ministry of Industry and Information Technology of the PRC

Table of Contents

Air cleaner for bus

1 Scope

This document specifies the general requirements, purification requirements, test methods, inspection rules and marking, packaging, transportation and storage of air cleaner for bus.

This document is applicable to air cleaners installed in categories M_2 and M_3 buses. Other vehicles can refer to it.

2 Normative references

The contents of the following documents constitute the essential terms of this document through normative references in the text. Among them, for dated references, only the version corresponding to that date is applicable to this document; for undated references, the latest version (including all amendments) is applicable to this document.

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

GB/T 13306 Plates

GB/T 13554 High efficiency particulate air filter

GB/T 14295 Air filter

GB/T 15089 Classification of power-driven vehicles and trailers

GB/T 21087-2020 Energy recovery ventilators for outdoor air handling

GB 21551.3-2010 Antibacterial and cleaning function for household and similar electrical appliances - Particular requirements of air cleaner

GB/T 30512 Requirements for prohibited substances on automobiles

GB 34660 Road vehicles - Requirements and test methods of electromagnetic compatibility

GB 38262 Flammability of interior materials for buses

HJ/T 400-2007 Determination of volatile organic compounds and carbonyl compounds in cabin vehicles

4 General requirements

4.1 Basic requirements

4.1.1 The rated voltage of the air cleaner for bus (hereinafter referred to as the "air cleaner") shall be DC 12 V or DC 24 V.

4.1.2 The air cleaner shall be safe and odor-free.

4.1.3 The air cleaner shall be cleanable; the replaceable parts shall be easy to disassemble and assemble.

4.1.4 The surface of the air cleaner shall be smooth and flat, without scratches, rust spots, indentations, damage. The spray layer shall be uniform, without flow marks, bubbles, peeling.

4.1.5 The parts shall be tight and not loose. The filter material, separator, protective net and other parts shall not be deformed; the sealing gasket shall not be loose.

4.1.6 The outer shell of the air cleaner shall be marked with electrical safety warning signs.

4.1.7 The materials used in the air cleaner shall meet the requirements for prohibited substances in GB/T 30512.

4.2 Performance requirements

4.2.1 The air filter in the air cleaner shall comply with the relevant provisions of GB/T 14295 and GB/T 13554.

4.2.2 The combustion characteristics of non-metallic materials in the air cleaner shall comply with the relevant provisions of GB 38262.

4.2.3 The basic technical requirements of air cleaners shall comply with the relevant provisions of QC/T 413.

4.2.4 The electromagnetic compatibility of air cleaners shall comply with the relevant provisions of GB 34660.

4.3 Rated power

The rated power of air cleaners shall meet the following requirements:

a) For nominal values not exceeding 30 W, the test results shall not exceed 120% of the nominal value;

b) For nominal values exceeding 30 W, the test results shall not exceed 110% of the

specify, the highest wind speed and maximum air outlet state shall prevail). After normal operation, turn off the air cleaner.

b) Arrange a sampling point. The sampling point shall avoid the air inlet and outlet, at a distance from the chamber wall of no less than 0.5 m and a distance from the laboratory floor of 1.1 m ~ 1.3 m. The sampling point is connected to the sampler outside the test chamber through a pipeline.

c) Turn on the air filter to purify the air in the test chamber; start the temperature and humidity control device at the same time, to make the temperature and relative humidity of the test chamber reach the specified state.

d) After the temperature and relative humidity in the test chamber reach the specified state, turn off the air filter and temperature and humidity control device; turn on the stirring fan and circulation fan.

e) Put the cigarette (tar content is 8 mg ~ 11 mg) into the cigarette burner; connect the burner to the low-pressure air source; connect the smoke outlet of the burner to a pipe that passes through the test chamber wall. Light the cigarette; cover the burner; after burning for a period of time, close the valve of the smoke delivery pipe; run the stirring fan for another 10 minutes, to mix the particulate pollutants evenly.

f) After the stirring fan stops rotating, record the initial concentration C_0, which shall be within the initial concentration range specified in Table 1, corresponding to t = 0 min. Turn on the air cleaner to be tested at the same time. After that, measure and record the concentration of particulate matter every 10 minutes. Measure continuously for 60 minutes.

g) Calculate the total decay constant k_e of particulate matter in accordance with the provisions of Appendix B; calculate the correlation coefficient R^2, requiring $R^2 \geq 0.98$.

6.8.4 Calculation

6.8.4.1 Calculation of clean air delivery rate

The clean air delivery rate is calculated according to formula (2):

$$Q_j = 60 \times (k_e - k_n) \times V \quad \cdots\cdots (2)$$

Where:

Q_j - Clean air delivery rate, in cubic meters per hour (m^3/h);

k_e - Total decay constant, in minus one power (min^{-1});

c) Sampling pump, calibrated with a primary flow meter to ensure that the flow deviation before and after sampling does not exceed 5%;

d) Sampling tank, which is a stainless steel tank with an inert inner wall.

6.9.3 Test steps

6.9.3.1 Test run

The test run steps of the air cleaner shall be carried out in accordance with 6.8.3.1.

6.9.3.2 Total decay test of gaseous pollutants

The total decay test of gaseous pollutants shall be carried out in accordance with the following steps:

a) The adjustment of the air cleaner, the arrangement of sampling points, the determination of record files, the setting of the cabin environment shall be carried out in accordance with a) ~ d) in 6.8.3.2.

b) Connect the gaseous pollutant generator to a pipe that passes through the test cabin wall, so that the generated gaseous pollutants enter the test chamber through the pipe. After the generated gaseous pollutants are delivered for a period of time, turn off the generator. Run the stirring fan for another 10 minutes, to mix the gaseous pollutants evenly; then turn off the stirring fan.

c) After the stirring fan stops rotating, collect the gaseous pollutants in the test chamber. The initial concentration of the gaseous pollutants is C_0, which shall be within the initial concentration range specified in Table 1.

d) The initial concentration in the test chamber is collected, corresponding to t = 0 min; the air cleaner to be tested is turned on at the same time; sampling is carried out according to the corresponding time in Table 3.

e) Gaseous pollutant collection method: Carry out sampling by sampling tank or adsorption tube (TENAX TA and DNPH).

Note 1: The sampling analysis method by sampling tank is shown in Appendix C;

Note 2: When TENAX TA is sampled and analyzed by thermal desorption gas chromatography-mass spectrometry for toluene, xylene, total volatile organic compound concentrations, the recommended sampling flow rate is 100 mL/min ~ 200 mL/min; the sampling time is 10 min; the analysis method is shown in Appendix B of HJ/T 400-2007.

Note 3: When DNPH is sampled and analyzed by liquid chromatography for formaldehyde concentration, the recommended sampling flow rate is 500 mL/min ~ 800 mL/min; the sampling time is 10 min; the analysis method is shown in Appendix C of HJ/T 400-2007.

c) Basic performance parameters (external dimensions, rated air flow, rated voltage, rated power, cleaning energy efficiency, noise, etc.);

d) Exit-factory date and exit-factory number.

8.2 Packaging

8.2.1 Air cleaners shall be packaged in accordance with the relevant provisions of GB/T 191.

8.2.2 The packaging box shall be accompanied by a product certificate and installation and use instructions.

8.2.3 The content of the product certificate shall at least include:

a) Product name and model;

b) Product exit-factory number;

c) Inspection conclusion;

d) Inspector signature or seal;

e) Inspection date.

8.2.4 The contents of the product installation and use manual shall at least include:

a) Product name and model;

b) Working principle;

c) Implementation standards

d) Main technical parameters;

e) Catalog of accessories;

f) Installation instructions and requirements

g) Instructions for use, repair and maintenance precautions.

8.3 Transportation

The air cleaner shall not be bumped, squeezed, thrown, subjected to strong vibration, rain, moisture and exposure to the sun during transportation.

8.4 Storage

The air cleaner shall be stored in a dry, ventilated warehouse without corrosive and

The test method of mixing degree shall use toluene as the tracer gas; it shall be carried out according to the following steps:

a) Arrange sampling points at 5 positions in front, back, left, right, center of the test chamber; avoid the air inlet and outlet; the distance from the wall shall be not less than 0.5 m, the height relative to the test chamber floor shall be 1.1 m ~ 1.3 m.

b) Turn on the air filter to purify the air in the test chamber, so that the background concentration of toluene of gaseous pollutants in the test chamber is ≤ 0.02 mg/m^3; start the temperature and humidity control device at the same time, to make the indoor temperature and relative humidity reach the specified state (A.3 requirements).

c) After the temperature and relative humidity in the test chamber reach the specified state, record the background concentration of gaseous pollutants; turn off the air filter and temperature and humidity control device; turn on the stirring fan and circulation fan.

d) Connect the gaseous pollutant generator to a pipe that passes through the test chamber wall. The generated pollutants can be drawn into the air vortex formed by the stirring fan. After a period of delivery, turn off the generator. The stirring fan stirs for another 10 minutes, to mix the gaseous pollutants evenly.

e) After the stirring fan stops rotating, use a sampling tank to collect the pollutant gas in the test chamber. Refer to Appendix C to analyze the gaseous pollutant concentration at 5 locations.

Note: When using thermal desorption gas chromatography-mass spectrometry to analyze toluene, the recommended sampling flow rate is 100 mL/min and the sampling time is 10 minutes. For the analysis method, refer to Appendix B in HJ/T 400-2007.

f) Calculate the relative standard deviation of the toluene concentration at 5 locations.

A.5 Schematic diagram of test chamber

Appendix C

(Normative)

Determination of volatile organic compounds - Gas chromatography mass spectrometry

C.1 Scope

This Appendix specifies the test method for determining the concentration of volatile organic compounds (toluene, xylene, total volatile organic compounds).

C.2 Principle of the method

Ambient air samples are collected using a sampling tank which has an inert inner wall. After cold trap concentration and thermal analysis, they enter the gas chromatography separation and are detected by a mass spectrometer. Qualitative analysis is performed by comparing the mass spectrum and retention time with the standard substance; quantitative analysis is performed by the external standard method.

C.3 Reagents and materials

C.3.1 Standard gas

Standard gas with a concentration of 10 nmol/mol toluene, m-xylene, p-xylene, o-xylene, n-hexane, n-hexadecane can also be configured with standard solutions to obtain standard gas of the same concentration.

C.3.2 Helium

Concentration ≥ 99.999%.

C.3.3 High-purity nitrogen

Concentration ≥ 99.999%.

C.4 Instruments and equipment

Sampling includes the following instruments and equipment:

a) Gas chromatograph-mass spectrometer;

b) Capillary column;

c) Gas cold trap concentrator;

d) Concentrator automatic sampler;

e) Tank cleaning device

f) Gas dilution device;

g) Sampling tank;

h) Flow controller;

i) Calibrated flow meter;

j) Vacuum pressure gauge;

k) Filter.

C.5 Sample

C.5.1 Preparation before sampling

Tank cleaning: Use the tank cleaning device to clean the sampling tank. The cleaning process can be operated according to the instructions of the tank cleaning device. During the cleaning process, the sampling tank can be humidified to reduce the active adsorption of the tank. If necessary, the sampling tank can be heated and cleaned at 50 °C ~ 80 °C. After cleaning, the sampling tank is vacuumed (<10 Pa), to prepare for use.

For every 20 sampling tanks cleaned, at least one tank shall be injected with high-purity nitrogen for analysis, to determine whether the cleaning process is clean. Each vacuum tank of a high-concentration sample to be tested shall be analyzed for background contamination after cleaning and before the next use.

C.5.2 Sample collection

Sample collection uses instantaneous sampling: Bring the cleaned and vacuumed sampling tank to the sampling point; connect the sampling catheter; open the sampling valve; start sampling. When the pressure in the tank is consistent with the atmospheric pressure at the sampling point, close the valve and seal it with a sealing cap. Record the sampling time, temperature, relative humidity, atmospheric pressure.

C.5.3 Sample preservation

The samples are stored at room temperature and shall be analyzed as soon as possible after sampling. The samples shall not be stored for more than 20 days.

C.5.4 Sample preparation

Before the actual sample analysis, the pressure in the tank needs to be measured using a vacuum pressure gauge. If the tank pressure is less than 83 kPa, it must be pressurized to 101 kPa with high-purity nitrogen; the dilution factor is calculated according to

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

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