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Draft for joint examination

National Standards of the People's Republic of China

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Replaces the related parts in GB 14761.3-93 and GB14763-93

Limits and Measurement Methods for Fuel Evaporative Pollutants from Heavy-duty Vehicles Equipped with P.I Engines (Trap Method)

(Draft for approval)

Issued on 200×-××-××

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Issued by State Environmental Protection Administration of China
National Quality Supervision and Inspection Quarantine Authority of the People's Republic of China

Table of Contents

Preface

The Standards is made to prevent the environment against the pollution of fuel evaporative pollutants from heavy-duty vehicles equipped with P.I engines and improve air quality following “Environmental Protection Law of the People's Republic of China” and “Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution”.

The Standards sets regulations of application for the pattern approval, test and emission limits for the pattern approval, and production conformability checking and emission limits of fuel evaporative pollutants emission from type M and N vehicles that are equipped with P.I engineers using gasoline and bi-fuel and have the weight more than 3500kg.

The Standards is amended by taking GB14761.3-93 “Emission Standards of Fuel Evaporative Pollutants from Vehicles with Petrol Engines” and GB14763-93 “Measurement of Fuel Evaporative Pollutants from Vehicles with Petrol Engines--Trap method” as the basis and taking the technical information in GB18352.2-2001 as reference.

The main differences between the Standards and GB14761.3-93 and GB14763-93 are as follows:

1. Re-define the scope of application. The emission requirements of fuel evaporative pollutants from light-duty vehicles have been written in GB18352.2-2001. Therefore, the requirements of light-duty vehicles in the original standards have been deleted.
2. Add the parts describing application for the pattern approval, expansion for the pattern approval and production conformability checking.
3. Add the requirements of aging disposal for canisters and set more strict requirements for the pre-test of canisters.
4. Control tests more strictly.
5. Cancel the measurement of running losses.

The related parts in the following standards will be abolished since the issue of the Standards.

1. GB14761.3-93 Emission Standards of Fuel Evaporative Pollutants from Vehicles with Petrol Engines
2. GB14761.3-93 Measurement of Fuel Evaporative Pollutants from Vehicles with Petrol Engines--Trap method.

The appendix A, B, C and D are standard appendixes.

The Standards was first issued in December, 1993 and this is the first revision.

The Standards is put forward by Technology Standards Office of State Environment Protection Administration of China.

The Standards is drafted by Beijing Vehicle Research Institute.

The Standards is approved by Technology Standards Office of State Environment Protection Administration of China on xx xx, 2004.

The Standards is explained by State Environment Protection Administration of China.

Limits and Measurement Methods for Fuel Evaporative Pollutants from Heavy-duty Vehicles Equipped with P.I Engines (Trap Method)

1 Scope

The Standards sets regulations of application for the pattern approval, test and emission limits for the pattern approval, expansion for the pattern approval, and production conformability checking and emission limits of fuel evaporative pollutants from heavy-duty vehicles equipped with P.I engineers.

The Standards is applicable to heavy-duty vehicles that are equipped with P.I engines and use gasoline and bi-fuel.

The Standards is not applicable to vehicles using single fuel or gas fuel.

The Standards is not applicable to the vehicles that have made the pattern approval of fuel evaporative pollutants emission by the means of sealed housing set in the GB18352.2-2001 “Limits and Measurement Methods for Pollutants from Light-duty Vehicles (II)”.

2 Normative reference

The articles in the following documents are quoted in the Standards and become a part of the Standards. For the undated reference, the latest versions of them are quoted in the Standards.

GB/T 15089 Vehicle classification

GB 17930 Vehicle unleaded gasoline

GB/T 18297 Method of testing engine performance of vehicles

3 Definition

The following terms and definitions are applicable to the Standards.

3.1 Heavy-duty vehicles

They are type M and N vehicles with more than 3500kg. Refer to GB/T 15089 for the definition of type M and N vehicles.

3.2 Complete vehicle kerb mass

It is the quality of an empty car with full fuel in the fuel tank, lubricant oil, limited cooling water, tools supplied with the car and spare tyres.

3.3 Basic quality

It is the quality of complete vehicle kerb mass plus 100kg.

3.4 Maximum total quality

It is the largest quality permitted in technology proposed by vehicle producers.

3.5 Evaporative pollutant

It is hydrocarbon lost in the evaporation from fuel (gasoline) system of vehicles. It is different from the

hydrocarbon in exhaust emission. It includes breath losses and hot soak losses of fuel tanks.

Fuel tank breath losses (air change losses in daytime): The hydrocarbon is emitted because of the temperature change of fuel in the fuel tank (in $C_1H_{2.33}$).

Hot soak losses: The hydrocarbon is emitted from the fuel system in a static vehicle after the vehicle runs for a period of time (in $C_1H_{2.20}$).

3.6 Control equipment of fuel evaporative pollutants

It is the equipment comprised by flow stopping equipment in rollover, vacuum pressure release equipment, gas-liquid separator, vapour storage equipment and desorption control valve and it is used to control or limit the emission of fuel evaporative pollutants.

3.7 Fuel system

It is the system comprised by fuel tank, fuel hose, fuel filter, fuel pump, carburettor or fuel injection component and the control equipment of fuel evaporative pollutants. It includes all the outlets to atmosphere in these two systems.

3.8 Gas fuel

It is liquefied petroleum gas (LPG) or natural gas (NG).

3.9 Vehicle using gas fuel

It is the vehicle that uses liquefied petroleum gas (LPG) or natural gas (NG).

3.10 Vehicle using bi-fuel

It is the vehicle that uses gasoline or a type of gas fuel.

3.11 Vehicle using single fuel

It is the vehicle that uses gasoline and a type of gas fuel (LPG or NG). Such vehicle uses gasoline only in emergency or starting of the engine and the volume of its fuel tank cannot be more than 15L.

4 Pattern approval

4.1 Application for the pattern approval

4.1.1 Vehicle producers must propose the application for the pattern approval of fuel evaporative pollutants emission in a kind of vehicle to the competent department of environmental protection administration under the State Council (hereinafter referred as “competent department of the pattern approval”) that is in charge of the pattern approval of vehicle emission.

4.1.2 Producers must submit technical documents related with the pattern approval according to Appendix A of the Standards, detection report of fuel evaporative pollutants emission from vehicles, indexes related with performance of main assemblies and warranty materials about production conformability of fuel evaporative pollutants emission. When taking expansion of the pattern approval, producers must provide duplicates of other related pattern approval and test data to support the expansion of the pattern approval.

4.1.3 Producers must provide a vehicle (or the related engine and accessories, fuel system and control equipment of fuel evaporative pollutants) that can stands for vehicles to be made pattern approval to the detection organization in charge of tests of the pattern approval. The vehicle will be made test according to the method set in Chapter 5 of the Standards.

4.2 Authorization of the pattern approval

If it meets all the technical requirements set in Chapter 5, the vehicle will be authorized by the competent department of the pattern approval.

5 Technical requirements and test

5.1 Producers must ensure that the design, manufacture and assembly of the components that may affect the emission performance of fuel evaporative pollutants in a vehicle must meet the requirements of the Standards in normal running.

5.2 Producers must take technical measures to ensure that fuel evaporative pollutants emission can be controlled effectively in the limits set in the Standards in normal running and lifetime of the vehicle. Producers must ensure that the manufacture of hoses, connectors and wires used in the system must meet requirements of design in reliability. If the fuel evaporative pollutants emission of a vehicle meets the requirements of Article 5.4 (emission limits) and Article 7.2 (production conformability checking), this vehicle will be regarded as meeting the requirements of this article.

5.3 Vehicles must have the measures that can prevent vehicles against evaporative pollutants emission and fuel overflow caused by the missing of fuel filler cap. The measures can be:

- using the fuel filler cap that cannot be uninstalled and can be opened and closed automatically.
- having indicators that can make warning about excessive evaporative pollutants emission in missing of the fuel filler cap.
- having equipment with the same function, such as fix the fuel filler cap with ropes or chains, a fuel filler cap shares a key with the ignition switch and the key can be pull out only when locking the fuel filler cap.

5.4 Emission limits

Make tests in the way described in Appendix B of the Standards. Evaporation emission must be less than 4.0g/measurement circle.

5.5 For vehicles using bi-fuel, only make test for gasoline.

6 Expansion of the pattern approval

6.1 If a vehicle equipped with control equipment of fuel evaporative pollutants has the authorization of the pattern approval, it can be expanded to become the vehicle that meets the following requirements.

6.1.1 The basic principle of fuel/air metrology must be the same.

6.1.2 The material of fuel tank and liquor fuel hose must be the same. In the test of the pattern approval, test the hoses that have the worst performance of evaporation emission in the cross section and length in the same series. The technical detection department in charge of the pattern approval determines whether different gas-liquid separators can be used. The volume difference of fuel tanks must be within ±10%. The setting of breath valves in fuel tanks must be the same.

6.1.3 The ways to store fuel vapour must be the same, such as the type and volume of activated carbon canister, storage media, air filter (if it is used in the control over evaporation emission) and so on.

6.1.4 The fuel volume difference of floating rooms in carburettors must be within 10mL.

6.1.5 The ways to make desorption storage of fuel vapour (such as air flow, and the desorption volume in starting or running circle) must be the same.

6.1.6 The way of seal and ventilation for fuel measurement system must be the same.

6.2 Differences are allowable in the following aspects:

6.2.1 Engine dimension

6.2.2 Engine displacement

6.2.3 Engine power

6.2.4 Automatically or manually shifted transmission, two or four wheel drive

6.2.5 Body shape

6.2.6 Wheel and tyre size

7 Production conformability

7.1 Producers must ensure that the production conformability of fuel evaporative pollutants emission complies with the regulations in warranty documents of production conformability submitted in the pattern approval. Make inspection of production conformability according to the regulations in Appendix A and B.

7.2 Competent department of the pattern approval can inspect the production conformability of fuel evaporative pollutants emission of producers anytime.

7.2.1 Take three inspection samples from one product series (including basic vehicle mode and expansion mode).

7.2.2 Test samples by following the control process set in warranty requirements about production conformability of producers and adopting the method in Chapter 5 or Article B.6.2 to B.6.4.

7.2.3 If the inspection result concluded according to Article B.6.2 to B.6.4 cannot meet the requirements, producers can ask to take the pattern approval process of Chapter 5.

7.2.3.1 Producers are not allowed to adjust or modify inspection samples unless these samples cannot meet the requirements in Chapter 5 or these jobs have been listed in the process files about vehicle assembly and inspection.

7.2.3.2 If change of evaporative pollutants emission may occur because of the operation of Article 7.2.3.1, producers can ask to make a single test to this vehicle (or engine).

7.2.3.3 If the first sample cannot meet the requirements of Article 5.4 after taking the test set in Chapter 5, inspection must be made to all the three samples and evaluation must be made based on the average of the three inspection results.

7.3 If a vehicle model cannot meet the requirements of Article 7.2, its producer must take necessary measures to re-establish production conformability; otherwise, the competent department will cancel the pattern approval of evaporative pollutants emission of this vehicle model.

8 Implementation of the Standards

Since January 1st, 2005, the vehicles set in Chapter 1 that take the pattern approval of evaporative pollutants emission must meet the requirements of the Standards. Before January 1st, 2005, the pattern approval can be made according to the related requirements of the Standards.

The production conformability inspection for vehicles that have had the authorization of the pattern approval will be made since the day of authorization.

Since January 1st, 2006, evaporative pollutants from all produced and sold vehicles set in Chapter 1 must meet the requirements of the Standards.

Appendix A

(Standard appendix)

Format for documents of application for the pattern approval

When applying for the pattern approval, producers must provide the following documents including table of contents in the electronic format.

Any diagram must describe detailed information by the appropriate proportion. The size is A4 or it can be folded into such size. If there are photos, details must be shown.

A1. Overview

A1.1. Make (product name of producers) _____

A1.2. Model and commercial description _____

A1.3. If there is a mark in the vehicle, show the way to recognize it _____

A1.3.1 Position of the mark _____

A1.4. Type of vehicle _____

A1.5. Name and address of producer _____

A2. Engine

A2.1. Producer _____

A2.1.1 Model and specifications of engine (if marked in the engine or having other recognition methods) _____

A2.1.2 Maximum net power: below _____kW_____r/min

A2.2. Fuel: unleaded gasoline, RON: _____

A2.3. Fuel supply

A2.3.1 Carburettor type: Yes/No[1)]

A2.3.1.1 Make: _____

A2.3.1.2 Model: _____

A2.3.1.3 Float level: _____

A2.3.1.4 Float volume: _____

A2.3.2 Fuel injection type: Yes/No[1)]

A2.3.2.1 Working principle: intake pipes (single point/multiple points)[1)]/direct injection/others (describe in detail)[1)]

A2.3.2.2 Make: _____

A2.3.2.3 Model: _____

A3. Control equipment of fuel evaporative pollutants

A3.1. Make: _____

A3.2. Model: _____

A3.3. Working principle of control equipment for fuel evaporative pollutants:

_____

A3.3.1.Effective volume of canister: _____

A3.3.2.Model of activated carbon: _____

A3.3.3.Quality of dry carbon in activated carbon: _____

A3.3.4.Control method of desorption valve: _____

1) Remove the inapplicable items.

A3.3.5.Working start and end point of desorption valve:

_____

A3.3.6.Desorption air flow: _____

A3.3.7.Desorption volume in running circle: _____

A3.3.8.Model/specification of vapour hose:_____

A3.3.9.Description of vapour hose:_____

A3.3.10. Other description:_____

A4. Fuel tank

A4.1. Make: _____

A4.2. Model: _____

A4.3. Material of fuel tank: _____

A4.4. Volume of fuel tank: _____

A4.5. Description of fuel tank accessories (such as pressure protection equipment, oil-gas separator and flow stopping equipment in rollover): _____

Appendix B

(Standard appendix)

Test Procedure for Fuel Evaporative Pollutants

B1. Test description

B1.1. Test of evaporative pollutants emission (see figure B1) comprises the following four parts:

a) Prepare;

b) Test breath losses (air change losses in daytime) and hot soak losses of a fuel tank;

c) Run a vehicle at the even speed 40km/h on a chassis dynamometer or simulate the running at 40km/h on an engine bench;

d) Test hot soak losses.

B1.2. Results: Emission quality of hydrocarbon got from the breath losses test adds that from the hot soak losses test and the unit is g/measurement circle.

B2. Test vehicles (or engines) and fuel

B2.1 Test vehicles (or engines)

B2.1.1 In the test of chassis dynamometer, the vehicle technology should be good and have 3000km running-in before the test. In the running-in, the control equipment of fuel evaporative pollutants installing on the vehicle must run well and the canister has no abnormal adsorption and desorption after use.

B2.1.2 In the test of engine bench, the engine technology should be good. The engine must be installed on the bench with all accessories (such as cooling fan, generator, air filter and exhaust silencer) and it must finish the running-in as required by producers. The control equipment of fuel evaporative pollutants installing on the vehicle must run well and the canister has no abnormal adsorption and desorption after use. In the test, the fuel system (fuel tank, fuel host and fuel pump), exhaust system (after-treatment system, silencer, size and length of exhaust pipes), cooling system, control equipment of evaporative pollutants of engine must be the same with those used in the vehicle and the relative position of fuel tank and engine must be the same.

B2.2 Fuel

The fuel used in the test must comply with the regulations of GB 17930.

B3. Test equipment

B3.1 Dynamometer system

B3.1.1 Engine dynamometer system

It can be all dynamometers that can measure the stable mode of engine and have the precision complying with the regulations of GB/T 18297.

B3.1.2 Chassis dynamometer

B3.1.2.1 The dynamometer must stimulate roadway load.

B3.1.2.2 The setting of dynamometer cannot be influenced by the change of time and cannot make vehicles have any vibration that may affect the normal running of them.

B3.1.2.3 The dynamometer must have the equipment that can simulate inertia and load. If it is a dual-roller dynamometer, the simulation equipment must be connected with the front roller.

B3.1.2.4 Accuracy

B3.1.2.4.1 The accuracy of measured and read indicated load must be within ±5%.

B3.1.2.4.2 The accuracy of load setting must be within ±5% in the 40km/h running of dynamometer.

B3.1.2.4.3 The speed must be measured by the speed of roller (for dual-roller dynamometer, use the front

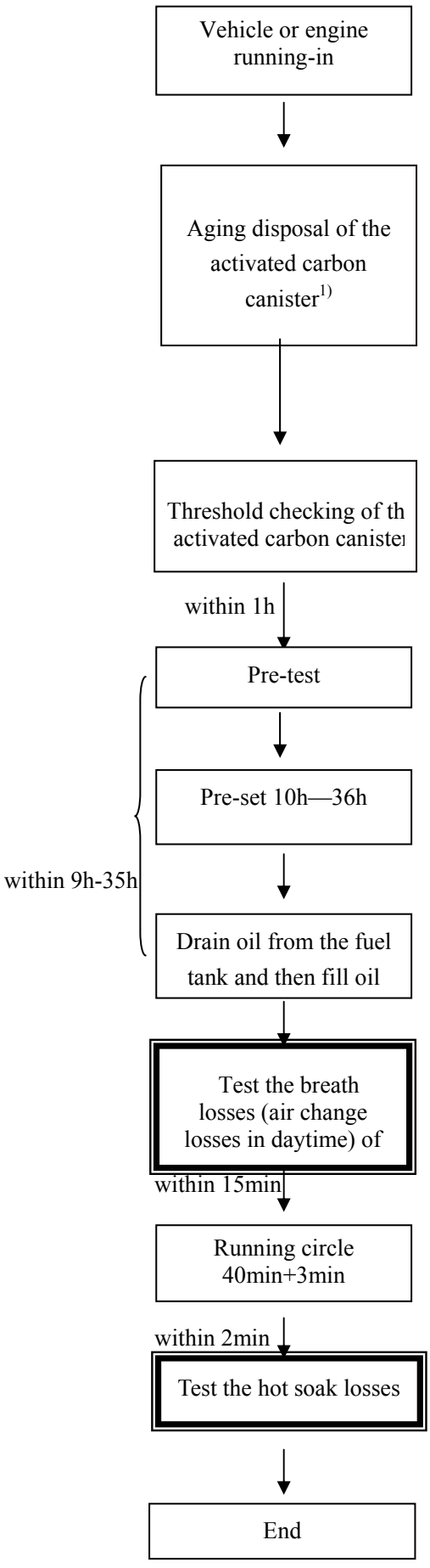
roller). When the speed is more than 10km/h, the accuracy of measurement must be within ±1km/h.

B3.1.2.4.4 The actual running distance must be measured by the speed of roller (for dual-roller dynamometer, use the front roller).

B3.1.2.5 The setting of load: Adjust the load simulator at the even speed of 40km/h to make it absorb the power on drive wheels.

B3.2 Test the cooling of vehicles/engines

When engines run on the dynamometer, use the normal bench cooling water system and fan that is consistent with the engine-cooling fan in the related test vehicle to cool the engine and make it run in the normal temperature. No other auxiliary fan should be used to cool engine.


Vehicle or engine running-in
When the vehicle runs for 3000km, its canister has no abnormal desorption/adsorption.
When the engine running-in follows the regulations of producer, its canister must have no abnormal desorption/adsorption.
Aging disposal of the activated carbon canister1)
1. When the vehicle runs for more than 3000km, its canister has no abnormal desorption/adsorption. or,
2. Use 52°C constant temperature fuel vapour to make absorption at the flow 2.4l/min. After reaching threshold, use dry air 600 times as much as the volume of canister to make desorption at the flow 25L/min for six times. or,
3. Heat the fuel tank to increase the temperature evenly from 52°C and produce fuel vapour to make absorption. After reaching threshold, use dry air 600 times as much as the volume of canister to make desorption at the flow 25L/min for nine times.
Threshold checking of th activated carbon canister
1. Heat the fuel tank to increase the temperature evenly from 52°C to 35°C and produce fuel vapour. And then use the canister to absorb it and reach the threshold. or,
2. Use the canister to absorb the gas combined by 50% butane and 50% nitrogen and then reach the threshold of absorption.
within 1h
Pre-test
Run the vehicle at the speed of 40km/h for 40min or run the engine with the related speed and load on the engine bench for 40min. Fill the fuel tank with the fuel of 40% nominal capacity. The temperature is the room temperature.
Pre-set 10h—36h
The environment temperature is 25°C ± 5°C. The connection of canister is normal and the outlet to the atmosphere is equipped with a moisture ejector. In the fuel tank, there is fuel left from the pre-test.
within 9h-35h
Drain oil from the fuel tank and then fill oil
Fill the tank with fuel of 40%±2% nominal capacity and the temperature of fuel is 283K—287K (10°C—14°C).
Test the breath losses (air change losses in daytime) of
When the temperature of fuel is 289K (16°C)±1K, the test starts and lasts for 60min ± 2min.
Temperature rise Δt = 14K±0.5K2)
within 15min
Running circle 40min+3min
Run the vehicle with direct drive at the speed of 40km/h for 40min or run the engine with the related speed and load on the engine bench for 40min and then run it at the idle speed for 3min.
within 2min
Test the hot soak losses
The time for hot soak is 60min±0.5min
The lowest temperature of environment is 296K (23°C) and the highest is 304K (31°C).2)
End
Test result (g) =
The breath losses (air change losses in daytime) (g) + hot soak losses (g).

Notes: 1) Select one of them.

2) The items with the widen box are measurement items and results of them are used to make evaluation.

Figure B1 Test procedures for fuel evaporative pollutants emission

When running vehicles on the chassis dynamometer, it is allowed to use variable-speed fan blower or fixed-speed fan blower to cool vehicles. If the fixed-speed fan blower is in use, the wind speed 300mm in front of vehicles must be 35km/h-45km/h.

B3.3 Equipment of heating and controlling fuel tank

B3.3.1 The fuel in fuel tank must be heated by controllable heat source, such as using the plate heated by electricity. The heating system must heat the wall of fuel tank below the fuel level and no overheated fuel in some parts is permitted. Heating fuel vapour above the fuel in the fuel tank is not permitted.

B3.3.2 The equipment of heating fuel tank can increase the 289K (16°C) fuel by 14k evenly. The position of temperature sensor is described in B4.1.2.2.2. The heating system can control the temperature of fuel within the required ±1.5K during the process of heating.

B3.4 Temperature measurement and record

B3.4.1 Use the instrument with accuracy within ±1.0K and resolution within 0.5K to measure and record fuel temperature in the fuel tank.

B3.4.2 Use the instrument with accuracy within ±1.0K and resolution within 1.0K to measure and record environment temperature.

B3.5 Equipment of filling and draining oil

The oil filling equipment should be a group of dual-pipeline sealed equipment (see figure B2). The speed of filling oil should ensure the oil temperature in the tank cannot be more than 287K (14°C) when the oil reaches the measurement volume of fuel tank. Drain oil by gravitation or pump and drain it thoroughly. Pipes and containers must be grounded to the fuel tank in advance in oil filling and draining to ensure security.

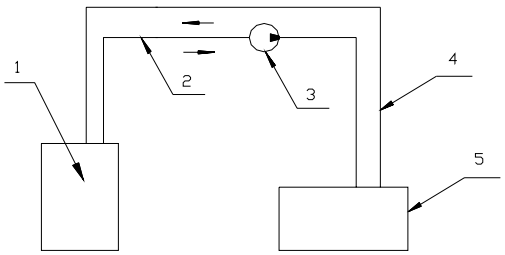


Figure B2 Pipeline of oil filling equipment

1— Oil reservoir, 2—Inlet pipeline, 3—Oil pump, 4—Gas return pipeline, 5—Fuel tank

The equipment must have enough capacity to have the fuel that can be used in measurement circle twice (one measurement circle uses 40% fuel in the rated volume of the fuel tank). The accuracy of temperature point must be set within ±0.5K.

B3.7 Trap equipment of fuel evaporative pollutants

B3.7.1 Trap equipment

B3.7.1.1 Structure of trap equipment

The structure of trap equipment is shown as figure B3.

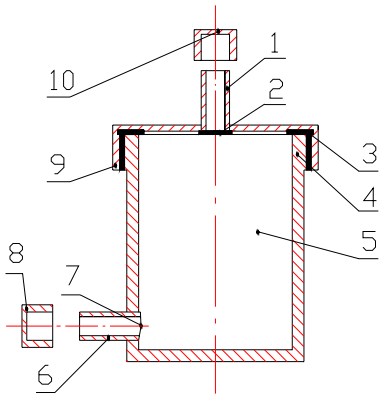


Figure B3 Trap equipment

1. Inlet hose; 2.Silk screen; 3.Gasket; 4.Tank; 5. Filled with activated carbon; 6.Outlet pipe
7. Silk screen; 8.Seal; 9.Tank cover; 10.Seal

B3.7.1.2 Factors of the trap equipment

a. The volume of tank is 300ml±25ml.

b. The effective ratio of length and diameter for the tank is 1.4±0.1.

c. The length of inlet and outlet hose is 25mm, inner diameter is φ8mm, outer diameter is φ12mm and the height from the central line of outlet hose to land is 15mm.

d. The inner end of inlet and outlet hoses is attached with 12'' or above metal silk screen to prevent the leakage of activated carbon.

e. The material of tank cover, inlet and outlet hose, tank, seal is aluminium or poly tetra fluoro ethylene. No requirements for metal silk screen.

f. Sealing: If the container is under the 14kPa air pressure and it is put into water for 30s, no leakage of air should occur.

B3.7.2 Activated carbon: The activated carbon in use must meet the following technical requirements.

B3.7.2.1 Minimum surface area: 1000m^2/g.

B3.7.2.2 Minimum absorption ability: (taking carbon tetrachloride as standard) 60% weight ratio.

B3.7.2.3 Volatile element and absorbed vapour: None.

B3.7.2.4 Analysis of dimension sifted:

1.7mm—2.4mm at least 90%

1.4mm—3.0mm 100%.

B3.7.3 Moisture ejector: Its length is 200mm±50mm, inner diameter is φ25mm—φ35mm, inner diameter of breathers in the two ends cannot be less than φ8mm. Fill the moisture ejector with drying agent and seal it with 12'' or above silk screen to prevent the leakage of drying agent.

B3.7.4 Drying agent: Discoloration silica gel. The specification of grain is φ2mm—φ5mm.

B3.7.5 Pipe and connector: The material is stainless steel, aluminium or poly tetra fluoro ethylene. Make them as short as possible. Inner diameter is φ8mm.

B3.7.6 Pressure balancing pipe: From the outlet of moisture ejector to that of gasoline vapour source.

B3.8 Weighting scale

Measure the quality of trap equipment. Accuracy is within ±10mg.

B3.9 Baking equipment for trap equipment

This equipment must be big enough to hold all trap equipment needed for a measurement circle. The baking temperature cannot be less than 423K (150°C).

B3.10 Dryer

This equipment must be big enough to hold all trap equipment and moisture ejectors needed for a measurement circle.

B3.11 Accessories

B3.11.1 Use the atmosphere manometer having the accuracy within ±0.1kPa for the pressure measurement in the test field.

B3.110.2 Use the thermometer having the accuracy within ±0.5K for the temperature measurement in the test field.

B4. Test procedures

B4.1 Measurement conditions and preparations

B4.1.1 Measurement conditions

In the measurement preparations and the measurement of fuel evaporative pollutants, the temperature of test room should be 298K±5K (25°C±5°C) and the pressure should be 97kPa±7kPa.

B4.1.2 Measurement preparations

B4.1.2.1 Fuel cooling

Before measurement, cool the fuel in the fuel cooling equipment to 283K—287K (10°C—14°C).

B4.1.2.2 Fuel system preparations

B4.1.2.2.1 Install the proper fuel system matched with the test vehicle in the bench test of engine.

B4.1.2.2.2 Install temperature sensor in the test fuel tank. The temperature sensor must be installed in a position where it can measure the temperature of geometry centre for the fuel that reaches the 40% nominal volume of the tank.

B4.1.2.2.3 Install connection equipment and accessories to drain the fuel from tank thoroughly.

B4.1.2.2.4 Pressure test of fuel system

Make the pressure test for the fuel system to check its seal. In the normal working of the fuel system (that is, the fuel tank is supplied with equipment used in common work, such as tank cover, oil level sensor, outlet pipe, vapour outlet. The fuel system is equipped with fuel pump, fuel filter, fuel hose, vapour pipeline and control equipment of fuel evaporative pollutants, etc.), input 4.0 kPa±0.1kPa compressed air to the fuel system in the way shown in figure B4 for 30min. The decrease of pressure cannot be more than 0.4kPa.

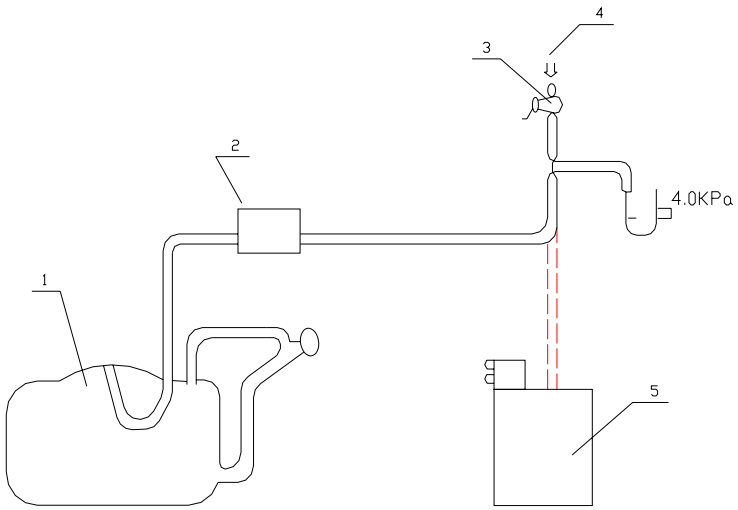


Figure B4 Pressure test of fuel system

1. Fuel tank; 2. Vacuum pressure release valve; 3. Valve; 4. Compressed air; 5. Vapour storage equipment

B4.1.2.3 Preparations and connection of trap equipment

B4.1.2.3.1 Preparations of trap equipment:

Fill trap equipment with activated carbon. And then bake it in an oven with the temperature 423K (150°C) for 3h. Seal it and then put it into a drying bottle. It is to be used after its temperature reaches the room temperature. The seals of inlet and outlet hoses for all trap equipment cannot be changed in measurement.

B4.1.2.3.2 Connection of trap equipment:

Before measurement, check the fuel system to know the position of all outlets where the fuel vapour enters the atmosphere. In measurement, connect the trap equipment to all outlets (outlet of canister, inlet of air filter) where the fuel vapour may enter the atmosphere.

The trap equipment should be installed a bit lower than vapour outlet. There is no sharp bend in the connection pipeline. The pipeline should be as short as possible.

When trapping the fuel vapour emitted from air filter, the trap connector must be at the lowest point of air filter inlet.

B4.1.2.3.3 Preparations of moisture ejector:

Fill a moist ejector with dehumidizer. And then bake it in an oven with the temperature 373K (100°C) (pay attention to the colour of dehumidizer). Seal it and then put it into a drying bottle. It is to be used after its temperature reaches the room temperature.

B4.1.2.4 Setting of dynamometer

When the test vehicle runs on the flat road according to the following conditions, test the speed and load of engine and then take the test results as the setting of dynamometer. The engine dynamometer sets speed and load according to the test vehicle and the chassis dynamometer sets load according to the test vehicle.

B4.1.2.4.1 Take the vehicle quality as the basic quality.

B4.1.2.4.2 Use direct drive.

B4.1.2.4.3 The speed is 40km/h±2km/h.

B4.1.3 Preparations of canister

B4.1.3.1 The canister used in the test must have been made aging disposal. The aging disposal can be made by installing the canister in the vehicle and then running the vehicle for 3000km. In the aging disposal of installing canisters in vehicles, the canister must be proven that it has no abnormal desorption/adsorption. Aging disposal can also be made following the way in Appendix C. When the aging disposal is made following the way in Appendix C, the aging disposal must be made to each canister separately in the system with multi-canister.

B4.1.3.2 Check the absorption threshold of test canisters that have been taken aging disposal by using the method set in B4.1.3.3 or B4.1.3.4. Within 1h after the test of checking absorption threshold, make the pre-test required by B4.1.4.

The absorption threshold is defined as the time when the total emission of hydrocarbon is 2g. The absorption threshold of test canisters can be measured by connecting trap equipment to the outlet of the test canister. The trap equipment must be made desorption using dry air. Alternatively, use trap equipment that has not been absorbed and saved in a dryer.

B4.1.3.3 Use the vapour of heated fuel to make a canister reach the threshold of absorption.

B4.1.3.3.1 The canister is connected to the fuel system according to the actual using condition. Use oil draining valve to drain oil thoroughly from the test tank. Open the cover of fuel tank when draining oil to prevent canisters against abnormal desorption or adsorption.

B4.1.3.3.2 Fill the tank with 283K—287K (10°C—14°C) test fuel and the required oil is 40%±2% of the nominal volume of tank. And then close the cover.

B4.1.3.3.3 Connect the temperature sensor of fuel tank to the temperature record system. Place the heat source

following the regulations of B3.3 in the appropriate position of tank and connect it to the temperature controller. If there are several tanks in the test vehicle, use the following one method to heat all fuel tanks and the difference in temperature for all tanks must be within ±1.5K.

B4.1.3.3.4 Fuel can be heated manually to make it reach the starting temperature of air change in daytime 289K (16°C) ± 1K.

B4.1.3.3.5 When the fuel in the tank reaches 289K (16°C), make linear heating to increase the temperature. During the heating, the temperature of fuel must comply with the following formula and the error must be within ±1.5K. Record the time of heating and the increase value of temperature.

$$T_r = T_o + 0.2333 \times t$$

Where,

T_r = Required temperature, K;

T_o = Starting temperature, K;

t = the time spent in heating the fuel tank, min.

B4.1.3.3.6 If the absorption threshold occurs or the temperature of fuel reaches 308K (35°C), turn off heat source and open the tank cover.

B4.1.3.3.7 If the temperature of fuel has reached 308K (35°C), but the absorption threshold has not occurred, remove heat source from the tank and repeat the procedures listed in B4.1.3.3.1—B4.1.3.3.6 until the occurrence of absorption threshold.

B4.1.3.4 Use butane to make a canister reach the threshold of absorption.

B4.1.3.4.1 Uninstall the canister. Do not damage the parts and fuel system.

B4.1.3.4.2 Use the gas combined by 50% butane and 50%nitrogen and the butane flow of 40g/h to make the canister absorb.

B4.1.3.4.3 If the canister reaches the threshold of absorption, turn off vapour source immediately.

B4.1.3.4.4 And then re-connect the cabinet to the engine bench or vehicle and make it recover to the status of normal running with the engine.

B4.1.4 Pre-test

According to B4.1.3.3 or B4.1.3.4, finish the absorption of canister within 1h. Run the test vehicle or engine for 40min in the mode set in B4.1.2.4. Now fill the fuel tank with the fuel of 40%±2% nominal volume. The temperature is the room temperature.

B4.1.5 After finishing the pre-test of B4.1.4, start to make the official test. Stop the test vehicle or engine for 10h to 36h. During this period, the canister must have been connected to the bench or vehicle and run normally. Equip the outlet to atmosphere with the moisture ejector. There must be fuel left from the pre-test in the tank. After the end of this period, the temperature of fuel and cooling liquid in the engine must be within ±2K of the test room temperature.

B4.2 Vapour emission test of breath losses (air change losses in daytime) in the fuel tank

B4.2.1 Within 9h to 35h after the pre-treatment running circle, perform the operation of B4.2.2.

B4.2.2 Open covers of all test tanks and drain fuel thoroughly. Fill the tank with 283K—287K (10°C—14°C) test fuel and the required oil is 40%±2% of the nominal volume of the tank. Now do not close the cover.

B4.2.3 If there are several tanks in the test vehicle, use the following one method to heat all fuel tanks. The temperature of all tanks must be consistent and the difference must be within ±1.5K.

B4.2.4 Shut off the engine and connect the temperature sensor of tank with heating equipment. Start to record the temperature of fuel immediately.

B4.2.5 Fuel can be heated manually to make it reach the starting temperature 289.0K (16°C) ± 1.0K. In addition, measure the quality of needed trap equipment.

B4.2.6 When the fuel temperature reaches 287.0K (14°C), close the cover immediately and seal the exhaust pipe of engine.

B4.2.7 When the fuel temperature reaches 289.0K (16°C) ± 1.0K,

a) Equip all the outlets to atmosphere (such as outlet to atmosphere of canister, inlet of air filter) with trap equipment whose quality has been measured and recorded.

b) Make the linear heating for 60min±2min to increase the temperature to 14.0K±0.5K. During the heating, the temperature of fuel must comply with the following formula and the error must be within ±1.5K.

$$T_r = T_o + 0.2333 \times t$$

Where,

T_r — Required temperature, K;

T_o — Starting temperature, K;

t —the time spent in heating the fuel tank, min.

B4.2.8 When the fuel temperature reaches 14.0K±0.5K after heating for 60min±2min, uninstall all the trap equipment and seal inlet and outlet pipe of them. Measure the weight of trap equipment and then put them into a dryer. Record the ending temperature T_f and time or the time spent in the test.

B4.2.9 Cut off heat source.

B4.2.10 Make preparations for the test vehicles or engines to make the next running circle test. The time for the ending of tank breath losses (air change losses in daytime) test to the starting of engine in the running circle test cannot exceed 15min.

B4.3 Running circle test

B4.3.1 Open the exhaust pipe of engine and start the engine.

B4.3.2 On the engine dynamometer or chassis dynamometer, run the engine in the mode set in B4.1.2.4 for 40min and then run it at idle speed for 3min. Turn off the engine. Make preparations for the test vehicles or engines to make the next measurement of hot soak losses.

B4.4 Measurement of hot soak losses

B4.4.1 After turning off the engine, seal the exhaust pipe of engine. Equip all the outlets to atmosphere (such as outlet to atmosphere of canister, inlet of air filter) with new trap equipment whose quality has been measured and recorded.

B4.4.2 Within 2min after shutting off the engine, start to make the hot soak for 60min±0.5min. During the 60min hot soak, the temperature in laboratory cannot be less than 296K (23°C) and cannot be more than 304K (31°C).

B4.4.3 After finishing the operation in B4.4.2, uninstall the trap equipment and seal inlet and outlet pipe of them. Measure the weight of trap equipment and then put them into a dryer. Stop measuring the temperature of fuel.

B4.5 Now the test procedures for evaporation emission have been finished.

B5. Calculation

B5.1 In all evaporation emission test described in B4, the hydrocarbon emission of vehicles is the algebraic sum of the measurement results of tank breath losses (air change losses in daytime) and that of hot soak losses.

B6. Performance checking of control equipment

B6.1 Producers can check the production conformability of the control system for evaporative pollutants in the terminal of product line by making the following checking.

B6.2 Leakage test

B6.2.1 Seal the outlet to atmosphere of the control equipment for evaporative pollutants.

B6.2.2 Force 4.0kPa±0.10kPa pressure to the fuel supply system.

B6.2.3 When the pressure of fuel supply system become stable, cut off the pressure source.

B6.2.4 After the pressure source for the fuel supply system has been cut off, the decrease of pressure cannot be more than 0.5kPa within 5min.

B6.3 Air Bleeding test

B6.3.1 Seal the outlet to atmosphere of the control equipment for evaporative pollutants.

B6.3.2 Force 4.0kPa±0.10kPa pressure to the fuel supply system.

B6.3.3 When the pressure of fuel supply system become stable, cut off the pressure source.

B6.3.4 Recover the products from the control equipment of evaporative pollutants to the outlet to atmosphere into the original status.

B6.3.5 Now the pressure of the fuel supply system must be reduced to be below 1.0kPa within 0.5min—2min.

B6.3.6 Equivalent substitute methods can be used to prove the capability of air bleeding as required by producers. In the period of the pattern approval, producers must prove the specified test procedures to the detection organization.

B6.4 Desorption test

B6.4.1 Install equipment that can measure 1.0L/min air flow in the desorption port. The capacity of equipment must be large enough. In the desorption port, fix a pressure container that has no bad influence on the system of desorption by a switch valve or use substitute methods.

B6.4.2 After the approval of competent departments, producers can select their own flow meters.

B6.4.3 Run vehicles, check all the design features that may limit desorption of the system and record the related information.

B6.4.4 When the engine runs in the mode described in B6.4.3, use one of the following methods to measure air flow.

B6.4.4.1 Turn on the measurement equipment in B6.4.1 and observe the pressure drop in pressure level of the atmosphere at the time when 1.0L air has flowed into the control equipment of evaporative pollutants within 1min.

B6.4.4.2 If using equipment that replace flow measurement equipment, you must get the flow value that is not less than 1.0L/min.

B6.4.4.3 During the period of pattern approval, producers submit a test procedure that replaces the desorption test to the detection organization. If the procedure is approved, the organization can use it as required by producers.

Appendix C
(Standard appendix)
Test Procedures for the Aging Test of Activated Carbon Canister

C1 Preface This appendix describes two test procedures for the activated carbon canister. Select one of them to make the aging disposal of canisters.

C2 Use gasoline vapour with constant temperature to make aging disposal

C2.1 Uninstall the canister. Do not damage the parts and fuel system.

C2.2 Measure the weight of the activated carbon canister.

C2.3 As shown in figure C1, connect the activated carbon canister to a gasoline vapour generator. Fill the activated carbon canister with 52°C±2°C gasoline vapour at the filling speed of 2.4L/min until the weight of trap equipment increases 2g.

C2.4 Measure the weight of the activated carbon canister.

C2.5 Use dry air with temperature 24°C±3°C to make desorption to the activated carbon canister. The desorption flow is 25L/min±2L/min and the desorption air is 600 times as much as the volume of the activated carbon.

C2.6 Measure the weight of the activated carbon canister.

C2.7 Repeat the procedures from C2.2 to C2.6 for six times.

C2.8 Compare the quality of activated carbon canister obtained from C2.6 in each circle. When the value is within a certain range, such as ±2g, reduce the times of circle, but the time cannot be less than three.

C2.9. Re-connect the activated carbon canister to the engine bench or vehicle and make it recover to the status of normal running with the engine.

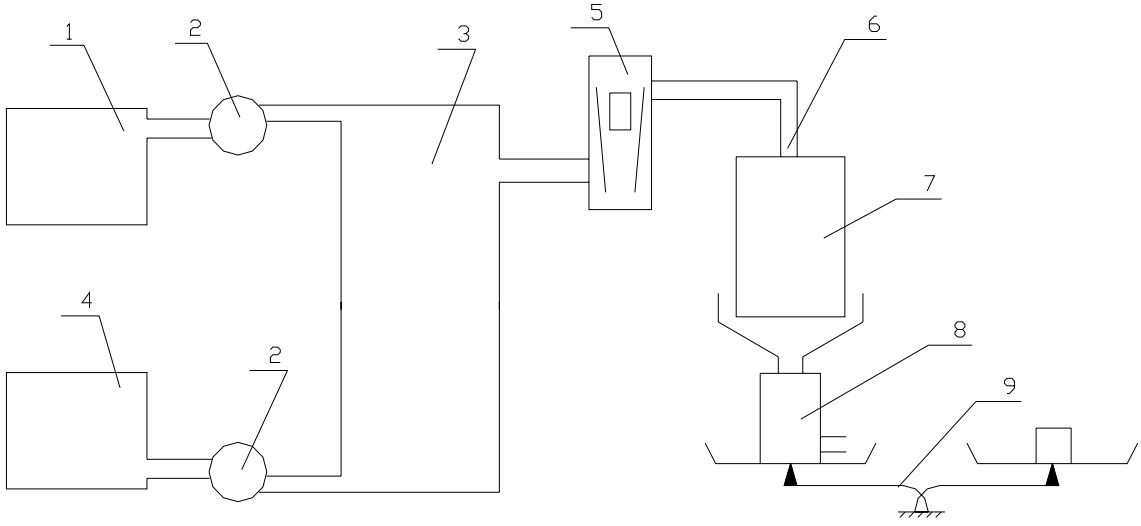


Figure C1 Aging disposal equipment of activated carbon canister

1— Fresh fuel container, 2—Pump, 3— Evaporator, 4— Fuel container after use, 5— Flow meter
6— Connector to fuel tank, 7— Activated carbon canister, 8— Trap equipment, 9— Scale

C3 Use vapour produced by heating the tank to make aging disposal

C3.1 Uninstall the activated carbon canister. Do not damage the parts and fuel system.

C3.2 Measure the weight of the activated carbon canister.

C3.3 Connect the activated carbon canister to the fuel tank that is consistent with the one used in the test vehicle.

C3.4 Fill the tank with 283K—287K (10°C—14°C) fuel and the required oil is 40% of the nominal volume of the tank..

C3.5 Heat the fuel tank to increase temperature from 288K (15°C) to 318K (45°C) (increasing 1°C per nine minutes).

C3.6 If the canister reaches the threshold of absorption before the temperature reaches 318K (45°C), turn off heat source immediately. And then measure the weight of the canister. If the temperature of fuel has reached 318K (45°C), but the absorption threshold has not occurred, repeat the procedures in C3.3—C3.6 until the occurrence of absorption threshold. And then measure the weight of the canister.

C3.7 Use dry air with the room temperature to make desorption to the activated carbon canister at the flow 25±5L/min. The air is 600 times as much as the volume of the activated carbon.

C3.8 Measure the weight of the activated carbon canister.

C3.9 Repeat the procedures from C3.4 to C3.8 for nine times. When the weight of the activated carbon canister is within a certain range after desorption, such as ±2g, the aging test can be ended in advance. But the time cannot be less than three.

C3.10 Re-connect the activated carbon canister to the engine bench or vehicle and make it recover to the status of normal running with the engine.

Appendix D

(Standard appendix)

Record Table for Test Data of Fuel Evaporative Pollutants Emission

Test No._____ Laboratory name: _____ Date: _____

Atmosphere temperature in laboratory: _____ Atmosphere pressure in laboratory: _____

Producer: _____ Model: _____ Date of manufacture: _____

Maximum total quality: _____ Mileage: _____ Fuel make : _____

Producer of engine: _____ Pattern: _____ Engine No.: _____

Number of cylinders: _____ Displacement: _____ Date of manufacture: _____

Producer of carburettor or gasoline injection system: _____ Model: _____ Number of barrels: ____

Producer of air filter: _____ Pattern: _____ Intake method: _____

Position and pattern of fuel tank: _____ Volume of fuel tank: _____ Ventilation system of fuel tank: _____

Ventilation system of carburettor: _____Pattern of gasoline pump: _____ Pattern of gasoline filter: _____

Trap method (such as position of trap): _____

Temperature of fuel in the tank		Air change losses in daytime			Hot soak losses		
	Date						
		Time	Environment	Fuel tank	Time	Environment	Fuel tank
	Start						
	End						
Quality of trap equipment		Canister	Air filter	Others	Canister	Air filter	Others
	Trap equipment No.						
	Net quality						
	Quality in ending						
	Evaporation capacity						
Total evaporation emission capacity:							

Tested by: Recorded by: