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GB XXXX

**Limits and measurement methods for evaporative pollutants from motorcycles
and mopeds**

(Draft for approval)

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Preface

This standard is drawn up to implement the “Environmental Protection Law of the People’s Republic of China” and the “Law of the People’s Republic of China on the Prevention and Control of Atmospheric Pollution”, to control environmental pollution from fuel evaporative pollutants from motorcycles and mopeds, to protect the environment and to save energy.

This standard defines the limits and measurement methods of evaporative pollutant emissions from motorcycles and mopeds.

The standard defines the type approval of evaporative pollutant emissions from motorcycles and mopeds, the production conformity inspection requirements and the examination method.

This standard is drawn up according to the domestic pollution protection and control requirements and the industrial development situation. The technical requirements in this standard are referenced to the national pollutant emission standard of “Limits and measurement methods for evaporative pollutants from light motor vehicles”(II) (GB18352.2-2001), the “Standard for fuel evaporative pollutant emissions from motor vehicles (TIS2130-2545-2002)” of Thailand and the “Test method and procedure for evaporative pollutants from motorcycles” of the Taiwan emission standard.

The main differences between the above standards and this standard are as follows:

- The airtight chamber method is used for the fuel evaporative pollutant emission test;
- The pre-treatment is carried out on the chassis function test equipment;
- The technical requirements for the reference fuel have changed;
- The production conformity inspection and examination have been added;
- The relevant management articles have been added.

All appendices to this standard are specification appendices.

According to the relevant laws this standard is compulsory.

This standard was proposed by the Science and Technology Standard Bureau of the State Environmental Protection Administration of China.

Drafting organisation of this standard: National Quality Supervision and Test Centre of Motorcycles

The organisations involved in drafting this standard include the National Quality Supervision and Test Centre of Motorcycles (Shanghai), National Quality Supervision and Test Centre of Motorcycles (Tianjin), China Jialing Industrial Co. Ltd (Group), Chongqin Loncin Industrial Co. Ltd, Luoyang Ek Chor Motorcycle Co. Ltd, Five Rams-Honda Motorcycle (Guangzhou) Co. Ltd.

This standard was approved by the State Environmental Protection Administration of China on (date).

This standard shall be implemented from 1 July 2007.

The State Environmental Protection Administration of China shall be responsible for the interpretation of this standard.

This is the first version of this standard.

Limits and measurement methods for evaporative pollutants from motorcycles and mopeds

1 Scope

This standard sets the limits and measurement methods for evaporative pollutant emissions from motorcycles and mopeds

This standard sets the type approval requirements for evaporative pollutant emissions from motorcycles and mopeds, the production conformity inspection and examination methods.

This standard is applicable to motorcycles and mopeds (hereinafter both referred to as 'motorcycles') that use petrol as fuel.

2 Normative References

The provisions of the following documents become provisions of this standard after being referenced. For dated reference documents, all later amendments (excluding corrigenda) and versions do not apply to this standard; however, the parties to the agreement are encouraged to study whether the latest versions of these documents are applicable. For undated reference documents, the latest versions apply to this standard.

GB 14622 Limits and measurement methods for evaporative pollutants from motorcycles (working condition method)

GB/T 15089-2001 Classification of Motor Vehicles and Trailers

GB/T 18176 Limits and measurement methods for evaporative pollutants from mopeds (working condition method)

3 Terms and Definitions

The following terms and definitions are applicable to this standard:

3.1 Motorcycle

Any two-wheeled motorcycle (Category L3), three-wheeled motorcycle with side car (Category L4) or motor tricycle (Category L5) as defined by GB/T 15089-2001.

3.2 Mopeds

Any two-wheeled moped (Category L1) or three-wheeled moped (Category L2) as defined by GB/T 15089-2001.

3.3 Fuel system

A system comprising the fuel tank, fuel pipe, fuel filter, fuel pump, carburettor or fuel injection components and a control system of the fuel evaporative pollutants. It includes all the outlets to the atmosphere in these two systems.

3.4 Evaporative pollutant

Any hydrocarbon emitted to the atmosphere from the motorcycle's fuel system

3.4.1 Diurnal loss

Any hydrocarbon emitted from the fuel system due to temperature change

3.4.2 Hot-soak loss

Any hydrocarbon emitted from the fuel system in a static vehicle after the vehicle has run for some time

3.5 Evaporative pollutant controlling system or device

A system or device in a motorcycle to control or restrict evaporative pollutant emissions

3.6 Test cycle

A test procedure comprising one diurnal loss test and one hot-soak test

3.7 Critical point

The time when the amount of the fuel evaporative pollutants has accumulated to 2 g

4 Application and Ratification of Type Approval

4.1 The motorcycles produced and sold by the motorcycle manufacturers must obtain the type approval for fuel evaporative pollutant control performance. An application for type approval for one type of motorcycle must be submitted by the motorcycle manufacturer.

4.2 The manufacturer must submit the technical documentation for the type approval according to Appendix A.

4.3 In order to conduct the test defined in Chapter 6 the manufacturer must provide a representative motorcycle to the organisation in charge of the type approval test.

4.4 If the motorcycle meets the requirements in Chapter 5 and Chapter 6, this type of motorcycle will be ratified by the type approval organisation and obtain a type approval certificate as shown in Appendix B.

4.5 To apply for a type approval extension the manufacturer should submit a copy of the type approval documentation of the ratified motorcycle together with information related to the desired extension.

5 Technical Requirements and Test Type

5.1 Technical Requirements

5.1.1 The manufacturer must ensure that the design, manufacture and assembly of the components that may affect the emissions of fuel evaporative pollutants in the motorcycle meet the requirements of this standard in normal running conditions, including when there are vibrations.

The manufacturer must take technical measures to ensure that the fuel evaporative pollutant emissions can be controlled effectively within the limits set in the standard in normal running conditions and within the lifetime of the motorcycle. In addition, the manufacturer must ensure that the liability for and manufacture of the pipes, connectors and wires used in the fuel evaporative pollutant control system meet their design requirements.

5.1.2 One of the measures below must be taken to prevent excessive evaporative pollutant emissions and fuel overflow due to a missing fuel filler cap.

- 1) Loss of the fuel filling cap may be prevented by the design or construction.
- 2) Other measures with the same effect may be taken, such as fixing the fuel filling cap with a wire or chain, or the fuel filling cap may share the same key as the ignition switch, which can only be pulled out when the fuel filling cap is locked.

5.2 Test Type

The tests are divided into the type approval test and the production conformity inspection test.

5.2.1 The type approval test is when the motorcycle manufacturer supplies a representative motorcycle according to the requirements in this standard to a test organisation to conduct a test on the motorcycle as defined in Chapter 6.

5.2.2 The production conformity inspection test is when the motorcycle manufacturer takes a sample at random from a production batch of the type approved motorcycles and conducts a test as defined in Chapter 7 at its own facilities or a test organisation.

6 Preparation of Type Approval Test

6.1 Requirements of type approval test

6.1.1 The test should be conducted according to the method defined in Appendix C.

6.1.2 The flow chart of the test is shown in Figure C.1.

6.1.3 The pre-treatment of the motorcycle should be carried out on chassis function test equipment with a power absorption and inertia simulation device.

6.2 The limits of the fuel evaporative pollutant emissions from motorcycles for the type approval are shown in Table 1.

Table 1 Limits of fuel evaporative pollutant emissions

Evaporative Pollutants	Limits (g/test)	
	Moped	Motorcycle
HC	2.0	

7 Production Conformity Inspection Test

7.1 For batch production motorcycles manufactured after passing the type approval test in this standard, any components that may affect the emissions of the fuel evaporative pollutants in the motorcycle should still conform to the requirements during the type approval test.

7.2 The production conformity inspection test can be conducted according to the provisions in Appendix C. 7 or Chapter 6 in this standard. The limits in Table 1 should be applied if the production conformity inspection test is conducted according to the provisions of Chapter 6.

7.3 If any type of motorcycle fails to meet the requirements of the production conformity inspection test, the motorcycle manufacturer should take measures immediately to re-establish production conformity; otherwise the type approval for this type of motorcycle will be revoked.

8 Type Approval Extension

8.1 Under the following circumstances motorcycles installed with a fuel evaporative pollutant control system which is ratified for type approval can have the type approval extended to them.

8.1.1 The basic principle (i.e. injection, carburettor) of the mixture gas (fuel/air) is identical.

8.1.2 For engines with a carburettor the fuel capacity difference of the bowl in the carburettors must be within 10 ml.

8.1.3 The shape and materials of the fuel tank must be the same, the nominal capacity of the fuel tank difference must be within $\pm 10\%$, the setting of the vent valve of the fuel tank must be the same; the materials of the liquid fuel hose must be the same and their length must be basically the same.

8.1.4 The fuel vapour storage must be the same in terms of the shape and capacity, storage media, and air filter of the activated carbon canister (if vapour pollutant emission control is used).

8.1.5 The fuel vapour desorption storage (i.e. the air flow, the desorption capacity in the starting or running circle) must be the same.

8.1.6 The sealing and ventilating of the fuel system must be the same.

8.2 Restriction on type approval extension

After a type approval extension has been made to another type of motorcycle according to the rules stipulated in 8.1, the type approval from this extended type approval motorcycle cannot then be extended to another type of motorcycle.

9 Implementation of Standard

The type approval defined by this standard is to be implemented from 1 July 2008.

From the stipulated implementing date of the type approval all motorcycles with the type approval for evaporative pollutant emissions must conform to the requirements of this standard. Before the implementing date the type approval application and ratification can be conducted according to the relevant requirements in this standard.

For motorcycles which are ratified for the type approval of this standard the production conformity inspection test can be conducted from their ratification date.

One year after the stipulated implementing date all motorcycles manufactured, sold and imported must meet the requirements of this standard in terms of evaporative pollutant emissions.

Appendix A
(Specification appendix)
Documentation of Application for Type Approval

Information covering the following content should be supplied in electronic form when applying for the type approval.

Any illustrations should be appropriately proportioned with a full explanation of the details; the size should be A4 or foldable into A4. The pictures should be able to show the details, if any. The performance data for the systems, components or independent technical devices should be supplied, if any.

A.1 General

- A.1.1 Brand Name
- A.1.2 Model
- A.1.3 VIN of Motorcycle
- A.1.4 Category of Motorcycle
- A.1.5 Manufacturer's Name and Address
- A.1.6 Address of General Assembly Factory
- A.1.7 Position of Motorcycle Name Plate

A.2 General Structural Features of Motorcycle

- A.2.1 Illustrations and/or Pictures of Motorcycle
- A.2.2 Drawing with Motorcycle Overview sizes
- A.2.3 Wheelbase and Tread
- A.2.4 Number of Axles and Wheels
- A.2.5 Engine Installation Position
- A.2.6 Number of Passengers

A.3 Complete Motorcycle Weight Data

- A.3.1 Gross Weight
- A.3.2 Reference Weight
- A.3.3 Manufacturer's Maximum Loading Weight

A.4 Engine

- A.4.1 Manufacturer
- A.4.2 Brand or Trade Mark
- A.4.3 Model
- A.4.4 Cylinder Diameter (mm)
- A.4.5 Stroke (mm)
- A.4.6 Cylinder Working Capacity (cm³)
- A.4.7 Compression Ratio²⁾
- A.4.8 Cooling System (Liquid Cooling/Air Cooling)¹⁾
- A.4.9 Air Cleaner: Manufacturer, Model and Drawing Number

A.5 Evaporative Pollutant Control Device

- 1) Delete as appropriate.
- 2) Specify the deviation.

- A.5.1 Evaporative Pollutant Control Devices: With/Without¹⁾
 - A.5.1.1 Explain the devices and their adjustment conditions in detail
 - A.5.1.2 Illustration of evaporative pollutant control system
 - A.5.1.3 Activated Carbon Canister
 - A.5.1.3.1 Manufacturer of Carbon Canister
 - A.5.1.3.2 Model of Carbon Canister
 - A.5.1.3.3 Number of Carbon Canister
 - A.5.1.3.4 Shape and Illustration of Carbon Canister
 - A.5.1.3.5 Capacity of Carbon Canister
 - A.5.1.3.6 Storage Media of Carbon Canister
 - A.5.1.3.7 Mass of Carbon Canister (g)
 - A.5.1.3.8 Bed Capacity
 - A.5.1.4 Fuel Tank
 - A.5.1.4.1 Manufacturer of Fuel Tank
 - A.5.1.4.2 Illustration of Fuel Tank
 - A.5.1.4.3 Nominal Capacity of Fuel Tank
 - A.5.1.4.4 Materials of Fuel Tank
 - A.5.1.4.5 Vent Valve of Fuel Tank
 - A.5.1.5 Liquid Fuel Hose
 - A.5.1.5.1 Manufacturer of Liquid Fuel Hose
 - A.5.1.5.2 Materials of Liquid Fuel Hose
 - A.5.1.5.3 Length of Liquid Fuel Hose
 - A.5.1.6 Sealing and Ventilating of Fuel System

A.6 Fuel Supply

- A.6.1 Fuel Supply
 - A.6.1.1 Carburettor: Yes/No¹⁾
 - A.6.1.1.1 Number
 - A.6.1.1.2 Manufacturer
 - A.6.1.1.3 Model
 - A.6.1.1.4 Fuel Capacity of Bowl
 - A.6.1.2 Fuel Injection: Yes/No¹⁾
 - A.6.1.2.1 System Explanation
 - A.6.1.2.2 Working Principle: Intake Manifold (single point/multi points)/Direct Injection/Other (note)¹
 - A.6.1.2.3 Fuel Pump
 - A.6.1.2.3.1 Manufacturer
 - A.6.1.2.3.2 Model
 - A.6.1.2.3.3 Fuel Pump Displacement (cm³)/Stroke (pump speed r/min)¹⁾²⁾ or Feature Curve¹⁾²⁾
 - A.6.1.2.4 Injector
 - A.6.1.2.4.1 Manufacturer
 - A.6.1.2.4.2 Model
 - A.6.1.2.4.3 Opening Pressure (kPa)¹⁾²⁾ or Feature Curve¹⁾²⁾

1) Delete as appropriate.
2) Specify the deviation.

Appendix B
(Specification appendix)
Certificate Format of Type Approval

(Maximum Size: A4 (210 x 297 mm))

According to GB xxxx, notification is hereby given that the type approval for the following type of motorcycle is:

type approval agreed¹⁾
type approval extended¹⁾
type approval denied¹⁾
type approval revoked¹⁾
type approval ratification number¹⁾:
type approval extended ratification number¹⁾:
reason for extension:

B.1 Part One

B.1.1 Trade Mark:
B.1.2 Model:
B.1.3 VIN of Motorcycle:
B.1.4 Category of Motorcycle:
B.1.5 Name and Address of Manufacturer:
B.1.6 Address of General Assembly Factory:

B.2 Part Two

B.2.1 Organisation in Charge of Type Approval Ratification Test:
B.2.2 Date of Test Report:
B.2.3 Serial Number of Test Report:
B.2.4 Issuing Date of Certificate:
B.2.5 Signature and Stamp (type approval organisation):
B.2.6 Note:
B.2.7 Archive Index of Type Approval Organisation, the information can be supplied on demand.

1) Delete as appropriate.

Appendix BA
(Specification appendix)
Additional Information on Type Approval Certificate

- BA.1 Parameters and Test Conditions of Motorcycle
 - BA.1.1 Gross Weight of Motorcycle
 - BA.1.2 Maximum Mass of Motorcycle
 - BA.1.3 Reference Weight of Motorcycle
 - BA.1.4 Number of Passengers (including the driver)
 - BA.1.5 Engine Model
 - BA.1.6 Fuel
- BA.2 Test Result:

Evaporative Pollutant Emission Test	HC (g/test)
Diurnal Loss	
Hot-soak Loss	

- BA.3 Evaporative Pollutant Control Device
 - BA.3.1 Evaporative pollutant control devices required by the relevant tests in this standard
 - BA.3.1.1 Factory brand name and model of evaporative pollutant control device
 - BA.3.2 Alternative evaporative pollutant control devices required by the relevant tests in this standard
 - BA.3.2.1 Factory brand name and model of alternative evaporative pollutant control device

Appendix C
(Specification appendix)
Test of Fuel Evaporative Pollutant Emissions

C.1 General

This appendix defines the test method for the fuel evaporative pollutant emissions of motorcycles.

C.2 Description of Test

The fuel evaporative pollutant emission test includes the following stages:

- Test preparation;
- Measuring the diurnal loss;
- Measuring the hot-soak loss.

Add the evaporative pollutant mass of the diurnal loss to the evaporative pollutant mass of the hot-soak loss to obtain the total result of the test.

C.3 Motorcycle and Fuel

C.3.1 Motorcycle

C.3.1.1 The vehicle should be in good technical condition. Motorcycles should have run no less than 1000 km before the test; mopeds should have run no less than 250 km before the test.

C.3.1.2 For motorcycles equipped with a fuel evaporating control system, the system should be connected correctly and work properly during the running-in period, and the carbon canister should not have been subject to any unusual absorption and desorption after normal operation.

C.3.2 Fuel

C.3.2.1 The fuel for the test should conform to the technical requirements of the reference fuel of the test defined in Appendix D.

C.4 Test Equipment

C.4.1 Chassis Function Test Equipment

The chassis function test equipment should conform to the requirements in GB 14622 and GB 18176.

C.4.2 Airtight Chamber

The airtight chamber for the evaporative pollutant emission test should be a rectangular test chamber with good air-tightness and enough room to accommodate the motorcycle and for the test staff to handle the motorcycle during the test. The airtight chamber should meet the requirements defined in Appendix E. The inside surfaces of the airtight chamber should not be subject to any infiltration of hydrocarbons, emit any hydrocarbons or react with hydrocarbons. At least one inside surface should be made of flexible, impervious materials to balance the pressure change caused by the minor change in temperature. The design of the wall surface of the airtight chamber should have good heat dissipation capabilities. The surface temperature inside the airtight chamber should not be lower than 293K (20°C) during the test.

C.4.3 Analysis System

C.4.3.1 Hydrocarbon Analyser

C.4.3.1.1 The Flame Ionisation Detector (FID) hydrocarbon analyser should be used to monitor the gas in the airtight chamber. Take the sample gas from one side or the ceiling; all bypassing air should be fed back into the airtight chamber downstream of the mixing fan.

C.4.3.1.2 The response time for the hydrocarbon analyser to reach 90% of its full measuring range should not be longer than 1.5 s. Enter Zero and Span gas at each working range; the stability within 15 minutes should be less than 2% for the corresponding range.

C.4.3.1.3 The standard deviation of the repeatability at each range of the analyser should be less than 1% after entering Zero and Span gas.

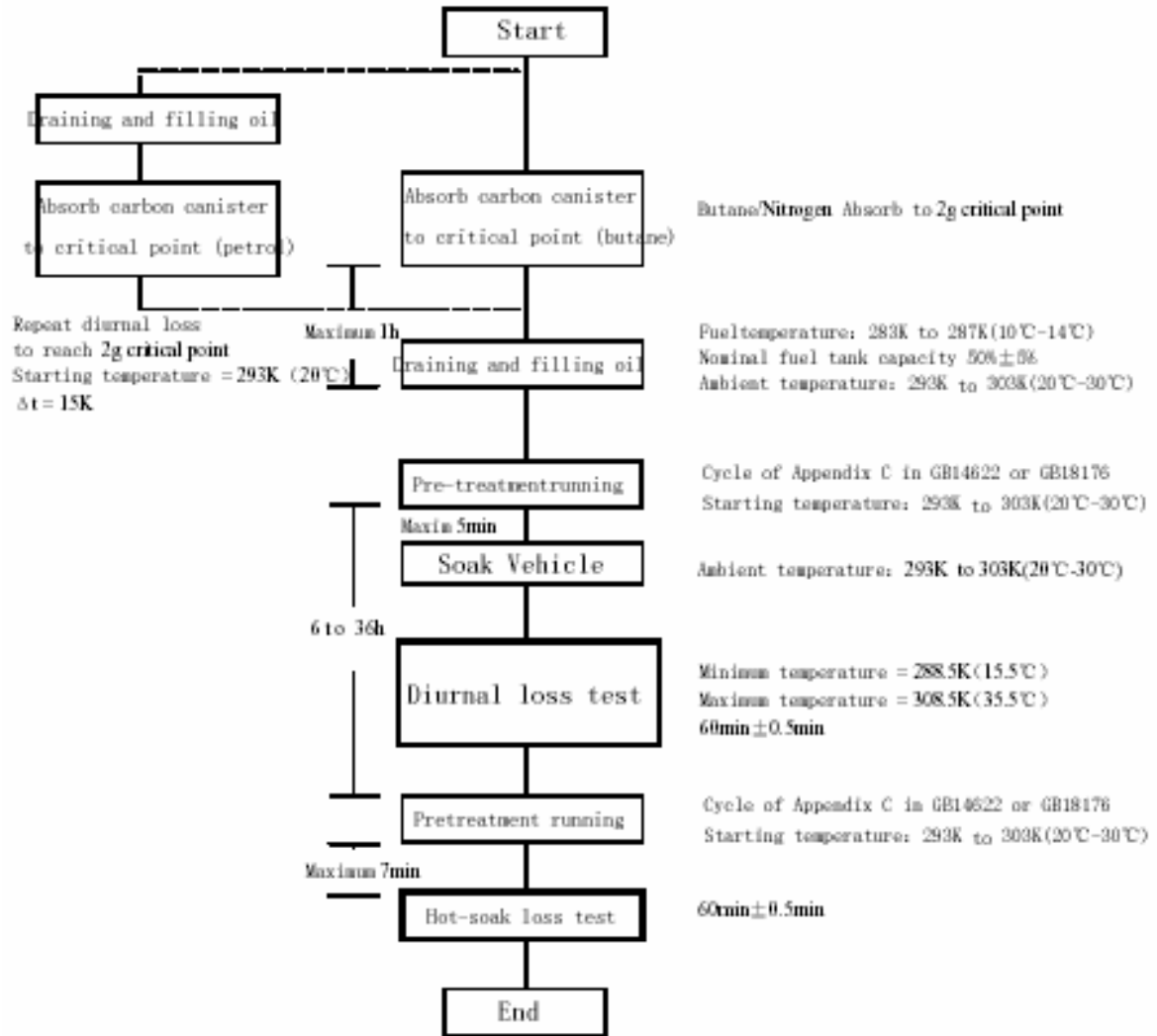


Figure C.1 Flow chart evaporative pollutant emission test

C.4.3.1.4 Select an appropriate range to get the best resolution in measurement, calibration and leak detection.

C.4.3.2 Data Recording System of Hydrocarbon Analyser

C.4.3.2.1 The hydrocarbon analyser should have a pen recorder or another type of data collection system to record the analyser's output signal at least once per minute. The recording system should have at least equivalent working characteristics to the recording signal and be able to continue recording results permanently. The recording should be able to show the starting point and the ending point of the hot-soak loss and the diurnal loss clearly (including the start and end of sampling, the time of each test from the start to the end).

C.4.4 Fuel Tank Heating System

C.4.4.1 The fuel tank heating system should have two controllable heaters and two controllers. A typical heater is an electric plate heater to heat the fuel and vapour. During the heating process it should heat evenly without causing part of the fuel or vapour to overheat.

C.4.4.2 The heating plate used to heat the fuel should be placed at a relatively low position on the fuel tank with the contacting area to be equivalent at least 10% of the area of the fuel tank contacted by the petrol. The central line of the heating plate should be parallel to the petrol surface and placed at 30% of the depth from the bottom of the fuel tank or at the lowest side position of the fuel tank. The central line of the vapour heating plate should be near the height centre of the vapour-occupied space.

C.4.4.3 The temperature controller should be able to control the temperature of the fuel and the vapour and meet the temperature change curve and the tolerance requirement. The positioning of the temperature sensor is described in C.5.1.1.

C.4.5 Temperature Recording System

C.4.5.1 The temperature recording system could be a paper tape recorder or an automatic data processing system. During the evaporative pollutant emission test the temperature recording system should record the temperature of the airtight chamber, fuel and vapour at least twice per minute or input the temperature into a data processing system.

C.4.5.2 For measurement of the temperature of the airtight chamber two temperature sensors should be placed at two positions in the airtight chamber and the average temperature from these two sensors is the chamber temperature. The height where the measurement should be taken is 0.9 ± 0.2 m from the floor at a position of 0.1 m from the wall.

C.4.5.3 Use the installed temperature sensors to record the temperature of the fuel and vapour during the evaporative pollutant emission test.

C.4.5.4 The accuracy of the temperature recording system should be within ± 1.0 K with the resolution no lower than ± 0.4 K.

C.4.5.5 The time resolution of the recording or data processing system should be no lower than ± 15 s.

C.4.6 Pressure Recording System

C.4.6.1 During the evaporative pollutant emission test the pressure difference Δp between the atmospheric pressure in the test area and the pressure in the airtight chamber should be recorded or input to a data processing system at least once per minute.

C.4.6.2 The accuracy of the pressure recording system should be within ± 200 Pa with the resolution no lower than ± 20 Pa.

C.4.6.3 The time resolution of the recording or data processing system should be no lower than ± 15 s.

C.4.7 Fan

C.4.7.1 One or more fans or blowers should be used to make sure the density of the hydrocarbons in the chamber can be reduced to the same density as the hydrocarbons in the surroundings when opening the door of the airtight chamber.

C.4.7.2 Install one or more fans or blowers in the airtight chamber with a capacity of $0.1\text{--}0.5$ m³/s, which can fully mix the air in the airtight chamber and ensure the evenness of the temperature and the hydrocarbon density in the chamber during the test. The air flow from the fan(s) or blower(s) should not be aimed directly at the motorcycle.

C.4.8 Gas

C.4.8.1 The following standard gas should be used for the calibration and test:

- Pure complex air: ($\text{HC} < 1 \text{ ppmC}$, $\text{CO} \leq 1 \times 10^{-6}$, $\text{CO}_2 \leq 400 \times 10^{-6}$, $\text{NO} \leq 0.1 \times 10^{-6}$); oxygen content is between 18% and 21% volume percentage;
- Fuel gas used by the hydrocarbon analyser (hydrogen $40 \pm 2\%$, others are helium, $\text{HC} < 1 \text{ ppmC}$, $\text{CO}_2 \leq 400 \times 10^{-6}$);
- Propane (C_3H_8), purity no lower than 99.5%;
- Butane (C_4H_{10}), purity no lower than 98%;
- Nitrogen (N_2), purity no lower than 98%.

C.4.8.2 The calibration and test gas should be a mixture of propane (C_3H_8) and pure complex air. The actual density of the calibration gas should be within $\pm 2\%$ of the nominal value. The accuracy of the diluted gas prepared with a gas separator should be within $\pm 2\%$ of its actual value. The density specified in Appendix E could be obtained by diluting the complex air with a gas separator.

C.4.9 Additional equipment

C.4.9.1 The measurement accuracy of the absolute humidity in the test site should be within $\pm 5\%$.

C.5 Test Procedure

C.5.1 Preparation of Test

C.5.1.1 The motorcycle should be prepared according to the following requirements before the test:

- The motorcycle could be cleaned with steam before the test;
- The temperature sensors should be installed at the motorcycle's fuel tank to measure the temperature of the fuel and vapour. The measuring point of the fuel temperature sensor should be near the fuel's geometry centre with 50% fuel of the nominal fuel capacity of the tank; the measuring point of the vapour temperature sensor should be near the centre of the fuel vapour volume. The temperature sensors for the fuel and vapour should be at least 2.54 cm away from the fuel tank surface;
- Without changing the fuel tank installation conditions, additional connectors and adapters can be installed to completely drain the fuel in the tank.

C.5.1.2 Place the motorcycle on a test site with the ambient temperature at 293–303K (20–30°C).

C.5.1.3 Determination of carbon canister aging. The aging can be proved by installing it to a motorcycle and running it for at least 1000 km. If it cannot be proved, the following aging test procedure can be conducted. For a multi carbon canister system each canister should be separately tested with this procedure.

C.5.1.3.1 Take the carbon canister off the motorcycle carefully without damaging any component or the integrity of the fuel system.

C.5.1.3.2 Weighing the carbon canister

C.5.1.3.3 Connect the carbon canister to a fuel tank or an accessory fuel tank; fill the fuel tank to 50% of its nominal capacity with the reference fuel.

C.5.1.3.4 The temperature of the fuel in the tank should be between 283K (10°C) and 287K (14°C).

C.5.1.3.5 Heat the fuel in the tank evenly from 288K (15°C) to 318K (45°C) (1°C/9 minutes).

C.5.1.3.6 If the carbon canister reaches the critical point before the temperature reaches 318K (45°C), disconnect the heat source and weigh the canister. If the carbon canister has not reached the critical point, repeat the above procedure in C.5.1.3.3 until it reaches the critical point.

C.5.1.3.7 The critical point can be checked according to C.5.1.5 and C.5.1.6 or using another set of sampling and analysis equipment capable of determining the level of hydrocarbons emitted from the canister to the critical point.

C.5.1.3.8 Use the emission laboratory's air at the flow volume of 25 ± 5 l/min to desorb the carbon canister until the air flow volume reaches 300 times the canister's bed capacity.

C.5.1.3.9 Weighing the carbon canister

C.5.1.3.10 Repeat the procedure from C.5.1.3.4 to C.5.1.3.9 nine times. After three aging cycles, if the weight of the carbon canister has been stabilised at the last cycle, the aging test can be stopped ahead of schedule.

C.5.1.3.11 Re-connect the carbon canister to return the motorcycle to its normal operating condition.

C.5.1.4 Pre-treatment of carbon canister

Use one of the methods defined in C.5.1.5 and C.5.1.6 to pre-treat the carbon canister. For motorcycles with multi carbon canisters each canister should be separately pre-treated.

C.5.1.4.1 Measuring discharging volume of carbon canister and determining critical point

The critical point here refers to the time when the amount of the fuel evaporative pollutants has accumulated to 2 g.

C.5.1.4.2 The critical point can be tested in an evaporative emission airtight chamber as described in C.5.1.5 or C.5.1.6 or by connecting a secondary evaporative carbon canister downstream of the motorcycle's carbon canister. This secondary carbon canister should be fully desorbed with dry air before the absorption.

C.5.1.4.3 Before the test start the air mixing fan(s) of the chamber and clear out the chamber for a few minutes until the background air is stabilised. Calibrate the hydrocarbon analyser with the zero and span setting.

C.5.1.5 Using the repeat heating method to bring the carbon canister's absorption to the critical point

C.5.1.5.1 Open the fuel tank cap and drain all fuel from the motorcycle completely through the draining valve of the fuel tank. Prevent any unusual desorption or absorption from the motorcycle's evaporative pollutant control device during the fuel draining.

C.5.1.5.2 Fill in all fuel tanks with the reference test fuel at a temperature of 283K (10°C) to 287K (14°C) to $50 \pm 2.5\%$ of the fuel tank's nominal capacity. Close the fuel tank cap.

C.5.1.5.3 After one hour move the motorcycle with the engine switched off into the airtight chamber. Connect the fuel tank's temperature sensors to the temperature recording system. Place the heating devices at the specified places in the fuel tank and connect them to the temperature controllers. The heat source is defined in C.4.4. If the motorcycle has more than one fuel tank, the following method should be used to heat all fuel tanks with the temperature difference in each fuel tank within ± 1.5 K.

C.5.1.5.4 The fuel can be heated manually to reach the starting temperature of 293K (20°C) ± 1 K.

C.5.1.5.5 The following operation should be started immediately when the fuel reaches at least 292K (19°C): switch off the ventilating fan; close and seal the door of the airtight chamber; measure the initial density of hydrocarbons in the airtight chamber.

C.5.1.5.6 Start linear heating when the temperature in the fuel tank reaches 293K (20°C) and raise the temperature to 308K (35°C). The temperature of the fuel in the heating process should conform to the following formula with the deviation within ± 1.5 K. Record the time and temperature increase values during the heating process.

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

In the formula:

Tr - required temperature (K);
To - starting temperature (K);
t - fuel tank heating time (min).

C.5.1.5.7 Once the critical point has been reached or the temperature reaches 308K (35°C), switch off the heat source, unseal and open the door of the airtight chamber and open the fuel tank cap. If the critical point has not been reached when the temperature of the fuel reaches 308K (35°C), remove the heat source from the motorcycle and move the motorcycle away from the evaporative emission airtight chamber, and then repeat all procedures from C.5.1.5.3 to C.5.1.5.7 until the critical point has been reached.

C.5.1.5.8 Re-fit the evaporative pollutant emission carbon canister to return the motorcycle to its normal operating condition.

C.5.1.6 Absorbing carbon canister to critical point with butane

C.5.1.6.1 If the airtight chamber is used to determine the critical point (see C.5.1.4.2), a switched off motorcycle should be placed in the evaporative pollutant emission airtight chamber.

C.5.1.6.2 An evaporative pollutant emission carbon canister should be prepared for the carbon canister absorption operation. The carbon canister should not be taken off the vehicle unless the canister is very difficult to access and it has to be taken off to do the absorption. If the carbon canister has to be taken off, care must be taken not to damage any component or the integrity of the fuel system.

C.5.1.6.3 Use a mixture gas of 50% butane and 50% nitrogen in volume at 40 g/h butane flow to absorb the carbon canister.

C.5.1.6.4 Switch the evaporative source off immediately once the carbon canister's critical point has been reached.

C.5.1.6.5 Re-fit the evaporative pollutant emission carbon canister to return the motorcycle to its normal operating condition.

C.5.1.7 Fuel Draining and Re-filling

C.5.1.7.1 Open the fuel tank cap and drain all fuel from the motorcycle completely through the draining valve of the fuel tank. Prevent any unusual desorption or absorption from the motorcycle's evaporative pollutant control device during the fuel draining.

C.5.1.7.2 Use a fuel draining device to empty the fuel as completely as possible. Fill the fuel tank with the reference test fuel to 50±5% of the fuel tank's nominal capacity. Close the fuel tank cap.

C.5.2 Pre-treatment Running

C.5.2.1 Place the motorcycle on the chassis function test equipment within one hour after finishing the carbon canister absorption defined in C.5.1.5 or C.5.1.6 and conduct at least one running cycle as defined in GB14622 or Appendix C of GB18176. No evaporative pollutant samples need to be taken during the running period.

C.5.3 Soaking Vehicle

C.5.3.1 Place the motorcycle in the test laboratory statically within 5 minutes after the pre-treatment.

C.5.3.2 The temperature of the test laboratory should be controlled at 298±5K (25±5°C).

C.5.3.3 The static placing time should be more than 6 hours but the interval to the second vehicle pre-treatment for the hot-soak loss test should not exceed 36 hours. After the vehicle's soaking period the temperature of the engine's oil and coolant should be within ±2K of the area's ambient temperature.

C.5.4 Diurnal loss test

C.5.4.1 Completely drain the fuel from the fuel tank and fill the fuel tank with the reference test fuel to $50 \pm 2.5\%$ of the fuel tank's nominal capacity. The temperature of the fuel in the tank should be lower than 15.5°C before the test.

C.5.4.2 The temperature in the airtight chamber should be controlled at $298 \pm 5\text{K}$ ($25 \pm 5^\circ\text{C}$).

C.5.4.3 Before the test clear out the airtight chamber for a few minutes until a stable environmental background value has been reached; the mixing fan of the chamber should be switched on during this period. For safety purposes switch the blower on immediately to clear the air out if the density of hydrocarbons in the airtight chamber exceeds $15,000$ ppmc.

C.5.4.4 Use the zero and span settings to calibrate the FID analyser before the test.

C.5.4.5 Switch the mixing fan on.

C.5.4.6 Place the motorcycle in the airtight chamber with the fuel tank cap off and the engine switched off.

C.5.4.7 Connect the temperature sensors to the temperature recorder and the temperature controller; place the heating mat in position.

C.5.4.8 Switch the temperature recorder on and start heating the fuel tank.

C.5.4.9 The heating of the fuel and vapour should be conducted according to the following conditions and the deviation kept within $\pm 1.7\text{K}$:

$$T_f = (1/3) t + 288.5\text{K (non-concealed fuel tank)}$$

$$T_v = (1/3) t + 294\text{K (non-concealed fuel tank)}$$

$$T_f = (2/9) t + 289\text{K (concealed fuel tank)}$$

In the formula:

T_f - fuel temperature (K)

T_v - vapour temperature (K)

t - duration (min)

The test time is 60 ± 0.5 min, the temperature rise for non-concealed tanks is 20K , the final temperature is $308.5 \pm 0.5\text{K}$ ($35.5 \pm 0.5^\circ\text{C}$). The temperature rise for concealed tanks is 20K , the final temperature is $302.3 \pm 0.5\text{K}$ ($29.3 \pm 0.5^\circ\text{C}$). The vapour's temperature for the initial test should not be higher than 289K (26°C); the vapour does not need to be heated for the test under this condition. For non-concealed fuel tanks, when the fuel is heated according to the heating curve T_f to 5.5K lower than the temperature of the vapour, it should be heated according to the heating curve T_v with the fuel heating time then.

C.5.4.10 Close the fuel tank cap immediately when the temperature of the fuel reaches 286.5K (13.5°C). Switch the blower off, if it is still on, and close and seal the airtight chamber. Analyse the hydrocarbon density in the airtight chamber immediately when the temperature reaches $288.5 \pm 0.5\text{K}$ ($15.5 \pm 0.5^\circ\text{C}$), i.e. the hydrocarbon density C_{HCi} at the start time ($t = 0$ min) and at the same time measure the temperature T_i and the pressure P_{ai} .

C.5.4.11 The FID hydrocarbon analyser should be calibrated at the zero and span settings immediately before finishing the test.

C.5.4.12 Analyse the hydrocarbon density in the airtight chamber immediately after the test, i.e. the hydrocarbon C_{HCf} at the ending time ($t = 60$ min) and at the same time measure the temperature T_f and the pressure P_{af} .

C.5.4.13 Switch off the power of the heater and open the door of the airtight chamber.

C.5.4.14 Take off the heating device and its connectors and remove the test vehicle with the engine switched off from the airtight chamber.

C.5.5 Pre-treatment Running

C.5.5.1 Place the motorcycle on the chassis function test equipment and conduct at least one running cycle defined in GB14622 or Appendix C of GB18176. No evaporative pollutant samples need to be taken during the running period.

C.5.6 Hot-soak Loss Test

C.5.6.1 Before finishing the pre-treatment, run clear out of the airtight chamber for a few minutes until a stable background value has established; the mixing fan of the airtight chamber should be switched on at this time.

C.5.6.2. Calibrate the FID hydrocarbon analyser with the zero and span settings immediately before the test.

C.5.6.3 Within 7 minutes after the pre-treatment with the engine switched off move the motorcycle into the airtight chamber and then seal the airtight chamber.

C.5.6.4 Start analysing and recording the hydrocarbon density C_{HCi} in the airtight chamber at the start time ($t = 0$ min) and at the same time measure the temperature T_i and the pressure P_{ai} .

C.5.6.5 The FID hydrocarbon analyser should be calibrated at the zero and span settings immediately after finishing the test.

C.5.6.6 The test time for the hot-soak loss test is 60 ± 0.5 min.

C.5.6.7 Immediately analyse the density of the hydrocarbon C_{HCf} at the ending time ($t = 60$ min) in the airtight chamber after the test, and at the same time measure the temperature T_f and the pressure P_{af} .

C.5.6.8 Open the airtight chamber and move the test motorcycle out.

C.6 Result Calculation

C.6.1 Test result of diurnal loss (breathing loss) and hot-soak loss

The hydrocarbons emitted in the diurnal loss (MDBL) test and the hot-soak loss (MHS) test can be calculated by the following formula, i.e. the amount of the evaporative pollutant for each test can be calculated by the hydrocarbon density, the temperatures in the airtight chamber at the start and end time and the net volume of the chamber.

$$M_{HC} = K \times V \times 10^{-4} \times (C_{HCf} \times P_{af} / T_f - C_{HCi} \times P_{ai} / T_i)$$

In the formula:

M_{HC} – mass (g) of the hydrocarbons emitted from the diurnal loss test and the hot-soak loss test;

C_{HC} - hydrocarbon density in the airtight chamber (ppmC);

V – net volume of the airtight chamber (m^3) after the adjustment with the motorcycle's volume, which is usually calculated as $0.142 m^3$;

T – environmental temperature (K) in the airtight chamber;

P_a –atmospheric pressure (kPa);

i – initial reading;

f – final reading;

$K = 1.2 \times (12 + H/C)$;

In the formula:

H/C – carbon and hydrogen ratio; 2.33 is used for the diurnal loss (breathing loss) test and 2.20 is used for the hot-soak loss test.

C.6.2 Final Result of Test

The total mass of the evaporative pollutant emissions from the motorcycle is:

$$M = M_{\text{DBL}} + M_{\text{HS}}$$

In the formula:

M – total mass (g) of the evaporative pollutant emissions from the motorcycle;

M_{DBL} – mass (g) of the evaporative pollutant emissions from the diurnal loss (breathing loss);

M_{HS} - mass (g) of the evaporative pollutant emissions from the hot-soak loss.

C.7 Production Conformity

C.7.1 The inspection test at the end of the production line by the manufacturer confirms that the sample vehicle meets the following conditions for the production conformity requirements.

C.7.2 Leak Test

C.7.2.1 Block the vent valve to the atmosphere of the vapour control system.

C.7.2.2 Apply pressure of 3.63 ± 0.10 kPa to the fuel supply system.

C.7.2.3 Cut the pressure source off after the pressure of the fuel supply system is stabilised.

C.7.2.4 The pressure drop should not be more than 0.49 kPa in 5 minutes from the pressure cut-off to the fuel supply system.

C.7.3 Vent Test

C.7.3.1 Block the vent valve to the atmosphere of the vapour control system.

C.7.3.2 Apply a pressure of 3.63 ± 0.10 kPa to the fuel supply system.

C.7.3.3 Cut the pressure source off after the pressure of the fuel supply system is stabilised.

C.7.3.4 Restore the vent valve to the atmosphere of the vapour control system to its original condition.

C.7.3.5 The pressure of the fuel supply system should fall below 0.98 kPa within 30 seconds to 2 minutes.

C.7.3.6 An alternative equivalent method can be used to prove the venting capability, if requested by the manufacturer. The manufacturer should provide evidence of its specific procedure to the inspection organisation during the type approval period.

C.7.4 Desorption Test

C.7.4.1 Install a device capable of measuring the air flow of 1 l/min to the desorption inlet and install a pressure container with enough capacity not to affect the desorption system to the inlet via a valve or use an alternative method.

C.7.4.2 The manufacturer can select its own flow meter after agreement by the type approval organisation.

C.7.4.3 Operate the motorcycle and check if there is any structure that restricts the desorption function in the desorption system and make a note of it.

C.7.4.4 When the engine is in operation as described in C.7.4.3, measure the air flow using one of the following methods:

C.7.4.4.1 While the device in C.7.4.1 is connected, observe the pressure drop level at which 1 litre air in 1 minute has flowed through the evaporative pollutant emission control system; or

C.7.4.4.2 Check the reading at which the flow volume is not less than 1 l/min, if an alternative flow measurement device is used.

C.7.4.4.3 During the type approval period, if an alternative desorption test procedure has been submitted by the manufacturer and it has been accepted, this alternative procedure can be used at the manufacturer's request.

C.7.5 The type approval authority can inspect the production conformity methods used by every manufacturer at any time.

C.7.5.1 The inspectors should take a sufficient quantity of samples from the product series.

C.7.5.2 The inspectors can carry out the tests to the motorcycle defined in 6.1 or C.7.2 to C.7.4.

C.7.5.3 If the result from the tests in C.7.2 to C.7.4 fail to meet the requirements, the manufacturer can request for the type approval procedure in 6.1 to be used.

C.7.5.3.1 No adjustment, repair or alteration to the motorcycles by the manufacturer is allowed unless these motorcycles cannot meet the requirements in 6.1 or these works are listed in the motorcycle's assembly and inspection procedure documents.

C.7.5.3.2 If the evaporative pollutant emission characteristics might have changed due to the work in C.7.5.3.1, the manufacturer could request for a test item to be repeated on the motorcycle.

C.7.6 If it still fails to meet the requirements of C.7.5, the type approval organisation should ask the manufacturer to take all necessary measures as soon as possible to re-establish the product's conformity.

Appendix D
(Specification appendix)
Technical Requirements for Reference Fuel

Type: Unleaded Petrol

Item	Quality Index	Test Method
Anti-explosion:		
Research Octane Number (RON) no less than	93	GB/T 5487
Anti-explosion index (RON+MON) /2 no less than	88	GB/T 503
Lead content ^a g/l not higher than	0.005	GB/T 8020
Iron content ^a g/l not higher than	0.01	SH/T 0712
Density (20°C), kg/m ³	735 to 765	GB/T 1884 GB/T 1885
Evaporation:		
10% evaporating temperature, °C	50 to 70	GB/T 6536
50% evaporating temperature, °C	90 to 110	
90% evaporating temperature, °C	160 to 180	
Evaporating point, °C	180 to 200	
Residue, % (volume percentage)	2	
Vapour pressure ^b , kPA	55 to 65	GB/T 8017
Actual colloid, mg/100 ml no higher than	4	GB/T 8019
Inducing period, min no less than	480	GB/T 8018
Sulphur content, % (mass percentage) no higher than	0.010 to 0.015	GB/T 380
Copper flake corrosion (50°C, 3h) Level no higher than	1	GB/T 5096
Water-soluble acid or alkali	Nil	GB/T 258
Mechanical impurity	Nil	GB/T 511
Water content	Nil	GB/T 260
Mercaptan (need to meet one of the following requirements):		
Mercaptan sulphur (Doctor Test Method)	Pass	SH/T 0174
Mercaptan sulphur content, % (mass percentage) no higher than	0.001	GB/T 1792
Oxygen, % (mass percentage) no higher than	2.3	SH/T 0663
Benzene, % (volume percentage) no higher than	1	SH/T 0713
Alkene, % (volume percentage) no higher than	30	GB/T 11132
Aromatic hydrocarbon content, % (volume percentage) no higher than	40	GB/T 11132
There are specified limits for lead and iron but these may not be added manually. No additives damaging the motor vehicle's evaporative purification system and harmful to human health should be added.		

Appendix E
(Specification appendix)
Calibration of Test Equipment for Evaporative Pollutant Emissions

E.1 Initial and Periodic Background Emission Quantity of Airtight Chamber

The airtight chamber should be checked to ensure there are no emitted HC materials inside before the initial use or after it has been in use for one year or after any repair, which could affect the background emissions of the airtight chamber.

E.1.1 Calibrate the hydrocarbon analyser with the zero and span settings.

E.1.2 Clear out the air in the chamber to get a stabilised background reading.

E.1.3 Switch the mixing blower on (if not switched on yet).

E.1.4 Seal the airtight chamber and measure the density of the hydrocarbon, the temperature and pressure, that is to take the initial readings of C_{HCi} , T_i and P_{ai} of the airtight chamber.

E.1.5 Take readings again after 4 hours. Use the same FID analyser to measure the HC density, i.e. the final density C_{HCf} , at the same time measure the final temperature and pressure.

E.1.6 Calculate the change in HC quantity in the airtight chamber using the formula in E4. The background emission quantity in 4 hours should not exceed 0.4 g.

E.2 Initial Capacity of Airtight Chamber

Calculate the capacity of the airtight chamber by the following procedure before using it:

E.2.1 Measure the length, width and height of the airtight chamber and any irregular parts (such as pillars and girders) and calculate its inside capacity.

E.2.2 Conduct a calibration check according to E.3.1 to E.3.7.

E.2.3 If the calculated quantity is 2% larger than the injected propane, a correction is needed.

E.3 Test and Calibration of HC Residue Quantity

The HC residue test can be used to check against the capacity calculation and to calculate the leakage ratio. The leakage ratio should be checked before putting the airtight chamber in use and monthly afterwards.

E.3.1 Calibrate the hydrocarbon analyser with the zero and span settings.

E.3.2 Clear out the air in the chamber to get a stabilised background reading.

E.3.3 Switch the mixing blower on (if not switched on yet).

E.3.4 Seal the airtight chamber and measure the background density of the hydrocarbon, the temperature and pressure as the initial readings of C_{HCi} , T_i and P_{ai} to determine the background values of the airtight chamber.

E.3.5 Inject a known quantity of pure propane into the airtight chamber (4 g can be injected). The quantity of the injected propane can be measured by measuring the volume flow and the mass flow. The accuracy of the measuring instrument is $\pm 0.5\%$.

E.3.6 Analyse the HC quantity in the air at least 5 minutes later after the mixing, and at the same time record the temperature and pressure. These measured values are the final reading of the calibrated airtight chamber and the initial reading for the residue check.

E.3.7 Calculate the propane quantity according to the measured values in E.4 and E.3.6 to confirm the airtight chamber's calibration. See E4 for the calculation formula, and the calculated value should be $\pm 2\%$ within the measured value.

E.3.8 Seal the airtight chamber and switch the mixing fan on. Keep it on for 4 hours without any sampling. After 4 hours analyse the HC quantity in the airtight chamber and record the temperature and pressure, this will be the final reading for the HC residue quantity check.

E.3.9 Calculate the HC quantity with the formula in E.4 and the readings in E.3.8, its value should not exceed 4% of E.3.6.

E.4 Calculation of HC Quantity Change To Determine Background Density and Leakage Ratio in Airtight Chamber

$$M_{HC} = K \times V \times 10^{-4} \times (C_{HCf} \times P_{af} / T_f - C_{HCi} \times P_{ai} / T_i)$$

In the formula:

- M_{HC} – mass (g) of the emitted hydrocarbon;
- C_{HC} – density of the hydrocarbon ppmC (ppmC = ppmC₃H₈ x3);
- V – volume of the airtight chamber (m³);
- T – temperature (K) in the airtight chamber;
- P_a – atmospheric pressure (kPa);
- K – 17.6;
- i – initial reading;
- f – final reading.

E.5 Calibration of Hydrocarbon Analyser

Initial and periodic calibrations should be carried out on the FID HC analyser. The FID operating temperature is 464 \pm 6K (191 \pm 6°C).

E.5.1 Best Response Characteristics of Analyser

The FID HC analyser should be adjusted to its best response characteristics before use and it should be adjusted at least once a year afterwards.

E.5.1.1 Operate the instrument according to the manufacturer's manual or rules, use propane gas (use air as the balance gas) to optimise the response characteristics in the most frequently used working ranges.

E.5.1.2 Keep the most operated ranges in the best condition. Make the propane density injected in the analyser equal to 90% of the density in the most frequently operated ranges.

E.5.1.3 The selected fuel flow rate should have the maximum response characteristics with the minimum deviation.

E.5.1.4 Use the above fuel flow volume setting and change the air flow volume to determine the best air flow volume.

E.5.1.5 When the best flow rate has been reached, record the value for reference.

E.5.2 Initial and Periodic Calibration

The FID HC analyser should be calibrated before and after use monthly, and the calibration should be carried out on all ranges in the usual test.

E.5.2.1 Adjust the instrument to its best performance.

E.5.2.2 Set the analyser to zero with the zero air setting.

E.5.2.3 Inject the propane into the airtight chamber and mix it with the calibrated air to the normal instrument operating density of 15%, 30%, 45%, 60%, 75% and 90%. In each calibration range, if the deviation between the measured value and the corresponding value of the straight line drawn by the least squares method is within 2%, its density value can be calculated by a single calibration coefficient in this range; if the deviation at any point exceeds 2%, the best approximate non-linear equation which can represent the data within 2% of each test point should be used to determine its density.
