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**PROFESSIONAL STANDARD OF
THE PEOPLE'S REPUBLIC OF CHINA**

中华人民共和国环境保护行业标准

P

HJ/T 390-2007

Replace HBC 32-2004

**Technical Requirement for Environmental
Protection Product - Control System of Fuel
Evaporative Pollutants from Vehicle WITH
Petrol Engine**

环境保护产品技术要求 汽油车燃油蒸发
污染物控制系统（装置）

Issued on December 3, 2007

Implemented on March 1, 2008

Issued by the State Environmental Protection Administration

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Foreword

This standard is formulated in order to follow out "Environmental Protection Law of the People's Republic of China", reduce the effects of light car use on environment and human health, and improve environment quality.

This standard is prepared on the base of the current industrial technology and equipment level, and it specifies the properties of control system (device) for fuel evaporative pollutants from vehicle with petrol engine.

The standard "Technical requirement for environmental protection product -- Control system of fuel evaporative pollutants from vehicle with petrol engine" HBC 32-2004 shall be abolished from the implementation date of this standard.

This standard applies as guidance document.

Compared with HBC 32-2004, this standard has the following differences:

——add the limits and measurement methods for emissions from light-duty vehicles (Chinese Phase III and IV) in the property requirements after assembling;

——add the limits and measurement methods for fuel evaporative pollutants from heavy-duty vehicles equipped with P.I engines (trap method) in the property requirements of assembling.

This standard is proposed by the technical standard center under the State Environmental Protection Administration.

Drafting organizations: China Association of Environmental Protection Industry (technical commission of automobile Pollution prevention and control), China Automotive Technology and Research Center, Beijing Automobile Research Institute, Nanjing Hongguang Airborne Equipment Factory, Hua'an Motor Vehicle Equipment Co., Ltd., Highway Research Institute under the Ministry of Communications

This standard is approved by the State Environmental Protection Administration on December 3, 2007.

This standard is implemented on March 1, 2008.

The State Environmental Protection Administration is in charge of the explanation of this standard.

Control System of Fuel Evaporative Pollutants from Vehicle with Petrol Engine

1 Application Scope

This standard specifies definition, technical requirements, test methods, test rules, marking, packaging, transportation and storage of control system (device) for fuel evaporative pollutants from vehicle with petrol engine.

This standard is applicable to control system for fuel evaporative pollutants from vehicle with petrol engine (hereinafter referred to as control system).

2 Normative References

This standard quotes the provisions of the following documents. For undated references, the effective edition of the normative documents is applicable to this standard.

GB/T 191	Packaging - Pictorial marking for handling of goods
GB 2828.1	Sampling procedures for inspection by attributes - Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
GB/T 6388	Transport package shipping mark
GB 14763-2005	Limits and measurement methods for fuel evaporative Pollutants from heavy-duty vehicles equipped with P.I engines (Trap method)
GB 17930	Unleaded petrol (gasoline) for motor vehicles
GB 18352.3-2005	Limits and measurement methods for emissions from light-duty vehicles

3 Terms and Definition

For the purposes of this standard, the following terms and definitions apply.

3.1 Control System

The system partially or all consisted of the devices of tumbler flow-stop, liquid-gas separation, vapor storage, carburetor vapor control and desorption control, used for controlling fuel evaporative pollutants from vehicle with petrol engine, for which activated charcoal is used as sorbent

3.2 Tumbler flow-stop device

Device to avoid oil fuel flowing out from the fuel tank in case of vehicle or fuel tank inversion

3.3 Liquid-gas separation device

Device to separate oil fuel liquid and oil fuel vapor

3.4 Vapor storage device

Device to store oil fuel vapor

3.5 Carburetor vapor control device

Device to control the fuel vapor from the carburetor enter into the vapor storage device

3.6 Desorption control device

Device to control the desorption process of the fuel vapor in the vapor storage device

3.7 Active volume of vapor storage device

Volume of activated charcoal contained in the vapor storage device, expressed in mL

3.8 Activated charcoal mass of vapor storage device

Filling mass of activated charcoal stored in the vapor storage device, expressed in g

3.9 Effective adsorption amount

Difference from the gross mass of the vapor storage device after vapor adsorption to the one after desorption, expressed in g

3.10 Initial working capability of vapor storage device

It comes with gasoline working capacity GWC and butane working capacity BWC
Effective adsorption amount per active volume of vapor storage device after 6 cycles of test, expressed in g/100mL

3.11 End working capacity of vapor storage device

It comes with gasoline working capacity GWC and butane working capacity BWC

Effective adsorption amount per active volume of vapor storage device after 150 cycles of test, expressed in g/100mL

3.12 Aeration resistance of control system

The pressure differential between the adsorption inlet and atmosphere inlet when the air from the adsorption inlet of the vapor storage device flows out through atmosphere inlet, blocked on the desorption port, and reaches the steady flow of 10L/min

3.13 Critical point

The moment the vapor storage device reaches the saturated adsorption and gets out 2g hydrocarbon from the atmosphere inlet

4 Fuel and Gas

4.1 Gasoline

The gasoline used herein shall meet the requirements of GB17930 "Unleaded petrol (gasoline) for motor vehicles".

4.2 Gas

Butane (C₄H₁₀): quality of 98% in minimum;

Nitrogen (N₂): quality of 98% in minimum.

5 Technical Requirements

5.1 Basic requirements

5.1.1 The property and quality of the control system and its components shall meet the requirements of this technical requirement, and manufactured according to the drawing and technical documentation approved through the specified procedure

5.1.2 The manufacturer shall accurately provide the active volume of the product vapor storage device, as well as model and manufacturer of the activated charcoal adopted

5.1.3 All components (including bought-in components and associated components) shall meet the requirements of the relevant standard and drawing; the appearance hereof shall be even, bright and clean, and it must be free of obvious defects like pit, crack, burr, scratch or

bump. They shall be checked off by the inspection department of the manufactory and marked with acceptance marks.

5.2 Property requirements of control system

5.2.1 Aeration resistance property of control system

The test is conducted as stated in Article 6.2.1, and the tested pressure differential shall be less than or equal 0.98kPa.

5.2.2 Sealing property of control system

The test is conducted as stated in Article 6.2.2, and the joints must be free of leak.

5.2.3 Property of tumbler flow-stop device

The test is conducted as stated in Article 6.2.3: where the device is under normal position and the pressure of 20.0 kPa, the stable gas flow shall be larger than 7.0 L/min; where the device is under the 180° overturn position and the pressure of 5.0 kPa, the stable gas flow shall be less than 0.05 L/min.

5.2.4 Property of carburetor vapor control device

The test is conducted as stated in Article 6.2.4, the carburetor vapor channel shall close when the engine starts; open when the engine closes.

5.2.5 Property of desorption control device

The test is conducted as stated in Article 6.2.5, the desorption control device shall meet the requirements of the enterprise standard.

5.2.6 Initial working capability of vapor storage device

The test is conducted as stated in Article 6.2.6, the initial working capability of vapor storage device: GWC shall be greater than or equal to 6.5 g/100mL; BWC shall be greater than or equal to 7.0 g/100mL.

5.2.7 End working capacity of vapor storage device

The test is conducted as stated in Article 6.2.6, the vapor storage device end working capacity: GWC shall be greater than or equal to 5.2 g/100mL; or BWC shall be greater than or equal to 5.6 g/100mL.

5.2.8 Vibration resistance property

The test is conducted as stated in Article 6.2.7, all components shall be free of obvious defects like deformation, installation / joint looseness, chip or abrasion; the amount of the activated charcoal powder falling out from the inlets and outlets of the vapor storage device shall not exceed 1g and meet the requirements of Articles 5.2.1 and 5.2.2.

5.2.9 Weathering resistance property

The test is conducted as stated in Article 6.2.8, all components shall be free of dimension change affecting the serviceability, or obvious defects like deformation, crimp, installation/joint looseness, chip, abrasion, drop-off, swelling, release and blushing; they shall meet the requirements of Article 5.2.2.

5.3 Property requirements after assembling

5.3.1 Sealing property

The test is conducted as stated in Article 6.3.1, and the pressure drop shall be less than or equal to 0.49 kPa.

5.3.2 Aeration property

The test is conducted as stated in Article 6.3.2, and the pressure shall drop down to under 0.98 kPa.

5.3.3 Oil fuel evaporation/emission property

The test is conducted as stated in Article 6.3.3, and the evaporation/emission shall meet the requirements of GB 18352.3-2005 and GB 14763-2005.

6 Test method

6.1 Laboratory environment temperature

The laboratory environment temperature is $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

6.2 Test methods for property of control system and its components

6.2.1 Aeration resistance property of control system

Test the pressure differential between the adsorption inlet and atmosphere inlet when the air from the adsorption inlet of the vapor storage device flows out through atmosphere inlet, blocked on the desorption port, and reaches the steady flow of 10L/min.

6.2.2 Sealing property of control system

Place the control system in water deep less than 100mm; inlet the 14.0 kPa compressed air and keep 30s; check whether the joint has air bubble. Air bubble means leak.

6.2.3 Property of tumbler flow-stop device

Connect the flow gauge and the tumbler flow-stop device in series and place them vertically. Place the device on normal position; inlet the 20.0 kPa compressed air from above to below and measure the stable gas flow rate; place the device on the 180° overturn position, inlet the 5.0 kPa compressed air from above to below and measure the stable gas flow rate.

6.2.4 Property of desorption control device

Connected the desorption control device to the vehicle and connected a flow gauge between the desorption control device and the engine. Measure the stable gas flow under the condition specified in the enterprise standard.

6.2.5 Working capacity of vapor storage device

The working capacity test of the vapor storage device is detailed as Figure 1. In the test, gasoline or butane/ nitrogen combination gas is used.

6.2.5.1 gasoline is used in the test

- A) Weigh the vapor storage device;
- B) Fill enough gasoline in the vapor generation (see Figure 2), and heat it;
- C) Fill fuel vapor at $(52 \pm 2)^{\circ}\text{C}$ into the vapor storage device at the air fill velocity of 2.4L/min, till the critical point;
- D) Weigh the vapor storage device;

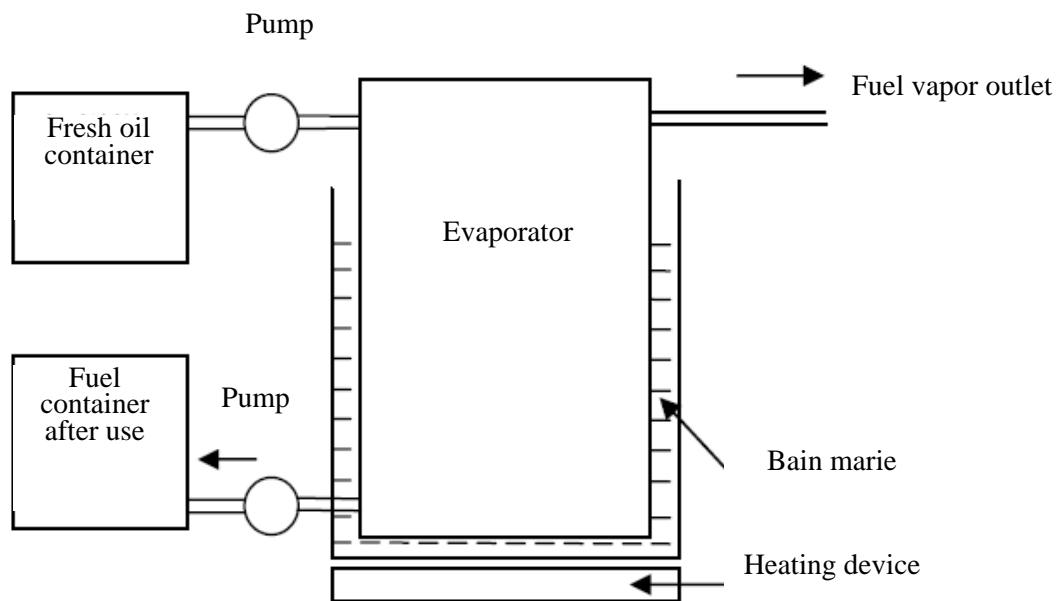
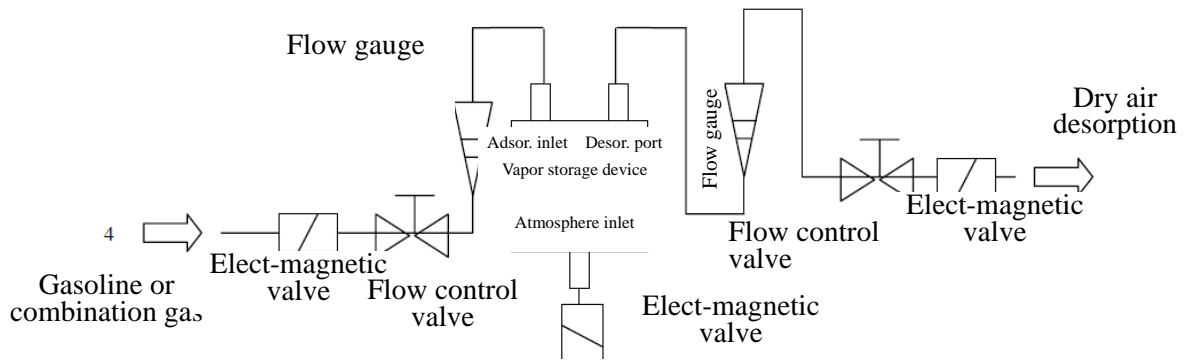


Figure 2 Vapor Generation Device

E) Conduct the desorption for the vapor storage device with dry air at 25 ± 5 °C; the desorption flowrate is (25 ± 1) L/min, and the desorption gas amount is 600 times of the vapor storage device active volume (if the maximum desorption flowrate of the vapor storage device is lower than (25 ± 1) L/min, the maximum desorption flowrate is adopted);

F) Weigh the vapor storage device;

G) Discharge the gasoline completely in the vapor generation device (in Figure 2);

H) Repeat procedures b) ~ g) for 150 cycles, and omit procedures d) and f) in the 7th~148th cycles;

I) Work out the mass deference of the vapor storage device in the procedure d) and the procedure f) among the 5th and 6th cycles;

J) The ratio of the mean gotten in procedure i) to the vapor storage device active volume is adopted as the initial working capability;

K) Work out the mass deference of the vapor storage device in the procedure d) and the procedure f) among the 149th and 150th cycles;

L) The ratio of the mean gotten in procedure k) to the vapor storage device active volume

is adopted as the end working capacity.

6.2.5.2 Butane is used in the test

- A) Weigh the vapor storage device;
- B) Prepare the combination gas of butane and nitrogen (1:1 in bulk volume); fill gas at the velocity of 2.5 g/min (butane); conduct the adsorption of the vapor storage device on the condition of $(25 \pm 5) ^\circ\text{C}$, till reaching the critical point;
- C) Weigh the vapor storage device;
- D) Conduct the desorption for the vapor storage device with dry air at $(25 \pm 5)^\circ\text{C}$; the desorption flowrate is (25 ± 1) L/min, and the desorption gas amount is 600 times of the vapor storage device active volume (if the maximum desorption flowrate of the vapor storage device is lower than (25 ± 1) L/min, the maximum desorption flowrate is adopted);
- E) Weigh the vapor storage device;
- F) Repeat procedures b) ~ e) for 150 cycles, and omit (maybe) procedures c) and e) in the 7th~148th cycles;
- G) Work out the mass difference of the vapor storage device in the procedure c) and the procedure e) among the 5th and 6th cycles;
- H) The ratio of the mean gotten in procedure g) to the vapor storage device active volume is adopted as the initial working capability;
- I) Work out the mass difference of the vapor storage device in the procedure c) and the procedure e) among the 149th and 150th cycles;
- J) The ratio of the mean gotten in procedure i) to the vapor storage device active volume is adopted as the end working capacity.

6.2.6 Vibration resistance property

- A) Conduct the test according to Table 1 and Table 2 on the vibration test bench;
- B) Appearance inspection;
- C) Conduct the test according to article 6.2.1;
- D) Conduct the test according to article 6.2.2.

Table 1: Conditions of fixed-frequency libration test

Vibration frequency Hz	Libration acceleration M/s ²	Duration time, h		
		Up-and-down	Back-and-forth	Right-and-left
33	32	8	4	4

Table 2: Conditions of sweep-frequency libration test

Sweep frequency scope, Hz	Displacement amplitude value / acceleration	Circle, min	Sweep frequency
8~200	0.4mm or 30m/s ²	20	32

6.2.7 Weathering resistance property

- A) Place the control system into the environment at the temperature of $(-40 \pm 2) ^\circ\text{C}$, and keep for 8 hours;
- B) Within 5min after completing procedure a), place the control system into the laboratory environment temperature, and keep for 1 hour;

C) Within 5min after completing procedure b), place the control system into the environment with the temperature of $(40 \pm 2) ^\circ\text{C}$ and the relative humidity of 90%~ 95%, and keep for 96 hours;

D) Within 5min after completing procedure c), place the control system into the laboratory environment temperature, and keep for 1 hour;

E) Within 5min after completing procedure d), place the control system into the environment with the temperature of $(100 \pm 2) ^\circ\text{C}$, and keep for 8 hours;

F) Appearance inspection;

G) Conduct the test according to article 6.2.2.

6.3 Method of property test after control system assembling

6.3.1 Sealing property test of fuel system (Figure 3)

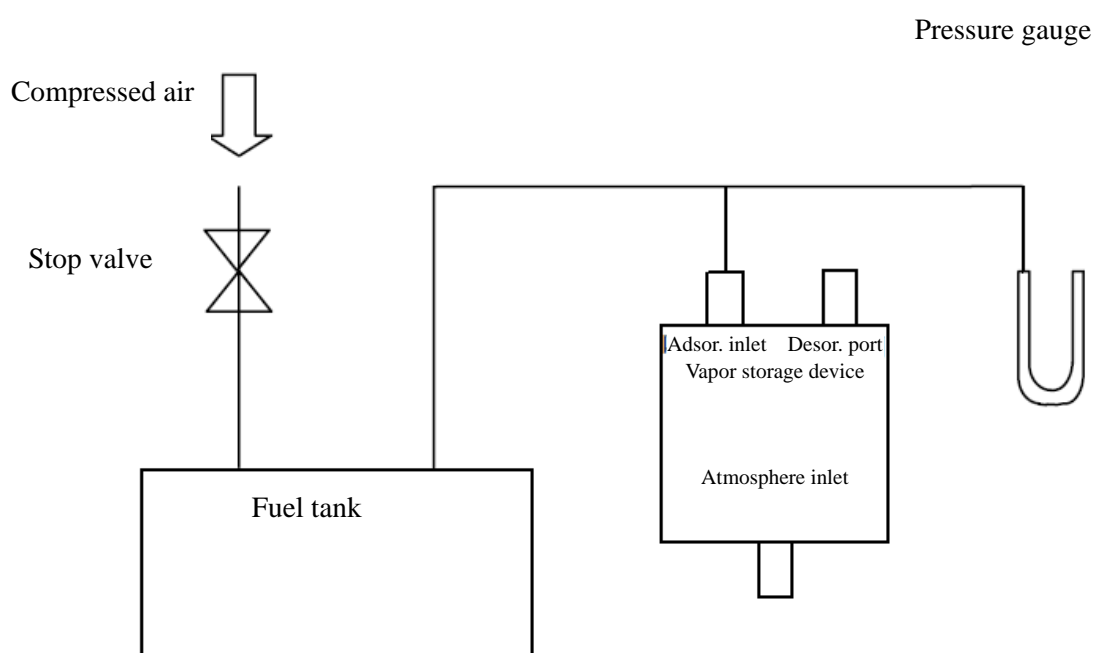


Figure 3: Sealing property and aeration property tests of fuel system

Install the control system onto the fuel system, and block off the atmosphere inlet of the control system. Connect the pressure gauge between the fuel tank and the control system. Inlet the compressed air (3.63 ± 0.10) kPa into the fuel tank. Shut down the pressure source after the pressure is stable, and observe the pressure drop within 5 min.

6.3.2 Aeration property test of fuel system (Figure 3)

Install the control system onto the fuel system, and block off the atmosphere inlet; connect the pressure gauge between the fuel tank and the control system. Inlet the compressed air (3.63 ± 0.10) kPa into the fuel tank. Shut down the pressure source after the pressure is stable; restore the atmosphere inlet of the control system to the product original state; observe the pressure within 0.5~ 2min.

6.3.3 Evaporation emission test

The evaporative emissions measurement shall comply with the requirements of GB 18352.3-2005 and GB 14763-2005.

7 Test Rules

7.1 Method of Sampling

Randomly sample the control system (device) and its components in accordance with the requirements of GB 2828.1; and the random sampling quantity is 4 sets at least.

7.2 Inspection classification

The inspection for the control system (device) comes with delivery inspection and type inspection.

7.2.1 Delivery inspection

The inspection items covers all items, expect item 5.2.7, specified in Article 5.1.3 and section 5.2.

7.2.2 Type inspection

7.2.2.1 The type inspection shall be conducted under one of the following conditions:

- A) New type approval;
- B) There are significant changes in product design, process and material;
- C) Change of activated charcoal model;
- D) Once every three years in normal production;
- E) The national quality supervision and inspection authority proposes the type inspection request.

7.2.2.2 Inspection item

- A) Conformity certificate issued in the delivery inspection;
- B) All items specified in 5.1~5.2.

7.3 Judgment rules

7.3.1 The inspection results shall meet the corresponding requirements of 5.1~5.2.

7.3.2 In case any item is disqualified, doubled quantity of samples shall be sampled and tested; if one item is always disqualnified, the product is judge disqualnified.

8 Marking, Packaging, Transportation and Storage

The marking, packaging, transportation and storage of the device shall meet the corresponding requirements of GB/T 6388 and GB/T 191.