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National Standard of the People's Republic of China

GB 18176-2016

Supersede GB 18176-2007 & GB 20998-2007, and partially supersede GB 14621-2011

Limits and Measurement Methods for Emissions from Mopeds (China IV)

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Promulgated by

Ministry of Environmental Protection (MEP)

and

General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ)

Contents

Foreword

This standard is formulated for the purposes of implementing the "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" , preventing and controlling the environmental pollution from mopeds, and improving the ambient air quality.

This standard provides the limits and measurement methods for tailpipe emissions and evaporative emissions from mopeds, together with the requirements for crankcase emissions, the requirements for durability test of emission-control devices and the technical requirements for on-board diagnostic (OBD) system.

Also, this standard provides the requirements for the type test of mopeds, the inspection and decision methods for conformity of production.

In this standard, test type I & test type II are modified from the Global Technical Regulation (GTR) No. 2 "Measurement procedure for two-wheeled motorcycles equipped with a positive or compression ignition engine with regard to the emission of gaseous pollutants, CO_2 emissions and fuel consumption", the EU Regulation "on the approval and market surveillance of two- or three-wheel vehicles and quadricycles" (No.168/2013) and the EU Regulation " supplementing Regulation (EU) No 168/2013 of the European Parliament and of the Council with regard to environmental and propulsion unit performance requirements and amending Annex V thereof" (No.134/2014).

Compared to the EU regulations above, the main modifications of this standard include:

— In the test type II, adding the requirements for the limits under two-speed idle conditions;

— Modifying the technical requirements for test type III;

— Modifying the technical requirements for on-board diagnostic (OBD) system;

— Modifying the technical requirements for reference fuels of test.

This standard constitutes the amendment to GB 18176-2007 "Limits and measurement methods for the emissions from mopeds on the running mode (CHINA stage III)" and GB 20998-2007 "Limits and measurement methods for evaporative pollutants from motorcycles and mopeds", with the main modifications including:

— Tightening the emission limits for the test type I of mopeds;

— Adding the requirements for test type II;

— Regarding test type V, adjusting the durability test mileage;

— Adding the test requirements for precious metal load of catalytic converter;

— Adding the test requirements for initial butane working capacity of canister;

— Adding the technical requirements for on-board diagnostic (OBD) system;

— Modifying the technical requirements for reference fuels of test.

This standard modifies the section of emission limits of type test and conformity of production inspection in "Limits and measurement methods for exhaust pollutants from motorcycles and mopeds under two-speed idle conditions" (GB 14621-2011).

In this standard, Annex A, Annex B, Annex C, Annex D, Annex E, Annex F, Annex G, Annex H, Annex I, Annex J are normative annexes.

This standard is formulated under the leadership of Department of Science, Technology, and Standards, Ministry of Environmental Protection.

Drafting committee of this standard: Tianjin Motorcycle Technology Center, Chinese Research Academy of

Environmental Sciences, National Motorcycle Quality Supervision and Testing Center.

This standard was approved by Ministry of Environmental Protection on May 11, 2016.

From the promulgation date of this standard, type test may be performed in accordance with this standard. From July 1, 2018, All type-tested mopeds should meet the requirements of this standard. From its effective date, this standard shall supersede GB 18176-2007, GB 20998-2007, and partially supersede GB 14621-2011.

This standard is interpreted by the Ministry of Environmental Protection.

Limits and Measurement Methods for Emissions from Mopeds (China IV)

1 Scope

This standard provides the limits and measurement methods for tailpipe emissions and evaporative emissions from mopeds, together with the requirements for crankcase emissions, the requirements for durability test of emission-control devices and the technical requirements for on-board diagnostic (OBD) system.

This standard provides the requirements for the type test of mopeds, the inspection and decision methods for conformity of production.

This standard applies to the two- or three-wheel mopeds powered by positive-ignition engine, the engine capacity is not more than 50 mL, the maximum design vehicle speed is not more than 50 km/h.

2 Normative References

This standard quoted the following documents or provisions thereof. For undated reference documents, the latest version shall apply throughout this standard.

GB/T 15089-2001	Classification of power-dirven vehicles and trailers
HJ/T 289	Equipment specifications and quality control requirements for Gasoline vehicles in two-speed idle exhuast emission test
QC/T 1003	Determination of precious metal in metal support catalytic converter for motorcycles
ISO 2575 : 2010	Road vehicles – Symbols for controls, indicators and tell-tales
ISO 9141-2	Road vehicles – Diagnostic systems – Part 2: CARB requirements for interchange of digital information
ISO 14229-3	Road vehicles – Unified diagnostic services (UDS) – Part 3: Unified diagnostic services on CAN implementation (UDSonCAN)
ISO 14229-4	Road vehicles – Unified diagnostic services (UDS) – Part 4: Unified diagnostic services on FlexRay implementation (UDSonFR)
ISO 14230-4	Road vehicles – Diagnostic systems – Keyword Protocol 2000 – Part 4: Requirements for emission-related systems
ISO 15031-3	Road vehicles – Communication between vehicle and external equipment for emissions-related diagnostics – Part 3: Diagnostic connector and related electrical circuits, specification and use
ISO 15031-4 : 2014	Road vehicles – Communication between vehicle and external equipment for emissions-related diagnostics – Part 4: External test equipment
ISO 15031-5 : 2011	Road vehicles – Communication between vehicle and external equipment for emissions-related diagnostics – Part 5: Emissions-related diagnostic services
ISO 15031-6 : 2010	Road vehicles – Communication between vehicle and external equipment for emissions-related diagnostics – Part 6: Diagnostic trouble code definitions
ISO 15765-4	Road vehicles – Diagnostics on Controller Area Network (CAN) – Part 4: Requirements for emissions-related systems
ISO 19689	Motorcycles and Mopeds – Communication between vehicle and external

	equipment for diagnostics – Diagnostic connector and related electrical circuits, specification and use
ISO 22901-2	Road vehicles – Open diagnostic data exchange (ODX) – Part 2: Emissions-related diagnostic data
SAE J1850	Class B data communications network interface

3 Terms and Definitions

The following terms and definitions shall apply throughout this standard.

3.1 Moped

According to GB/T 15089-2001:

Two-wheel moped (category L_1): The two-wheel vehicle of which, in case internal combustion engine is used, the cylinder displacement is not more than 50 mL, and, no matter what kinds of propulsion, the maximum design vehicle speed is not more than 50 km/h.

Three-wheel moped (category L_2): The vehicle of which, in case internal combustion engine is used, the cylinder displacement is not more than 50 mL, and, no matter what kinds of propulsion, the maximum design vehicle speed is not more than 50 km/h, and three wheeled vehicle with any wheel arrangement.

3.2 Type test

The engineering approval evaluation test performed over the new products from trial production after the completion of the design of one vehicle type of moped, with the aim to validate whether the products could fulfill the technical requirements of this standard.

3.3 Gas fuel

Liquefied petroleum gas (LPG) or natural gas (NG).

3.4 Bi-fuel moped

Moped which could be powered by gasoline and by one kind of gaseous fuel; however, both fuels cannot be used simultaneously.

3.5 Mono fuel gas moped

Moped which could be powered only by one kind of gaseous fuel (NG or LPG), or moped which could be powered by a gaseous fuel (NG or LPG) and gasoline but gasoline is only used for emergencies or for engine starting.

3.6 Equivalent inertia

Means the mass equivalent to the inertia when the moped is moving and rotational inertia by using inertia emulator to emulate it on a chassis dynamometer.

3.7 Reference mass

The complete vehicle kerb mass of moped plus the driver's mass of 75 kg.

3.8 Diluted gases

The uniform gas mixture obtained after the moped's exhaust gas is diluted by the surrounding air.

3.9 Gaseous pollutants

CO, HC and NO_X represented by NO_2 in the tailpipe emissions. HC assumes the carbon-hydrogen ratio as follows:

— Gasoline: $C_1H_{1.85}$;

— LPG: $C_1H_{2.525}$;

— NG: CH_4.

3.10 Tailpipe emissions

The gaseous pollutants emitted from the exhaust pipe of moped.

3.11 Operating mode at normal idling speed or at high idling speed

Operating mode at normal idling speed means the engine's no-load running state at the minimum stable speed, i.e., the engine running in the normal condition, with the transmission set to the neutral, the throttle control set to the minimum, the choke set to fully open, and the engine speed complying with the instructions of the manufacturer's documentation.

Operating mode at high idling speed means: meet the above conditions (except the position of throttle control; as for vehicles with automated transmission, the driven wheels shall remain the free state), through regulating the throttle control, steadily control the engine speed at the high idle speed specified in the manufacturer's documentation, but no less than 2,000 r/min). If there are no instructions in the documentation, engine speed shall be controlled at 2,500 r/min ± 250 r/min.

3.12 Crankcase emissions

The gaseous pollutants emitted into the atmosphere from the vent hole of engine's crankcase or the aperture of lubricating system.

3.13 Evaporative emissions

The hydrocarbon vapors that are lost through the moped's fuel (gasoline) system other than emitted from the moped's exhaust pipe. They include:

Diurnal breathing loss: Hydrocarbon emissions caused by temperature changes in the fuel storage tank (assuming a ratio of $C_1H_{2.33}$).

Hot-soak loss: Hydrocarbon emissions arising from the fuel system of a stationary moped after a period of driving (assuming a ratio of $C_1H_{2.20}$).

3.14 Volume of the carbon in canister

The volume of canister for loading carbon.

3.15 Weight of carbon in canister

The filling mass of the carbon stored in canister.

3.16 Efficient loading quality of canister

The difference in total mass between the canister after absorption of vapor and the canister after the desorption.

3.17 Bed volume of canister

The designed capacity in the canister for containing charcoal.

3.18 Initial butane working capacity of canister

The effective absorption quantity per unit of volume of the carbon in canister after 13 test runs.

3.19 Breakthrough point

The moment when fuel evaporative emissions accumulate to 2 g.

3.20 Non-exposed type of fuel storage tank

A fuel storage tank on vehicle which, except the fuel storage tank cap, is not directly exposed to the irradiation of sunshine.

3.21 On-board diagnostic (OBD) system

An on-board diagnostic system (in short, "OBD") for emission control which must have the capability of identifying the likely area of malfunction, this information is stored in the memory of electronic control unit as the form of a fault code.

3.22 Defect device

A device which measures, senses or responds to moped operation parameters (e.g., vehicle speed, engine RPM, transmission gear position, temperature, manifold vacuum or other parameters) for the purpose of activating, modulating, delaying or deactivating the operation of any part or the function of the emission control system, that reduces the effectiveness of the emission control system under normal moped use conditions.

The following devices shall not be considered as defeat devices:

(1) The purpose for the device is justified in terms of protecting the engine against damage or accident and for safe operation of the moped;

(2) The device acts only when the engine starting;

(3) The device actually acts in the type I or IV test.

3.23 Irrational emission control strategy

A measure or method which, with the moped under the normal working and use conditions, makes the effectiveness of its emission control system to reduce to an emission level not in compliance with the type test requirements.

3.24 Emission-control devices

The devices on moped which are used for controlling or restricting tailpipe emissions or evaporative emissions.

3.25 Fuel

The fuel used by moped engine in the normal circumstances, include:

— Gasoline;

— LPG;

— NG;

— Gasoline and LPG;

— Gasoline and NG.

3.26 Cold-start device

The device used for temporarily enriched oil-gas mixture for assisting the engine start-up.

4 Type Test and Test Information Publication

4.1 Type test shall be performed in accordance with this standard, and the requirements of this standard shall be satisfied.

4.2 Moped manufacturer or its authorized agent shall make information public in accordance with Annex A and Annex B; if manufacturer's confidential information is involved, it may merely make the information public to the competent authority.

4.3 For the purpose of performing the test that described in Chapter 6, it must submit one representative sample vehicle to the testing institutions responsible for type test. For the test type IV, it shall also submit two identical sets of canisters, and for the test type V, it shall also submit two identical sets of catalytic converters.

5 General Requirements

5.1 The designing, manufacturing and assembling of the parts that affect the tailpipe emissions, crankcase emissions, and evaporative emissions shall ensure the moped should meet the requirements of this standard, when it is in normal use, no matter what kind of vibration the vehicle is experiencing.

5.2 Moped manufacturers must adopt technical measures to ensure that moped meets the requirements of Chapter 6 and Chapter 7. If such, it is deemed that, under the normal service conditions and within the life cycle, the tailpipe emissions and evaporative emissions could be controlled within the limits provided in this standard.

5.3 Moped manufacturer must take one of the following measures to avoid excessive evaporative emissions and fuel spillage caused by the loss of fuel storage tank cap.

(1) An automatically opening and closing, non-removable fuel storage tank cap;

(2) Design structure which avoid excessive evaporative emissions caused by the loss of fuel storage tank cap;

(3) Any other measures which have the same effect. For examples, a tethered fuel storage tank cap; or a same key to be shared by the lock of fuel storage tank cap and moped's ignition, and the key shall be removable from the locked fuel storage tank cap.

5.4 All moped shall be equipped with OBD system, and this system shall be such designed, manufactured and assembled that the moped could identify and record the fault types within the entire life cycle. Unless after the type test, no tampering which would affect emissions should be performed over the technical measures employed by manufacturer and the OBD system equipped on moped. OBD system shall be equipped with a malfunction indicator (MI) that could rapidly make the driver perceive.

5.5 The security of electronic control system should meet the following requirements:

(1) Any moped with an electronic control unit to control emissions should be able to prevent modification, unless authorized by the manufacturer. Any removable chips for saving calibration data shall be encased in a sealed container or protected by electronic algorithms and the saved data shall not be changed without using specialized tools and procedures. Such protection requirements merely apply to the functions directly relating to emissions calibration or relating to the protection against unauthorized use of vehicle.

(2) Engine operating parameters that expressed in electronic control unit codes should not be changed without using specialized tools and procedures (e.g., welded or sealed electronic control unit components, or enclosed (or sealed) electronic control unit box).

(3) Manufacturers using electronic control unit programmable code system (e.g., Electrical Erasable Programmable Read-Only Memory) should be able to prevent unauthorized reprogramming. Manufacturers should take tamper protection strategies and anti-compilation function, for example, requiring electronic access to an off-site computer system maintained by manufacturer. Such method should be made publice to the competent authority.

5.6 Moped is prohibited to use any defeat device and (or) irrational emission control strategy.

5.7 When one of the following requirements is met, moped could installed with and put into use any related engine control device, function, system or measure.

(1) For engine protection, cold start or warm-up only;

(2) For operation security or insurance and limp home only.

5.8 In case the engine control device, function, system or measure used by moped would lead to that the employed engine control strategy is different from that normally used in the emission test cycle or that an adjusted engine control strategy is used, if it shall be sufficiently demonstrated that such measure would not reduce the efficiency of the emission control system, the measure is permitted. Under all the other conditions, it is deemed defeat device.

6 Type Test Requirements

6.1 Test items

During the type test, the test items of moped are shown in Table 1.

Table 1 Test items

Classification of test	Moped		
	Gasoline	Bi-fuel	Mono fuel gas
Test type I	Yes	Yes (two fuels)	Yes
Test type II	Yes	Yes (two fuels)	Yes
Test type III	Yes	Yes (gasoline only)	Yes
Test type IV [a]	Yes	Yes (gasoline only)	No
Test type V [b]	Yes	Yes (gasoline only)	Yes
OBD system test	Yes	Yes (two fuels)	Yes

Note 1: Test type I: The test of tailpipe emissions after cold start at normal ambient temperature.

Note 2: Test type II: Measuring CO and HC under two-speed idle conditions and λ value (excess-air coefficient) at the high idling speed.

Note 3: Test type III: The test of crankcase emissions.

Note 4: Test type IV: The test of evaporative emissions.

Note 5: Test type V: The durability test of emission-control devices.

a Before test type IV, it should also test the canister in accordance with the requirements of 6.2.4.3.

b Before test type V, it should also test the catalytic converter in accordance with the requirements of 6.2.5.1.

6.2 Emission limit requirements and test methods

6.2.1 Test type I (test of tailpipe emissions after cold start at normal ambient temperature)

6.2.1.1 All mopeds should perform this test.

6.2.1.2 In the case of bi-fuel mopeds, the two fuels should be respectively used for performing the test type I.

6.2.1.3 Test type I should be performed in accordance with the method provided in Annex C . Various tailpipe emission gases should be collected and analyzed in the prescribed method.

6.2.1.4 The flowchart of test type I is shown in Figure 1.

6.2.1.5 Moped should be placed on chassis dynamometer equipped with power absorbing device and inertia simulation device.

6.2.1.6 During the test, exhaust gas shall be diluted, and sample gas shall be proportionally collected into the sampling bag. The exhaust gas of test vehicle shall be diluted, collected and analyzed in accordance with requirements, and the total volume of the diluted exhaust gas shall be measured.

6.2.1.7 Except the cases provided in 6.2.1.8, the test should be performed three times. For each test, the measured value of CO, HC, NOx and PM should be multiplied with the deterioration factor (DF) as determined in 6.2.5, and all the calculated values should be less than the emission limits provided in Table 2.

Table 2 Emission limits of test type I

Vehicle category	Emission limits (mg/km)			Test cycle
	CO	HC	NOx	
Two-wheel moped	1000	630	170	See Annex C
Three-wheel moped	1900	730	170	

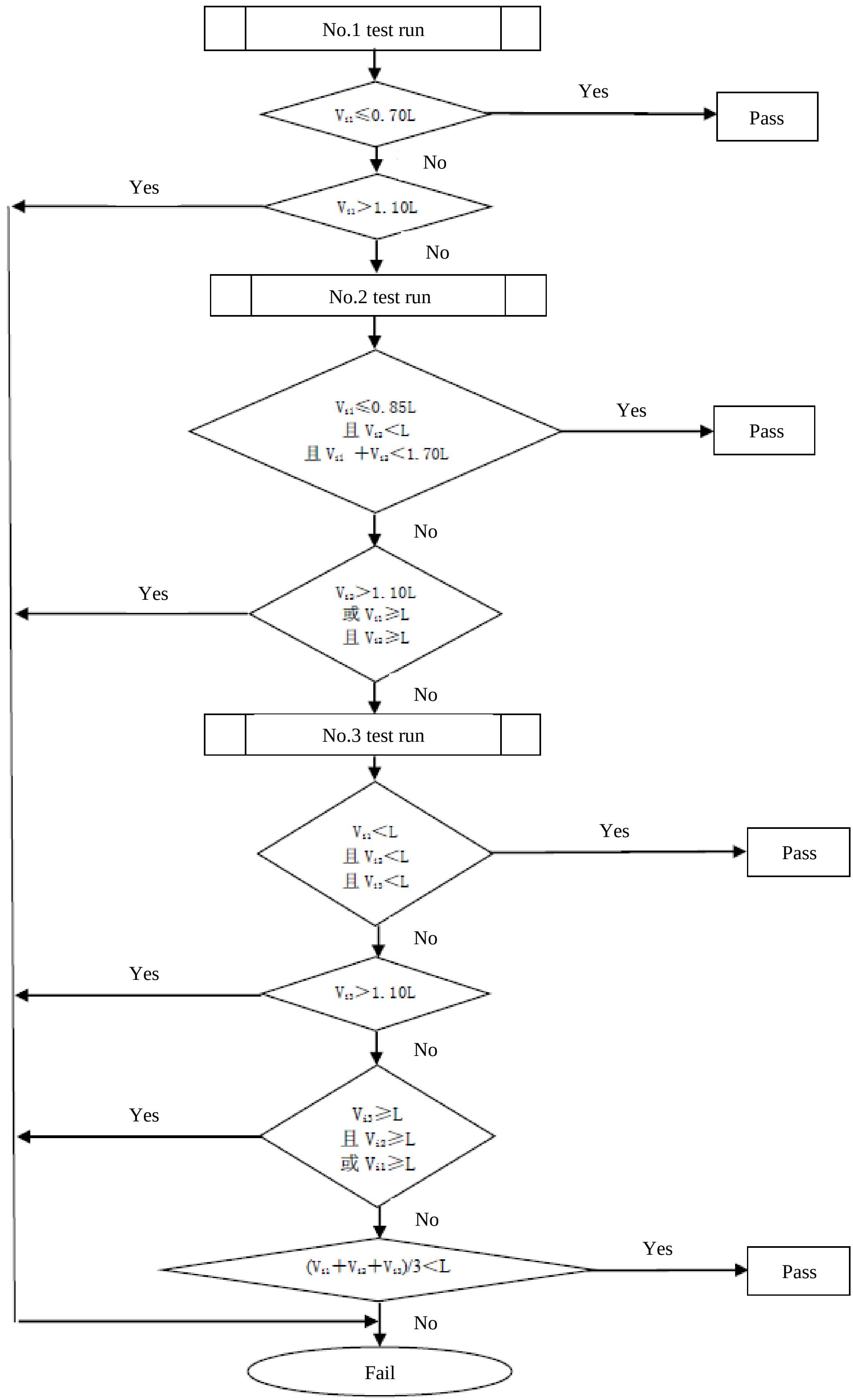

Figure 1　The flowchart of test type I

6.2.1.8　Notwithstanding the provisions of 6.2.1.7, for each pollutant above, if the arithmetic average of three measurement result is less than the specified limit, one of the three measurement results is permitted to exceed the specified limit, but does not exceed 1.1 times of the limit. More than one pollutant is allowed to exceed the specified limit, irrespective of occurring within the same test or in different test.

6.2.1.9 Under the following conditions, the number of test provided in 6.2.1.7 could decrease. For each pollutant mentioned in 6.2.1.7, V_1 and V_2 respectively denote the measuring result of the first test and the second test, 'L' is the limit of each pollutant provided in Table 2 of 6.2.1.

6.2.1.9.1 For all the pollutants, if $V_1 \leq 0.70$ L, only one test is required.

6.2.1.9.2 In case each pollutant doesn't meet the requirements of 6.2.1.9.1, but each pollutant meets the requirements that $V_1 \leq 0.85$ L and $V_1 + V_2 < 1.70$ L & $V_2 < L$, then merely two tests are required.

6.2.2 Test type II (test under two-speed idle conditions)

6.2.2.1 All the mopeds should be performed this test.

6.2.2.2 In the case of bi-fuel mopeds, the two fuels should be respectively used for performing this test.

6.2.2.3 In the case of mono fuel gas mopeds, only the gaseous fuel should be used for performing this test.

6.2.2.4 When manufacturer undergoes the type test, the test results under two-speed idle conditions should meet the requirements of Table 3, and the λ value at high idle speed should be controlled within ± 0.05 of manufacturer's declared value.

Table 3 Emission limits for test type II (test under two-speed idle conditions) (volume fraction)

Operating mode at normal idling speed		Operating mode at high idling speed	
CO (%)	HC [a] (ppm) [b]	CO (%)	HC [a] (ppm) [b]
0.8	150	0.8	150

[a] HC (v/v) is expressed as the n-hexane equivalent.
[b] $1ppm=10^{-6}$, through this standand.

6.2.2.5 Test should be performed immediately after the completion of the test type I, and the test method should comply with the provisions of Annex D.

6.2.3 Test type III (test of crankcase emissions)

The engine's crankcase ventilation system don't allow to discharge any crankcase emissions into the atmosphere. If necessary, the manufacturer shall provide the approval authority with technical details and drawings to prove that the engine is or engines are so constructed as to prevent any fuel, lubrication oil or crankcase gases from escaping to the atmosphere from the crankcase gas ventilation system.

6.2.4 Test type IV (test of evaporative emissions)

6.2.4.1 Except mono fuel gas moped, all the mopeds equipped with P.I. engine should be performed this test. In the case of bi-fuel mopeds, this test should be performed merely with the gasoline.

6.2.4.2 Test shall be performed in accordance with Annex E, and the evaporative emissions should not exceed 2.0 g/test.

6.2.4.3 Before the test, moped manufacturer should separately provide two identical sets of canisters, with one canister to be mounted on vehicle for performing the type IV test, while the other canister to be tested for its initial butane working capacity (BWC) in accordance with the test method of Appendix EB, and the measuring results should not exceed 1.15 times of the value declared by manufacturer.

6.2.5 Test type V (durability test of emission-control device)

6.2.5.1 Before the test, manufacturer should also separately provide two identical sets of catalytic converters, with one catalytic converters for performing the durability test while the other catalytic converters to be tested for its content of precious metals in accordance with the provisions of QC/T 1003, and the measuring results should not exceed 1.2 times of the value declared by manufacturer.

6.2.5.2 All the mopeds to undergo type test should be performed the emission deterioration durability test, and the test method should comply with the provisions of Annex F. Total mileage of moped durability test is 11000km.

6.2.5.3 According to the requirements of manufacturer, before the completion of the test type V, the testing institutions could use the DF of Table 4 for performing the type I test. After the completion of test type V, the testing institutions should substitute the DF measured in accordance with Annex F for the DF of Table 4.

Table 4 Deterioration factor (DF)

CO	HC	NOx
1.3	1.2	1.2

6.2.5.4 DF should be determined in accordance with the test procedures provided in 6.2.5.2. DF is used to determine whether the tailpipe emissions of moped meet the requirements provided in 6.2.1 and 7.1.

6.2.6 Requirements for on-board diagnostic (OBD) system

Moped's OBD system should be tested in accordance with Annex G, and should meet the requirements therein.

6.3 Test fuel

Except the test type V, all the tests should adopt the reference fuel in accordance with the requirements of Annex H; test type V should adopt the commercially available vehicle fuel in accordance with the provisions of appropriate standard.

7 Conformity of Production (COP) Inspection

Measures should be performed in accordance with Annex I for assuring COP. COP inspection is based on Annex A and Annex B, and if necessary, all or partial tests described in Chapter 6 shall be performed.

7.1 COP inspection for test type I

7.1.1 Upon test type I, if the moped for type test has one or more extensions, then such test may be performed on the vehicle type or a correlated extension type described in Annex A.

7.1.2 Once the competent authority selects moped, manufacturer can't make any adjustment over the selected moped.

7.1.2.1 Randomly pick three vehicles of a vehicle type, and perform the test type I in accordance with the provisions of Annex C. The DF measured during type test shall be adopted. The limits are provided in Table 2.

7.1.2.2 If the competent authority accepts the production standard deviation provided by the manufacturer in accordance with Annex I, then the test result shall be judged in accordance with IA.1.

7.1.2.3 If the competent authority doesn't accept the production standard deviation provided by the manufacturer or the manufacturer doesn't have related records, then the test result shall be judged in accordance with IA.2.

7.1.2.4 According to the decision criteria of IA.1 or IA.2 and based on the quantity of sample vehicles picked for test, once all the pollutants meet the critical value for pass decision, then this series of products are deemed qualified as to the test type I; once a pollutant satisfies the critical value for fail decision, then this series of products are deemed disqualified as to the type I test.

Once a pollutant meets the critical value for pass decision, such conclusion would not change along with the additional test performed for other pollutant(s) to draw its/their conclusion. If it cannot be decided that all the pollutants meet the critical value for pass decision, and meanwhile it cannot decide that a pollutant meets the critical value for fail decision, then another vehicle should be picked for test; see Figure 2.

If the statistics of a pollutant neither meets the critical value for pass decision nor meets the critical value for fail decision, upon picking additional vehicles for test, manufacturer requests for terminating the test with additional vehicles, then the COP inspection with respect to test type I should be deemed disqualified.

7.1.2.5 Notwithstanding the requirements of 7.1.2.2 ~ 7.1.2.4, the competent authority could select the following decision criteria:

-- If the emission results of various pollutants of the three vehicles don't exceed 1.1 times of the limit, and their average doesn't exceed the limit, then the COP inspection with respect to type I test shall be deemed qualified.

-- If the emission result of a pollutant of any of the three vehicles exceeds 1.1 times of the limit, or its average exceeds the limit, then the COP inspection with respect to type I test shall be deemed disqualified.

7.1.3 Sample vehicles shall be directly picked out of the qualified inspected vehicles at the end of the production line for carrying out the test, and the test vehicles don't need to run-in. Upon manufacturer's request, run-in of less than 250 km may be performed in accordance with manufacturer's run-in specifications, but no adjustment should be carried out over these mopeds.

7.1.4 Commercially available vehicle fuel in accordance with appropriate standard provisions shall be used for the test. At the request of manufacturer, the reference fuel provided in Annex H could be adopted.

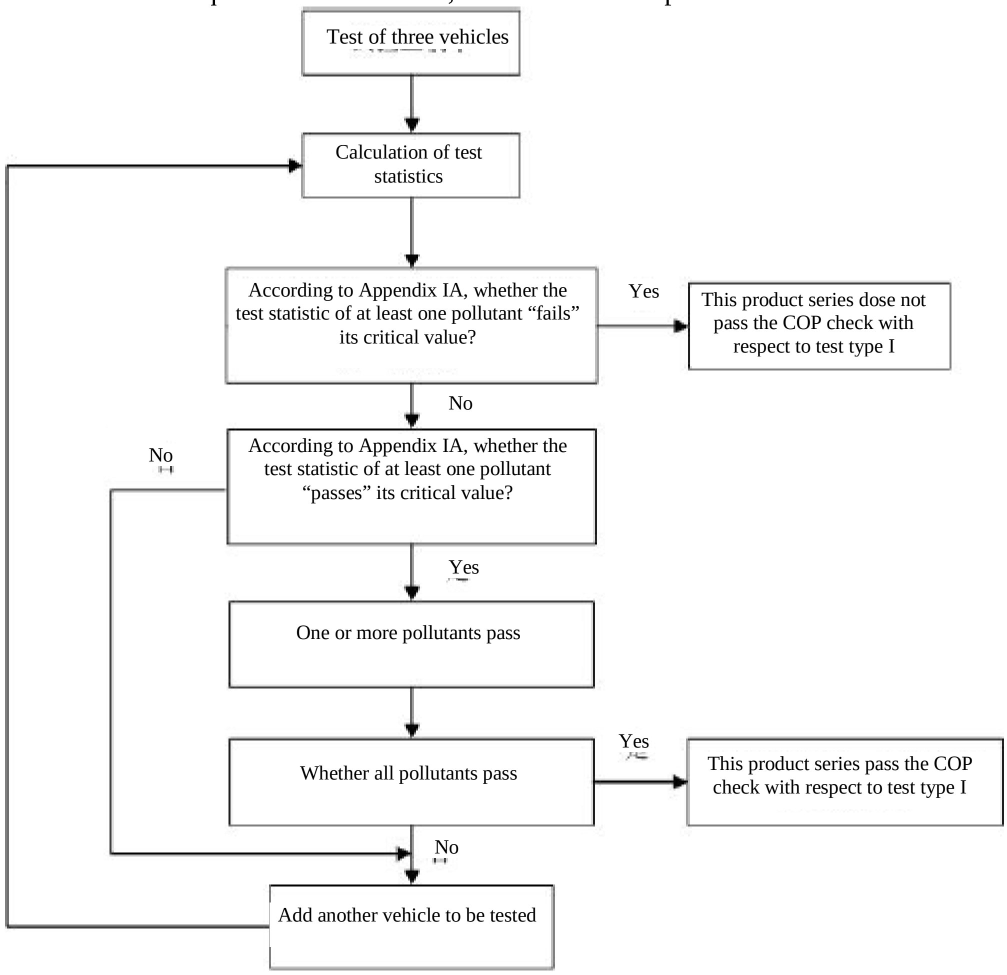

Figure 2 The flowchart of test type I for the COP inspection

7.2 COP inspection for test type II

7.2.1 COP inspection for the test under two-speed idle conditions of the mopeds ,manufacturer should perform spot check of test under two-speed idle conditions, over the qualified inspected mopeds at the end of the production line.

7.2.2 The CO , HC emissions of moped under two-speed idle conditions and the λ value at high idling speed should meet the requirements of 6.2.2. 4.

7.3 COP inspection for test type III

It should meets the requirements of 6.2.3.

7.4 COP inspection for test type IV

COP inspection should be performed in accordance with the provisions of E.7.

7.5 COP inspection of OBD system

7.5.1 Randomly pick three vehicles from the mass production, and perform the test that is provided in Annex G.

7.5.2 If all the three vehicles meet the requirements that is provided in Annex G, then the OBD system is deemed meeting the COP requirements. Otherwise, the COP inspection of the OBD system is deemed disqualified.

7.6 COP inspection of canister

7.6.1 Randomly pick three vehicles (or three sets of canisters) from the assembling line or mass production, and test the initial butane working capacity (BWC) of canister in accordance with the provisions of Appendix EB.

7.6.2 Decision criteria of canister's COP:

-- If the measuring results of initial butane working capacity (BWC) of all the three sets of canisters under test are not less than 0.85 times of the declared value, and their average is not less than 0.9 times of the declared value, then the canister's COP inspection is deemed qualified.

-- If the measuring result of initial butane working capacity (BWC) of any of the three sets of canisters under test is less than 0.85 times of the declared value, or their average is less than 0.9 times of the declared value, then the canister's COP inspection is deemed disqualified.

7.7 COP inspection of catalytic converter

7.7.1 Randomly pick three vehicles (or three sets of catalytic converters) from the assembling line or mass production, and test the content of each precious metal of the sampled catalytic converters in accordance with the provisions of QC/T 1003.

7.7.2 Decision criteria of COP of catalytic converter:

-- If the measuring results of content of various precious metals of the three sets of catalytic converters under test are not less than 0.8 times of the declared value, and their average is not less than 0.85 times of the declared value, then the COP inspection of catalytic converter is deemed qualified.

-- If the measuring result of content of a precious metal of any of the three sets of catalytic converters is less than 0.8 times of the declared value, or their average is less than 0.85 times of the declared value, then the COP inspection of catalytic converter is deemed disqualified.

7.8 General requirements

If a vehicle type cannot meet any paragraph of the COP inspection requirements provided in 7.1 ~ 7.7, moped manufacturer should take all the necessary measures for re-establishing the COP assurance system as soon as possible.

8 Extension of Vehicle Type

Extension of vehicle type should meet the requirements of Annex J. When extension is granted to a vehicle type, such extended vehicle type cannot be further extended to other vehicle types.

9 In-service Conformity

Manufacturer should take measures to ensure that, within the durability mileage stipulated in this standard and under the normal service conditions, the emission control devices equipped on moped could remain normal operation and comply with the emission limits of the related pollutants.

10 Implementation of Standard

10.1 Type test

From July 1, 2018, all the mopeds to undergo type test should meet the requirements of this standard. Before the effective date mentioned above, type test could be performed in accordance with the corresponding requirements of this standard.

10.2 Sales and initial registration

From July 1, 2019, all the mopeds for sales and initial registration should meet the requirements of this standard.

In the regions suffering severe pollution from power-driven vehicles, this standard could be put into implementation ahead of schedule for improving the air quality.

Annex A

(Normative)

Type Test Related Information

For any drawings in the documents submitted, details shall be explained at appropriate scales. In case picture exists, its details shall be provided. If the systems, components or stand-alone technologies are controlled by micro-processors, their performance information shall be provided as well.

A.1 Introduction

A.1.1 Trademark of moped ________________________________

A.1.2 Model of moped____________________________________

A.1.3 Vehicle identification number_________________________

A.1.4 Category of vehicle__________________________________

A.1.5 Name and address of manufacturer_____________________

A.1.6 Name and address of assembly plant___________________

A.1.7 Location of nameplate of vehicle______________________

A.2 General construction characteristics of moped

A.2.1 Photo and/or drawing of representative moped

A.2.2 Scale drawing of the whole vehicle

A.2.3 Axle base___________________mm; Wheel spacing___________________mm

A.2.4 Number of axles and wheels ___________________

A.2.5 Position and arrangement of engine_____________

A.2.6 Authorized occupant number (incl. driver)___________________

A.2.7 Max. designed vehicle speed___________________km/h

A.3 Mass parameters of the whole vehicle

A.3.1 Kerb mass_____________________kg

A.3.2 Reference mass___________________kg

A.3.3 Distribution of reference mass between axles_________________________________kg

A.3.4 Manufacturer's max. payload___________________kg

A.3.5 Distribution of max. payload between axles___________________________________kg

A.3.6 Max. technically permissible mass on each axle___________________kg

A.4 Engine

A.4.1 Manufacturer___________________

A.4.2 Make or trademark___________________

A.4.3 Model___________________

A.4.4 Location of engine code_____________________

[1] Strike out what doesn't apply

A.4.5 Working principles: 2-/4-stroke [1)]

A.4.6 Number and arrangement of cylinders___________________

A.4.7 Cylinder centerline spacing [3)] ___________________ mm

A.4.8 Ignition order_________________

A.4.9 Bore___________________mm

A.4.10 Stroke___________________mm

A.4.11 Working capacity of cylinder___________________mL

A.4.12 Compression ratio [2)]___________________

A.4.13 Min. & max. sectional diameter of intake and exhaust ports___________________mm

A.4.14 Drawings of cylinder head, piston, piston ring and cylinder block

A.4.15 Normal idle speed of engine (incl. tolerance)___________________r/min [2)]

A.4.16 High idle speed (incl. tolerance)___________________ r/min [2)]

A.4.17 Control range of λ value at high idle speed of engine [2)] ___________________

A.4.18 Max. net power of engine ____kW and corresponding rotation speed____r/min [2)]

A.4.19 Fuel: gasoline/LPG/NG [1)]

A.4.20 Max. torque of engine ____N·m and corresponding rotation speed____r/min [2)]

A.4.21 Cooling system: (liquid cooling /air cooling) [1)]

A.4.21.1 Liquid cooling

A.4.21.1.1 Liquid characteristics: water/oil/coolant [1)]

A.4.21.1.2 Circulation pump: Yes/No [1)]

A.4.21.1.3 Max. outlet temperature___________________°C

A.4.21.2 Air cooling

A.4.21.2.1 Fan: Yes/No [1)]

A.4.21.2.2 Location of reference point ___________________

A.4.21.2.3 Max. temperature of reference point___________________°C

A.4.22 With or without supercharger, and description of supercharging system______________

A.4.23 Intercooler: with/without [1)]

A.4.24 Crankcase gas recirculation device (description and schematic drawing)_______________

A.4.25 Air filter: Drawing or manufacturer & model___________________

A.5 Pollution control device

A.5.1 Catalytic converter: with/without [1)] ___________________; Model:___________________

A.5.1.1 Manufacturer of catalytic converter ___________________

1) Strike out what doesn't apply
2) Specify the tolerance
3) Exempted in the case of multi-cylinder engine other than of the in-line type

A.5.1.2 Number of catalytic converters and elements ________________

A.5.1.3 Dimensions (mm) and shape of catalytic converter（volume, ...）________________

A.5.1.4 Type of catalytic reaction (oxidization, three-way, ...)___________________

A.5.1.5 Total content (g) and ratio of precious metals _________________________

A.5.1.6 Substrate (structure and material)______________________

A.5.1.7 Cell density___________________

A.5.1.8 Casing of catalytic converter _________________________

A.5.1.9 Location of catalytic converter (position and reference distance in the exhaust system)______mm

A.5.2 Air injection device: with/without [1)]

A.5.2.1 Manufacturer of air injection device_____________; Model: __________________

A.5.2.2 Type (air pulsation, air pump, ...)_______________________

A.5.3 Exhaust gas re-circulation device (EGR): with/without [1)]_________; Model: ________

A.5.3.1 Characteristics (flow rate, ...)___________________

A.5.3.2 Working principles: (internal/external) [1)]

A.5.3.3 Type______________________

A.5.3.4 Max. EGR rate (± 5%)___________________

A.5.4 Oxygen sensor: with/without [1)]____________________; Model: __________________

A.5.4.1 Manufacturer___________________

A.5.4.2 Type______________________

A.5.4.3 Working principles: (narrow-band/broad-band/others) [1)]___________________

A.5.4.4 Functionality of OS in the closed-loop controlled fuel system (chemical equivalent ratio/lean-burn/rich-burn) [1)]________________

A.5.5 Evaporative emission control device

A.5.5.1 Evaporative emission control device: with/without [1)]

A.5.5.1.1 Detailed explanations of the devices and their adjustment state

A.5.5.1.2 Schematic drawing of evaporative emission control system

A.5.5.1.3 Canister

A.5.5.1.3.1 Canister model__________

A.5.5.1.3.2 Number of canisters__________

A.5.5.1.3.3 Shape and schematic drawing of canister

A.5.5.1.3.4 Volume of the carbon in canister __________mL

A.5.5.1.3.5 Manufacturer of storage medium of canister __________

A.5.5.1.3.6 Storage medium & model of canister__________

A.5.5.1.3.7 Weight of carbon in canister __________g

[1)]Strike out what doesn't apply

[2)] Specify the tolerance

A.5.5.1.3.8 Bed volume of canister__________mL

A.5.5.1.3.9 Initial butane working capacity (BWC) of canister__________g/100 mL

A.5.5.1.3.10 Description of storage and desorbing method of fuel vapor

A.5.5.1.3.11 Sealing and ventilation manner of fuel metering system

A.5.5.1.4 Fuel tank

A.5.5.1.4.1 Shape and schematic drawing of fuel tank

A.5.5.1.4.2 Nominal capacity of fuel tank__________L

A.5.5.1.4.3 Material of fuel tank__________

A.5.5.1.4.4 Breather valve of fuel tank__________

A.5.5.1.4.5 Material, length and sectional area of liquid fuel__________

A.5.5.1.4.6 Sealing and ventilation manner of fuel system__________

A.6 Air intake and fuel supply

A.6.1 Description and drawing of air intake system and accessories (intake silencer, heating device, additional air intakes etc.)

A.6.2 Fuel supply

A.6.2.1 Fuel injection: Yes/No [1)]

A.6.2.1.1 Description of system

A.6.2.1.2 Working principles: Intake manifold (single-/multi-point)/direct injection/others (specify) [1)]________________

A.6.2.1.3 Fuel pump

A.6.2.1.3.1 Manufacturer__________________

A.6.2.1.3.2 Model__________________

A.6.2.1.3.3 Displacement of fuel pump____________________mm^3/stroke (pump speed at r/min) [1)2)] or characteristic curve [1)2)] __________________

A.6.2.1.4 Injector

A.6.2.1.4.1 Manufacturer__________________

A.6.2.1.4.2 Model__________________

A.6.2.1.4.3 Opening pressure_____________kPa [1)2)] or characteristic curve [1)2)]

A.6.2.2 Manual or automatic choke [1)] closure regulating [2)]__________________

A.6.2.2.1 Description of system__________

A.6.2.3 Cold-start system

A.6.2.3.1 Manufacturer__________

A.6.2.3.2 Model__________

A.6.2.3.3 Description__________

A.7 Lubrication system

[1)] Strike out what doesn't apply

[2)] Specify the tolerance

A.7.1 Description of system

A.7.1.1 Lubrication mode (separate lubrication/mixed lubrication/splash lubrication/forced lubrication/others) [1] ________________

A.7.1.2 Location of oil reservoir (if any)________________

A.7.1.3 Supply system (pump/injection into induction system/mixed with fuel, etc.) [1]

A.7.2 Lubrication

A.7.2.1 Manufacturer________________

A.7.2.2 Specifications________________

A.7.2.3 In the case of mixed lubrication, specify the per cent of lubricant in the mixture

A.7.3 Engine oil cooler: Yes/No [1]

A.7.3.1 Schematic drawing

A.7.3.2 Trademark________________

A.7.3.3 Model________________

A.8 Valve timing

A.8.1 Mechanically controlled valve timing

A.8.1.1 Max. valve lift, and the valve opening & closing angles relative to the upper & lower dead points ________________

A.8.1.2 Reference clearance and adjusted clearance [1] __________ mm

A.8.2 Description of air intake and exhaust ports

A.8.2.1 Number of valves________________

A.8.2.2 Crankcase capacity when piston is at the upper dead point________________mL

A.8.2.3 In the case of reed valve, provide its technical description (attached with the dimensional graph) __________

A.8.2.4 Technical description of air intake port, purge port and exhaust port as well as their corresponding valve phase graphs (attached with the dimensional graph)__________

A.9 Ignition system

A.9.1 Type of ignition ________________

A.9.2 Ignition advance curve [2] ________________

A.9.3 Ignition timing (angle before upper dead point) [2] ________________

A.9.4 Breaker point gap [1)2)] ________________

A.9.5 Closure angle [1)2)] ________________

A.9.6 Spark plug

A.9.6.1 Manufacturer________________

A.9.6.2 Model________________

A.9.6.3 Spark plug regulating clearance ________________

---

[1] Strike out what doesn't apply

[2] Specify the tolerance

A.9.7 Ignition coil

A.9.7.1 Manufacturer________________________

A.9.7.2 Model________________________

A.9.8 Ignition controller

A.9.8.1 Manufacturer________________________

A.9.8.2 Model________________________

A.9.9 Divider

A.9.9.1 Manufacturer________________________

A.9.9.2 Model_____________________________

A.10 Electronic control unit (ECU)

A.10.1 Manufacturer__________________

A.10.2 Model__________________

A.11 OBD system

A.11.1 Written description and/or schematic drawing of malfunction indicator (MI) __________

A.11.2 List of all components monitored by OBD system and the purposes _________________

A.11.3 Written description of the following items:

A.11.3.1 Monitoring of engine load sensor [1)]__________________

A.11.3.2 Monitoring of OS [1)] __________________

A.11.3.3 Monitoring of injector [1)]__________________

A.11.3.4 Other components monitored by OBD system [1)] __________________

A.11.4 Criteria of MI activation (fixed number of drive cycles or statistical method)_____________

A.11.5 List of all the output codes used by the OBD system and the format (each one to be specified); the required information shall be furnished as per the format below, which shall be attached to this Annex:

Designation of component	Fault code	Monitoring strategy	Malfunction decision	Decision of MI activation	Related parameters	Demonstration test

A.12 Exhaust gas system

A.12.1 Manufacturer of muffler_________________________________

A.12.2 Technical description and graph of complete exhaust system______________________

1) Strike out what doesn't apply

2) Specify the tolerance

A.13 Transmission

A.13.1 Type and model of clutch ______________________________________

A.13.2 Manufacturer of transmission ____________________________________

A.13.3 Drawing of transmission system

A.13.4 Type of transmission: (manual/automatic) [1)]

A.13.4.1 Gear shifting mode: (hand/foot) [1)]

A.13.4.2 Gear ratios

Primary____________Final _____________

Gear No. 1____Gear No. 2____Gear No. 3____Gear No. 4____Gear No. 5____Gear No. 6 ____

Reversing gear _____

Continuous drive ratio: Min.______Max. ______

A.14 Wheel

A.14.1 Tyre (category, size, max. load) _______________

A.14.2 Tyre pressure [1)] _________________

A.14.3 Rim (size) _______________

[1)] Strike out what doesn't apply

[2)] Specify the tolerance

Annex B
(Normative)
Type Test Results

B.1 Basic information of moped

B.1.1 Trademark:__________

B.1.2 Model:__________

B.1.3 Vehicle identification number :__________

B.1.4 Category of vehicle:__________

B.1.5 Name and address of manufacturer:__________

B.1.6 Name and address of assembly plant:__________

B.2 Index of test report

B.2.1 Test agency responsible for performing type test:__________

B.2.2 Date of test report:__________

B.2.3 ID No. of test report:__________

B.3 Vehicle parameters and test conditions

B.3.1 Kerb mass of moped:__________

B.3.2 Reference mass of moped:__________

B.3.3 Max. total mass of moped:__________

B.3.4 Number of passenger (incl. driver):__________

B.3.5 Engine model:__________

B.3.6 Fuel used by engine:__________

B.3.7 Engine lubrication mode: __________

B.3.7.1 Manufacturer:__________

B.3.7.2 Model:__________

B.3.8 Transmission

B.3.8.1 Type of transmission:(manual / automatic)[1)]:__________

B.3.8.2 Gear shifting mode: (hand / foot) [1)]:__________

B.3.8.3 Gear ratios

Primary______________Final ____________

Gear No. 1______Gear No. 2____Gear No. 3____Gear No. 4____Gear No. 5____Gear No. 6 ____ Reversing gear __

Continuous drive ratio: Min.____Max. ___

B.3.9 Tyre (type, specification, maximum load):__________

1) Strike out what does not apply

B.4 Test results

B.4.1 Type I test

Type I	Tailpipe emissions (mg/km)		
	CO	HC	NOx
Test result			
Multiplied with DF			

B.4.2 Type II test

Type II	Lubricant temperature/°C	Engine speed/ r/min	CO/%	$HC/10^{-6}$	Excess air factor, λ
High idle speed					
Normal idle speed					--

B.4.3 Type III test

No gases in the engine's crankcase ventilation system may escape to the atmosphere: Yes/No [1)]

B.4.4 Type IV test

Type IV test	HC (g/test)
Diurnal breathing loss	
Hot soak loss	
Total emissions	

B.4.5 Type V test

-- Durability type: 11,000 km/nil [1)]

-- Measured deterioration factor (DF):

B.5 Catalytic converter

Manufacturer & model of catalytic converter:

B.6 Evaporative emission-control devices

B.6.1 Model of canister:___________

B.6.2 Manufacturer and model of storage medium of canister:___________

B.6.3 Initial butane working capacity (BWC) of canister___________g/100 Ml

[1)] Strike out what does not apply

Annex C

(Normative)

Test of Tailpipe Emissions after a Cold Start at Normal Ambient Temperature (Type I Test)

C.1 Introduction

C.1.1 Vehicle shall be placed on a chassis dynamometer fitted with power absorption unit and inertia simulator; vehicle shall be tested as per the test cycle provided in Appendix CC.

C.1.2 During test, surrounding air shall be used to dilute the exhaust gases, and the volumetric flow of gas mixture shall remain constant. In the test process, continuously sampled gas flow of gas mixture is fed into the sample bag for determining the concentrations of carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NO_X) and carbon dioxides (CO_2).

C.2 Test conditions

C.2.1 Test room and soak area

C.2.1.1 Test room

The test room with the chassis dynamometer and the gas sample collection device shall have a temperature of 298,2 ± 5 K (25 ±5 °C). The room temperature shall be measured in the vicinity of the vehicle cooling blower (fan) before and after the type I test.

C.2.1.2 Soak area

The soak area shall have a temperature of 298,2 ± 5 K (25 ±5 °C) and be such that the test vehicle to be preconditioned can be parked in accordance with point C.3.4 of this Annex.

C.2.2 Test vehicle

C.2.2.1 General

Vehicle's intake system shall remain airtight, and exhaust system shall have no leak; test agency shall check whether the vehicle could travel in the normal way, especially the starting capability under the normal ambient temperature state.

C.2.2.2 Run-in

The vehicle shall be presented in good mechanical condition, properly maintained and used. It shall have been run in and driven at least 250km before the test. If the run-in mileage required by the manufacturer is less than 250 km, then it shall be run-in to the mileage indicated by the manufacturer.

C.2.2.3 Adjustment

The test vehicle shall be adjusted in accordance with the manufacturer’s requirements, e.g., idle speed, tyre inflation pressure, etc.

C.2.3 Classification of two-wheel vehicle

Mopeds are classed into two wheel mopeds and three wheeled mopeds.The numerical values of the engine capacity and maximum vehicle speed shall not be rounded up or down.

C.2.4 Reference fuel

Test shall adopt the reference fuel provided in Annex H of this Standard.

C.2.5 Test requirements

C.2.5.1 Driver

C.2.5.1.1 Driver shall be put up with fit clothes; based on actualities, it may decide whether to put up the protection helmet, add weights, etc.

C.2.5.1.2 Under the conditions that C.2.5.1.1 is fulfilled, it shall ensure that the load on the driven wheel(s) of vehicle should run identical to the normal running state of the vehicle while carrying a 75 kg driver.

C.2.5.2 Requirements for and settings of chassis dynamometer

C.2.5.2.1 The main characteristics of chassis dynamometer are as follows:

The tyre of each driven wheel shall stay contact with the roller;

Roller diameter ≥ 400 mm;

Equation of power absorption profile: From the initial speed of 12 km/h, chassis dynamometer shall reproduce, at the accuracy of ± 15%, the power outputted by the rear wheel when the vehicle travels on leveled road, with the wind velocity as closer as possible to 0 m/s. The power absorbed by power absorption unit and the internal friction of dynamometer may be calculated as per CB.3.11 of Appendix CB, or may be:

$$KV^3 \pm 5\% P_{V50}$$

Where:

K -- Characteristic value of chassis dynamometer;

V -- Operation speed of vehicle, km/h;

P_{V50} -- Power absorbed by chassis dynamometer when vehicle operates at the speed of 50 km/h, kW.

Additional inertia: From 10 kg to an integral fold of 10 kg. Equivalent inertia may alternatively be substituted by equivalent electrical simulation quantity.

Dynamometer flywheels or other means shall be used to simulate the inertia specified in C.3.2.

The dynamometer rollers shall be clean, dry and free from anything which might cause the tyre to slip.

C.2.5.2.2 Cooling fan specifications as follows:

-- Throughout the test, a variable-speed cooling blower (fan) shall be positioned in front of the vehicle so as to direct the cooling air onto it in a manner that simulates actual operating conditions. The blower speed shall be such that, within the operating range of 10 to 50 km/h, the linear velocity of the air at the blower outlet is within ±5 km/h of the corresponding roller speed. At the range of over 50 km/h, the linear velocity of the air shall be within ± 10 percent. At roller speeds of less than 10 km/h, air velocity may be zero.

-- The aforesaid air velocity shall be determined as an averaged value of nine measuring points which are located at the centre of each rectangle dividing the whole of the blower outlet into nine areas (dividing both horizontal and vertical sides of the blower outlet into three equal parts). The device used to measure the linear velocity of the air shall be located at between 0 and 20 cm from the air outlet. The value at each of the nine points shall be within 10 percent of the average of the nine values.

-- The blower outlet shall have a cross-section area of at least 0.4 m^2 and the bottom of the blower outlet shall be between 15 and 20 cm above floor level. The blower outlet shall be perpendicular to the longitudinal axis of the vehicle, between 30 and 45 cm in front of its front wheel.

C.2.5.3 Exhaust gas sampling and volume measuring system

C.2.5.3.1 In the test process, the examples of the system for exhaust gas collection, dilution, sampling and volume measuring are shown in Figure C.1, Figure C.2, and Figure C.3.

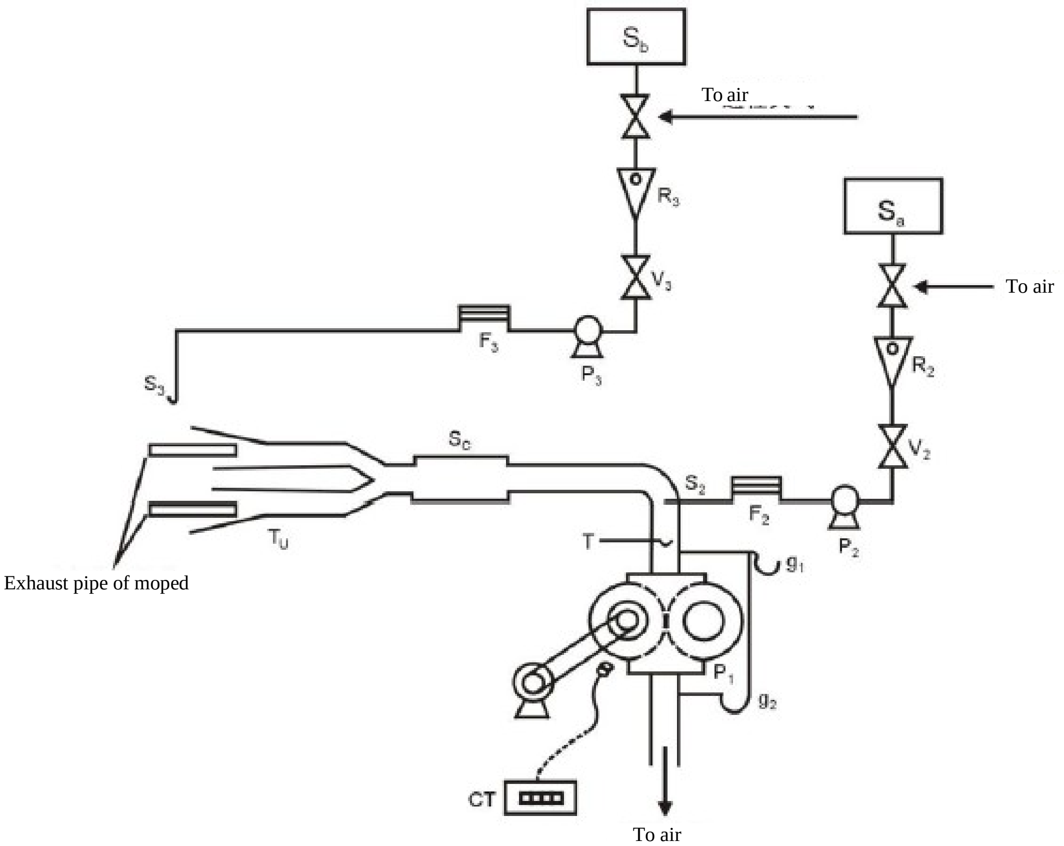

Figure C.1 Exhaust gas analytical system: Example 1

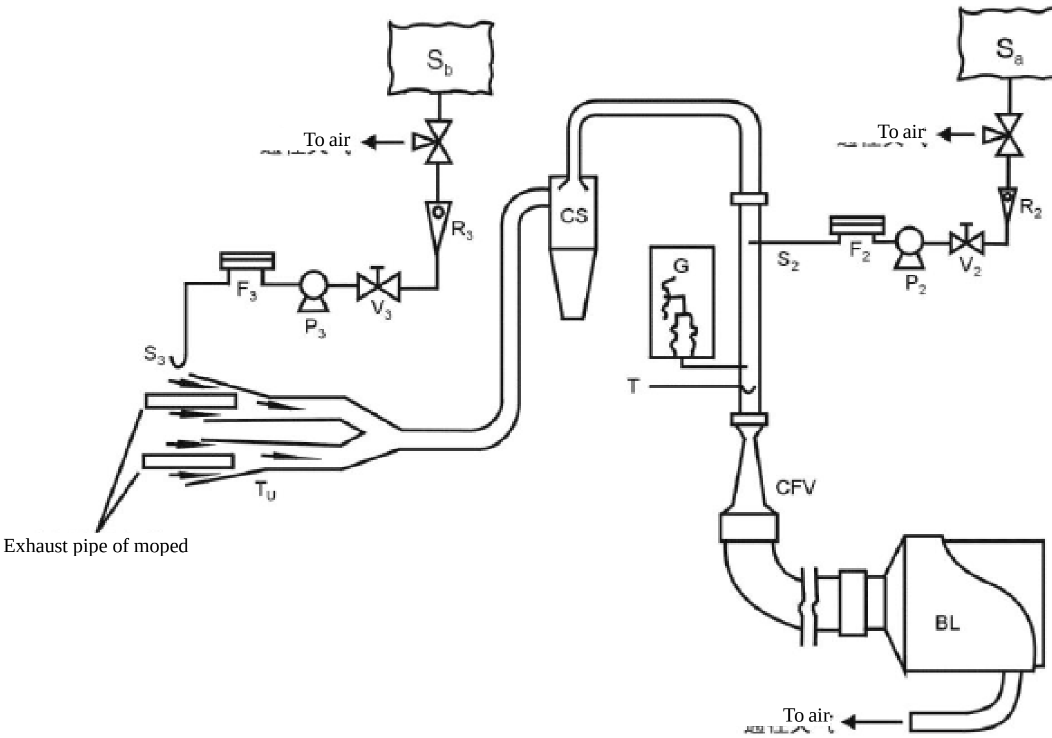

Figure C.2 Exhaust gas analytical system: Example 2

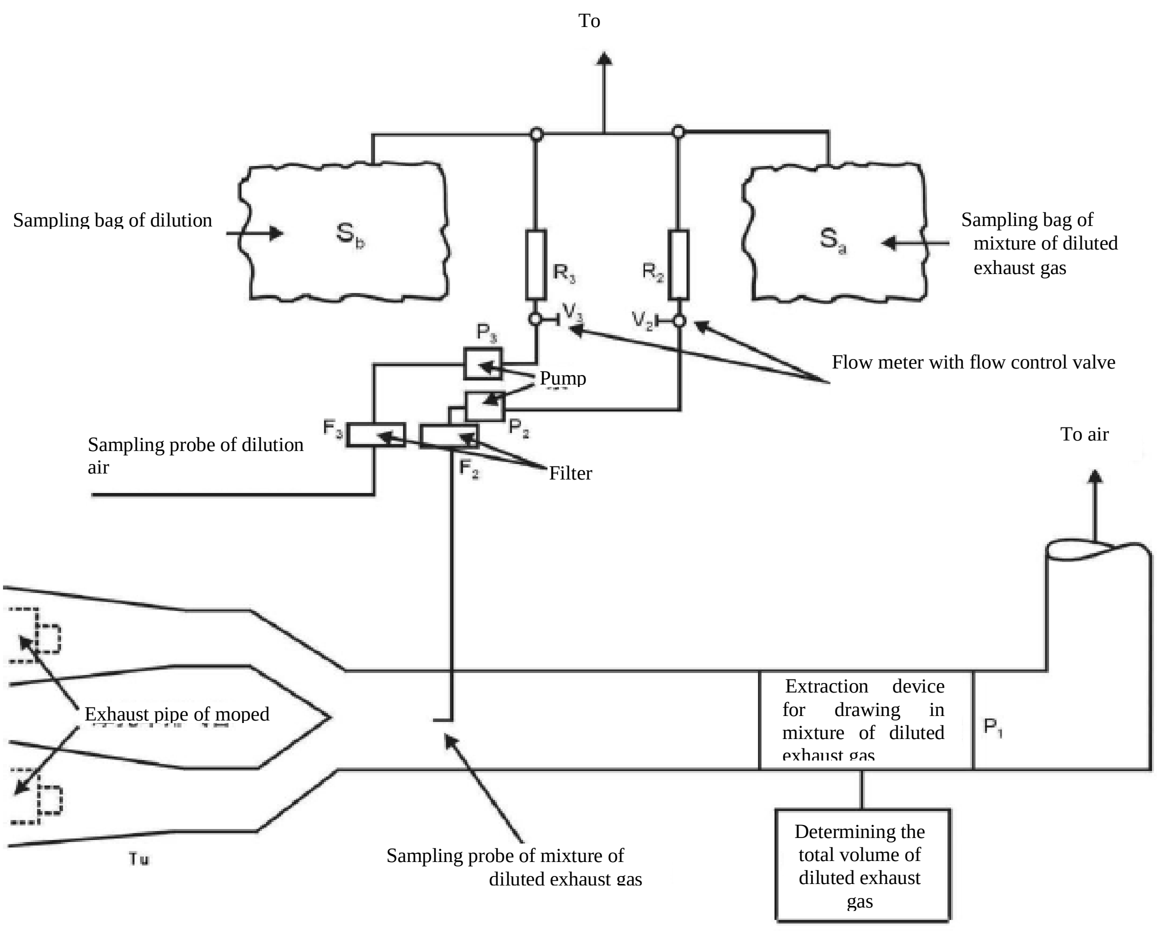

Figure C.3 Exhaust gas analytical system: Example 3

C.2.5.3.2 In the following paragraphs regarding requirements for test equipment, the components are denoted by the corresponding symbols of Figure C.1, Figure C.2, and Figure C.3. When other different equipments are used, test agency shall verify its equivalency.

C.2.5.3.2.1 The gas-collection device shall be a closed-type device that can collect all exhaust gases at the vehicle exhaust outlets on condition that it satisfies the backpressure condition of ± 1.25 kPa. The gas collection shall be such that there is no condensation which could appreciably modify the nature of exhaust gases at the test temperature. An open system may be used if it is confirmed that the moped exhaust pipe outlet to maintain ambient atmospheric pressure and all the exhaust gases can be collected.

C.2.5.3.2.2 A connecting tube (T_U) shall be placed between the device and the exhaust gas sampling system. This tube and the device shall be made of stainless steel, or of some other material which does not affect the composition of the gases collected and which withstands the temperature of these gases.

C.2.5.3.2.3 A heat exchanger (S_C) capable of limiting the temperature variation of the diluted gases in the pump intake to ± 5 °C shall be in operation throughout the test. This exchanger shall be equipped with a preheating system capable of bringing the exchanger to its operating temperature (with the tolerance of ± 5 °C) before the test begins.

C.2.5.3.2.4 A positive displacement pump P_1 shall be used to draw in the diluted exhaust mixture. This pump shall be equipped with a motor with several strictly controlled uniform speeds. The pump volume shall be large enough to ensure the intake of the exhaust gases. A device using a critical-flow venturi (CFV) may also be used.

C.2.5.3.2.5 A device shall be used for the continuous recording of the temperature of the diluted exhaust mixture entering the pump（or CFV）.

C.2.5.3.2.6 A probe S3 shall be located near to, but outside, the gas-collecting device, to collect samples of the dilution air stream through a pump, a filter and a flow meter at constant flow rates throughout the test.

C.2.5.3.2.7 A sample probe S2 pointed upstream into the dilute exhaust mixture flow, upstream of the positive displacement pump, shall be used to collect samples of the dilute exhaust mixture through a filter, a flow meter and a pump, at constant flow rates throughout the test. The minimum sample flow rate in the sampling devices shall be at least 150 litre/hour.

C.2.5.3.2.8 Two filters F_2 and F_3 correspondingly fitted downstream probes S_2 and S_3, which are used for filtering the suspended particulates in the gas sample. Particular care shall be taken to prevent these filters altering the concentration of each gaseous constituent in the gas sample.

C.2.5.3.2.9 Two sampling pumps P_2 and P_3 respectively collect, through probes S_2 and S_3, the gas sample into the sample bags S_a and S_b.

C.2.5.3.2.10 Two manually regulated valves V_2 and V_3 respectively fitted downstream pumps P_2 and P_3, which are to control the flow of gas sample entering sample bag.

C.2.5.3.2.11 Two rotor flow meters R_2 and R_3 connected, in series, in the piping of "probe, filter, pump, regulating valve, sample bag" (S_2, F_2, P_2, V_2, S_a and S_3, F_3, P_3, V_3, S_b), which are used to check, from time to time, the flow rate of gas sample.

C.2.5.3.2.12 For dilution air and dilute exhaust mixture the collection bags shall be of sufficient volume not to impede normal sample flow. The bags shall have an automatic self-locking device and shall be easily disconnected to the sampling system at the end of the test or connected to the analysing system at the start of analysis.

C.2.5.3.2.13 Two pressure gauges g_1 and g_2 having different roles, for which the installation locations are as follows:

a) Installed upstream the positive displacement pump P_1, one is used to measure the pressure difference between the atmosphere and the diluted exhaust gas;

b) Installed upstream and downstream the positive displacement pump P_1, the other is used to measure the pressure difference of the gas flow upstream and downstream the pump.

C.2.5.3.2.14 A revolution counter (CT) shall be used to count the revolutions of the positive displacement pump P_1 throughout the test.

C.2.5.3.2.15 Three-way valves in the aforesaid sampling system shall be used on the sampling system to direct the samples either to their respective bags or to the outside throughout the test. The valves shall be of the quick-action type. Three-way valves shall be made of the materials not affecting the gas constituents, of which the flow cross-section and geometry shall minimize the pressure losses.

C.2.5.3.2.16 Blower (BL) used to deliver diluted exhaust gas.

C.2.5.3.2.17 Cyclone separator (CS) used to filter the particles in diluted exhaust gas.

C.2.5.3.2.18 Pressure gauge (G) installed upstream critical flow venturi, which is used for measuring diluted exhaust gas pressure.

C.2.5.4 Analytical equipments

C.2.5.4.1 For measuring HC concentration

In the test process, the concentration of the non-combusted HC in the gas sample collected into the sample bags S_a and S_b is determined via flame ionized detection (FID) method.

C.2.5.4.2 For measuring CO and CO_2 concentration

In the test process, the concentration of the CO and CO_2 in the gas sample collected into the sample bags S_a and S_b is determined via non-dispersive infrared absorption method.

C.2.5.4.3 For measuring NOx concentration

In the test process, the concentration of the NO_X in the gas sample collected into the sample bags S_a and S_b is determined via chemical luminescence (CL) method.

C.2.5.5 Apparatus and measuring accuracies

C.2.5.5.1 Chassis dynamometer shall be verified in individual test, and shall fulfill the accuracy requirements of Table C.3. As for the total inertia including the rotary mass of the rotating parts of roller and power absorption unit, the measuring accuracy is ± 2%.

C.2.5.5.2 Vehicle speed is determined via the rotating speed of roller of the chassis dynamometer. Given the vehicle speed within 0 km/h ~ 10 km/h, its measuring accuracy shall be ± 2 km/h, and, given the vehicle speed above 10 km/h, its measuring accuracy shall be ± 1 km/h.

C.2.5.5.3 Regarding C.2.5.3.2.5, the temperature measuring accuracy is ± 1°C; and regarding C.2.1.1 and C.2.1.2, the temperature measuring accuracy is ± 2°C.

C.2.5.5.4 The measuring accuracy of atmospheric pressure is ± 0.133 kPa.

C.2.5.5.5 The measuring accuracy of relative humidity of air is ± 5%.

C.2.5.5.6 For the pressure difference between diluted exhaust gas and atmospheric pressure as measured at the inlet of positive displacement pump P_1 (see C.2.5.3.2.13), the measuring accuracy is ± 0.4 kPa. For the pressure difference of diluted exhaust gas between cross-sections upstream and downstream the positive displacement pump P_1, the measuring accuracy is ± 0.4 kPa.

C.2.5.5.7 The volume emitted per revolution of positive displacement pump P_1 as recorded by the revolution counter and the displacement value at the min. pump speed shall be such that the measuring accuracy of the total volume of diluted exhaust gas emitted by the positive displacement pump during the entire measuring process shall be ± 2%.

C.2.5.5.8 Without considering the accuracy of reference gas, each measuring range of the analyzer upon measuring different constituents shall all reach the accuracy of ± 3%. The FID analyzer for measuring HC concentration shall be able to reach 90% of the full range within 1 s.

C.2.5.5.9 The error of the concentration of reference gas relative to its nominal value shall not exceed 2%. The diluent of CO and NO_X is nitrogen (N_2), and that of HC (propane or C_3H_8) is air.

C.2.5.6 Description of test cycle

C.2.5.6.1 Test cycles (vehicle speed patterns) for the type I test, as laid down in Appendix CC, consist of up to two parts: The first four sub cycles are defined as cold cycles, and the last four sub cycles are defined as warm cycles.

C.2.5.7 Vehicle speed tolerances

C.2.5.7.1 A tolerance of ± 1 km/h on the theoretical speed shall be allowed during all phases. Speed tolerances greater than those prescribed shall be accepted during phase changes, provided that the tolerances are never exceeded for more than 0.5 second on any occasion except for C.2.5.7.2 and C.2.5.7.3.

C.2.5.7.2 If the acceleration capability of the vehicle is not sufficient to carry out the acceleration phases, the vehicle shall be driven with the throttle fully open until the set speed is reached, and then the cycle shall proceed normally as per the provisions.

C.2.5.7.3 If the period of deceleration is shorter than that prescribed for the corresponding phase, the set speed shall be restored by a constant vehicle speed or idling period merging into succeeding constant speed or idling operation.

C.2.5.7.4 The permissible time tolerance is ± 0.5 s.

C.2.5.7.5 The complex tolerance of vehicle speed and time is as shown in AppendixCC.

C.2.5.7.6 The measuring accuracy of cycle travel distance shall be ± 2%.

C.2.5.8 Description of gear-shifting

C.2.5.8.1 If the manufacturer has the specified use method, the transmission shall be used according to the use method specified by the manufacturer; If not specified, the following principles shall be adopted.

C.2.5.8.2 Test vehicles with automatic transmission (AT)

Vehicles equipped with transfer cases, multiple sprockets, etc., shall be tested in highway use,if there are both street.

The "forward gear" (top gear) of automatic transmission shall be used for all tests. The automatic transmission vehicle with manual function can be switched to manual according to the manufacturer.

Idle modes shall be run with automatic transmissions in ‘Drive’ and the wheels braked.

AT shall shift automatically through the normal sequence of gears.

In the case of two-wheel vehicles, the deceleration modes shall be run in gear using brakes or throttle as necessary to maintain the desired speed.

C.2.5.8.3 Test vehicles with manual transmission (MT)

C.2.5.8.3.1 Upon constant speed of 20km/h, it shall make, as much as possible, the engine speed to fall within 50% ~ 90% of the max. speed. If more than one gear position meets such requirements, then the highest gear position shall be picked for the vehicle test.

C.2.5.8.3.2 Upon acceleration, it shall utilize the gear position capable of delivering the max. acceleration for performing the vehicle test. When engine speed reaches 110% of the speed corresponding to the max. power, it shall shift to the immediately higher gear for continuing the test. Upon deceleration, it shall downshift to the immediately lower gear before the engine presents unstable idling operation or when the engine speed drops to 30% of the speed corresponding to the max. power. During deceleration, it shall not downshift to the lowest gear.

C.3 Test process

C.3.1 Introduction

C.3.1.1 Test consists of several steps below: preparations of chassis dynamometer, preparations of analyzer, pre-conditioning and operation cycle.

C.3.1.2 Operate vehicle on chassis dynamometer as per specific cycle; via a proper emission measuring system, continuously collect diluted exhaust gas of a certain proportion; then, conduct analysis, so ad to determine the emissions of CO, HC, NO_X and CO_2 when real-world traffic conditions are simulated.

C.3.1.3 In the test process, vehicle's emission control system shall work normally; in case it suffers a malfunction, the test shall be halted.

C.3.1.4 The test shall also measure the concentration of CO, HC, NO_X and CO_2 in the dilution air.

C.3.2 Setting and confirmation of chassis dynamometer

Measurements shall be taken to the accuracies specified in Table C.1. The running resistance force for the chassis dynamometer settings can be derived either from on-road coastdown measurements(Appendix CD) or from a running resistance table in Appendix CE.

Table C.3 Measuring accuracy requirements

Measuring items		At measured value	Resolution
a)	Road resistance F	+ 2%	--
b)	Vehicle speed (v_1,v_2)	± 1%	0.2 km/h
c)	Coast-down speed interval ($2\Delta v = v_1-v_2$)	± 1%	0.1 km/h
d)	Coast-down time (Δt)	± 0.5%	0.01 s
e)	Reference mass ($m_k + m_{rid}$)	± 0.5%	1.0 kg
f)	Wind speed	± 10%	0.1 m/s
g)	Wind direction	--	5°
h)	Temperature	± 1°C	1°C
i)	Atmospheric pressure	--	0.2 kPa
j)	Distance	± 0.1%	1 m
k)	Time	± 0.1 s	0.1 s

C.3.2.1 Preparations of vehicle

C.3.2.1.1 Manufacturer shall furnish the spare parts and connecting parts as per test requirements, e.g., mounting a fuel drain device at the lowest point of fuel tank, furnishing the device or connecting part convenient for collecting exhaust gas, etc.

C.3.2.1.2 Tyre inflation pressure shall conform to the manufacturer's instructions, and shall run identical to that upon road coasting test.

C.3.2.1.3 The vehicle under test shall be warmed up on chassis dynamometer up to the same state as that in the road coasting test.

C.3.2.2 Setting the chassis dynamometer via the measuring results of road coasting test

C.3.2.2.1 Equipment requirements

The instrumentation for the speed and time measurement shall have the accuracies specified in Table C.1.

C.3.2.2.2 Setting of inertia mass

The equivalent inertia mass m_i for the chassis dynamometer shall be the flywheel equivalent inertia mass, m_{fi}, closest to the actual sum m_a which is the sum of the front wheel rotation mass m_{rf} and the total mass m of the vehicle, driver and onboard instruments and equipment in coasting performance test. Thereinto, the equivalent inertia mass mi can be derived from Appendix CG. m_{rf} may be obtained through measuring or calculation, as expressed in kg; for the calculation, it may be estimated as 3% of the total mass m upon road coasting test.

If the actual sum m_a cannot be equalised to the flywheel equivalent inertia mass m_{fi}, to make the target running resistance force F* equal to the running resistance force F_E (which is to be set to the chassis dynamometer), the corrected coast-down time ΔT_E may be adjusted in accordance with the total mass ratio road in the following sequence:

$$\Delta T_{\text{road}} = \frac{1}{3.6}(m_a + m_{r1})\frac{2\Delta v}{F^*} \quad (1)$$

$$\Delta T_E = \frac{1}{3.6}(m_i + m_{r1})\frac{2\Delta v}{F_E} \quad (2)$$

$$F_E = F^* \quad (3)$$

$$\Delta T_E = \Delta T_{\text{road}} \times \frac{m_i + m_{r1}}{m_a + m_{r1}} \quad (4)$$

$$0.95 < \frac{m_i + m_{r1}}{m_a + m_{r1}} < 1.05 \quad (5)$$

Where:

ΔT_{road} -- Target coast-down time, s;

ΔT_E -- Coast-down time corrected by inertia mass ($m_i + m_{r1}$), s;

F_E -- Chassis dynamometer's equivalent running resistance, N;

m_{r1} -- Equivalent inertia mass of the rear wheel(s) and the vehicle section rotating together with the of wheel during coasting. m_{r1} may be fetched from measuring or calculation, as expressed in kg; for the calculation, it may be estimated as 4% of the total mass m upon road coasting test.

C.3.2.2.3 Dynamometer resistance settings with on-road coast-down measurement results

Before the test, the chassis dynamometer shall be appropriately warmed up to the stabilised frictional force F_f.

The load on the chassis dynamometer F_E is, in view of its construction, composed of the total friction loss Ff, which is the sum of the chassis dynamometer rotating frictional resistance, the tyre rolling resistance, the frictional resistance of the rotating parts in the powertrain of the vehicle and the braking force of the power absorbing unit (pau) F_{pau}, as in the following equation:

$$F_E = F_f + F_{\text{pau}} \quad (6)$$

The target road resistance F* mentioned in Appendix CD shall be reproduced on chassis dynamometer based on vehicle speed, i.e.,:

$$F_E(v_i) = F^*(v_i) \quad (7)$$

The total friction loss F_f of chassis dynamometer shall be determined as per the method provided in C.3.2.2.3.1 or C.3.2.2.3.2.

C.3.2.2.3.1 Motoring by chassis dynamometer

This method applies only to chassis dynamometers capable of driving an vehicle. The test vehicle shall be driven steadily by the chassis dynamometer at the reference speed v_0 with the drive train engaged and the clutch disengaged. The total friction loss F_f (v_0) at the reference speed v_0 is given by the chassis dynamometer force.

C.3.2.2.3.2 Coast-down without absorption

The method for measuring the coast-down time is the coast-down method for the measurement of the total friction loss F_f.

Vehicle coast-down on a non-power absorption chassis dynamometer, the coasting process shall observe the steps described in Appendix CF; also, it shall measure the corresponding coast-down time Δt_i at the reference speed v_0.
The measurement shall be carried out at least three times, and the average coast-down time $\overline{\Delta t}$ is calculated with the formula below:

$$\overline{\Delta t} = \frac{1}{n}\sum_{i=1}^{n}\Delta t_i \tag{8}$$

C.3.2.2.3.3 Total friction loss

The total friction loss F_f (v_0) at reference speed v_0 is calculated with the formula below:

$$F_f(v_0) = \frac{1}{3.6}(m_i + m_{r1})\frac{2\Delta v}{\Delta t} \tag{9}$$

C.3.2.2.3.4 Calculation of power-absorption unit force

The force F_{pau} (v_0) absorbed by chassis dynamometer at reference speed point v_0 is calculated through subtracting the target road resistance F^* (v_0) by the F_f (v_0):

$$F_{pau}(v_0) = F^*(v_0) - F_f(v_0) \tag{10}$$

C.3.2.2.3.5 Setting of chassis dynamometer

Depending upon the type of chassis dynamometer, the setting may be accomplished by wither method listed in C.3.2.2.3.5.1 ~ C.3.2.2.3.5.4.

C.3.2.2.3.5.1 Chassis dynamometer with polygonal function

For a chassis dynamometer with polygonal function, in which the absorption characteristics are determined by load values at several speed points, at least three specified speeds, including the reference speed, shall be chosen as the setting points. At each setting point, the chassis dynamometer shall be set to the value F_{pau} (V_j) obtained in point C.3.2.2.3.4.

C.3.2.2.3.5.2 Chassis dynamometer with coefficient control

For a chassis dynamometer with coefficient control function, its absorption characteristics are determined by given equation coefficient; the F_{pau} (V_j) corresponding to the designated speed point is the value calculated as per the method of C.3.2.2.3.1 to C.3.2.2.3.4.

Assuming the load characteristics are:

$$F_{pau}(v) = a \times v^2 + b \times v + c \tag{11}$$

Where: Coefficients a, b, and c are determined through polynomial regression method.

Chassis dynamometer shall be set with the coefficients a, b, and c calculated as per the method above.

C.3.2.2.3.5.3 Chassis dynamometer with F* polygonal digital setter

C.3.2.2.3.5.3.1 For a chassis dynamometer with F* polygonal digital setter, its CPU is included in the system, and the target road resistance F* of the chassis dynamometer is directly set with the formula $F^*= f^*_0 + f^*_2 v^2$ through the automatic measuring and calculation over Δt_i, F_f and F_{pau}.

C.3.2.2.3.5.3.2 In this case, the F^*_j and v_j values corresponding to some points are continuously inputted; and, during the coasting, it shall simultaneously measure the coast-down time Δt_i. The calculation is accomplished by the built-in CPU in the following sequence: At the interval of 0.1 km/h of vehicle speed, F_{pau} is automatically set into the memory, and coasting shall be repeated for 3 times:

$$F^* + F_f = \frac{1}{3.6}(m_i + m_{r1})\frac{2\Delta v}{\Delta t_i} \qquad (12)$$

$$F_f = \frac{1}{3.6}(m_i + m_{r1})\frac{2\Delta v}{\Delta t_i} - F^* \qquad (13)$$

$$F_{pau} = F^* - F_f \qquad (14)$$

C.3.2.2.3.5.4 Chassis dynamometer with f^*_0 and f^*_2 coefficient digital setter

For a chassis dynamometer with f^*_0 and f^*_2 coefficient digital setter, CPU is included in the system, and the target road resistance $F^* (V_0) = f^*_0 + f^*_2 \times V_0{}^2$ will be automatically set onto the chassis dynamometer.

In such case, parameters f^*_0 and f^*_2 are directly inputted in numeral form, and, in the coasting process, it shall simultaneously measure the coast-down time. The calculation is accomplished by the built-in CPU in the following sequence: At the interval of 0.06 km/h of vehicle speed, F_{pau} is automatically set into the memory, until the end of the calculation and setting of road resistance:

$$F^* + F_f = \frac{1}{3.6}(m_i + m_{r1})\frac{2\Delta v}{\Delta t_i} \qquad (15)$$

$$F_f = \frac{1}{3.6}(m_i + m_{r1})\frac{2\Delta v}{\Delta t_i} - F^* \qquad (16)$$

$$F_{pau} = F^* - F_f \qquad (17)$$

C.3.2.2.3.6 Dynamometer settings verification

C.3.2.2.3.6.1 Immediately after the initial setting, via the method provided in Appendix CF, the coast-down time Δt_E on chassis dynamometer corresponding to the reference speed (v_0).

Min. three measuring runs shall be performed, and the average coast-down time Δt_E will be calculated from the measuring results.

The set running resistance F_E (v_0) on chassis dynamometer at the reference speed point is calculated with the formula below:

$$F_E(v_0) = \frac{1}{3.6}(m_i + m_{r1})\frac{2\Delta v}{\Delta t_E} \qquad (18)$$

Where:

F_E -- Set running resistance on chassis dynamometer, N;

Δt_E -- Average coast-down time on chassis dynamometer, s.

C.3.2.2.3.6.2 The setting error ε is calculated with the formula below:

$$\varepsilon = \frac{\left|F_E(v_0) - F^*(v_0)\right|}{F^*(v_0)} \times 100 \qquad (19)$$

The chassis dynamometer shall be readjusted if the setting error does not satisfy the following criteria:

$\varepsilon \leq 2$ percent for $v \geq 50$ km/h

$\varepsilon \leq 3$ percent for 30 km/h $\leq v < 50$ km/h

$\varepsilon \leq 10$ percent for $v < 30$ km/h

It shall keep repeating the procedures described in paragraphs C.3.2.2.3.6.1 and C.3.2.2.3.6.2, until the setting error satisfies the criteria.

C.3.2.3 Chassis dynamometer setting via equivalent inertia mass table

Determine the running resistance via the look-up of equivalent inertia mass table instead of the coasting method. For the table look-up method, dynamometer will be set according to reference mass, disregarding other vehicle characteristics. Cares shall be taken when setting vehicle with special features via the table look-up method.

Flywheel's equivalent inertia mass m_{fi} is the equivalent inertia mass m_i in Appendix CG. The chassis dynamometer will be set by the front-wheel resistance coefficient "a" and the air resistance coefficient "b" listed in Appendix CG.

C.3.2.3.1 Setting chassis dynamometer's running resistance via the equivalent inertia mass table

Chassis dynamometer's running resistance F_E is determined with the formula below:

$$F_E = F_T = a + b \times v^2 \qquad (20)$$

Where:

F_T -- Running resistance from the look-up of equivalent inertia mass table, N;

a -- Front wheel rolling resistance, N;

b -- Air resistance coefficient, N/ $(km/h)^2$;

v -- Designated speed, km/h.

Whereas target running resistance F* equals to the running resistance F_T looked up from the equivalent inertia mass table, it is unnecessary to make corrections with respect to the reference environmental conditions.

C.3.2.3.2 The specified vehicle speed for the chassis dynamometer

The running resistance on the chassis dynamometer shall be verified at the specified vehicle speed v. At least four specified speeds shall be verified.The interval of the designated speed points (incl. the reference speed point) may not exceed 20 km/h, and shall be uniformly distributed. The range of specified vehicle speed points (the interval between the maximum and minimum points) shall extend either side of the reference speed or the reference speed range. If there is more than one reference speed point, take the value of Δv as per the provisions of Appendix CF.

C.3.2.3.3 Verification of chassis dynamometer

C.3.2.3.3.1 Immediately after the initial setting, the coast-down time on the chassis dynamometer corresponding to the specified speed shall be measured. The vehicle shall not be set up on the chassis dynamometer during the coast-down time measurement. The coast-down time measurement shall start when the chassis dynamometer speed exceeds the maximum speed of the test cyclee.

C.3.2.3.3.2 Min. three measuring runs shall be performed, and the average coast-down time Δt_E will be calculated from the measuring results.

C.3.2.3.3.3 The running resistance F_E (v_j) on chassis dynamometer corresponding to the designated speed point is calculated with the formula below:

$$F_E(v_j) = \frac{1}{3.6} \times m_i \times \frac{2\Delta v}{\Delta t_E} \tag{21}$$

C.3.2.3.3.4 The setting error ε at the designated speed point is calculated with the formula below:

$$\varepsilon = \frac{\left|F_E(v_j) - F_T\right|}{F_T} \times 100 \tag{22}$$

C.3.2.3.3.5 The chassis dynamometer shall be readjusted if the setting error does not satisfy the following criteria:

$\varepsilon \le 2$ percent for $v \ge 50$ km/h

$\varepsilon \le 3$ percent for 30 km/h $\le v < 50$ km/h

$\varepsilon \le 10$ percent for $v < 30$ km/h

C.3.2.3.3.6 The aforesaid procedures shall be repeated until the setting error satisfies the criteria.

C.3.3 Calibration of analyzers

C.3.3.1 The quantity of gas at the indicated pressure compatible with the correct functioning of the equipment shall be injected into the analyser by the flow metre and the pressure-reducing valve mounted on each gas cylinder. The apparatus shall be adjusted to indicate as a stabilised value the value inserted on the standard gas cylinder. Starting from the setting obtained with the gas cylinder of greatest volume, a curve shall be drawn of the deviations of the apparatus according to the content of the various standard cylinders used.The routine calibration of analyzer shall be conducted at least once each month.

C.3.3.2 Hydrogen flame ionization analyzer shall be calibrated using air/propane mixture or air/hexane mixture with nominal concentrations equal to 50% and 90% of full scale.

C.3.3.3 Non-dispersive infrared absorption analyzer shall be calibrated using nitrogen/CO or nitrogen/CO2 mixture with nominal concentrations equal to 10%, 40%, 60%, 85%, and 90% of full scale.

C.3.3.4 Chemiluminescene analyzer shall be calibrated using nitrogen/CO mixture (in such calibration gas, the content of NO_2 shall not exceed 5% of that of NO) with nominal concentrations equal to 50% and 90% of full scale.

C.3.3.5 The calibration of all three types of analysers shall be checked before each series of tests, using mixtures of the gases, which are measured in a concentration equal to 80 percent of full scale. A dilution device can be applied for diluting a 100 percent calibration gas to required concentration.

C.3.3.6 Requirements for pure gases

a) Nitrogen purity: ≤ 1 ppmC, ≤ 1 ppmCO, ≤ 400 ppmCO_2, ≤ 0.1 ppmNO;

b) Synthetic air purity: ≤1 ppmC, ≤1 ppmCO, ≤ 400 ppmCO_2, ≤ 0.1 ppmNO; the oxygen content (v/v) falls within 18% ~ 21%;

c) Oxygen purity: O_2 (v/v) > 99.5%;

d) Hydrogen (and helium-containing mixture) purity: ≤ 1 ppmC, ≤ 400 ppmCO_2;

e) CO purity: Min. 99.5%;

f) Propane (C_3H_8) purity: Min. 99.5%;

g) The actual concentration of calibration gas shall fall within ± 2% of its nominal value.

C.3.4 Test vehicle pre-conditioning

C.3.4.1 The vehicle shall be moved to the test area and the following operations performed:

Via fuel drain device, drain off the fuel in the fuel system, and fill the test reference fuel provided in C.2.4 to half of the tank volume.

The vehicle shall be placed, either by being driver or pushed, onto chassis dynamometer and secured, and shall be pre-conditioned as per the cycle provided in C.2.5.6. The vehicle need not be cold, and may be used to set chassis dynamometer's power.

C.3.4.2 During the pre-conditioning cycle, no exhaust gas will be collected. Within five minutes of completion of preconditioning, the test vehicle shall be removed from the dynamometer and may be driven or pushed to the soak area to be parked. The vehicle shall be stored for between 6 and 36 hours prior to the cold start type I test or until the engine oil temperature or the coolant temperature or the sparkplug seat/gasket temperature equals the air temperature of the soak area within 2 ℃.

C.3.4.3 Tyre inflation pressure shall fulfill the provisions of C.3.2.1.2. Given a roller diameter less than 500 mm, the tyre inflation pressure may increase by 30% ~ 50%.

C.3.5 Description of driving

C.3.5.1 General requirements

After instrument & equipment goes through the pre-operations, e.g., gas sampling, diluting, analysis and measuring, start the engine with choke, starting valve, etc. as per the operational instructions or owner's manual of vehicle manufacturer. Sampling shall begin at the same time when engine gets started, and the sampling shall be simultaneously carried out with the measuring of revolutions of positive displacement pump.The test vehicle shall be driven with minimum throttle movement to maintain the desired speed. No simultaneous use of brake and throttle shall be permitted. If the test vehicle cannot accelerate at the specified rate, it shall be operated with the throttle fully opened until the roller speed reaches the value prescribed for that time in the driving schedule.

C.3.5.2 Engine starting and re-starting

C.3.5.2.1 The engine shall be started according to the manufacturer’s recommended starting procedures. The test cycle run shall begin when the engine starts.

C.3.5.2.2 Vehicle equipped with automatic chokes shall be operated according to the manufacturer's instructions on operations or the owner's manual, incl. the choke setting and "kick-down" in the initial stage of the cold start. 15 s after engine is started, the transmission shall be placed in the forward gear. If necessary, braking maybe employed to keep the drive wheels from turning.

C.3.5.2.3 Vehicle equipped with manual chokes shall be operated according to the manufacturer's instructions on operations or the owner's manual.

C.3.5.2.4 The driver may use throttle, choke, etc. to control the engine running.

C.3.5.2.5 If the manufacturer's operating instructions or owner's manual do not specify the warm engine starting procedure, the engine (automatic and manual choke engines) shall be started by opening the throttle about half way and cranking the engine until it starts.

C.3.5.2.6 If, during the cold start, the test vehicle does not start after ten seconds of cranking or ten cycles of the manual starting mechanism, cranking shall cease and the reason for failure to start determined. The revolution counter on the constant volume sampler shall be turned off and the sample solenoid valves placed in the ‘standby’ position during this diagnostic period. In addition, either the CVS blower shall be turned off or the exhaust tube disconnected from the tailpipe during the diagnostic period.

C.3.5.2.7 If, during the cold start, the failure to start is an operational error, the test vehicle shall be rescheduled for testing from a cold start. If failure to start is caused by vehicle malfunction, corrective actionlasting less than 30 minutes may be taken and the test continued. The sampling system shall be reactivated at the same time cranking is started. The driving schedule timing sequence shall begin when the engine starts. If failure to start is caused by vehicle malfunction and the vehicle cannot be started in 30 minutes, the test shall be voided, the vehicle removed from the dynamometer, corrective action taken and the vehicle rescheduled for test. The reason for the malfunction (if determined) and the corrective action taken shall be reported.

C.3.5.2.8 If, during the hot start, the test vehicle does not start during the hot start after ten seconds of cranking or ten cycles of the manual starting mechanism, cranking shall cease, the test shall be voided, the vehicle removed from the dynamometer, corrective action taken and the vehicle rescheduled for test. The reason for the malfunction (if determined) and the corrective action taken shall be reported.

C.3.5.2.9 If the engine ‘false starts’, the operator shall repeat the recommended starting procedure (such as resetting the choke, etc.)).

C.3.5.3 Stalling

C.3.5.3.1 If the engine stalls during an idle period, it shall be restarted immediately and the test continued. If it cannot be started soon enough to allow the vehicle to follow the next acceleration as prescribed, the driving schedule indicator shall be stopped. When the vehicle restarts, the driving schedule indicator shall be reactivated.

C.3.5.3.2 If the engine stalls during some operating mode other than idle, the driving schedule indicator shall be stopped, the test vehicle restarted and accelerated to the speed required at that point in the driving schedule, and the test continued. During accelerationto this point, gearshifts shall be performed in accordance with point C.2.5.8.

C.3.5.3.3 Upon suspension of the test cycle, it shall simultaneously stop the sampling; in case the sampling cannot stopped, it shall cancel the test. If the test vehicle will not restart within one minute, the test shall be voided, corrective action taken and the vehicle rescheduled for test. The reason for the malfunction (if determined) and the corrective action taken shall be reported.

C.3.5.4 Use of manual chokes

The usage of choke shall be carried out as per the operational instructions or owner's manual of vehicle manufacturer.

C.3.5.5 Idling

C.3.5.5.1 Hand-/foot-operated transmission

In order to enable the acceleration to proceed as per the test requirements, the vehicle shall,at 5 s after the idling and before the acceleration, disengage the clutch, with the transmission placed in gear 1.

C.3.5.5.2 Automatic transmission and Torque converter

When the test started, the mode should be sure. Vehicles shall be tested in the highway use, if there are both street and highway use.

C.3.5.6 Acceleration

At the end of idling, vehicle shall be driven with the throttle fully open. If nessecery, transmission shall be used to reach the speed of cycle as soon as possible.

C.3.5.7 Constant-speed

During the constant-speed of high speed, vehicle shall be driven with the throttle fully open ,until deceleration starts. During the constant-speed of 20km/h mode, it shall remain the throttle position unchanged.

C.3.5.8 Deceleration

C.3.5.8.1 All the deceleration modes shall be conducted under the state with the throttle fully closed and the clutch engaged. When vehicle speed declines to 10 km/h disengage the engine.

C.3.5.8.2 If the deceleration mode operation time is longer than the time prescribed in the corresponding cycle, it shall employ the vehicle's brake, so as to make the cycle proceed as per the provisions.

C.3.5.8.3 If the deceleration mode operation time is shorter than the time prescribed in the corresponding cycle, it shall carry out a period of constant-speed or idling operation up till to the next operation mode. Here, the provisions of C.2.5.7 would no longer apply.

C.3.5.8.4 At the end of the deceleration period (halt of the vehicle on the rollers), the gears shall be placed in neutral and the clutch engaged.

C.3.6 Exhaust gas sampling, analysis and volume measuring procedures

C.3.6.1 For the complete test cycle of chassis dynamometer, see C.2.5.6.

C.3.6.2 Test procedure

C.3.6.2.1 Operations before starting of vehicle

C.3.6.2.1.1 Sample bags S_a and S_b shall be completely extracted and closed.

C.3.6.2.1.2 Start the positive displacement pump P_1 which already becomes disengaged from the revolution counter.

C.3.6.2.1.3 Upon starting of sampling pumps P_2 and P_3, it shall rotate the three-way valve to the position where gas sample is vented to air, and regulate the flow rate via valves V_2 and V_3.

C.3.6.2.1.4 Make the temperature sensor T and the pressure gauges g_1 and g_2 in the operating state.

C.3.6.2.1.5 Zero the revolution counter (CT) of positive displacement pump and the roller's revolution counter.

C.3.6.2.2 Operations at the beginning of sampling and volume measuring

C.3.6.2.2.1 Synchronously carry out the operations provided in C.3.6.2.2.2 ~ C.3.6.2.2.5 below.

C.3.6.2.2.2 Switch the three-way valve from the previous position (i.e., gas sample directly vented to air) to the position where gas sample is vented to sample bags S_a and S_b, so as to enable the gas sample to continuously pass through the probe S_2 & S_3 in bags S_a and S_b.

C.3.6.2.2.3 On the recorder connected to temperature sensor T and pressure gauges g_1 & g_2, mark the location at the moment when the first test cycle begins.

C.3.6.2.2.4 Activate the revolution counter (CT) for recording the revolutions of the positive displacement pump P_1.

C.3.6.2.2.5 Activate the blower for cooling vehicle as described in C.2.5.2.2.

C.3.6.2.3 Operations at the end of sampling and volume measuring

C.3.6.2.3.1 At the moment when the test cycle comes to its end, synchronously carry out the operations provided in C.3.6.2.3.2 ~ C.3.6.2.3.5 below.

C.3.6.2.3.2 Switch the three-way valve to the position where the sample bags S_a and S_b are closed, such that the gas sample extracted by sampling pumps P_2 and P_3 via probes S_2 and S_3 is vented to air.

C.3.6.2.3.3 Mark the location, onto the recorder, at the moment when the cycle comes to end (see C.3.6.2.2.3).

C.3.6.2.3.4 Disengage the revolution counter (CT) connected with the positive displacement pump P_1.

C.3.6.2.3.5 Deactivate the blower for cooling vehicle as described in C.2.5.2.2.

C.4 Analysis of results

C.4.1 Analysis of the samples contained in the bags

The analysis shall begin as soon as possible, and in any event not later than 20 minutes after the end of the tests.

C.4.2 Calibration of analysers and concentration results

The analysis of the results has to be carried out in the following steps:

a) Prior to each sample analysis, the zero calibration of analyser range to be used for each pollutant shall be conduct with the appropriate zero gas;

b) The analysers are set to the calibration curves by means of span gases of nominal concentrations of 70 to 100 percent of the range;

c) The analysers' zeros are rechecked. If the reading differs by more than 2 percent of range from that set in C.4.2a), the procedure is repeated;

d) Analyze the gas sample;

e) After the analysis, zero and span points are rechecked using the same gases. If the readings are within 2 percent of those in C.4.2a), C.4.2b), the analysis is considered acceptable;

f) At all points in this section the flow-rates and pressures of the various gases shall be the same as those used during calibration of the analysers;

g) The figure adopted for the concentration of each pollutant measured in the gases is that read off after stabilisation on the measuring device.

C.4.3 Measuring covered distance

The distance (S) actually covered for a test part shall be calculated by multiplying the number of revolutions read from the cumulative counter by the circumference of the roller. This distance shall be expressed in km.

C.4.4 Determination of the quantity of gas emissions

C.4.4.1 The mass of carbon monoxide (CO) emitted by the exhaust of the vehicle during the test shall be calculated using the following formula:

$$CO_M = \frac{1}{S} \times V \times d_{CO} \times CO_C \tag{23}$$

Where:

CO_M -- Mass of CO emissions, mg/km;

S -- Covered distance provided in C.4.3, km;

d_{CO} -- Density of CO at the temperature of 20°C and the atmospheric pressure of 101.33 kPa, d_{CO} = 1.164 kg/m^3;

CO_c -- CO concentration (v/v) in the diluted exhaust gas, ppm, corrected to take account of the dilution air by the following equation::

$$CO_c = CO_e - CO_d(1 - \frac{1}{df}) \tag{24}$$

Where:

CO_e -- CO concentration (v/v) in the diluted exhaust gas of sample bag S_a, ppm;

CO_d -- CO concentration (v/v) in the diluted exhaust gas of sample bag S_b, ppm;

d_f -- Coefficient provided in C.4.4.5;

V -- Total volume of diluted gas adjusted to the conditions of 20°C and 101.33 kPa, m^3/cycle part.

It is calculated with the formula below:

$$V=\frac{293.2\times V_0\times N\times(P_a-P_i)}{101.33\times(t_p+273.2)} \tag{25}$$

Where:

V_0 -- Volume of gas displaced per revolution of pump P_1, m^3/revolution, this volume is a function of the differences between the intake and output sections of the pump P_1;

N -- Number of revolutions made by pump P_1 during each part of the test, revolution;

P_a -- Ambient pressure, kPa;

P_i -- Average under-pressure during the test part in the intake section of pump P_1, kPa;

T_p -- Average temperature of the diluted gas in the intake section of pump P_1 during the test part, °C.

C.4.4.2 The unburned hydrocarbons (HC) emissions from vehicle in the test is calculated with the formula below:

$$HC_M=\frac{1}{S}\times V\times d_{HC}\times HC_C \tag{26}$$

Where:

HC_M -- Mass of HC emissions, mg/km;

S -- Covered distance provided in C.4.3, km;

d_{HC} -- Density of HC at the temperature of 20°C and the atmospheric pressure of 101.33 kPa, respectively being as follows for different fuels:

In the case of gasoline with the average H/C ratio of 1: 1.85, d_{HC} = 0.577 kg/m^3;

In the case of LPG with the average H/C ratio of 1: 2.525, d_{HC} = 0.517 kg/m^3;

In the case of NG with the average H/C ratio of 1: 4, d_{HC} = 0.511 kg/m^3;

V -- Total volume (C.4.4.1);

HC_c -- HC concentration (v/v) in the diluted exhaust gas (in the case of propane, concentration to be multiplied with 3), ppm, corrected to take account of the dilution air by the following equation::

$$HC_c=HC_e-HC_d(1-\frac{1}{df}) \tag{27}$$

Where:

HC_e -- HC concentration (v/v) in the diluted exhaust gas of sample bag S_a, ppm;

HC_d -- HC concentration (v/v) in the diluted exhaust gas of sample bag S_b, ppm;

d_f -- Coefficient provided in C.4.4.5.

C.4.4.3 The nitrogen oxides (NOx) emissions from vehicle in the test is calculated with the formula below:

$$NO_{xM}=\frac{1}{S}\times V\times d_{NO_2}\times NO_{xC}\times K_h \tag{28}$$

Where:

NO_{xM} -- Mass of NOx emissions, mg/km;

S -- Covered distance provided in C.4.3, km;

d_{NO2} -- Density of NOx in exhaust gas, denoted by NO_2 equivalent; at the temperature of 20°C and atmospheric pressure of 101.33 kPa, d_{NO2} = 1.913 kg/m^3;

V -- Total volume (C.4.4.1);

NO_{xc} -- NOx concentration (v/v) in the diluted exhaust gas, ppm, corrected to take account of the dilution air by the following equation::

$$NO_{xc} = NO_{xe} - NO_{xd}(1 - \frac{1}{df}) \quad (29)$$

Where:

NO_{xe} -- NOx concentration (v/v) in the diluted exhaust gas of sample bag S_a, ppm;

NO_{xd} -- NOx concentration (v/v) in the diluted exhaust gas of sample bag S_b, ppm;

df -- Coefficient provided in C.4.4.5;

K_h -- Humidity correction factor:

$$K_h = \frac{1}{1 - 0.0329 \times (H - 10.7)} \quad (30)$$

Where:

H -- Absolute humidity in g of water per kg of dry air. It shall be calculated with the formula below:

$$H = \frac{6.2111 \times U \times P_d}{P_a - P_d \times (U/100)} \quad (31)$$

Where:

U -- Humidity as a percentage (%);

P_d -- Saturated vapor pressure of water at test temperature, kPa;

P_a -- Atmospheric pressure, kPa.

C.4.4.4 The CO_2 emissions from vehicle in the test is calculated with the formula below:

$$CO_{2M} = \frac{1}{S} \times V \times d_{CO_2} \times CO_{2c} \times 10^4 \quad (32)$$

Where:

CO_{2M} -- Mass of CO_2 emissions, mg/km;

S -- Covered distance provided in C.4.3, km;

dco_2 -- Density of CO_2 at the temperature of 20°C and the atmospheric pressure of 101.33 kPa, d_{CO2} = 1.829 kg/m^3;

V -- Total volume (C.4.4.1);

CO_{2c} -- CO_2 concentration (v/v) in the diluted exhaust gas, ppm, corrected to take account of the dilution air by the following equation:

$$CO_{2c} = CO_{2e} - CO_{2d}(1 - \frac{1}{df}) \tag{33}$$

Where:

CO_{2e} -- CO_2 concentration (v/v) in the diluted exhaust gas of sample bag S_a, % (v/v);

CO_{2d} -- CO_2 concentration (v/v) in the diluted exhaust gas of sample bag S_b, % (v/v);

df -- Coefficient provided in C.4.4.5.

C.4.4.5 Dilution factor *df*

The dilution factor calculation is as follows:

For petrol:

$$df = \frac{13.4}{C_{CO_2} + (C_{HC} + C_{CO}) \times 10^{-4}} \tag{34}$$

For LPG:

$$df = \frac{11.9}{C_{CO_2} + (C_{HC} + C_{CO}) \times 10^{-4}} \tag{35}$$

For NG:

$$df = \frac{9.5}{C_{CO_2} + (C_{HC} + C_{CO}) \times 10^{-4}} \tag{36}$$

Where:

C_{CO2}-- CO_2 concentration (v/v) in the diluted exhaust gas of sample bag S_a, % (v/v);

C_{HC} -- HC concentration (v/v) in the diluted exhaust gas of sample bag S_a, ppm;

C_{CO} -- CO concentration (v/v) in the diluted exhaust gas of sample bag S_a, ppm.

C.4.5 Weighting of results

Emission test shall be performed as per C.3.1, and emission pollutant calculation conducted as per C.4. As shown in Appendix CC, the test cycle of vehicle consists of eight sub test cycles, where the first four test cycles are defined as the cold test cycle, while the fifth ~ eighth sub test cycles defined as the hot test cycle; the test result of the cold test cycle is denoted as R_C, and that of hot test cycle as R_W. All the emission pollutants are expressed in mg/km, and the final result is defined as R, with $R = 0.3 \times R_C + 0.7 \times R_W$.

Appendix CA

(Normative)

Symbols Used

Table CA.1 Description of symbols

Symbol	Definition	Unit
A	Coefficient of polygonal function	--
a	Rolling resistance of front wheel	N
B	Coefficient of polygonal function	--
b	Coefficient of aerodynamic function	$N / (km/h)^2$
C	Coefficient of polygonal function	--
C_{CO}	Concentration of carbon monoxide	%
C_{COcorr}	Corrected concentration of carbon monoxide	%
CO_{2c}	Carbon dioxide concentration of diluted gas, corrected to take account of diluent air	%
CO_{2d}	Carbon dioxide concentration in the sample of diluent air collected in bag B	%
CO_{2e}	Carbon dioxide concentration in the sample of diluent air collected in bag A	%
CO_{2M}	Mass of carbon dioxide emitted during the test part	mg/km
CO_c	Carbon monoxide concentration of diluted gas, corrected to take account of diluent air	ppm
CO_d	Carbon monoxide concentration in the sample of diluent air, collected in bag B	ppm
CO_e	Carbon monoxide concentration in the sample of diluent air, collected in bag A	ppm
CO_M	Mass of carbon monoxide emitted during the test part	mg/km
d_0	Standard ambient relative air density	--
d_{CO}	Density of carbon monoxide	kg/m^3
d_{CO2}	Density of carbon dioxide	kg/m^3
df	Dilution factor	--
d_{HC}	Density of hydrocarbon	kg/m^3
d_{NOx}	Density of nitrogen oxide	kg/m^3
d_T	Relative air density under test condition	--
Δt	Coasting time	s
ΔT_{ai}	Coast-down time measured in the first road test	s
ΔT_{bi}	Coast-down time measured in the second road test	s
ΔT_E	Coast-down time corrected for the inertia mass	s
Δt_E	Mean coast-down time on the chassis dynamometer at the reference speed	s
ΔT_i	Average coast-down time at specified speed	s
Δt_i	Coast-down time at corresponding speed	s

ΔT_j	Average coast-down time at specified speed	s
ΔT_{road}	Target coast-down time	s
Δt	Mean coast-down time on the chassis dynamometer without absorption	s
Δv	Coast-down speed interval ($2\Delta v = v_1 - v_2$)	km/h
ε	Chassis dynamometer setting error	%
F	Running resistance force	N
F*	Target running resistance force	N
$F^*_{(v0)}$	Target running resistance force at reference speed on chassis dynamometer	N
F^*_{vi}	Target running resistance force at specified speed on chassis dynamometer	N
f^*_0	Corrected rolling resistance in the standard ambient condition	N
f^*_2	Corrected coefficient of aerodynamic drag in the standard ambient condition	$N / (km/h)^2$
F^*_j	Target running resistance force at specified speed	N
f_0	Rolling resistance	N
f_2	Coefficient of aerodynamic drag	$N / (km/h)^2$
F_E	Set running resistance force on the chassis dynamometer	N
$F_{E(v0)}$	Set running resistance force at the reference speed on the chassis dynamometer	N
$F_{E(v2)}$	Set running resistance force at the specified speed on the chassis dynamometer	N
F_f	Total friction loss	N
$F_{f(v0)}$	Total friction loss at the reference speed	N
F_j	Running resistance force	N
$F_{j(v0)}$	Running resistance force at the reference speed	N
F_{pau}	Braking force of the power absorbing unit	N
$F_{pau(v0)}$	Braking force of the power absorbing unit at the reference speed	N
$F_{pau(vj)}$	Braking force of the power absorbing unit at the specified speed	N
F_T	Running resistance force obtained from the running resistance table	N
H	Absolute humidity	%
HC_c	Concentration of diluted gases expressed in the carbon equivalent, corrected to take account of diluent air	ppm
HC_d	Concentration of hydrocarbons expressed in the carbon equivalent, in the sample of diluent air collected in bag B	ppm
HC_e	Concentration of hydrocarbons expressed in the carbon equivalent, in the sample of diluent air collected in bag A	ppm
HC_M	Mass of hydrocarbon emitted during the test part	mg/km
K_0	Temperature correction factor for rolling resistance	--
K_h	Humidity correction factor	--
L	Limit values of gaseous emission	mg/km
m	The total mass of the vehicle and the mass of the , driver (75 kg) and onboard instruments and equipment in coasting performance test	kg
m_a	Actual mass of the test L-category vehicle	kg

m_{fi}	Flywheel equivalent inertia mass	kg
m_i	Equivalent inertia mass	kg
m_k	Kerb mass (L-category vehicle)	kg
m_r	Equivalent inertia mass of all the wheels	kg
m_{ri}	Equivalent inertia mass of all the rear wheel and L-category vehicle parts rotating with wheel	kg
m_{ref}	Reference mass	kg
m_{rf}	Rotating mass of the front wheel	kg
m_{rid}	Rider mass	kg
N	Engine speed	r/min
N	Number of data regarding the emission or the test	--
N	Number of revolution made by pump P	--
n_{idle}	Idling speed	r/min
NO_{xc}	Nitrogen oxide concentration of diluted gases, corrected to take account of diluent air	ppm
NO_{xd}	Nitrogen oxide concentration in the sample of diluent air collected in bag B	ppm
NO_{xe}	Nitrogen oxide concentration in the sample of diluent air collected in bag A	ppm
NO_{xM}	Mass of nitrogen oxides emitted during the test part	mg/km
P_0	Standard ambient pressure	kPa
P_a	Ambient/atmospheric pressure	kPa
P_d	Saturated vapor pressure of water at test temperature	kPa
P_i	Average under-pressure during the test part in the section of pump P	kPa
P_n	Rated engine power	kW
P_T	Mean ambient pressure during the test	kPa
ρ_0	Standard relative ambient air volumetric mass	kg/m^3
R_C	Test result of cold test cycle	mg/km
R_W	Test result of hot test cycle	mg/km
S	Test distance	km
T_0	Standard ambient temperature	°C
T_P	Temperature of the diluted gases during the test part, measured in the intake section of pump P	°C
T_T	Mean ambient temperature during the test	°C
U	humidity	%
v	Specified speed	km/h
V	Total volume of diluted gas	m^3
V_h	Engine displacement	mL
v_j	Designated speed in the road coasting test	km/h
v_{max}	Maximum design speed of test vehicle (L-category vehicle)	km/h
v_0	Reference vehicle speed	km/h

V_0	Volume of gas displaced by pump P during one revolution	m^3/rev.
v_1	Vehicle speed at which the measurement of the coast-down time begins	km/h
v_2	Vehicle speed at which the measurement of the coast-down time ends	km/h
v_i	Specified vehicle speed selected for the coast-down time measurement	km/h

Appendix CB

(Normative)

Calibration Method for Moped's Road Absorption Power on Chassis Dynamometer

CB.1 Scope

This Appendix describes the procedure for determining the road absorption power of moped on a chassis dynamometer.

CB.2 Methodology

The load absorbed comprises the load absorbed by frictional effects and the load absorbed by the power-absorption device. The dynamometer is brought into operation beyond the range of test speeds. The device used for starting up the dynamometer is then disconnected; the rotational speed of the driven roller decreases. The kinetic energy of the rollers is dissipated by the power-absorption unit and by the frictional effects. This method disregards variations in the roller's internal frictional effects caused by vehicle gyrating mass. For double drum chassis dynamometer, the difference of stopping time between free rear drum and driving front drum can be ignored.

CB.3 Test procedures

CB.3.1 Measure drum's rotating speed, by means of fifth wheel, revolution counter, etc.

CB.3.2 Place the vehicle on the dynamometer or devise some other method for starting up the dynamometer.

CB.3.3 Depending upon moped's mass classification, engage flywheel onto the chassis dynamometer or adopt other inertia simulation system.

CB.3.4 Make the chassis dynamometer to reach the speed of 90 km/h.

CB.3.5 Record the indicated value of power absorption.

CB.3.6 Make the chassis dynamometer to reach the speed of 110 km/h.

CB.3.7 Disengage the device propelling the chassis dynamometer.

CB.3.8 Record the time needed for the chassis dynamometer speed to decline from 99 km/h to 81 km/h.

CB.3.9 Adjust the power absorption unit to another different level.

CB.3.10 Repeat the steps in CB.3.4 ~ CB.3.9 above, so as to cover the entire power scope.

CB.3.11 Absorbed power is calculated with the formula below:

$$P_d = \frac{M_1\left(v_1^2 - v_2^2\right)}{2000t} = \frac{0.03858M_1}{t} \quad \cdots\cdots (1)$$

Where:

P_{d} -- Power, kW;

M_1 -- Equivalent inertia, kg;

v_1 -- Initial speed, m/s (99 km/h = 27.5 m/s);

v_2 -- Final speed, m/s (81 km/h = 22.5 m/s);

s -- Time needed for the drum to drop from 99 km/h to 81 km/h, s.

CB.3.12 The relational curve between the power absorption and the indicated power of chassis dynamometer speed at 90 km/h is shown in Figure CB.1.

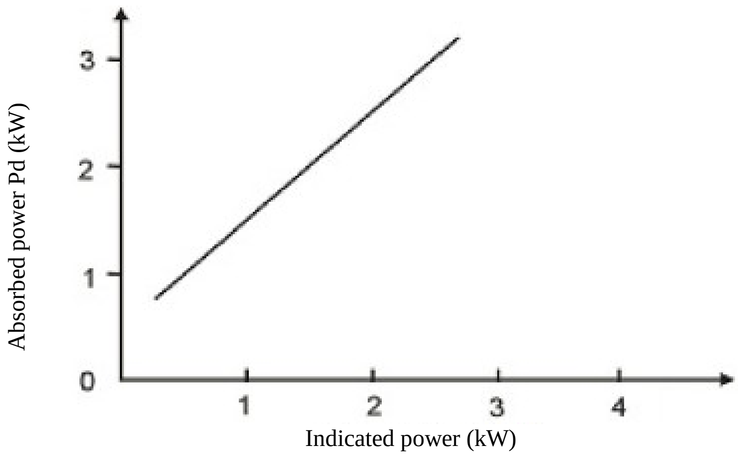

Figure CB.1 Relational curve between power absorption and indicated power

Appendix CC

(Normative)

Type I Test cycle

CC.1 Test cycle

The test cycle of moped consists of eight sub cycles, 896s in total.concretely, the first four sub cycles are defined as cold-state test cycle, while the fifth ~ eighth urban cycles are defined as the hot-state test cycle.each sub cycle is consist of seven phases (idling, acceleration, constant-speed and deceleration),112s intotal.

CC.2 Mode of sub cycle

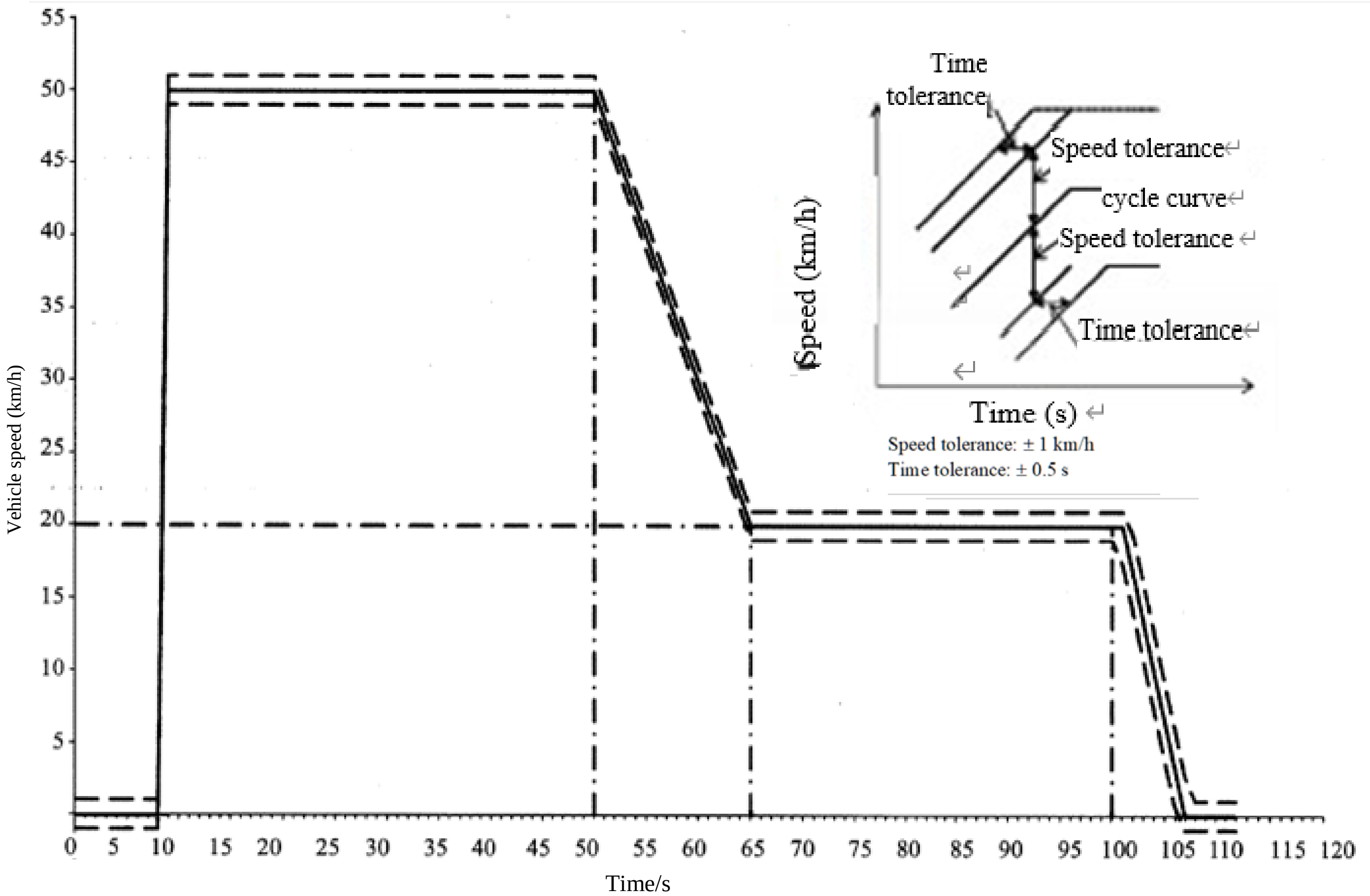

Figure CC.1 Mode graph of sub cycle

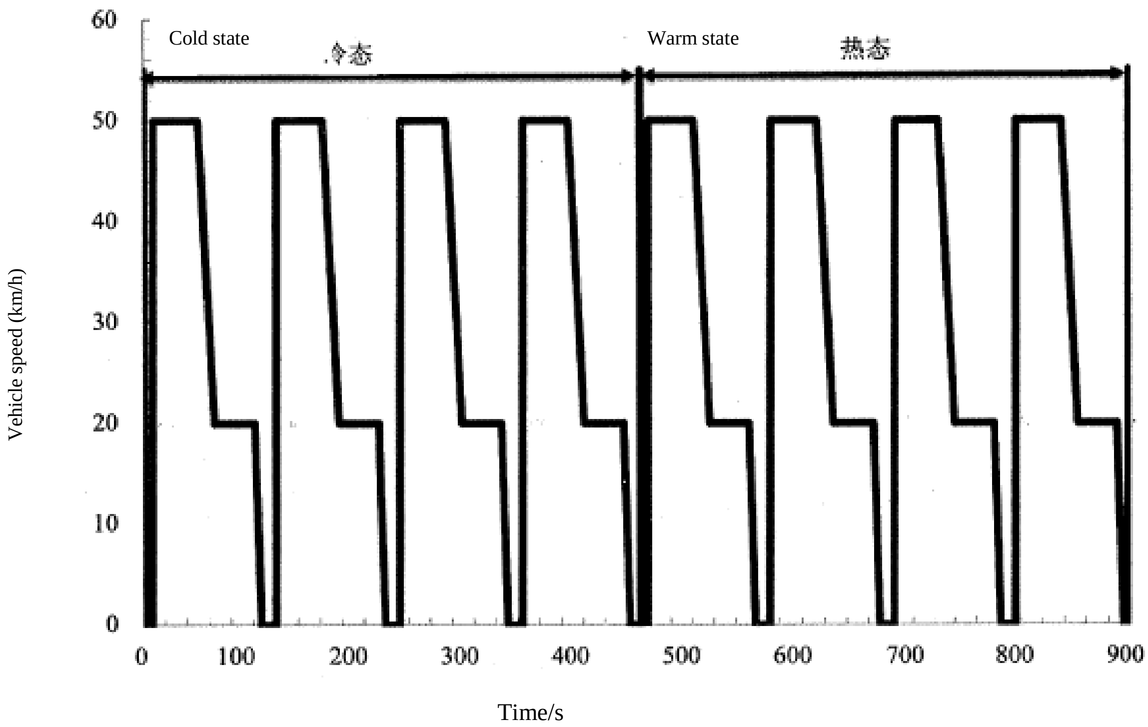

Figure CC.2 Mode graph of test cycle

Table CC.1 Mode sheet of sub cycle

Sr. No. of operation	Operation state	Acc. m/s^2	Vehicle speed km/h	Mode time s	Cumulative time s
1	Idle	-	-	8	8
2	Acceleration	Throttle fully open	0→max	57	-
3	Constant speed	Throttle fully open	max		-
4	Deceleration	-0.56	max→20		65
5	Constant speed	-	20	36	101
6	Deceleration	-0.93	20→0	6	107
7	Idle	-	-	5	112

Appendix CD

(Normative)

Road Coasting Test Performed for Setting Chassis Dynamometer

CD.1 Requirements for driver

CD.1.1 Driver shall put up fit clothes, in addition to helmet, eye mask, boots and gloves.

CD.1.2 The rider, dressed and equipped as described in point 1.1., shall have a mass of 75 kg ± 5 kg and be 1,75 m ± 0,05 m tall.

CD.1.3 The rider shall be seated on the seat provided.This position shall allow the rider to have proper control of the vehicle at all times during the tests.

CD.2 Requirements for road and surrounding environment

CD.2.1 The test road shall be flat, level, straight and smoothly paved. The road surface shall be dry and free of obstacles or wind barriers that might impede the measurement of the running resistance. The slope of the surface shall not exceed 0,5 percent between any two points at least 2 m apart.

CD.2.2 During data collecting periods, the wind direction shall be steady. The speed and the direction of the wind shall be measured continuously or with adequate frequency at a fixed location.

CD.2.3 The ambient conditions shall be within the following limits:

-- Maximum wind speed: 3 m/s

-- Maximum wind speed for gusts: 5 m/s

-- Average wind speed, parallel: 3 m/s

-- Average wind speed, perpendicular: 2 m/s

-- Maximum relative humidity: 95%

-- Temperature: 5 ~ 35°C

CD.2.4 Standard ambient conditions shall be as follows:

-- Barometric pressure P_0 is 100 kPa;

-- Temperature T_0 is 20°C;

-- Relative air density d_0 is 0.9197;

-- Air density ρ_0 is 1.189 kg/m^3;

-- Wind speed is 0.

CD.2.5 The relative air density when the vehicle is tested, calculated in accordance with the formula (1), shall not differ by more than 7.5 percent from the air density under the standard conditions.

$$d_T = d_0 \times \frac{p_T}{P_0} \times \frac{T_0}{T_T} \quad \cdots\cdots (1)$$

Where:

d_T -- Relative air density for test;

P_T -- Barometric pressure for test, kPa;

T_T -- Test temperature, K.

CD.3 State of moped

CD.3.1 Moped shall attain the state provided in C.2.2.

CD.3.2 When installing the measuring instruments on the test vehicle, care shall be taken to minimise their effects on the distribution of the load across the wheels. When installing the speed sensor outside the vehicle, care shall betaken to minimise the additional aerodynamic loss.

CD.4 Designated coasting speed

Measure the coasting time of the vehicle between v_1 and v_2 according to Table CD.1.

Where, $v_1 = v_j + \Delta v$, $v_2 = v_j - \Delta v$ (Δv = 5 km/).

When running resistance is set as per C.3.2.3.2, test shall be conducted at $v_j \pm 5$ km/h, and the accuracy of time measurement shall fulfill Table C.1.

Table CD.1 Start and end speed for measuring coasting time

Unit: km/h

v_j	v_1	v_2
40	45	35
30	35	25
20	25	15

CD.5 Measurement of coasting time

CD.5.1 After a warm-up period, the vehicle shall be accelerated to the coast-down starting speed, and the coast-down measurement procedure shall be started.

CD.5.2 Since shifting the transmission to neutral can be dangerous and complicated by the construction of the vehicle, the coasting may be performed solely with the clutch disengaged. Vehicles that have no means of cutting the transmitted engine power off prior to coasting may be towed until they reach the coast-down starting speed. When the coast-down test is reproduced on the chassis dynamometer, the drive train and clutch shall be in the same condition as during the road test.

CD.5.3 The operation of moped should be minimized and the brakes shall not be operated until the coast-down measurement is over.

CD.5.4 The first coast-down time Δt_{ai}corresponding to the specified speed v_j shall be measured as the time taken for the vehicle to decelerate from $v_j + \Delta v$ to $v_j - \Delta v$.

CD.5.5 The procedure described in points CD 5.1. to 5.4. shall be repeated in the opposite direction to measure the second coast-down time Δt_{bi}

CD.5.6 The average Δt_i of the two coast-down times Δt_{ai} and Δt_{bi} shall be calculated using the following equation:

$$\Delta T_i = \frac{\Delta T_{a\ i} + \Delta T_{b\ i}}{2} \quad \cdots\cdots (2)$$

CD.5.7 At least four tests shall be performed and the average coast-down time ΔT_j calculated using the following equation:

$$\Delta T_j = \frac{1}{n} \times \sum_{i=1}^{n} \Delta T_i \quad \cdots\cdots (3)$$

CD.5.8 Tests shall be performed until the statistical accuracy P is equal to or less than 3 percent (P ≤ 3 percent). The statistical accuracy P is calculated using the following equation:

$$P = \frac{t \times s}{\sqrt{n}} \times \frac{100}{\Delta T_j} \quad (4)$$

Where:

t -- Coefficient given in Table CF.2;

s -- Standard deviation calculated with the formula below:

$$s = \sqrt{\sum_{i=1}^{n} \frac{(\Delta T_i - \Delta T_j)^2}{n-1}} \quad (5)$$

Where:

n -- Number of test runs.

Table CD.2 Factor of statistical accuracy

n	t	$\frac{t}{\sqrt{n}}$
4	3.2	1.60
5	2.8	1.25
6	2.6	1.06
7	2.5	0.94
8	2.4	0.85
9	2.3	0.77
10	2.3	0.73
11	2.2	0.66
12	2.2	0.64
13	2.2	0.61
14	2.2	0.59
15	2.2	0.57

CD.5.9 In repeating the test, care shall be taken to start the coast-down after observing the same warm-up procedure and at the same coast-down starting speed.

CD.5.10 The coast-down times for multiple specified speeds may be measured in a continuous coast-down. In this case, the coast-down shall be repeated after observing the same warm-up procedure and at the same coast-down starting speed.

CD.5.11 The coast-down time shall be recorded.

CD.6 Data processing

CD.6.1 Calculation of running resistance force

CD.6.1.1 The running resistance force F j , in Newton, at the specified speed v j shall be calculated using the following equation:

$$F_j = \frac{1}{3.6} \times (m + m_r) \times \frac{2\Delta v}{\Delta T_j} \quad (6)$$

Where:

m -- Mass of tested moped, expressed in kg, incl. driver as well as instruments and equipment;

m_r -- Equivalent inertia mass of wheel and the parts rotating with wheel in the coasting test, expressed in kg. Equivalent inertia mass m_r may be measured or calculated through a proper method. Concretely, for the calculation method, it may be estimated as 7% of the mass of tested moped.

CD.6.1.2 Road running resistance F_j is corrected as per the provisions of CF.6.2.

CD.6.2 Road running resistance curve

Road running resistance F is calculated with the formula below.

CD.6.2.1 Based on the test data of F_j and v_j, calculate f_0 and f_2 in the following formula through the "linear regression method".

$$F = f_0 + f_2 \times v^2 \quad (7)$$

Where:

F -- Running resistance, incl. air resistance, N;

f_0 -- Rolling resistance, N;

f_2 -- Air resistance coefficient, N/ $(km/h)^2$.

CD.6.2.2 The factors f_0 and f_2 shall be corrected with the formula below under the standard environmental conditions:

$$f^*_0 = f_0\left[1 + K_0(T_T - T_0)\right] \quad (8)$$

$$f^*_2 = f_2 \times \frac{T_T}{T_0} \times \frac{p_0}{p_T} \quad (9)$$

Where:

f^*_0 -- Rolling resistance corrected to the standard environmental conditions, N;

T_T -- Average ambient temperature, K;

f^*_2 -- Air resistance coefficient corrected to the standard environmental conditions, N/ $(km/h)^2$;

K_0 -- Correction factor for rolling resistance in consideration of temperature, an empirical value resulted from moped and tyre tests; given no available data, it may be assumed as $K_0 = 6 \times 10^{-3}\ K^{-1}$.

CD.6.3 The target running resistance F*(v0) of chassis dynamometer at the reference vehicle speed (v0) is calculated with the formula below, expressed in N.

$$F^*(v_0) = f^*_0 + f^*_2 \times v_0^2 \quad (10)$$

Appendix CE
(Normative)
Equivalent Inertia Mass

Table CE.1 Equivalent inertia mass

Reference mass, m_{ref} (kg)	Equivalent inertia mass m i (kg)	Rolling resistance of front wheel, aN	Aero drag coefficient, b N/(km/h)^2
$95 < m_{ref} \leq 105$	100	8.8	0.0215
$105 < m_{ref} \leq 115$	110	9.7	0.0217
$115 < m_{ref} \leq 125$	120	10.6	0.0218
$125 < m_{ref} \leq 135$	130	11.4	0.0220
$135 < m_{ref} \leq 145$	140	12.3	0.0221
$145 < m_{ref} \leq 155$	150	13.2	0.0223
$155 < m_{ref} \leq 165$	160	14.1	0.0224
$165 < m_{ref} \leq 175$	170	15.0	0.0226
$175 < m_{ref} \leq 185$	180	15.8	0.0227
$185 < m_{ref} \leq 195$	190	16.7	0.0229
$195 < m_{ref} \leq 205$	200	17.6	0.0230
$205 < m_{ref} \leq 215$	210	18.5	0.0232
$215 < m_{ref} \leq 225$	220	19.4	0.0233
$225 < m_{ref} \leq 235$	230	20.2	0.0235
$235 < m_{ref} \leq 245$	240	21.1	0.0236
$245 < m_{ref} \leq 255$	250	22.0	0.0238
$255 < m_{ref} \leq 265$	260	22.9	0.0239
$265 < m_{ref} \leq 275$	270	23.8	0.0241
$275 < m_{ref} \leq 285$	280	24.6	0.0242
$285 < m_{ref} \leq 295$	290	25.5	0.0244
$295 < m_{ref} \leq 305$	300	26.4	0.0245
$305 < m_{ref} \leq 315$	310	27.3	0.0247
$315 < m_{ref} \leq 325$	320	28.2	0.0248
$325 < m_{ref} \leq 335$	330	29.0	0.0250
$335 < m_{ref} \leq 345$	340	29.9	0.0251
$345 < m_{ref} \leq 355$	350	30.8	0.0253
$355 < m_{ref} \leq 365$	360	31.7	0.0254
$365 < m_{ref} \leq 375$	370	32.6	0.0256
$375 < m_{ref} \leq 385$	380	33.4	0.0257

385 < m_{ref} ≤ 395	390	34.3	0.0259
395 < m_{ref} ≤ 405	400	35.2	0.0260
405 < m_{ref} ≤ 415	410	36.1	0.0262
415 < m_{ref} ≤ 425	420	37.0	0.0263
425 < m_{ref} ≤ 435	430	37.8	0.0265
435 < m_{ref} ≤ 445	440	38.7	0.0266
445 < m_{ref} ≤ 455	450	39.6	0.0268
455 < m_{ref} ≤ 465	460	40.5	0.0269
465 < m_{ref} ≤ 475	470	41.4	0.0271
475 < m_{ref} ≤ 485	480	42.2	0.0272
485 < m_{ref} ≤ 495	490	43.1	0.0274
495 < m_{ref} ≤ 505	500	44.0	0.0275
505 < m_{ref} ≤ 515	510	44.9	0.0277
515 < m_{ref} ≤ 525	520	45.8	0.0278
525 < m_{ref} ≤ 535	530	46.6	0.0280
535 < m_{ref} ≤ 545	540	47.5	0.0281
545 < m_{ref} ≤ 555	550	48.4	0.0283
555 < m_{ref} ≤ 565	560	49.3	0.0284
565 < m_{ref} ≤ 575	570	50.2	0.0286
575 < m_{ref} ≤ 585	580	51.0	0.0287
585 < m_{ref} ≤ 595	590	51.9	0.0289
595 < m_{ref} ≤ 605	600	52.8	0.0290
605 < m_{ref} ≤ 615	610	53.7	0.0292
615 < m_{ref} ≤ 625	620	54.6	0.0293
625 < m_{ref} ≤ 635	630	55.4	0.0295
635 < m_{ref} ≤ 645	640	56.3	0.0296
645 < m_{ref} ≤ 655	650	57.2	0.0298
655 < m_{ref} ≤ 665	660	58.1	0.0299
665 < m_{ref} ≤ 675	670	59.0	0.0301
675 < m_{ref} ≤ 685	680	59.8	0.0302
Every 10 kg being taken as one class	Every 10 kg being taken as one class	$a = 0.088 \times m_i$	$b = 0.000015 \times m_i + 0.02$
Notes: 1) The value shall be rounded to one decimal place. 2) The value shall be rounded to four decimal places.			

Annex D

(Normative)

Tailpipe emissions at (increased) idle and free acceleration (Type II test)

D.1 Introduction

This Annex describes the procedures of the tailpipe emissions at (increased) idle mentioned in 6.2.2.

D.2 Measurement procedures

D.2.1 Instrument preparation and use

The measurement equipment for tailpipe emission shall comply with the provisions of HJ/T 289. The preparations (incl. warm-up) and utilization of instruments shall be carried out as per the use instructions of instrument manufacturer.

D.2.2 Test environment and vehicle preparations

D.2.2.1 The type II emission test shall be conducted immediately after the type I emission test. During the test, the environmental temperature shall be between 293.2K and 303.2 K (20 °C and 30 °C).

D.2.2.2 The fuel for type II test shall be the same as that for the type I test. In case the engine adopts mixed lubrication manner, the volume & grade of the lube oil added into fuel shall comply with the provisions of the manufacturer's documentation.

D.2.2.3 Test vehicle shall remain at the normal state indicated by the manufacturer, and the exhaust system shall not have any leakage.

D.2.2.4 Upon COP inspection, vehicle shall be warmed up as per the provisions of manufacturer's documentation, and the test may be performed at ambient temperature.

D.2.2.5 Upon test, a dedicated air-tight connecting tube, 600 mm long and Φ40 mm inside diameter, shall be fitted to the tail of the vehicle's exhaust silencer, and shall assure the variation in exhaust gas back pressure would not exceed 1.25 kPa,and without disturbing operation of the engine.

D.2.2.6 If the test vehicle has multiple exhaust pipes, y-shaped nozzles should be used to collect exhaust for measurement, or multiple exhaust pipes can be measured separately, and the arithmetic average value of each pollutant measurement result of each exhaust pipe is taken as the final measurement result of the vehicle.

D.2.3 Measurement of tailpipe emissions under the operating mode of high idle speed

D.2.3.1 Accelerate the engine from the normal idle state to 70% engine speed corresponding to the max. net power, operate for min. 10 s, and then decelerate to the operation mode of high idle speed.

D.2.3.2 Maintain the operating mode of high idle speed, and insert the sampling probe into the connecting tube, assuring a minimum insertion depth of 400 mm; after the retention of ca. 15 s, read the average within 30 s via an instrument having the averaging function; or, alternatively, it may manually read the maximum and the minimum within 30 s, and take their average as the measurement results of pollutants at high idle speed.

D.2.3.3 Read the λ value, or record the concentration of CO, HC, CO_2 & O_2 in the exhaust gas, and calculate the λ value with the formula below.

$$\lambda=\frac{[CO_2]+\frac{[CO]}{2}+[O_2]+\left(\frac{HCv}{4}\times\frac{3.5}{3.5+\frac{[CO]}{[CO_2]}}-\frac{OCv}{2}\right)\times([CO_2]+[CO])}{\left(1+\frac{HCv}{4}-\frac{OCv}{2}\right)\times([CO_2]+[CO]+K1\times[HC])} \quad (1)$$

Where:

[ ] -- Concentration, %, v/v;

K1 -- Coefficient for converting NDIR measurement into FID measurement (to be provided by the manufacturer of measuring equipment);

Hcv -- Hydrogen-carbon atom ratio;

-- Gasoline = 1.73

-- LPG = 2.53

-- NG = 4

Ocv -- Oxygen-carbon -carbon atom ratio.

-- Gasoline = 0.02

-- LPG = 0

-- NG = 0

D.2.4 Measurement of tailpipe emissions under the operating mode of normal idle speed

Decelerate the engine from the operating mode of high idle speed to the operating mode of normal idle speed; after the retention of 15 s, read the average within 30 s via an instrument having the averaging function; or, alternatively, it may manually read the maximum and the minimum within 30 s, and take their average as the measurement results at normal idle speed.

D.2.5 Parameters of measurement results

It needs to record the concentration of CO, CO_2 & HC in exhaust gases and the λ value at high idle speed, in addition to engine speed and the engine oil temperature or coolant temperature.

D.2.5.1 Correction of CO measurement results

For vehicles powered by respective fuel, if the sum of carbon monoxide and carbon dioxide concentrations measured is less than the following values:

(1) Gasoline: 10% for two-stroke, 15% for four-stroke;

(2) LPG: 13.5%;

(3) NG: 11.5%;

Then, the measured CO concentration shall be corrected with the formula provided in D.2.5.2 or D.2.5.3; otherwise, no correction is necessary. The corrected measurement results shall prevail.

D.2.5.2 In the case of two-stroke engine, the corrected CO concentration is:

$$C_{CO修正}=C_{CO}\times\frac{10}{C_{CO}+C_{CO_2}}\% \quad (2)$$

D.2.5.3 In the case of four-stroke engines, the corrected CO concentration is:

$$C_{CO修正} = C_{CO} \times \frac{15}{C_{CO} + C_{CO_2}} \% \quad \cdots\cdots (3)$$

D.2.6 Rounding-off of value

CO measurement results shall be rounded off to the first place behind the decimal point; HC measurement results shall be rounded off to ten's place; and the calculation results of λ value shall be rounded off to the third place behind the decimal point.

D.3 Mono fuel gas vehicles and bi-fuel vehicles

In the case of mono fuel gas vehicles, emission test shall be carried out only with the use of gaseous fuel; in the case of bi-fuel vehicles, emission test shall be carried out respectively and separately with the two types of fuels.

Annex E

(Normative)

Test of Evaporative Emissions (Type IV test)

E.1 Introduction

This Annex sets out the measuring method for the fuel evaporative emissions test (type IV test) of mopeds.

E.2 Description of test

The evaporative emissions test mainly consists of the stages below:

-- Test preparations;

-- Diurnal (breathing loss) test;

-- Driving cycle;

-- Hot soak loss test.

Mass emissions of hydrocarbons from the tank breathing loss and the hot soak loss phases are added together to provide an overall result for the test.

E.3 Vehicle and fuel

E.3.1 Vehicle

E.3.1.1 The test vehicle, shall be in good mechanical condition and, before the evaporative test, have been run in and driven at least 250 km. In the run-in process, the continuous operation time of vehicle shall not exceed 4 h, and the time of each stop shall be min. 1 h.

E.3.1.2 The evaporative emission-control system shall be connected and functioning correctly over this period and the carbon canister and evaporative emission control valve subjected to normal use, undergoing neither abnormal purging nor abnormal loading.

E.3.2 Fuel

The appropriate test fuel, as defined in Annex H, shall be used.

E.4 Test equipment

E.4.1 Chassis dynamometer

The chassis dynamometer shall meet the requirements of Annex C.

E.4.2 Evaporative emission measurement enclosure (SHED)

The closed chamber shall meet the requirements specified in Appendix EA, and the inner surface of the closed chamber shall not permeate or release hydrocarbons and with reacting with them. At least one inner surface of the closed chamber shall be equipped with a flexible impermeable material to balance the pressure changes caused by small changes in temperature. The walls of the closed chamber shall be designed with good heat dissipation. The surface temperature of the closed chamber shall be 298.2K±5K (25℃±5℃) during the test.

E.4.3 Analytical system

E.4.3.1 Hydrocarbon analyser

E.4.3.1.1 The atmosphere within the chamber is monitored using a hydrocarbon detector of the flame ionisation detector (FID) type. Sample gas shall be drawn from the midpoint of one side wall or the roof of the chamber and any bypass flow shall be returned to the enclosure, preferably to a point immediately downstream of the mixing fan.

E.4.3.1.2 It shall choose the working range of the analyser to get the best resolution during measuring, calibrating, leakage detection, etc.

E.4.3.1.3 The hydrocarbon analyser shall have a response time to 90 % of final reading of no more than 1,5 seconds. Its stability shall be better than 2 % of full scale at zero and full scale over a 15-minute period for all operational ranges. Hydrocarbon analyser shall be calibrated at least once each year as to its response time and stability.

E.4.3.1.4 The repeatability of the analyser expressed as one standard deviation shall be better than 1 % of full scale deflection at zero and at full scale on all ranges used. Hydrocarbon analysershall be calibrated at least once each year as to its repeatability.

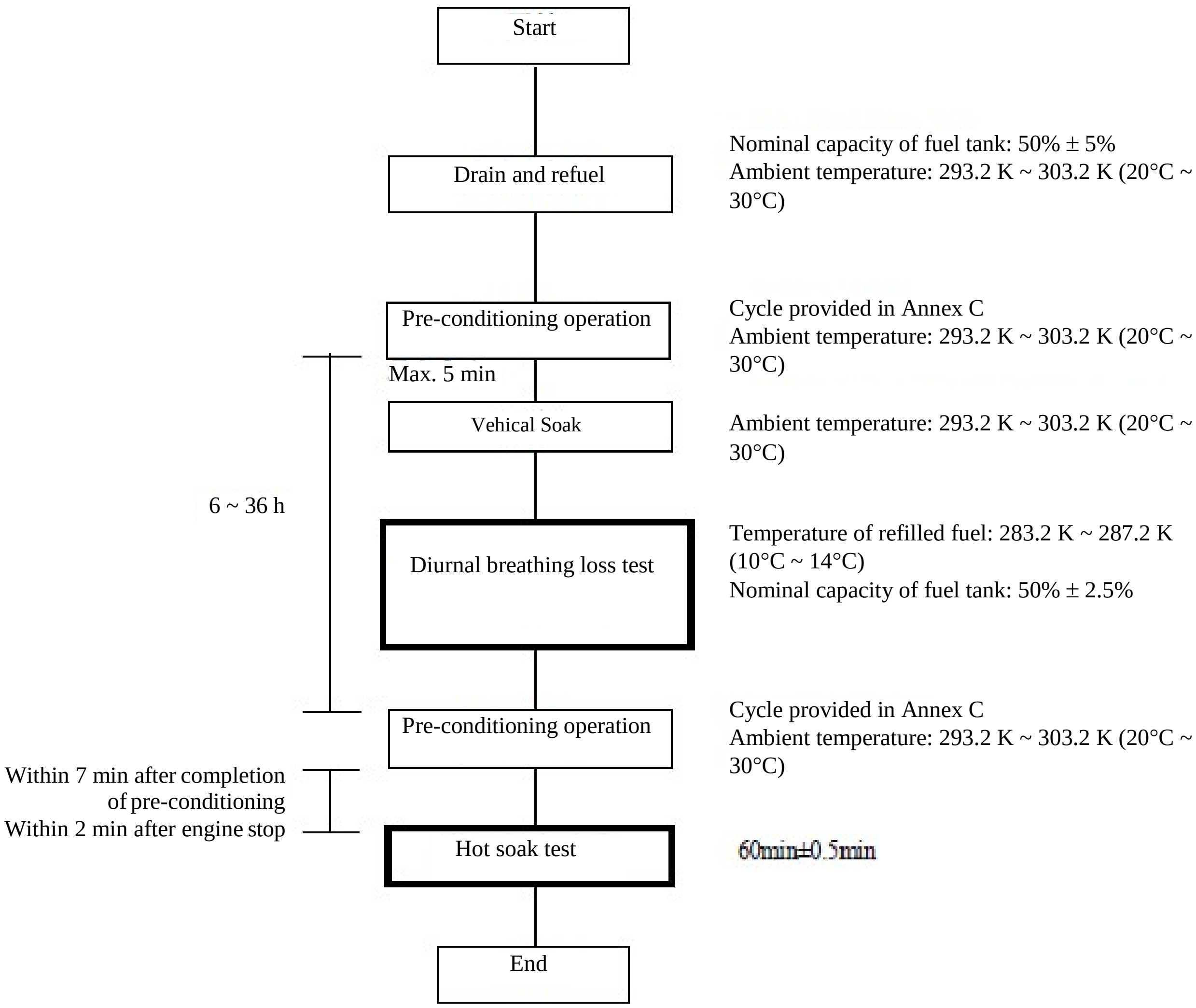

Figure E.1 Flow chart of evaporative emissions test

E.4.3.2 Hydrocarbon analyser data recording system

The hydrocarbon analyser shall be fitted with a device to record electrical signal output either by strip chart recorder or other data-processing system at a frequency of at least twice per minute. The recording system shall have operating characteristics at least equivalent to the signal being recorded and shall provide a permanent record of results. The record shall show a positive indication of the beginning and end of the fuel tank heating and hot soak periods together with the time elapsed between start and completion of each test.

E.4.4 Fuel tank heating system

E.4.4.1 The fuel tank heating system shall consist of two separate heat sources with two temperature controllers. Typically,the heat sources will be electric heating strips, which is used to heat the fuel and fuel vapor. During the heating process, it shall be heated evenly and shall not cause local overheating of fuel oil or steam.

E.4.4.2 Heating strips for the fuel should be located as low as practicable on the fuel tank and shall cover at least 10 % of the wetted surface. The centre line of the heating strips shall be below 30 % of the fuel depth as measured from the bottom of the fuel tank, and approximately parallel to the fuel level in the tank. The centre line of the vapour heating strips, if used, shall be located at the approximate height of the centre of the vapour volume.

The temperature controllers shall be capable of controlling the fuel and vapour temperatures，so as to fulfill the temperature rise profile and tolerance range. The location of temperature sensor is as described in E.5.1.1.

E.4.5 Temperature recording system

E.4.5.1 Temperature recording system shall be of paper-tape recorder or automated data processing system. Throughout the evaporative emission measurements, temperatures shall be recorded or entered into a data processing system at a frequency of at least twice per minute.

E.4.5.2 The temperature in the chamber is recorded at two points by temperature sensors which are connected so as to show a mean value. The measuring points are extended approximately 0.1 m into the enclosure from the vertical centre line of each side wall at a height of 0.9 ± 0.2 m.

E.4.5.3 The temperatures of the fuel and fuel vapour shall be recorded by means of sensors positioned in the fuel tank.

E.4.5.4 The accuracy of the temperature recording system shall be within ± 1.0K and capable of resolving temperatures to ± 0.4K.

E.4.5.5 The recording or data processing system shall be capable of resolving time to ± 15 seconds.

E.4.6 Pressure recording system

E.4.6.1 During the measurement of evaporative emissions, it shall record or input into the data processing system the difference Δp between the barometric pressure in the test area and that inside the chamber at least twice per minute.

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

E.4.6.3 The recording or data processing system shall be capable of resolving time to ± 15 seconds.

E.4.7 Fans

E.4.7.1 It shall be possible to reduce the hydrocarbon concentration in the chamber to the ambient hydrocarbon level by using one or more fans or blowers with the SHED door(s) open.

E.4.7.2 The chamber shall have one or more fans or blowers of likely capacity 0.1 to 0.5 m^3/s with which to thoroughly mix the atmosphere in the enclosure. It shall be possible to attain an even temperature and hydro-carbon concentration in the chamber during measurements. The vehicle in the enclosure shall not be subjected to a direct stream of air from the fans or blowers.

E.4.8 Gases

E.4.8.1 The following pure gases shall be available for calibration and operation:

-- Purified synthetic air: (HC < 1 ppm, CO ⩽ 1 ppm, CO_2 ⩽ 400 ppm, NO ⩽ 0.1 ppm); the content of oxygen is between 18% and 21% by volume;

-- Fuel gas for hydrocarbon analyser (40% ± 2% hydrogen, the rest is helium, HC < 1 ppm, CO_2 ⩽ 400 ppm);

-- Propane (C_3H_8), purity not lower than 99.5%;

-- Butane (C_4H_{10}), purity not lower than 98%;

-- Nitrogen (N_2), purity not lower than 98%.

E.4.8.2 Calibration and span gases shall be available containing mixtures of propane (C3H8) and purified synthetic air. The true concentrations of a calibration gas shall be within ± 2 % of the stated figures. The accuracy of the diluted gases obtained when using a gas divider shall be to within ±2 % of the true value. The concentrations specified in Appendix EA may also be obtained by the use of a gas divider using synthetic air as the diluting gas.

E.4.9 Additional equipments

E.4.9.1 The relative humidity in the test area shall be measurable to within ±5 %.

E.4.9.2 The pressure within the test area shall be measurable to within ± 0,1kPa.

E.5 Test procedures

E.5.1 Test preparations

E.5.1.1 The vehicle is mechanically prepared before the test as follows:

-- the exhaust system of the vehicle shall not exhibit any leaks;

-- the vehicle may be steam-cleaned before the test;

-- the fuel tank of the vehicle shall be equipped with temperature sensors so that the temperature of the fuel and fuel vapour in the fuel tank can be measured when it is filled to 50 % of its rated capacity;Fuel and vapor temperature sensors shall be kept at least 2.54 cm from the surface of the fuel tank;

-- Without changing the installation condition of the fuel tank, additional connectors and adapters can be installed in the fuel system to drain the fuel in the fuel tank.

E.5.1.2 The vehicle shall be taken into the test area where the ambienttemperature is between 293,2 K and 303,2 K (20 °C and 30 °C).

E.5.1.3 Ageing of canister can be proved through installing it onto vehicle and travelling for min. 1,000 km. In case such proof is impossible, ageing test may be performed with the following procedures. In the case of multiple-canister system, each canister shall undergo these procedures separately and respectively.

E.5.1.3.1 Carefully dismount canister from vehicle, without impairing the integrity of components and fuel system.

E.5.1.3.2 Weigh the mass of canister.

E.5.1.3.3 Connect canister to a fuel tank, which may be an extra fuel tank, and fill the reference fuel into the tank up to 50% of its nominal capacity.

E.5.1.3.4 Fuel temperature in the tank shall be between 283.2 K (10℃) and 287.2 K (14℃).

E.5.1.3.5 Heat the fuel in the tank, at a uniform rate, from 288.2 K (15℃) to 318.2 K (45℃) (rise by 1℃ every 9 min).

E.5.1.3.6 If, before the temperature rises to 318.2 K (45℃), canister reaches the breakthrough point, then cut off the heat source, and weigh the canister. If, after temperature reaches 318.2 K (45℃), the canister doesn't attain the breakthrough point yet, it shall repeat the above procedures from E.5.1.3.3, until the breakthrough point occurs.

E.5.1.3.7 It may check the breakthrough point as described in E.5.1.4 and E.5.1.5, or adopt another set of sampling & analytical equipment which could detect the HC emitted from the canister upon occurrence of breakthrough point. Or, alternatively, one auxiliary evaporative canister may be connected downstream the tested canister, for collecting the HC overflowed from the tested canister, thus determining the breakthrough point. Such auxiliary canister shall, prior to the adsorption, be fully desorbed with dry air.

E.5.1.3.8 The air in the emission lab must be used to purge the canister at the flow rate of (25±5) L/min, until the air volume used reaches 300 times of the bed volume of the canister.

E.5.1.3.9 Weight the mass of canister.

E.5.1.3.10 Repeat the steps of E.5.1.3.4 ~ E.5.1.3.9 for 9 times. If, after three ageing cycles, the canister mass after the final cycle already becomes stabilized, it may halt the ageing test in advance.

E.5.1.3.11 Re-connect the canister, and restore vehicle to the normal operation state.

E.5.1.4 Via repetitive heating, make the canister adsorption up to breakthrough point.

E.5.1.4.1 Open the fuel tank cap, and, via the fuel tank drain valve, drain off all the fuel tanks on the vehicle. Upon fuel drain, it shall avoid abnormal canister desorption or adsorption of the vehicle.

E.5.1.4.2 All fuel tanks shall be filled with the test fuel having the temperature at 283.2 K (10℃) ~ 287.2 K (14℃), and the filled fuel quantity shall be 50%±2.5% of each fuel tank's nominal capacity. Then, recover the fuel tank cap.

E.5.1.4.3 Within 1 h after fuel filling, relocate the vehicle into the airtight chamber, with the engine stopped. Connect the fuel tank's temperature sensor to the temperature recording system. Place the heating source at a proper position of the fuel tank, which shall be connected to the temperature controller. Heating source is specified in E.4.4. If test vehicle is fitted with several fuel tanks, all of them shall be heated via one same method described below, and the temperature difference among fuel tanks shall be within ±1.5 K.

E.5.1.4.4 It may artificially heat the fuel, such that it could attain the initial temperature of 293.2 K ±1 K (20℃ ±1℃).

E.5.1.4.5 When fuel temperature attains min. 292.2 K (19℃), it shall promptly perform the following manipulations: Deactivate the purging fan, close and seal the door of airtight chamber, and measure the original HC concentration inside the airtight chamber.

E.5.1.4.6 When the fuel temperature in the fuel tank reaches 293.2 K (20℃), start the temperature rise process of 15 K (15℃) via linear heating. In the heating process, the fuel temperature shall conform to the formula below, with the tolerance being within ±1.5 K. Record the heating duration and temperature rise value.

$$T_r = T_0 + 0.2333 \times t \quad (1)$$

Where:

T_r -- Required temperature, K;

T_o -- Initial temperature, K;

t -- Time elapsed from the start of heating fuel tank, min.

E.5.1.4.7 Once breakthrough point occurs or the fuel temperature reaches 308.2 K (35℃), no matter which occurs first, it shall cut off the heating source, de-seal & open the door of airtight chamber, and open the fuel tank cap. If breakthrough point doesn't occur when fuel temperature reaches 308.2 K (35℃), remove the heating source from the vehicle, get the vehicle out of the airtight chamber for evaporative emissions, and then repeat all the procedures provided in E.5.1.4.1 ~ E.5.1.4.7, until the breakthrough point occurs.

E.5.1.4.8 Then, it shall re-connect the evaporative emission canister, and restore vehicle to the normal operation state.

E.5.1.5 Via butane, make the canister adsorption to reach the breakthrough point

E.5.1.5.1 If airtight chamber is used to determine the breakthrough point, the vehicle, with engine stopped, shall be placed inside the evaporative airtight chamber.

E.5.1.5.2 It shall sufficiently prepare the evaporative emissions canister for the canister adsorption manipulations. It may not dismount canister from the vehicle, unless the canister is highly hardly accessible from a normal position and it is a must to dismount the canister from the vehicle for the adsorption purpose. If canister dismounting is necessary, particular care shall be taken to avoid impairing the integrity of components and fuel system.

E.5.1.5.3 Via gas mixture comprising 50% n-butane (v/v) and 50% nitrogen (v/v), proceed with canister adsorption at the n-butane flow rate of 40 g/h .

E.5.1.5.4 Once canister reaches the breakthrough point, it shall promptly cut off the vapor source.

E.5.1.5.5 Then, re-connect the evaporative emissions canister, and restore the vehicle to the normal operation state.

E.5.1.6 Fuel drain and refueling

E.5.1.6.1 Open the fuel tank cap, and, via fuel pumping device, extract the fuel as completely as possible, or, via fuel tank drain valve, drain off all the fuel of vehicle. Upon fuel drain, it shall prevent the canister fitted on vehicle from abnormal desorption or abnormal adsorption.

E.5.1.6.2 Fill the test reference fuel up to 50% ± 5% of fuel tank's nominal capacity. Then, recover the fuel tank cap.

E.5.2 Pre-conditioning operation

The vehicle is placed on a chassis dynamometer， and, depending upon respective vehicle classification, operate one drive cycle provided in Annex C. In the operation period, tailpipe emissions are not sampled.

E.5.3 Soak

E.5.3.1 Within 5 min after pre-conditioning, it shall place vehicle in the test chamber for soaking.

E.5.3.2 The temperature within test chamber shall be controlled within 298.2 K ±5 K (25℃ ± 5℃).

E.5.3.3 Soak time shall not be less than 6h; provided, however, the time interval from the second run of vehicle pre-conditioning prior to the hot soak losses test shall not exceed 36h. At the end of soak period, engine oil and coolant (if any) temperature shall fall within ±2 K of the temperature in this zone.

E.5.4 Tank breathing (diurnal) evaporative emission test

E.5.4.1 The fuel tanks shall be emptied and refilled with test fuel at a temperature of between 283.2 K and 287.2 K (10 °C and 14 °C) to 50 ± 2 % of its normal volumetric capacity.prior to the test, fuel temperature shall fall below 288.7 K (15.5℃).

E.5.4.2 In the test process, the temperature in the enclosure shall be controlled within 298.2 K±5 K (25℃ ±5℃).

E.5.4.3 The measuring chamber shall be vented/purged for several minutes immediately before the test until a stable background is obtainable.The chamber mixing fan(s) shall be switched on at this time also. For the sake of safety, the blower shall be immediately activated whenever the hydrocarbon concentration in the airtight chamber exceeds 15,000 ppmc.

E.5.4.4 The hydrocarbon analyser shall be set to zero and spanned immediately before the test.

E.5.4.5 Activate the mixing fan.

E.5.4.6 With the fuel tank cap not recovered and the engine stopped, the test vehicle shall be brought into the test enclosure with the engine switched off and parked in an upright position.

E.5.4.7 Connect the temperature sensor with the temperature recorder & temperature controller, and satisfactorily mount the heating pad.

E.5.4.8 Activate the temperature recorder, and start heating the fuel tank.

E.5.4.9 Fuel and vapor heating shall be carried out as per the formulae below, and the deviations shall be remained within ±1.7 K:

For exposed type of fuel storage tanks:

$$T_f = 0.3333\,t + 288.7 \quad (2)$$

$$T_v = 0.3333\,t + 294.2 \quad (3)$$

For non-exposed type of fuel storage tanks:

$$T_f = 0.2222\,t + 288.7 \quad (4)$$

$$T_v = 0.2222\,t + 294.2 \quad (5)$$

Where:

T_f -- Fuel temperature, K;

T_v -- Vapor temperature, K;

t -- Time elapsed, min.

The test duration is (60±0.5) min; in the case of exposed type fuel tank, the temperature rise shall be 20 K, and the final temperature shall be 308.7 K±0.5 K (35.5℃±0.5℃). In the case of non-exposed type fuel tank, the temperature rise shall be 13.3 K, and the final temperature shall be 302.0 K±0.5 K (28.8℃±0.5℃). At the debut of test, the vapor temperature may not be higher than 299.2 K (26.0℃), if the vapor temperature is higher than 299.2 K (26.0℃), it is not required to heat vapor. When fuel temperature rises, as per the T_f heating profile, to a value 5.5 K below that of vapor, it shall, as per the fuel heating time at that time, heat the vapor as per the T_v heating profile.

E.5.4.10 As soon as the fuel temperature reaches 287.2 K (14.0 ℃），immediately install the fuel filler cap(s). Here, turn off the purge blowers, if not already off at that time;in addition to close and seal enclosure doors.. When fuel temperature reaches 288.7 K±0.5 K (15.5℃±0.5℃), it shall immediately analyze the hydrocarbon concentration in the airtight chamber, i.e., the HC concentration at the start moment (t= 0 min) C_{HCi}, and simultaneously measure the temperature Ti and pressure P_{ai}.

E.5.4.11 The hydrocarbon analyser shall be zeroed and spanned immediately before the end of the test period.

E.5.4.12 After the completion of the test, it shall immediately analyze the HC in the airtight chamber, i.e., the final HC concentration (t = 60 min) C_{HCf}, and simultaneously measure the temperature T_f and pressure P_{af}.

E.5.4.13 Turn off the power supply of heater and open the door of airtight chamber.

E.5.4.14 Take down the heating device and its connections, and push the test vehicle, with engine stopped, out of the airtight chamber.

E.5.5 Pre-conditioning operation

Place the vehicle onto the chassis dynamometer, and, depending upon vehicle classification, operate one drive cycle provided in Annex C. The drive cycle shall get started within 60 min after the completion of the diurnal breathing losses test, and, in the operation process, no tailpipe emissions shall be sampled.

E.5.6 Hot soak evaporative emissions test

E.5.6.1 Before the pre-conditioning operation, the measuring chamber shall be purged for several minutes until a stable hydrocarbon background is obtained. The enclosure mixing fan(s) shall also be turned on at this time.

E.5.6.2 The hydrocarbon analyser shall be set to zero and spanned immediately prior to the test.

E.5.6.3 Within 7 min after the completion of pre-conditioning and within 2 min after engine stop, push the vehicle, with engine stopped, into the airtight chamber, and seal up the airtight chamber for starting the test.

E.5.6.4 Start analyzing and recording the hydrocarbon concentration CHc_i in the airtight chamber at the initial moment (t = 0 min), and simultaneously measure the temperature T_i and pressure P_{ai}.

E.5.6.5 The hydrocarbon analyser shall be zeroed and spanned immediately before the end of the test period.

E.5.6.6 The duration of hot soak losses test shall be (60 ±0.5) min.

E.5.6.7 After the completion of test, it shall immediately analyze the hydrocarbon concentration C_{HCf} in the airtight chamber at the final moment (t = 60 min) , and simultaneously measure the temperature T_f and pressure P_{af}.

E.5.6.8 Open the airtight chamber, and push out test vehicle.

E.6 Calculation of results

E.6.1 Test results of diurnal breathing losses and hot soak losses

The evaporative emission tests described allow the hydro-carbon emissions from the tank breathing and hot soak phases to be calculated. Evaporative losses from each of these phases is calculated using the initial and final hydrocarbon concentrations, temperatures and pressures in the enclosure, together with the net enclosure volume.

$$M_{HC} = K \cdot V \cdot 10^{-4} \times (\frac{C_{HCf} \cdot P_{af}}{T_f} - \frac{C_{HCi} \cdot P_{ai}}{T_i}) \quad \cdots\cdots (6)$$

Where:

M_{HC} -- Mass of hydrocarbon emitted over the test phase (grams);

C_{HC} -- Hydrocarbon concentration measured in the enclosure (ppm(volume) Ci equivalent);

V -- Net enclosure volume in cubic metres corrected for the volume of the vehicle. If the volume of the vehicle is not determined,a volume of 0,14 m^3 shall be subtracted;

T -- Ambient chamber temperature in K;

P_a -- Barometric pressure in kPa;

H/C -- Hydrogen-carbon ratio; for the measurements of diurnal breathing losses test, it is assumed by 2.33; and for the measurements of hot soak losses test, 2.20;

K --Equal to 1.2 ×(12+H/C);

i -- Initial reading;

f -- Final reading.

E.6.2 Overall results of test

The overall evaporative hydrocarbon mass emission for the vehicle is taken to be:

$$M = M_{DBL} + M_{HSL} \quad \cdots\cdots (7)$$

Where:

M -- Overall evaporative mass emissions of the vehicle (grams);

M_{DBL} -- Evaporative hydrocarbon mass emission for the tank heat build (grams);

M_{HS} -- Evaporative hydrocarbon mass emission for the hot soak (grams).

E.7 Conformity of production (COP)

E.7.1 Confirmative check of manufacturer

E.7.1.1 Leak test

E.7.1.1.1 Plug up the vent to atmosphere of the evaporative control system.

E.7.1.1.2 Impose a pressure of 3.63 kPa±0.10 kPa over the fuel feeding system.

E.7.1.1.3 After the fuel feeding system pressure becomes stabilized, cut off the pressure source.

E.7.1.1.4 After the interruption of pressure source of fuel feeding system, the pressure drop within 5 min shall not exceed 0.49 kPa.

E.7.1.2 Ventilation test

E.7.1.2.1 Plug up the vent to atmosphere of the evaporative control system.

E.7.1.2.2 Apply a pressure of 3.63 kPa ±0.10 kPa to the fuel supply system.

E.7.1.2.3 When the pressure of the fuel supply system is stable, cut off the pressure source.

E.7.1.2.4 The vent to atmosphere of the evaporative control system is restored to its original product state.

E.7.1.2.5 The pressure in the fuel supply system shall fall below 0.98 kPa within 30 s ~ 2 min.

E.7.1.2.6 Manufacturer may adopt an equivalent alternative method to prove its air ventilation ability, and shall prove the equivalency of its particular procedures.

E.7.1.3 Purge test

E.7.1.3.1 Install a device which can measure the air at a 0.25 L/min flow rate at the purge inlet. Use a switch valve to connect a pressure container that has enough volume and will not affect the purge system undesirably at the purge entrance. Or connect it in another way.

E.7.1.3.2 Under the conditions that accuracy is guaranteed, manufacturer may select flow meter at its own discretion.

E.7.1.3.3 Operate the vehicle, check all the structural features of the desorption system which would possibly restrict the desorption function, and record the situations.

E.7.1.3.4 When the engine is operating as specified by E.7.1.3.3, use one of the following to measure the air flow:

E.7.1.3.4.1 After the device indicated in E.7.1.3.1 is put through, carefully observe the process where the pressure drops from the ambient pressure to the pressure level signaling that the air of a capacity of 0.25 L already flows into the evaporative emissions control system within 1 min; or

E.7.1.3.4.2 If any alternative flow measurement device is used, it shall be able to detect the min. flow reading of 0.25 L/min.

E.7.1.3.4.3 Manufacturer may adopt an alternative desorption test procedure, and shall prove the equivalency of its test procedure.

E.7.2 COP auditing

E.7.2.1 The competent authority may, at any time, audit the COP control method utilized by each production entity.

E.7.2.1.1 The test personnel shall select a sufficient number of samples from the product series.

E.7.2.1.2 The test personnel can test these vehicles according to the provisions in 6.2.4 or E.7.1.1 to E.7.1.3.

E.7.2.1.3 If the inspection result following E.7.1.1 to E.7.1.3 does not satisfy the requirements, manufacturer may request for applying the type test procedures in 6.2.4.

E.7.2.1.3.1 The manufacturer is not allowed to make any adjustment, repair or change to these vehicles, unless these vehicles cannot satisfy the requirements of 6.2.4 or these jobs have been listed in the manufacturer's procedural documents for vehicle assembling and inspection.

E.7.2.1.3.2 If, due to the operation of E.7.2.1.3.1, vehicle's evaporative emission characteristics have possibly been altered, manufacturer can request for retesting an individual item of the vehicle.

E.7.2.2 If the requirements in E.7.2.1 cannot be satisfied, the competent authority shall ask the manufacturer to take actions as soon as possible to re-establish the conformity of production.

Appendix EA

(Normative)

Calibration of equipment for evaporative emission testing

EA.1 Initial and periodic background emissions of enclosure

Before the initial use of enclosure, or after the use of one year, or when any repair would possibly affect the background emissions of airtight chamber, it shall check the airtight chamber so as to determine that no material emitting HC is contained therein.

EA.1.1 The hydrocarbon analyser shall be set to zero and spanned immediately before the test.

EA.1.2 Purge the enclosure until a stable hydrocarbon reading is obtained.

EA.1.3 Activate the mixing blower (if it is not activated yet).

EA.1.4 Seal the chamber and measure the background hydrocarbon concentration,temperature and barometric pressure. These are the initial readings C_{Hci}, T_i and P_{ai} used in the enclosure background calculation.

EA.1.5 Remain the airtight chamber under such state for 4 h, and start the sampling. Use the same analyser to measure the hydrocarbon concentration, which are the final readings CH_{cf}, the temperature T_f and barometric pressure P_{af} .

EA.1.6 Calculate the change in mass of hydrocarbons in the enclosure over the time of the test in accordance with point EA.4. The background emission of the enclosure shall not exceed 0,4 g.

EA.2 Initial determination of enclosure internal volume

Before airtight chamber is put into the initial use, its initial capacity shall be determined with the procedures below:

EA.2.1 The internal dimensions of the chamber are carefully measured, allowing for any irregularities such as bracing struts.The internal volume of the chamber is determined from these measurements.

EA.2.2 According to the provisions of EA.3.1 ~ EA.3.7, implement the calibration check of airtight chamber.

EA.2.3 If the propane mass does not tally to within ± 2 % with the injected mass, corrective action is required.

EA.3 Check and calibration of residual HC

The check of residual HC may be used for verifying the calculated capacity and for calculating the leak rate. The leakage rate of the airtight chamber should be checked every month before the closed chamber is put into use.

EA.3.1 The hydrocarbon analyser shall be set to zero and spanned immediately before the test.

EA.3.2 Purge the enclosure until a stable hydrocarbon reading is obtained.

EA.3.3 Activate the mixing blower (if it is not activated yet). Then, activate the ambient temperature control system (if it is not activated yet), and adjust the initial temperature to 298.2 K±2 K (25℃± 2℃); during the test, such temperature range shall be retained.

EA.3.4 Seal the enclosure and measure the background concentration, temperature and barometric pressure. These are the initial readings C_{HCi}, T_i and P_{ai} used in the enclosure calibration.

EA.3.5 Inject approximately 4 grams of propane into the enclosure. The mass of propane shall be measured to an accuracy of ± 5 % of the measured value.

EA.3.6 After min. 5 min mixing, analyze the HC content in the air of the airtight chamber, and simultaneously record the temperature and pressure. Such measurement is the final calibration reading of the airtight chamber and the initial reading for checking the residual quantity.

EA.3.7 To confirm the calibration of airtight chamber, propane mass shall be calculated based on the measurements of EA.3.4 and EA.3.6. The formula is shown in EA.4, and the calculated value shall fall within ±2% of the measurement of EA.3.5.

EA.3.8 Seal up the airtight chamber, and activate the mixing fan. Retain at least four hours and don't perform sampling. After 4 h, analyze the HC content in the airtight chamber, and record the temperature and pressure. This is the final reading for checking the residual HC quantity.

EA.3.9 With the formula of EA.4 and the reading of EA.3.8, calculate the mass of HC, of which the value may not exceed 4% of that of EA.3.6.

EA.4 The calculation of net hydrocarbon mass change within the enclosure shall be used to determine the chamber's hydrocarbon background and leak rate.

$$M_{HC} = K \cdot V \cdot 10^{-4} \times \left(\frac{C_{HCf} \cdot P_{af}}{T_f} - \frac{C_{HCi} \cdot P_{ai}}{T_i} \right) \quad \text{......................} \quad (1)$$

Where:

M_{HC} -- Mass of hydrocarbon emissions (g);

C_{HC} -- Hydrocarbon concentration in ppmC (ppmC = ppmC_3H_8 × 3);

V -- Capacity of airtight chamber (m^3);

T -- Temperature in the chamber (K);

P_a -- Barometric pressure (kPa);

K -- 17.60;

i -- Initial reading;

f -- Final reading.

EA.5 Calibration of hydrocarbon analyzer

FID HC analyzer shall go through initial calibration and periodic calibration.

EA.5.1 Optimal response characteristics of analyzer

Prior to the use, FID HC analyzer shall be adjusted to the optimal HC response characteristics, and, after the use, such adjustment is necessary at least once every year.

EA.5.1.1 The FID analyser shall be adjusted as specified by the instrument manufacturer. Propane in air shall be used to optimise the response on the most common operating range.

EA.5.1.2 Make the most frequently used operation range to reach the optimal status. The concentration of the propane injected into analyzer shall be equivalent to 90% of the most frequently used operation range.

EA.5.1.3 Fuel flow shall be such selected that it could present the max. response characteristics and the min. deviation as to the small change in fuel flow.

EA.5.1.4 To decide the optimal air flow, utilize the aforesaid fuel flow to set and alter the air flow.

EA.5.1.5 After the optimal flow rate is reached, record this value for the reference.

EA.5.2 Initial and periodic calibrations

Before FID HC analyzer is put into use and at the monthly interval thereafter, it shall calibrate all the instrument ranges for normal use. A same flow rate shall be used for the analysis purpose.

EA.5.2.1 Adjust analyzer to the optimal performance.

EA.5.2.2 Zero the analyzer with class-0 air.

EA.5.2.3 After the mixing with calibration air, the concentration shall be 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, and 90% of the normal working concentration of instrument. For each calibration range, if the deviation of the test value relative to the corresponding value on the line plotted with the least square method falls within 2%, its concentration value may be calculated via one individual correction factor within such range. If the deviation of any point exceeds 2%, then its concentration shall be decided by the optimal approximate non-linear equation which may represent the data within 2% at each test point.

Appendix EB

(Normative)

Test Method for Canister's Initial Butane Working Capacity

EB.1 Canister's initial butane working capacity

It means the effective adsorption quantity per unit of effective capacity of canister, after a brand new canister goes through 13 runs of adsorption and desorption test, expressed in g/100 mL.

EB.2 Test method for canister's initial butane working capacity

Canister's initial butane working capacity test is as shown in Figure EB.1; during the test process, the canister shall be mounted by simulating the real-world location on the sample vehicle. Adsorption state: the gas mixture of n-butane (C_4H_{10}) and nitrogen (N_2) shall enter from the adsorption port of the canister, and flow out of canister's vent to air. When necessary, it may plug up the canister's desorption port, so as to assure all the gas flows out of the vent to air. Desorption state: purge air shall enter from the canister's vent to air, and flow of the purge port.

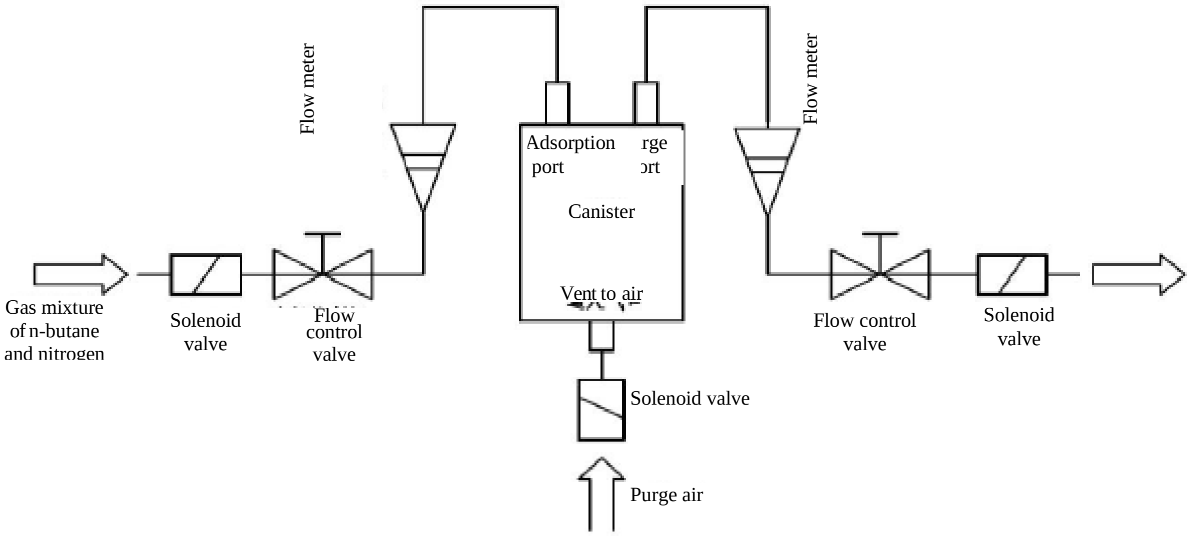

Figure EB.1 Schematic graph for testing canister's initial butane working capacity

EB.2.1 Test method for initial butane working capacity

EB.2.1.1 Weigh the canister to get the value of W_{Ii}; the vent to air shall be open, while the purge port shall be closed.

EB.2.1.2 Via the gas mixture of 50% ± 5% (v/v) n-butane and 50% ± 5% (v/v) nitrogen, proceed with the canister adsorption at (25 ± 5) °C. Based on canister's effective capacity, determine the loading rate as per Table EB.1;

Table EB.1 Loading rate for testing canister's butane working capacity

Effective capacity of canister, V_{EV} (ml)	Small < 100	Medium 100 ≤and < 249	Large ≥249
Butane loading rate (g/h)	5.0	10.0	15.0

EB.2.1.3 Canister shall be loaded to the breakthrough point of $2.0^{+0.1}_{0}$g, and immediately cut off the source of gas mixture. At the breakthrough point, it shall detect that:

1) The cumulative emissions of FID analyzer reading (using a mini sealed housing for evaporative determination (SHED) or similar) reaches $2.0^{+0.1}_{0}$g or the ransient reading of the FID connected to atmospheric interface reaches 5,000 ppm; or

2) Gravity test method: One auxiliary canister may be connected downstream the tested canister for collecting the HC overflowed from the tested canister, consequently determining the adsorption up to the breakthrough point. Such auxiliary canister shall, prior to the start of adsorption, be sufficiently purged via dry air.

EB.2.1.4 Weight the canister to get the W_{Fi}.

EB.2.1.5 Between canister adsorption and desorption, an interval of 5 min shall be arranged, which is taken as one integral part of the test cycle for the initial butane working capacity.

EB.2.1.6 Perform purging via the purge port, while the adsorption port shall be closed. With the dry air or nitrogen having the temperature of (25±5) ℃, perform canister desorption; the desorption flow is (24±1) L/min, and the purge air quantity shall be 400 folds of the effective capacity of canister (if the canister's max. permissible purge flow is below (24±1) L/min, its max. purge flow shall be adopted).

EB.2.1.7 Weight the canister to get $W_{I(i+1)}$.

EB.2.1.8 Repeat the steps of EB.2.1.2 ~ EB.2.1.7 for 13 runs.

EB.2.1.9 Calculate the average of the mass difference between canister adsorption and desorption in the 12th and the 13th cycles, i.e.:

$$\overline{W} = \frac{(W_{F12} - W_{I12}) + (W_{F13} - W_{I13})}{2} \quad \cdots\cdots (1)$$

EB.2.1.10 The ratio between $\overline{W}$ and the effective capacity of canister is the device's initial butane working capacity expressed in g/100 mL.

Annex F

(Normative)

Durability Test of Pollution-control Devices (Test Type V)

F.1 Introduction

This Annex describes the procedures for type V test to verify the durability of pollution-control devices of mopeds.

F.2 Requirements for durability test mileage

The total durability test mileage shall be in accordance with 6.2 .5.2.

F.3 Test moped

The test mopeds shall be in good mechanical order at the start of mileage accumulation and it shall not have more than 100 km accumulated after it was first started at the end of the production line.

F.4 Fuel

During the durability test of pollution-control device, the fuel for driving test shall be commercially available unleaded gasoline or gas fuel, and its technical specifications shall meet the requirements recommended by the manufacturer in the user manual. The emission performance test shall utilize the reference fuel specified in Annex H.

If the test mopeds is/are equipped with a two-stroke engine, lubricating oil shall be used in the proportion and of the grade recommended by the manufacturer in the user manual.

F.5 Maintenance and adjustment of moped

F.5.1 Maintenance, adjustments and the use of the controls of the test mopeds shall be as recommended by the manufacturer in the appropriate repair and maintenance information and in the user manual.

F.5.2 During maintenance, only the following items can be inspected, cleaned, adjusted or replaced.

-- Timing device;

-- Idle speed and idle air-fuel ratio;

-- Valve clearance;

-- Torque of engine fixing bolts;

-- Spark plug;

-- Engine oil;

-- Fuel pipe;

-- Crankcase venting pipe;

-- Battery terminal post and venting pipe;

-- Throttle control state;

-- Engine oil filter;

-- Air filter;

-- Removal of carbon deposit.

F.5.3 In the case of unscheduled maintenance, such approval will be given if:

-- part failure or system malfunction, or the repair of such failure or malfunction does not directly affect the combustion of the engine, or it is merely restricted to the removal or replacement of the spark plug;

-- need for maintenance or repairs is indicated by an overt indication of malfunction such as persistent misfire, vehicle stall, overheating, fluid leakage, loss of oil pressure, or charge indicator warning:

F.5.4 For parts other than the engine, emission control system or fuel system, maintenance can only be carried out when the function of the parts/ system fails .

F.5.5 Emission measurement may not be used as a mean of determining the need for unscheduled maintenance.

F.5.6 If the part failure or system malfunction occurrence and/or repair rendered the moped unrepresentative of mopeds in use, the vehicle shall not be used as a test moped.

F.5.7 Any test moped which incurs major mechanical failure necessitating disassembly of the engine shall not be used as a test vehicle. This prohibition does not apply to failures occurring after the completion of all required tests at the total test distance.

F.5.8 Except for the initial maintenance or only changing the engine oil or filter, the interval mileage of other maintenance shall not be less than 2,000km.

F.6 Moped operation procedures on test road or chassis dynamometer

F.6.1 General requirements

F.6.1.1 During the test type V, the reference mass deviation of the vehicle shall be within ± 5 kg.

F.6.1.2 Throughout the durability test, all the pollution-control devices or systems shall be installed on the vehicle.

F.6.1.3 In the test type V, the continuous operation time of the moped shall not exceed 12 h. During the continuous operation, it is allowed to shut down the engine, but the time after shutting down the engine is not counted in the operation time of 12 h.

F.6.1.4 After each continuous operation, the moped's engine shall be shut down for a rest period of minimum 6h or till the engine oil temperature reaches the ambient temperature.

F.6.1.5 For the test type V, either of the following two test methods may be selected.

F.6.1.5.1 Durability test procedure with full mileage accumulation

Test vehicle shall undergo the complete durability test as per the total test mileage provided 11000km. After the start of durability test, the type I emission test shall be carried out at equal test intervals, and the deterioration coefficient shall be calculated after the durability test is completed. The test process is shown in Figure F.1.

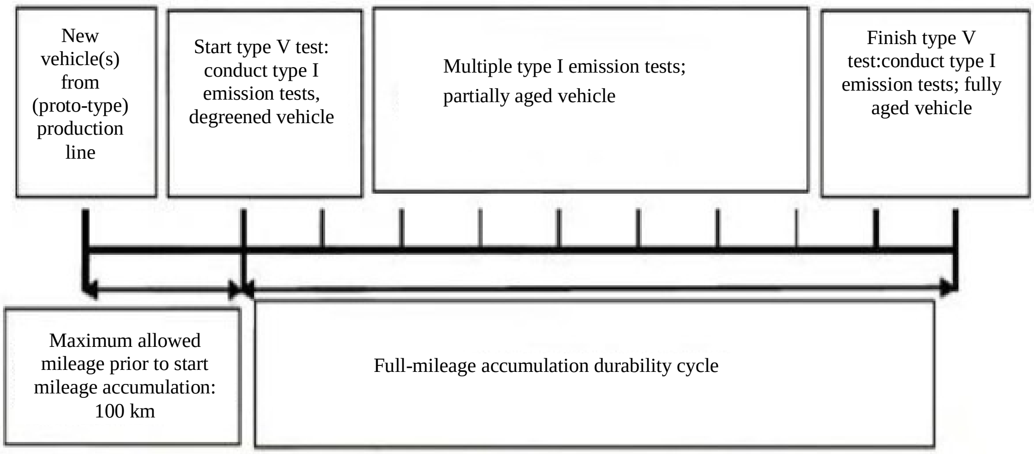

Figure F.1 Test type V- durability test procedure with full mileage accumulation

F.6.1.5.2 Accelerated durability test procedure with partial mileage accumulation

The test vehicle shall carry out the durability test of at least 50% of the total test mileage specified in Table 4 (50% of the total durability test mileage). After the start of durability test, the type I Emission test shall be carried out at equal test intervals, and the deterioration coefficient shall be calculated after the durability test is completed. The test process is shown in Figure F.2.

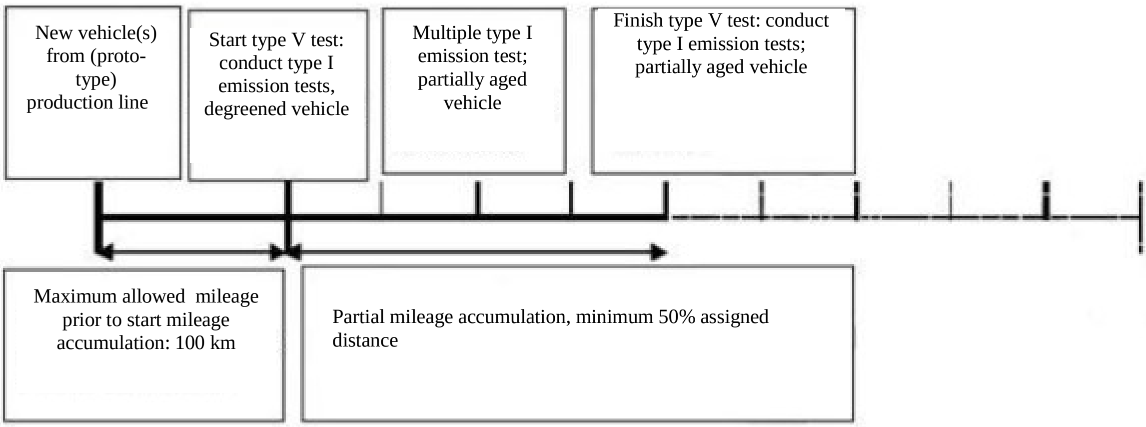

Figure F.2 Test type V-accelerated durability test procedure with partial mileage accumulation

F.6.2 Driving cycle

F.6.2.1 During the operation on the test road or chassis dynamometer, One operation cycle shall be performed as shown in Figure F.3:

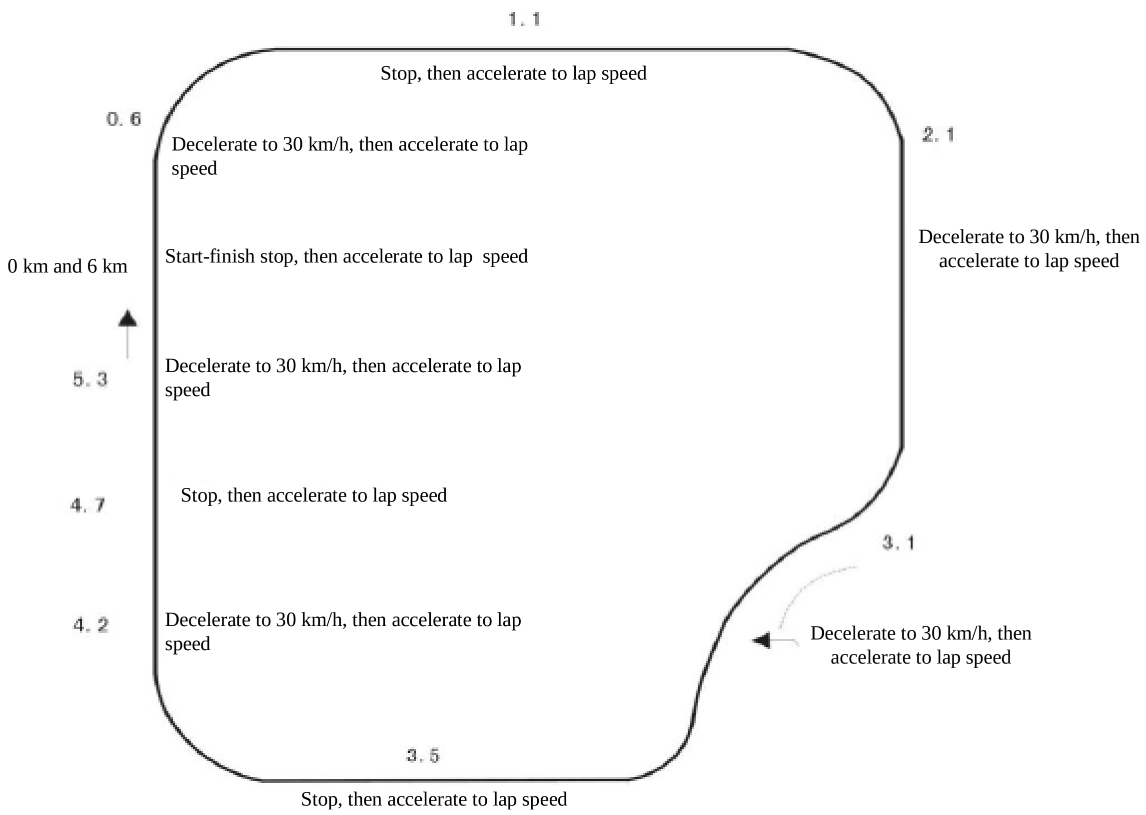

Figure F.3 Driving cycle

During the driving cycles, the moped shall be accelerated and decelerated normally according to the shift specifications of the moped manufacturer.

The driving procedure of test type V consists of 11 cycles, and the driving mileage of each cycle is 6km.

During the first nine driving cycles, the test vehicle is stopped four times with the engine idling each time for 15 seconds.

A driving cycle shall consist of five decelerations, dropping from cycle speed to 15 km/h. The moped shall then gradually be accelerated again until the maximum cycle speed is attained.

For the tenth cycle, the mopeds should run at 45km/h.

The 11th cycle shall begin with a maximum acceleration from stop point up to 45km/h. At halfway, the brakes are applied normally until the test vehicle comes to a stop. This shall be followed by an idle period of 15 seconds and a second maximum acceleration.

F.6.2.2 An alternative durability mileage accumulation cycle can be used at the request of the moped manufacturer after agreement of the testing service, The alternative cycle shall have the same average vehicle speed, vehicle speed distribution, number of vehicle stops per kilometer and acceleration times per kilometer as the test cycle (shown in detail in figure F.3 and table F.1) on the test road or chassis dynamometer.

F.6.2.3 If the durability test is completed on a test track or road, the reference mass of the mopeds shall be at least equal to the mass tested on the chassis dynamometer.

F.6.2.4 At the manufacturer's request, and with the agreement of the testing service, the highest speed it can reach shall be used for the test when the test moped cannot reach the specified cycle speed.

Table F.1 Maximum vehicle speed in a cycle

Cycle	Maximum cycle speed/(km/h)
1	45
2	35
3	45
4	45
5	35
6	35
7	35
8	45
9	35
10	45
11	45

F.6.3 Durability test equipment

F.6.3.1 Chassis dynamometers used to accumulate test type V durability mileage shall enable the durability mileage accumulation cycle in F.6.2. In particular, the dynamometer shall be equipped with systems simulating inertia and resistance.

F.6.3.2 The chassis dynamometer shall be adjusted to the running resistance at a stable vehicle speed of 50 km/ h. The methods of determining the resistance and adjusting the brake is the same as those in Annex CB. The setting of chassis dynamometer for durability test shall be consistent with the inertia and resistance setting used in type I test. During the durability test the same inertia, flywheel setting and calibration procedure shall be used as those used in the test type I.

F.6.3.3 The durability test shall be carried out on the chassis dynamometer in accordance with the test cycle (shown in Figure F.3 and Table F.1). When equipped with moped autopilot system, the throttle, clutch, brake and gear-shifting device of the moped should be controlled in real time to meet the specifications.

F.6.3.4 The moped's cooling system shall be such that the vehicle temperatures (lubricating oil, coolant, exhaust system, etc.) during driving on the dynamometer shall be similar to those during running on road.

F.6.3.5 If necessary, some other test bench adjustments and characteristics shall be the same as those required in Annex C (e.g., inertia, being mechanical or electrically simulated).

F.6.3.6 The test vehicles may be moved to a different bench in order to conduct type I emission verification tests.

F.7 Emission tests and deterioration factor

F.7.1 Requirements for emission tests

F.7.1.1 A zero kilometer emission test may be performed prior to the beginning of service accumulation in accordance with the requirements of 6.2.1.

F.7.1.2 The first emission test at not more than 20% of the accumulation mileage and the final emission test at 50% of the total accumulation mileage or the total accumulation mileage included, and at least other two tests shall be performed at equal intervals between the minimum and total test distances. At least one emission test according to the requirements of type I test described in 6.2.1 shall be conducted at each test point (if multiple tests are conducted, the average value of multiple test results shall be taken as the test result of that mileage point).

F.7.1.3 All emission tests shall be carried out at the accumulation mileage point more than 500 km before or after maintenance.

F.7.2 Selection of test points for emission tests in the type V test

F.7.2.1 The first test must be conducted at an accumulated distance within 250 kilometers of the nominal distance at the first test point.

F.7.2.2 The final test must be conducted at an accumulated distance within 250 kilometers of the test mileage or the total test mileage.

F.7.2.3 Selection of test points for the second and the third emission tests

F.7.2.3.1 If no maintenance is scheduled, the second and the third emission tests shall be carried out at equal intervals between the minimum and total test distances.

F.7.2.3.2 If maintenance is scheduled, under the condition of maintaining the same test interval as far as possible, the second and the third emission tests shall be carried out at the accumulation mileage point more than 500 km before or after maintenance.

F.7.3 Test results

During the test type V, the result of each emission test at all the test points shall meet the limit listed in Table 2 in 6.2.

F.7.4 Determination of the deterioration factor

F.7.4.1 The measurement results of all exhaust pollutants are plotted as a function of accumulation mileage. The accumulation mileage is rounded to an integer according to the rounding method, and the best fitting straight line of all measurement points is obtained by the least square method. If the partial mileage durability test method is selected, the extrapolation method shall be used to obtain the emission of each exhaust pollutant at the total accumulation mileage. The 0 km test results shall not be considered in the calculation.

F.7.4.2 The data can be used to calculate the deterioration factor only when the emissions at all points on the best fit line of each exhaust pollutant are lower than the limits in Table 2 of 6.2.

F.7.4.3 For each exhaust pollutant, the deterioration factor (DF) is calculated by the following formula:

Where:

$$DF = \frac{M_{i2}}{M_{i1}} \quad \cdots\cdots (1)$$

M_{i1} -- Interpolation of the emission of each exhaust pollutant when the accumulation mileage is 250 km, mg/km;

M_{i2} -- Interpolation of the emission of each exhaust pollutant at the total accumulation mileage, mg/km.

F.7.4.4 These interpolations shall be retained to at least one decimal place. The calculation results of deterioration factor shall be rounded to 3 decimal places according to the rounding rules of values.

F.7.4.5 Deterioration factors computed to be less than 1.000 shall be 1.000.

F.7.4.6 For dual fuel vehicles, the deterioration factor when using gasoline can be used as the deterioration factor when using gaseous fuel.

Annex G

(Normative)

On-board Diagnostic (OBD) System

G.1 Introduction

This Annex applies to the OBD system for controlling emissions of moped.

G.2 Definitions

In this Annex:

G.2.1 Emission control system

Engine's electronic management controller and any emission-related component in the exhaust or evaporation systems that supply an input to or receives an output from this controller.

G.2.2 Malfunction

The circuit failure of the emission-related component or system, or the OBD system being unable to fulfil the basic diagnostic requirements in this Annex.

G.2.3 Malfunction indicator (MI)

The indicator which prompts the presence of malfunction via visual signals or via visual & audible signals, which, when any OBD system connected and emissions related component or the OBD system itself has a malfunction, could clearly notify the driver.

G.2.4 Driving cycle

A test cycle consists of engine start-up, driving mode where a malfunction would be detected if present, and engine shut-off.

G.2.5 Access

The availability of all emission-related OBD data including all fault codes required for the inspection, diagnosis, servicing or repair of emissions-related parts of the vehicle, via the serial interface for the standard diagnostic connection (see G.6.3.5).

G.3 Requirements for OBD system

G.3.1 Description of OBD system test

Simulate a malfunction of the engine management system or emission control system, operate the moped having the simulated malfunction as per the type I test cycle, and determine whether the OBD system reacts to this simulated malfunction and indicate the malfunction to the driver in a proper means.

Upon type test, randomly select the to-be-simulated malfunctions, but the total number of the to-be-simulated malfunction modes shall not exceed 4 to the maximum.

G.3.2 Monitoring requirements for the mopeds fitted with spark-ignition engine

G.3.2.1 Moped's OBD system shall, to the minimum (but not limited to), monitor the circuit connection status of the following sensors and actuators:

Sensors: Oxygen sensor, engine load sensors (e.g., throttle position sensor or intake pipe pressure sensor);

Actuator: Fuel injector.

G.3.2.2 Unless otherwise monitored, any other emissions-related part or system, or ECU-connected and emissions-related powertrain part or system, shall be monitored for its circuit connection status.

G.3.2.3 Electrically controlled purging system of evaporative emissions, if fitted, shall be monitored for its circuit connection status.

G.3.3 Activation of malfunction indicator (MI)

The MI shall be visible in all reasonable lighting conditions. The MI shall activate when the moped's ignition is in the 'key on' position before engine starting; in case no malfunction is detected, MI shall be deactivated. When OBD system is unable to fulfil the basic diagnostic requirements of G.3.2, MI shall also activate.

When activated, MI shall display a symbol in conformity with ISO 2575 : 2010, as shown in Figure G.1. The use of red colour for an MI is prohibited.

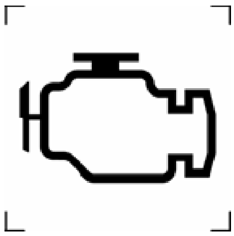

Figure G.1 The symbol of MI

G.3.4 Storage of fault code and freeze frame

OBD system shall record the codes indicating the status of the emission control system. Separate status codes shall be used to correctly identify the circuit connection status of the monitored sensors and actuators. In case any circuit malfunction arouses the activation of MI, the fault code and freeze-frame capable of identifying the corresponding malfunction type shall be stored.

G.3.5 Deactivation of malfunction indicator (MI)

The MI may be deactivated if the monitored malfunction doesn't exist any longer and no other malfunction which would separately activate the MI is detected.

G.3.6 Clearing of fault code and freeze frame

If one malfunction doesn't appear again within 3 or more driving cycles, corresponding fault code and saved freeze frame information may be cleared out.

G.3.7 Bi-fuel moped

Bi-fuel moped may utilize one set of OBD system, or, alternatively, each type of fuel may use one separate set of OBD system. All the OBD requirements for mono fuel gas mopeds apply to various fuel types of bi-fuel mopeds (gasoline, LPG, NG).

G.4 Preparations for OBD system test

G.4.1 Set the malfunction mode for test based on the features of the selected test component, and simulate the failure of the monitored circuit required in G.3.2 and G.3.3. If needed, manufacturer shall furnish defective components and/or electrical devices to be used to simulate failures.

G.4.2 The conditions for performing the OBD system test and such equipment as chassis dynamometer, etc. shall fulfill the requirements for type I test.

G.5 Test procedures of OBD system

G.5.1 With the moped on which malfunction is already simulated, operate one type I test cycle, and, before the end of the test cycle, MI shall be activated and OBD system shall save the corresponding fault code and freeze frame.

G.5.2 For strategies requiring two or more type I test cycles for MI activation, the manufacturer shall provide data and/or an engineering evaluation which adequately demonstrate that the monitoring system is equally effective and timely in detecting the circuit connection status of components. Strategies requiring on average more than ten type I test cycles for MI activation are not accepted. As for the mopeds having the strategies of activating MI with multiple cycles, MI shall be activated before the end of the final type I test cycle and the OBD system shall save the corresponding fault code and freeze frame.

G.5.3 If manufacturer could demonstrate that, under the operating state of type I test cycle, monitoring would affect the monitoring conditions restricted for the real-world use of moped, then it may require for performing monitoring under the state beyond the type I test cycle. For such moped, MI shall be activated before the end of the manufacturer's designated operation cycle or after the taking of proper actions and the OBD system shall save the corresponding fault code and freeze frame.

G.6 Diagnosis signals

G.6.1 Upon determination of the first malfunction of any component or system, 'freeze-frame' engine conditions present at the time shall be stored in computer memory. The manufacturer shall choose the most appropriate set of conditions facilitating effective and efficient repairs in freeze-frame storage, and stored engine conditions may include: calculated load, engine speed, trimmed fuel value, fuel pressure, vehicle speed, coolant temperature, intake manifold pressure, closed- or open-loop operation state, etc. Only one frame of data is required. Manufacturers may choose to store additional frames provided that at least the required frame can be read by a generic scan tool. Via the serial port of the standard data connector provided in G.6.3, it shall be able to fetch the OBD system requirements for the type test of moped.

G.6.2 The diagnostic system is not required to evaluate components during malfunction if such evaluation would result in a risk to functional safety or component failure.

G.6.3 The diagnostic system shall provide for standardised and unrestricted access to OBD and conform with the following ISO standards and/or SAE specification:

G.6.3.1 One of the following standards with the restrictions described shall be used as the on-board to off-board communications link: ISO 9141-2, SAE J1850, ISO 14229-3, ISO 14229-4, ISO 14230-4, ISO 15765-4, ISO 22901-2.

G.6.3.2 Test equipment and diagnostic tools needed to communicate with OBD systems shall meet or exceed the functional specification in ISO 15031-4 (Feb. 15, 2014).

G.6.3.3 Basic diagnostic data and bi-directional control information shall be provided using the format and units described in ISO 15031-5 (Apr. 15, 2011) and shall be available using a diagnostic tool meeting the requirements of ISO 15031-4.

G.6.3.4 When a fault is registered, the manufacturer shall identify the fault using an appropriate fault code consistent with those in Section 6.3 of ISO 15031-6. If this is not possible, the manufacturer may use the diagnostic trouble codes in Sections 5.3 and 5.6 of ISO 15031-6 (Aug. 15, 2010), Alternatively, fault codes may be compiled and reported according to ISO14229, The fault codes shall be fully accessible by standardised diagnostic equipment complying with the provisions of G.6.3.2.

G.6.3.5 The connection interface between vehicle and diagnosis tester shall be standardized, meet all the requirements of ISO 15031-3 or ISO 19689. The installation location of diagnostic connector shall be convenient for the reading of the repair & service staff; however, it shall be protected against any modification by unauthorized personnel and against any inadvertent damage under the normal use conditions. The position of the connection interface shall be clearly indicated in the user manual.

G.7 Access to moped's OBD and maintenance & repair information

G.7.1 Acquisition of moped's OBD information

G.7.1.1 Upon publicity of the information of Annex A and Annex B, moped manufacturer or its authorized agent shall simultaneously disclose the OBD system related information; in case manufacturer's secret is involved, it may be disclosed to the competent authority only. This information shall enable manufacturers of replacement or retrofit components to make the parts they manufacture compatible with the vehicle OBD system, with a view to fault-free operation assuring the vehicle user against malfunctions. Similarly, such relevant information shall enable the manufacturers of diagnostic tools and test equipment to make tools and equipment that provide for the effective and accurate diagnosis of vehicle emission control systems.

G.7.1.2 Once any manufacturer pertinent to component, diagnosis tool or test equipment puts forward the demand for acquiring OBD information, the competent authority shall, on the impartial basis, furnish it with the OBD system related information of Annex A.

G.7.1.2.1 Upon proposing the demand for acquiring OBD information, it shall explain the accurate specifications of the vehicle type involved by the needed information, and verify that this information is necessary for the development of spare parts, reclaiming of component, R&D of diagnosis tool or test equipment. The needed information shall be merely restricted to the type test involved spare parts or repair components, or the components in a system involved in the type test.

G.7.1.2.2 If the competent authority receives the demands for the OBD system information of a moped already satisfactorily passing the type test:

-- The competent authority shall, within 30 days, ask the moped manufacturer concerned to furnish the OBD system related information of Annex A.

-- Moped manufacturer shall furnish such information within 60 days after receiving the requirement of the competent authority.

G.7.2 Acquisition of moped maintenance and repair information

G.7.2.1 Moped manufacturer shall furnish, to the authorized distributors or repair workshops, all the information necessary for the moped diagnosis, maintenance, inspection, periodic monitoring or repair. If needed, such information shall include the repair handbook, technical guides, circuit diagram, calibration software identification number applicable to a vehicle type, explanations on exceptional and particular circumstances, and the information of corresponding special tools and equipments provided on the vehicle. Manufacturer has right to not furnish any information involving intellectual property right protection, or the special technical secrets of manufacturer and/or OEM suppliers; nevertheless, it shall not improperly conceal necessary technical information. Manufacturer shall, by charging a proper, rational fee, furnish the maintenance & repair information to the enterprises in compliance with the requirements of G.7.2.2, within three months after the maintenance & repair information (incl. subsequent improvements and supplements) to the authorized distributors or authorized repair workshops.

G.7.2.2 Any enterprise engaged in repair, road rescue, moped testing, or manufacturing/sales of spare parts & reclaimed parts, diagnostic tool or testing equipments shall be deemed qualified to have access to these information.

G.7.2.3 If, during type test and in-service conformity check, it is found that such provisions are not followed, the competent authority shall take proper actions to assure the access to the maintenance and repair information.

Annex H
(Normative)
Specifications of Reference Fuels

H.1 Specifications of liquid reference fuels for testing mopeds in environmental tests

H.1.1 Specifications of reference petrol (Table H.1).

Type: Unleaded petrol

Table H.1 Specifications of petrol

Parameter		Limits	Test method
Anti-knock property:			
Research octane number (RON)	Minimum	92	GB/T 5487
Anti-knock index (RON+MON)/2	Minimum	87	GB/T 503, GB/T 5487
Density [a] (20°C) / (kg/m^3)		725 ~ 760	GB/T 1884, GB/T 1885
Distillation:			GB/T 6536
Evaporated at 10% / °C		50 ~ 70	
Evaporated at 50% / °C		90 ~ 120	
Evaporated at 90% / °C		160 ~ 190	
Final boiling point / °C		180 ~ 205	
Residue (v/v) / %		2	
Vapor pressure / kPa		55 ~ 65	GB/T 8017
Existent gum after solution washing/(mg/100mL	Maximum	4	GB/T 8019
Induction period / min	Minimum	480	GB/T 8018
Sulfur content / (mg/kg)	Maximum	10	SH/T 0689
Mercaptan (need to meet either following requirements to pass):			
Doctor test		Pass	SH/T 0174
Mercaptan sulphur content (v/v) / %	Maximum	0.001	GB/T 1792
Copper strip corrosion (50°C, 3h) / grade	Maximum	1	GB/T 5096
Water soluble acid or alkali		None	GB/T 259
Mechanical impurity and water content [b]		None	GB/T 511, GB/T 260
Benzene content (v/v) /%	Maximum	1.0	SH/T 0713
Aromatics content [c] (v/v) /%	Maximum	35	GB/T 11132
Olefins content [c] (v/v) /%	Maximum	25	GB/T 11132
Oxygen content (m/m) /%	Maximum	2.7	SH/T 0663
Methanol content [d] (m/m) /%	Maximum	0.3	SH/T 0663
Lead content [d] /(g/L)	Maximum	0.005	GB/T 8020

Iron content [d] / (g/L)	Maximum	0.01	SH/T 0712
Manganese content [d] / (g/L)	Maximum	0.002	SH/T 0711
Copper content [d] / (g/L)	Maximum	0.001	SH/T 0102
Phosphorous content [d] / (g/L)	Maximum	0.0002	SH/T 0020

[a] SH/T 0604 is allowed to adopt; In case of dispute, the test result as per GB/T 1884 and GB/T 1885 shall apply.

[b] Inject the test sample into a 100 mL glass measuring cylinder. The test sample shall be transparent, containing no suspending or settled moisture content and mechanical impurities. In case of disputes, the test results obtained as per GB/T 511 and GB/T 260 shall apply.

[c] It is allowed to use SH/T 0714 "Standard test method for detailed analysis of petroleum naphthas through n-nounane by capillary gas chromatography"; in case of disputes, the result as per GB/T 11132 shall govern.

[d] No intentional addition allowed.

H.2 Specifications of gaseous reference fuels for testing moped.

H.2.1 Specifications of liquefied petroleum gas (LPG) (Table H.2).

Table H.2 Specifications of liquefied petroleum gas (LPG)

		Fuel A	Fuel B	Test method
Composition	v/v %			SH/T 0614
C_3 – content	v/v %	30 ± 2	85 ± 2	
C_4 – content	v/v %	Balance	Balance	
< C_3, > C_4	v/v %	Max. 2	Max. 2	
Olefins	v/v %	Max.12	Max.15	
Evaporation residue	mg/kg	Max. 50	Max. 50	SY/T 7509
Water content		None	None	Visual inspection
Total sulfur content	mg/kg	Max. 10	Max. 10	SH/T 0222
Hydrogen sulphide		None	None	
Copper strip corrosion		Class 1	Class 1	SH/T 0232 [a]
Odor		Characteristic	Characteristic	
Motor octane number		Min. 89	Min. 89	GB/T 12576

[a] This method may not accurately determine the presence of corrosive materials if the sample contains corrosion inhibitors or other chemicals which diminish the corrosivity of the sample to the copper strip. Therefore, the addition of such compounds for the sole purpose of biasing the test method is prohibited.

H.2.2 Specifications of natural gas (NG) (Table H.3) for testing vehicles.

Table H.3 Specifications of natural gas (NG)

Parameter	Unit	Basis	Limits		Test method
			Min.	Max.	
Reference fuel G_{20}					
Composition:					
Methane	Percent mole (%)	100	99	100	GB/T 13610
Balance [a]	Percent mole (%)	--	--	1	GB/T 13610
N_2	Percent mole (%)				GB/T 13610
Sulfur content	mg/m^3 [b]	--	--	10	GB/T 11061
Wobbe index (net)	Mj/m^3 [c]	48.2	47.2	49.2	
Reference fuel G_{25}					
Composition:					
Methane	Percent mole (%)	86	84	88	GB/T 13610
Balance [a]	Percent mole (%)	--	--	1	GB/T 13610
N_2	Percent mole (%)	14	12	16	GB/T 13610
Sulfur content	mg/m^3 [b]	--	--	10	GB/T 11061
Wobbe index (net)	Mj/m^3 [c]	39.4	38.2	40.6	

[a] Inerts (different from N_2) + C_2 +C_{2+}.

[b] Value to be determined at 293.2 K (20°C) and 101.3 kPa.

[c] Value to be determined at 273.2 K (0°C) and 101.3 kPa.

Wobbe index is defined as the product of the fuel's calorific value per unit volume and the square root of its relative concentration (in the same reference state) :

Wobbe index:

$$W = H_{fuel} * \sqrt{\frac{\rho_{air}}{\rho_{fuel}}} \quad (1)$$

Where:

H_{fuel} -- fuel's calorific value, MJ/m^3 (0ºC)

ρ_{air} -- air's concentration at 0ºC

ρ_{fuel} -- fuel's concentration at 0ºC

Whether the Wobbe index is the gross index or net index depends on whether the calorific value is the gross or net value.

H.3 Documents cited in this Annex

GB/T 259 Petroleum products – Determination of water-soluble acids and alkalis

GB/T 260 Determination of water content in petroleum products

GB/T 503 Test method for knock characteristics of motor and aviation fuels by the motor method

GB/T 511 Petroleum, petroleum products and additives – Method for determination of

	mechanical admixtures
GB/T 1792	Distillate fuels – Determination of mercaptan sulphur – Potentiometric titration method
GB/T 1884	Petroleum and liquid petroleum products – Determination of concentration by concentration meter method
GB/T 1885	Petroleum conversion table
GB/T 5096	Petroleum products – Corrosiveness to copper – Copper strip test
GB/T 5487	Test method for knock characteristics of motor fuels by the Research method
GB/T 6536	Petroleum products – Determination of distillation
GB/T 8017	Petroleum products – Determination of vapour pressure – Reid method
GB/T 8018	Gasoline – Determination of oxidation stability – Induction period method
GB/T 8019	Motor gasoline and aviation fuels – Determination of existent gum – Jet evaporation method
GB/T 8020	Gasoline – Determination of lead content – Atomic absorption spectrometry
GB/T 11061	Natural gas – Determination of sulphur – Oxidative microculometry method
GB/T 11132	Liquid petroleum products – Determination of hydrocarbon types
GB/T 12576	Liquefied petroleum gases – Calculation of vapour pressure and relative concentration and octane number
GB/T 13610	Natural gas composition analysis (gas chromatography method)
SH/T 0020	Determination of sulphur content in petroleum products (spectrophotometric method)
SH/T 0102	Determination of copper content in lubricating oil and liquid fuels (atomic absorption spectrometry method)
SH/T 0174	Determination of Mercaptan stability in aromatic hydrocarbon and light petroleum products (Doctor method)
SH/T 0222	Determination of total sulphur content in liquefied petroleum gas (Coulometric method)
SH/T 0232	Liquefied petroleum gas – Corrosiveness to copper – Copper strip test SH/T 0604 Crude petroleum and petroleum produces – Determination of density – Oscillating U-tube method
SH/T 0604	Crude petroleum and petroleum produces – Determination of density – Oscillating U-tube method
SH/T 0614	Determination of industrial propane and butane compositions (gas chromatography method))
SH/T 0663	Determination of alcohol and ether types in petroleum products
SH/T 0689	Standard test method for determination of total sulphur in light hydrocarbons motor fuels and oils by ultraviolet fluorescence
SH/T 0711	Determination of manganese content in petroleum products
SH/T 0712	Determination of iron content in petroleum products by atomic absorption spectrometry

SH/T 0713	Motor gasoline and aviation fuels – Determination of benzene and methylbenzene contents by gas chromatography method
SH/T 0714	Standard test method for detailed analysis of petroleum naphthas through n-nounane by capillary gas chromatography
SY/T 7509	Determination of remains of liquefied petroleum gas

Annex I

(Normative)

Requirements for Assuring Conformity of Production

I.1 Introduction

Conformity of production (COP) intends for assuring that the mass-produced mopeds, systems, components and separate technical units in production conform to the approved type.

The COP assurance requirements proposed by the competent authority over the moped manufacturer include: evaluation of the quality management system and confirmation check on the manufacturer and the production process control.

I.2 Requirements for moped manufacturers

I.2.1 It shall have the plan and procedure to effectively control the production process or obtain the certificate of quality management system which satisfies the requirements in GB/T 19001-2008 (for this certificate, however, the requirements of 7.3 regarding the design and development may be exempted), in order to make sure that the whole mopeds, systems, components and separate technical units in production are consistent with the approved type.

I.2.2 It shall develop the assurance plan and written controlling plan for each type-approval tests, and shall perform necessary tests or related checks at the specified intervals, so as to make sure that they could stay consistent with the approved type continuously. When applicable, the specifically prescribed tests shall be included.

I.2.3 It shall have and implement the procedure to effectively control the conformity of products with the approved type.

I.2.4 Necessary test equipment or other related devices shall be used to check the conformity of production of each vehicle type for type test.

I.2.5 The test records or documents formed from inspection results shall be maintained during the period of time specified by the competent authority and shall be accessible. The required duration can be up to 10 years.

I.2.6 Analyse the test or assessment result of each vehicle type to verify and ensure the stability of its emissions and work out the allowed deviation from controlling the production process.

I.2.7 Make sure that each vehicle type has gone through each conformity test and check required by this Standard; also, inspection shall be conducted to the initial working performance and durability of the emission-control device.

I.2.8 If any sample group or tested component fails the required conformity check or test, make sure to test or check another sample. Take every possible step to restore the conformity of production.

I.2.9 In the vehicle type inspection, the inspection involved in I.2.7 is limited to verifying whether the data related to the type test, especially the data related to the provisions in Appendix A, are correctly established.

I.3 Regular check plan

I.3.1 The competent authority can check the method used by vehicle manufacturer to control the conformity of production at any time, to assure its continuous effectiveness.

I.3.2 During each verification by the competent authority, the inspection staff shall be able to obtain test or check records and production records.

I.3.3 The inspection staff can choose the samples randomly and test them in the manufacturer's laboratory (or tested by a third-party testing organazation) if the test conditions are proper.

I.3.4 If the control level cannot be accepted or the validity of the test performed according to I.3.2 needs to be verified, the inspection staff shall choose the samples and have them tested by a third-party testing organazation.

I.3.5 The competent authority can perform any check or test listed in this Standard.

I.3.6 The competent authority shall supervise the manufacturer to take every necessary means to restore the conformity of production as soon as possible if the assessment or verification is found to be unsatisfactory.

Appendix IA

(Normative)

Pass/Fail Determination Method for Conformity of Production Check

IA.1 When the manufacturer's standard deviation from the production is satisfactory, the following steps can be used to verify the conformity of production of type I test.

IA.1.1 The number of sample vehicles shall be at least three. The sampling procedure stipulates that when 40% of a batch of products have defects, the probability of passing the test is 0.95 (manufacturer's risk = 5%); when 65% of a batch of products have defects, the probability of acceptance is 0.1 (consumer's risk = 10%).

IA.1.2 Use the following procedure (refer to Figure 2) for each pollutant specified in 6.2.1.9:

L -- Natural logarithm of the pollutant's limit value,

x_i -- Natural logarithm of the measurement for the i^{-th} vehicle of the sample,

s -- Estimate of the production standard deviation (take the natural logarithm of the measurement),

n -- Current sample number.

IA.1.3 Quantify the sum of the standard deviations of each limit value and calculate the test statistic of the sample vehicles. The definition is as follows:

$$\frac{1}{s}\sum_{i=1}^{n}(L-x_i) \quad \cdots\cdots (1)$$

IA.1.4 If the test statistic is greater than or equal to the pass critical value for the sample size given in Table IA.1, a pass decision is reached for the pollutant; if the test statistic is less than the fail critical value for the sample size given in Table IA.1, a fail decision is reached for the pollutant; otherwise, additionally pick one sample vehicle for test as per the provisions of 7.1.2.4, and re-calculate the test statistics as per the quantity of sample vehicles after the additional picking.

Table IA.1

Cumulative count of test mopeds (Current sample size)	Critical value for pass decision	Critical value for fail decision
3	3.327	-4.724
4	3.261	-4.790
5	3.195	-4.856
6	3.129	-4.922
7	3.063	-4.988
8	2.997	-5.054
9	2.931	-5.120
10	2.865	-5.185
11	2.799	-5.251
12	2.733	-5.317
13	2.667	-5.383
14	2.601	-5.449

15	2.535	-5.515
16	2.469	-5.581
17	2.403	-5.647
18	2.337	-5.713
19	2.271	-5.779
20	2.205	-5.845
21	2.139	-5.911
22	2.073	-5.977
23	2.007	-6.043
24	1.941	-6.109
25	1.875	-6.175
26	1.809	-6.241
27	1.743	-6.307
28	1.677	-6.373
29	1.611	-6.439
30	1.545	-6.505
31	1.479	-6.571
32	-2.112	-2.112

IA.2 If the manufacturer's production standard deviation is not satisfactory or it does not have related records, use the following procedure to confirm the conformity of production of type I test.

IA.2.1 The number of sample vehicles shall be at least three. The sampling procedure stipulates that when 40% of a batch of products have defects, the probability of passing the test is 0.95 (manufacturer's risk = 5%); when 65% of a batch of products have defects, the probability of acceptance is 0.1 (consumer's risk = 10%).

IA.2.2 Considering the measurement of each pollutant specified in 6.2.1 is in normal distribution, its natural logarithm shall be obtained first for transfer. Assume m_0 and m represent respectively the minimum and maximum sample size (m_0 = 3 and m = 32) and n is the current sample size.

IA.2.3 If the natural logarithms of the sample vehicle's measured values are respectively x_1, x_2 .., x_j, and L is certain pollutant's natural logarithm, then:

$$d_j = x_j - L$$

$$\bar{d}_n = \frac{1}{n}\sum_{j=1}^{n} d_j$$

$$v_n^2 = \frac{1}{n}\sum_{j=1}^{n}\left(d_j - \bar{d}_n\right)^2 \qquad \text{(2)}$$

IA.2.4 Table IA.2 shows the relationship between the current sample size and pass critical value (A_n) and fail critical value (B_n). The test statistic is the ratio of $\bar{d}_n / v_n$. The following method shall be used to determine whether each pollutant passes the test:

If $m_0 \le n \le m$:

--If $\bar{d}_n / v_n \le B_n$, the pollutant passes,
--If $\bar{d}_n / v_n > B_n$, the pollutant does not pass,
--If $A_n < \bar{d}_n / v_n \le B_n$, add another sample.

IA.2.5 The following regression formulas may be used for calculating the test statistic:

$$\bar{d}_n = \left(1-\frac{1}{n}\right)\times \bar{d}_{n-1} + \frac{1}{n} d_n$$

$$v_n^2 = \left(1-\frac{1}{n}\right)\times v_{n-1}^2 + \frac{\left(\bar{d}_n - d_n\right)^2}{n-1} \quad \text{(3)}$$

$$(n = 2,3,\ldots; \bar{d}_1 = d_1; v_1 = 0)$$

Table IA.2

Count of sample mopeds/n	Critical value for pass decision/ A_n	Critical value for fail decision/B_n
3	-0.80381	16.64743
4	-0.76339	7.68627
5	-0.72982	4.67136
6	-0.69962	3.25573
7	-0.67129	2.45431
8	-0.64406	1.94369
9	-0.61750	1.59105
10	-0.59135	1.33295
11	-0.56542	1.13566
12	-0.53960	0.97970
13	-0.51379	0.85307
14	-0.48791	0.74801
15	-0.46191	0.65928
16	-0.43573	0.58321
17	-0.40933	0.51718
18	-0.38266	0.45922
19	-0.35570	0.40788
20	-0.32840	0.36203
21	-0.30072	0.32078
22	-0.27263	0.28343
23	-0.24410	0.24943

24	-0.21509	0.21831
25	-0.18557	0.18970
26	-0.15550	0.16328
27	-0.12483	0.13880
28	-0.09354	0.11603
29	-0.06159	0.09480
30	-0.02892	0.07493
31	0.00449	0.05629
32	0.03876	0.03876
Note: Minimum 3 sample vehicles.		

Annex J

(Normative)

Extension of type-approval Requirements

Vehicle type to undergo extension of type-approval shall follow the requirements set out in J.1 and J.2.

J.1 Requirements for extension of type-approval with respect to the type I, type II and type V tests

Sr. No.	Classification criteria description	Type I test	Type II test	Type V test	OBD test
1	Vehicle				
1.1	Category	√	√	√	√
1.2	Sub-category	√	√	√	√
1.3	Manufacturer	√	√	√	√
1.4	The inertia of a vehicle variant(s) or version(s) within two inertia categories above or below the nominal inertia category	√	/	√	√
1.5	Overall gear ratio (± 8%)	√	/	√	√
2	Propulsion family characteristics				
2.1	Manufacturer	√	√	√	√
2.2	Number of cylinders of the combustion engine	√	√	√	√
2.3	Engine capacity of the combustion engine (± 2%) (± 30% for OBD test)	√	√	√	√
2.4	Number and control (variable cam phasing or lift) of combustion engine valves	√	√	√	√
2.5	Mono fuel/bi-fuel/others	√	√	√	√
2.6	Fuel system (scavenging port/ fuel injection position /other)	√	√	√	√
2.7	Type of cooling system of combustion engine	√	√	√	√
2.8	Combustion cycle (two-stroke/four-stroke/other)	√	√	√	√
2.9	Intake air system (naturally aspirated/supercharged /intercooler/boost control) and air induction control (mechanical throttle/electronic throttle control/no throttle)	√	√	√	√
2.10	ECU				
2.10.1	ECU manufacturer	√	√	√	√
2.10.2	Model of ECU	√	√	√	√
3	Pollution control system characteristics				
3.1	Propulsion exhaust (not) equipped with catalytic converter(s)	√	√	√	/
3.1.1	Manufacturer of catalytic converter	√	√	√	/
3.1.2	Type of catalytic converter(s)	√	√	√	/
3.1.3	Number and elements of catalytic converters	√	√	√	/
3.1.4	Size of catalytic converters (volume of monolith(s) ± 15%)	√	√	√	/

3.1.5	Operation principle of catalytic activity (oxidising, three-way, heated, other.)	√	√	√	/
3.1.6	Precious metal load (identical or higher)	√	√	√	/
3.1.7	Precious metal ratio (± 15%)	√	√	√	/
3.1.8	Substrate (structure and material)	√	√	√	/
3.1.9	Cell density	√	√	√	/
3.1.10	Type of casing for the catalytic converter(s)	√	√	√	/
3.2	With/without air injection device	√	√	√	/
3.2.1	Type (air pulsation, air pump, etc.; in the case of OBD test, only 'being electrically controlled or not' would be considered)	√	√	√	√
3.3	With/without a cold-start device/starting aid device(s)	√	√	√	√
3.3.1	Manufacturer	√	√	√	√
3.3.2	Type	√	√	√	√
3.3.3	Operation principle	√	√	√	√
3.3.4	Activation time of cold-start or starting aid device(s) and/or duty cycle (only limited time activated after cold start/continuous operation)	√	√	√	√
3.4	With/without O_2 sensor	√	√	√	√
3.4.1	Manufacturer	√	√	√	√
3.4.2	Type	√	√	√	√
3.4.3	Operation principle (binary/wide range/other)	√	√	√	√
3.4.4	O_2 sensor interaction with closed-loop fuelling system (stoichiometry/lean or rich operation)	√	√	√	√
3.5	With/without exhaust gas recirculation system (EGR)	√	√	√	/
3.5.1	Manufacturer	√	√	√	/
3.5.2	Type	√	√	√	/
3.5.3	Operation principle (internal/external)	√	√	√	/
3.5.4	Max. EGR rate (± 5%)	√	√	√	/
4	Functional monitoring and fault monitoring methods of OBD system, and the method by which the driver is indicated with the malfunction	/	/	/	√

J.2 Requirements for extension of type-approval with respect to the type III and type IV tests

Sr. No.	Classification criteria description	Type III test	Type IV test
1	Vehicle		
1.1	Category	√	√
1.2	Sub-category	/	√
1.3	Manufacturer	√	√
2	System		
2.1	With/without crankcase ventilation system	√	/
2.1.1	Type	√	/

2.1.2	Operation principle	√	/
2.2	With/without evaporative emission control system	/	√
2.2.1	Type	/	√
2.2.2	Operation principle (active/passive/mechanically or electrically controlled)	/	√
2.2.3	Identical basic principle of fuel/air metering(e.g. single point injection)	/	√
2.2.4	Identical material of fuel tank and liquid fuel hose	/	√
2.2.5	Similar sectional area and length of liquid fuel hose	/	√
2.2.6	The fuel storage volume is within a range of ± 10%	/	√
2.2.7	The setting of the fuel storage relief valve is identical	/	√
2.2.8	Identical method of storage of the fuel vapour (i.e. trap form and volume, storage medium, air cleaner (if used for evaporative emission control) etc.)	/	√
2.2.9	Identical method of purging of the stored vapour (e.g. air flow, purge volume over the driving cycle)	/	√
2.2.10	Identical method of sealing and venting of the fuel metering system	/	√
Note 1: "√" denotes that the classification criteria description is identical or within the prescribed and declared tolerances.			