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Limits and measurement methods for emissions from light-duty vehicles (CHINA 6)

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Foreword

In order to implement the "Environmental Protection Law of the People's Republic of China" and the "Law of the People's Republic of China on Prevention and Control of Atmospheric Pollution", to prevent and control the pollution of motor vehicles and improve the quality of the ambient air, this standard is hereby formulated.

This standard specifies the requirements for the CHINA 6 type inspection requirements, the consistency of production, and the inspection and determination methods for conformity of emissions from light-duty vehicles. Manufacturers are obliged to ensure that the vehicles they produce and sell meet the requirements for in-use conformance of this standard.

Compared with GB 18352.5-2013 "Limits and measurement methods for emissions from light-duty vehicles (CHINA 5)", the main changes in this standard include:

- CHANGE the type I test cycle, TIGHTEN the pollutant emission limits, ADD the measurement requirements for the number of particulate emissions from gasoline vehicles;
- DESIGNATE the real driving emission (RDE) test as type II test;
- TIGHTEN the Type VI test items and limits;
- REVISE technical requirements for monitoring items, thresholds and monitoring conditions for on-board diagnostic systems;
- REVISE the relevant requirements for obtaining vehicle on-board diagnostic systems and vehicle maintenance and repair information;
- REVISE the determination method of production consistency inspection and the relevant requirements for the in-use conformance inspection;
- REVISE the technical requirements for test fuels;
- ADD requirements for control of pollutants in the refueling process;
- ADD test requirements for hybrid electric vehicles.

This part of the standard modifies and uses European Union (EC) No 715/2007 "Regulations on Type Approval of Pollutants Emitted by Light Passenger Vehicles and Commercial Vehicles and Regulations on Obtaining Maintenance and Repair Information for Vehicles", (EC) No 692/2008 "Regulations on (EC) the Implementation and Revision of (EC) No 715/2007 Regulations on Type Approval of Pollutants Emitted by Light Passenger Vehicles and Commercial

Limits and measurement methods for emissions from light-duty vehicles (CHINA 6)

1 Scope

This standard specifies the emission limits and measurement methods for exhaust emissions at normal temperature and low temperature, real driving emission (RDE) exhaust emissions, crankcase pollutants, evaporative emissions, and refueling pollutants, as well as the technical requirements and measurement methods for the pollutant control device durability and on-board diagnostics (OBD) systems of light-duty vehicles which are equipped with ignition type engine.

This standard specifies the emission limits and measurement methods for exhaust emissions at normal temperature and low temperature, real driving emission (RDE) exhaust emissions, crankcase pollutants, as well as the technical requirements and measurement methods for the pollutant control device durability and on-board diagnostics (OBD) systems of light-duty vehicles which are equipped with compression-ignition type engine.

This standard specifies the requirements and confirmation of light-duty vehicle type inspection, production conformance and in-use conformity inspection and determination methods.

This standard also specifies special requirements for the light-duty vehicles which use liquefied petroleum gas (LPG) or natural gas (NG).

This standard also specifies the type inspection procedures for pollutant emissions of the alternative pollutant control devices which are used as an independent technology assembly and proposed to be installed on light-duty vehicles.

This standard also specifies the technical requirements for vehicles that use reactants in exhaust aftertreatment systems, as well as the emission test procedures for vehicles that are equipped with periodic regenerative systems.

This standard applies to light-duty vehicles (including hybrid electric vehicles) powered by ignition engines or compression-ignition engines with a maximum design speed of 50 km/h or more.

Under the requirements of production companies, category M_1, M_2, N_1 and N_2 vehicles with a maximum design total mass of more than 3500 kg can be subject to type inspection in accordance with this standard.

This standard does not apply to vehicles that have passed the CHINA 6 type inspection in accordance with the provisions of GB 17691.

The use of vehicles whose fuel types are not contained in Appendix K may be implemented with reference to the relevant provisions of this standard.

2 Normative references

The following documents or clauses therein are referenced in this standard. For undated references, the latest edition is applicable to this standard.

GB 1495 Limits and measurement methods for noise emitted by accelerating motor vehicles

GB 3847 Limits and measurement methods for exhaust smoke from C.I.E. (Compression Ignition Engine) and vehicle equipped with C.I.E.

GB 7258 Safety specifications for power-driven vehicles operating on roads

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

GB 17691 Limits and measurement methods for exhaust emissions from compression ignition and gas fueled positive ignition engines of vehicles (III IV V)

GB 18285 Limits and measurement methods for exhaust emissions from vehicles equipped ignition engine under two-speed idle conditions and simple driving mode conditions

GB/T 19001 Quality management system requirements

GB/T 27630 Guideline for air quality assessment of passenger car

HJ/T 390 Technical requirement for environmental protection product - Control system of fuel evaporative emissions from vehicle with petrol engine

HJ 509 Determination of platinum, palladium and rhodium loading in the vehicle-used ceramic catalytic converters - Inductive coupled plasma-optical emission spectrometry and inductive coupled plasma-mass spectrometry

ISO 2575 Road vehicles - Symbols for controls, indicators and tell-tales

ISO 8422-1991 Sequential sampling plans for inspection by attributes

ISO 9141-2 Road vehicles - Diagnostic systems - Part 2: CARB requirements for interchange of digital information

ISO 14230-4 Road vehicles - Diagnostic systems - Keyword Protocol 2000 - Part4: Requirements for emission-related systems

ISO 15031-3 Road vehicles - Communication ceilings - Related diagnostics - Part 3: Diagnostic connector and related electrical circuits, specification and use

ISO 15031-4 Road vehicles - Communication between vehicle and external equipment for emissions - related diagnostics - Part 4: External test equipment

ISO 15031-5 Road vehicles - Communication between vehicle and external equipment for emissions-related diagnostics - Part 5: Emissions-related diagnostic services

ISO 15031-6 Road vehicles - Communication between vehicle and external equipment for emissions-related diagnostics - Part 6: Diagnostic trouble code definition

ISO 15031-7 Road vehicles - Communication between vehicle and external equipment for emissions-related diagnostics - Part 7: Datalink security

ISO 15765-4 Road vehicles - Diagnostics on Controller Area Network (CAN) - Part 4: Requirements for emissions-related systems

EN 1822 High efficiency air filters (EPA, HEPA and ULPA)

SAE J1850 Class B data communications network interface

SAE J2186 E/E datalink security

SAE J1930 Electronic system diagnostic items, definitions, and abbreviations (equivalent to ISO/TR 15031-2)

SAE J1930-DA Electronic system diagnostic items, definitions and abbreviations, and abbreviations website tool spreadsheet program (equivalent to ISO/TR 15031-2)

SAE J1962 Diagnostic interface (equivalent to ISO/DIS 15031-3: December 14, 2001)

SAE J1978 OBDII scan tool (equivalent to ISO/DIS 15031-4: December 14, 2001)

SAE J1979 E/E diagnostic test mode

An apparatus or strategy that activates, adjusts, delays or stops the work of a certain component or function of exhaust control system through measuring, sensing or responding the operation parameters of vehicles (e.g., vehicle speed, engine speed, transmission gear, temperature, altitude, intake manifold vacuum, or other parameters), to make the control effect of the emission control system lower under normal use conditions of vehicles.

The following measures are not regarded as defeat devices:

(1) Measures required to protect the engine from damage or accidents and to ensure safe driving of the vehicle;

(2) Measures that only work when the engine starts;

(3) Measure that does work in type I, type II, type III, type IV, type VI, and type VII tests.

3.29

Reagent

An agent that is provided to the emission after-treatment system as required by the emission control system, is stored on the vehicle but not used as fuel.

3.30

Periodically regenerating system

A catalytic converter, particle trap or other pollution control device that requires a periodic regeneration process during normal vehicle operation not exceeding 4000 km.

For a periodical regeneration system, emissions during the regeneration phase can be exceeded. If at least one regeneration occurs during the type I test after the pollution control device has undergone at least one regeneration during the pretreatment period, the regeneration system shall be considered as a continuous regeneration system and not applicable to the test procedure of the periodical regeneration system as specified in Appendix Q.

If the data provided by production companies to the environmental protection authorities shows that the emissions during the regeneration phase are lower than the limit of 5.3.1.4, the periodical regeneration system test procedure may not be used, and a written statement may be made to the environmental protection authority.

3.31

5.1.2 The production enterprise shall adopt technical measures to ensure that the vehicle can effectively control its exhaust emissions, actual exhaust emissions, crankcase pollutants, evaporative emissions, and refueling emissions within the limits specified in this standard under normal use conditions and normal life span. This also includes hoses and their joints used in emission control systems, as well as the reliability of individual wiring, which shall be manufactured to meet their original design requirements.

All vehicles shall be equipped with an OBD system that shall be designed, manufactured, and installed on the vehicle to ensure that the vehicle recognizes and records the type of degradation or failure throughout its full life.

If the provisions of clause 5 (type inspection), clause 7 (production consistency) and clause 8 (in-use conformity) are satisfied, it is determined that the requirements of these terms are satisfied.

It is forbidden to use defeat devices.

During the full life of the vehicle, the technical measures taken by the production enterprises and the OBD system of the vehicle equipment shall not be transformed, unless it is necessary to solve the problem of vehicle emission defects, and the manufacturer has given written explanation of the transformation.

5.1.3 One of the following measures shall be taken to prevent excessive evaporative emissions or fuel spillage due to the loss of the fuel tank cap.

(1) Automatically opened and closed fuel tank caps that cannot be removed;

(2) To prevent excessive evaporative emissions caused by the loss of the fuel tank cap from the structural design;

(3) Any other measures with the same effect. For example, fastened fuel tank cap; or otherwise the fuel tank cap is locked, and the vehicle ignition share the same key, and the key can only be removed when the fuel tank cap is locked.

5.1.4 Safety provisions for electronic control systems

5.1.4.1 The manufacturer shall ensure that the discharge-related requirements or parameters in the electronic control unit are not altered. If changes are required to diagnose, maintain, inspect, renew, or repair the vehicle, it shall be authorized by the manufacturer and recorded in-detail in the conformance material. Manufacturers shall provide a certain level of protection measures to prevent any reprogrammable electronic control unit code or operating parameters from being illegally altered. The protection level is at least for future reference, and it shall be kept for at least 3 years.

5.3.9 Type inspection test for alternative pollution control devices as an independent technology assembly

5.3.9.1 For alternative pollution control devices, tests shall be conducted in accordance with Appendix M.

5.3.9.2 For the original alternative pollution control device, if it meets the requirements of M.4.2.1 and M.4.2.2, it does not have to be tested in accordance with Appendix M.

5.3.10 Type inspection test for LPG or NG fueled vehicles

For vehicles that use LPG or NG, they shall be tested in accordance with Appendix L.

5.3.11 Technical requirements for vehicles using reactants for exhaust aftertreatment systems

Vehicles that use reactants for aftertreatment systems to achieve emissions reduction purposes shall meet the requirements of Appendix P.

5.4 Internal air quality

All vehicles of category M_1 shall meet the requirements of the “Guideline for air quality assessment of passenger car” (GB/T 27630-2011) and subsequent revisions.

5.5 Test fuel

In the type inspection test, all the tests except the type II and type V tests shall use the reference fuel that meets the requirements of Appendix K. The type II and type V tests shall use the commercially available vehicle fuels that meet the requirements of the CHINA 6 gasoline/diesel standard.

For fuel types not included in Appendix K, commercially available vehicle fuels that comply with the relevant national standards shall be used.

5.6 Provisions on emissions warranty period

5.6.1 The production enterprise shall ensure that the materials, manufacturing processes and product quality of the emission-related parts and components, to ensure its normal function during useful life.

5.6.2 If the emission-related parts and components fail or damage during the warranty period, resulting in the failure of the exhaust system, or vehicle emissions exceeding the limits of this standard, the manufacturer shall bear the

6.2 Extension related to crankcase emissions (type III test)

The engine model and manufacturer are the same. The crankcase emission pollution control method is the same.

6.3 Extension related to evaporative emissions (type IV and VII tests)

6.3.1 Fuel tank

- The fuel tank shape, the fuel tank, and the liquid fuel hose are same in materials;

- The difference in volume of the fuel tank is within ±10%;

- The type of gas-liquid separator (if applicable) is the same as the type and emission type of the breathing valve of the fuel tank;

- The setting pressure of the fuel tank breathing valve opening pressure is the same;

- Fuel tank thermal shielding device (with/without);

- The oil refueling pipe has the same sealing methods for preventing the oil gas leakage;

- Fuel tank cap.

6.3.2 Fuel/air metering method

- The basic principles of fuel/air metering are the same (for example, whether there are throttles, inlet passage with multiple injections, single-point injections, and in-fuel tank direct-injection vehicles cannot be in the same family).

6.3.3 Canister

- The method for storing fuel vapors is the same, that is, specifications and models, materials and production plants of activated carbon canisters and storage media, and air cleaners (if used for evaporative emission control);

- The method of desorption of storage vapor is the same (e.g. the same starting point is set; the volumetric error of desorption in the air flow or test cycle is within 10%);

- The structure of the canister system in the fuel system is the same;

- The basic principle of the desorption valve is the same (electromagnetic/mechanical);

in Appendix A and Appendix B, select new production vehicles to carry out some or all of the tests described in 5.3 and 5.4. The selection of vehicles and the determination of inspection results shall be performed in accordance with 7.2 to 7.10. If a certain vehicle model cannot meet any requirement of the production consistency inspection, it is determined that the model does not meet the requirements of this standard. OBD production consistency assurance shall also meet the requirements of Appendix JA.7.

7.1 In order to ensure that mass-produced vehicles, systems, components, and independent technology assemblies are in line with the status after type inspection, and that the emission of the mass-produced vehicle is up to standard, the manufacturer shall formulate and implement a production consistency assurance plan for each vehicle model family. A production consistency assurance plan may include one or more emission family.

7.1.1 Vehicle manufacturer shall formulate a production consistency assurance plan before mass production of vehicles and report to the competent department of environmental protection for registration. The production consistency assurance plan for vehicle manufacturers may not include type II tests and type V tests. For other specific requirements, see Appendix N. OBD's production consistency assurance shall also meet the requirements of Appendix JA.7.

7.1.2 If a non-conformity occurs, the vehicle manufacturer shall re-establish the production consistency assurance system as soon as possible, and shall include the vehicle models of the same family that may be affected by the same defects.

7.1.3 In the production consistency test, all the tests except the type II and type V tests shall use the reference fuel that meets the requirements of Appendix K. The type II and type V tests shall use the commercially available vehicle fuel which is in conformity with the CHINA 6 gasoline/diesel standard. For the use of fuel types not included in Appendix K, the commercially available vehicle fuels that comply with the relevant national standards shall be used.

7.2 Type I test production consistency inspection

7.2.1 When the test is carried out, if the type-tested vehicle has one or more extensions, this test can be carried out on the vehicle model described in Appendix A or on the relevant extended model.

7.2.2 After the competent department of environmental protection selects the production consistency inspection prototype, the manufacturer shall not make any adjustment to the selected prototype.

7.2.2.1 Three vehicles shall be arbitrarily selected in batch products of the same family and the tests shall be carried out in accordance with the provisions of shall meet the requirements of 5.3.3.2.

7.5 Production consistency inspection of type IV test

7.5.1 Rapid inspection of production consistency shall be carried out in accordance with the provisions of Appendix F.7.

7.5.2 If necessary, a vehicle shall be randomly selected from the three vehicles drawn from 7.2, to perform the whole vehicle evaporative emission test as described in Appendix F. If the test result adopts the deterioration factor determined in 5.3.5.1.2.1 or the type IV test deterioration factor in Table 8 and complies with the requirements of 5.3.4.3 after addition correction, it is determined that the production consistency of the type IV test complies with requirements.

7.5.3 If the vehicle being taken cannot meet the requirements of 7.5.2, the other two vehicles taken in 7.2 shall be tested in accordance with Appendix F.

7.5.4 Test results shall use the deterioration factor determined in 5.3.5.1.2.1 or the type IV test deterioration factor in Table 8 for addition correction. Production consistency inspection results are determined in accordance with the following criteria:

- If the evaporative emission results of the three vehicles do not exceed 1.1 times the limit value, and the average value does not exceed the limit value, then the type IV test production consistency inspection is determined to be qualified.

- If the evaporative emissions from any one of the three vehicles exceeds 1.1 times the limit, or if the average value exceeds the limit, then the type IV test production consistency inspection is determined to be disqualified.

7.6 Production consistency inspection of type V test

7.6.1 During the type V test, a vehicle is randomly taken from the three vehicles drawn in 7.2 to carry out the durability test described in Appendix G. If the results meet the requirements of 5.3.1, 5.3.4, and 5.3.7, the production consistency of the type V test is determined to meet the requirements.

7.6.2 If the measurement result exceeds the standard limit during the durability test, the test shall be terminated, and it shall be determined that the vehicle taken cannot meet the requirements of 7.6.1. If the manufacturer submits a written application, the competent department of environmental protection shall carry out the tests described in Appendix G to the other two vehicles taken from 7.2.

7.6.3 If the durability test results of the other two vehicles meet the requirements

Appendix A

(Normative)

Type inspection material

When applying for type inspections, the following materials including the contents and catalogue shall be provided in electronic documents.

In any sketch, the details shall be adequately stated in an appropriate proportion; its size is A4, or it is folded to that size. If there are photos, their details shall be displayed. If the system, component or independent technology assembly is controlled by a microprocessor, its performance data shall be provided.

A.1 Overview

A.1.1 Manufacturing company name (full name, abbreviation or logo): ....

A.1.2 Model (1) and business general description: ....

A.1.3 Vehicle model marks: ....

A.1.4 Vehicle categories: ....

A.1.5 Production enterprise address: ....

A.1.6 Assembly plant address: ....

A.1.7 Model identification method and position (whole vehicle nameplate position): ....

A.2 Overall structure characteristics of vehicle

A.2.1 Photos and/or diagrams representing vehicles: ....

A.2.2 Emission control device location schematics: ....

A.2.3 Power shafts (number, position, interconnection): ....

A.2.4 Drive type: ....

A.2.5 Hybrid power (Yes/No): .... Hybrid type: ....

A.4.2.10.2.6.14.1 Manufacturer name: ....

A.4.2.10.2.6.14.2 Model: ....

A.4.2.10.2.6.14.3 Pressure: .... and vacuum settings: ....

A.4.2.10.2.6.14.4 If no refueling cap design is used, provide a description of the method for the fuel pipe sealing or a corresponding design plan: ....

A.4.2.10.2.6.15 Sealing

A.4.2.10.2.6.15.1 Pressure valve opening pressure of fuel tank and refueling pipe pressure: .... kPa

A.4.2.10.2.6.15.2 Vacuum relief valve opening pressure: .... kPa

A.4.2.10.2.6.15.3 Schematic diagram of sealing structure of refueling pipe: ....

A.4.2.10.2.6.16 Information on vehicle pretreatment for the purpose of reducing non-fuel hydrocarbons, etc.: ....

A.4.2.10.2.6.17 The desorption amount measured in seconds, and the sum of them, when operating Appendix F.5.9. Time from vehicle ignition startup to the start of desorption: ....

A.4.2.10.2.6.18 The desorption amount measured in seconds, and the sum of them, when operating Appendix I.5.7.1, I.5.7.3 or I.5.7.4, as well as the time from vehicle cold start to the desorption startup: ....

A.4.2.10.2.7 OBD system

A.4.2.10.2.7.1 System vendor: ....

A.4.2.10.2.7.2 Version number: ....

A.4.2.10.2.7.3 Communication interface location: ....

A.4.2.10.2.7.4 OBD system malfunction indicator light (MIL) written description (and) or schematic diagram, and MIL activation determination (fixed number of test cycles or statistical methods): ....

A.4.2.10.2.7.5 List and purpose of all components monitored by the OBD system: ....

A.4.2.10.2.7.6 The description of the normal operation of the OBD system of the following items, including a complete written description of each monitoring strategy, and outlining each step of the implementation of each strategy during the monitoring process, using a logic flow diagram to describe step by step the enabling standard and failure criteria. Where it is necessary to adequately

A.4.2.10.2.7.6.1.9 Other components monitored by OBD system (2): ....

A.4.2.10.2.7.6.2 Compression ignition engine (2)

A.4.2.10.2.7.6.2.1 NMHC catalytic converter (2): ....

A.4.2.10.2.7.6.2.2 NOx catalytic converter (2): ....

A.4.2.10.2.7.6.2.3 Particle trap monitoring (2): ....

A.4.2.10.2.7.6.2.4 Fuel supply system monitoring (2): ....

A.4.2.10.2.7.6.2.5 Misfire (2)

A.4.2.10.2.7.6.2.5.1 Within the entire engine speed and load range, the data of event occurrence probability of the following modes as monitored by the misfire monitoring system, these several kinds of misfire modes include the fault limit random cylinder misfire, continuous misfire of individual cylinder, and continuous misfire of paired cylinders as specified in J.5.3.2.2 ....

A.4.2.10.2.7.6.2.5.2 Data of all shutdown misfire monitoring that can be identified in the emission test cycle period, for each shutdown occurred in the cycle, the data shall be able to identify that: this shutdown is occurred relative to which time section of the driving curve, the number of revolutions of engine in each period when the misfire monitoring is shutdown, and the descriptions on which shutdown conditions cause this misfire monitoring shutdown in the type inspection application. It shall also include the number of completed monitoring cycles with a length of 1000 revolutions and the number of monitoring cycles when the number of monitored misfires exceed the misfire rate threshold. A set of data is submitted to meet the requirements of J.3.1.5.1 to cover the same OBD family (as defined in Appendix JB), and the manufacturer shall provide vehicle models that can represent the OBD family and any OVC-HEV vehicle data required in J.5.3.2.2 ....

A.4.2.10.2.7.6.2.6 Fuel system (2): ....

A.4.2.10.2.7.6.2.7 Exhaust gas sensor (2): ....

A.4.2.10.2.7.6.2.8 Exhaust gas recirculation (EGR) system (2): ....

A.4.2.10.2.7.6.2.9 Booster pressure control system (2): ....

A.4.2.10.2.7.6.2.10 NOx adsorber (2): ....

A.4.2.10.2.7.6.2.11 Cold start emission reduction strategy (2): ....

A.4.2.10.2.7.6.2.12 Variable throttle timing and/or its control system (2): ....

A.4.2.10.2.7.6.2.13 Other components monitored by the OBD system (2): ....

A.4.2.10.2.7.9.5 A description of the test flags from $00 to FF in the $06 mode shall be given, along with a description of each supported OBD system monitoring flag: ....

A.4.2.10.2.7.10 A statement that the actual monitoring frequency (IUPR) of the OBD system complies with the requirements of Appendix J.3.3.2.1 in a reasonably predictable driving situation: ....

A.4.2.10.2.7.11 A plan detailing the technical criteria and determination method used: for each monitoring, the increase in the molecular count and denominator count shall comply with the requirements of J.3.4.2 and J.3.4.3; the interruption of the work of its molecular count, denominator count and general denominator count shall comply with the requirements of J.3.4.5: ....

A.4.2.10.2.7.12 Descriptions on the fault simulation or degraded components used by each test monitoring item to simulate the fault: ....

A.4.2.10.2.7.13 If applicable, details of the car family described in Appendix JB: ....

A.4.2.10.2.7.14 Where applicable, description of all alternative monitoring programs proposed by the manufacturer in accordance with the requirements of J.4 and J.5: ...

A.4.2.10.2.7.15 Where applicable, all applications for exemptions and related materials for monitoring items permitted for exemptions in J.4 and J.5 filed by manufacturer: ....

A.4.2.10.2.7.16 Where applicable, copies of other type inspections, accompanied by information related to type inspection extensions: ....

A.4.2.10.2.8 Other systems (instructions and working principles): ....

A.4.2.11 LPG supply system: Yes/No (2)

A.4.2.11.1 Type inspection number: ....

A.4.2.11.2 Engine electronic control management unit for LPG

A.4.2.11.2.1 Name of manufacturer: ....

A.4.2.11.2.2 Model: ....

A.4.2.11.2.3 Emission-related adjustment possibilities: ....

A.4.2.11.3 Supplementary information

A.4.2.11.3.1 Description of measures to protect the catalytic converter when

Appendix B

(Informative)

Type inspection report format

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

In accordance with the GB 18352.6-2016 standard, a certain type of vehicle/component/independent technology assembly is notified as follows:

Type inspection passed (1)

Type inspection extended (1)

Type inspection rejected (1)

Type inspection application cancelled (1)

Type inspection number (1): ....

Type inspection extension number (1): ....

Reason for extension: ....

B.1 Part I

B.1.1 Name of manufacturer: ....

B.1.2 Type: ....

B.1.2.1 Trade names (if applicable): ....

B.1.3 Vehicle type identification method and position, if indicated on the vehicle (2): ....

B.1.3.1 Marker location: ....

B.1.4 Vehicle types: ....

B.1.5 Production enterprise address: ....

B.1.6 Name and address of final assembly plant: ....

B.1.7 Legal representatives of production enterprises and final assembly plants: ....

B.1.8 Name and address of main pollution control device company: ....

Attachment BA

(Informative)

Additional information on type inspection reports

BA.1 Vehicle parameters and test conditions

BA.1.1 Vehicle curb mass: ....

BA.1.2 Maximum total vehicle mass: ....

BA.1.3 Vehicle test mass: ....

BA.1.4 Number of seats (including driver seat): ....

BA.1.5 Vehicle body style:

BA.1.5.1 For vehicles of category M: Cars, hatchback, passenger and goods double-service vehicle, two-compartment vehicle, open car, utility vehicle (1) ....

BA.1.5.2 For vehicles of category N: Trucks, vans (1) ....

BA.1.6 Drive wheel: Front wheel, rear wheel, 4 × 4 (1) ....

BA.1.7 Engine identification number: ....

BA.1.7.1 Engine displacement: ....

BA.1.7.2 Fuel supply system: direct injection/indirect injection (1) ....

BA.1.7.3 Fuels recommended by manufacturers: ....

BA.1.7.4 Boosting device: Yes/No (1) ....

BA.1.7.5 Maximum power: .... kW; Speed: .... r/min

BA.1.7.6 Ignition system: compression ignition/ignition (1) ....

BA.1.8 Lubricating oil for engine

BA.1.8.1 Name of manufacturer: ....

BA.1.8.2 Model: ....

BA.1.9 Transmission

BA.1.9.1 Gearbox type: manual/automatic/variable speed (1) ....

Appendix C

(Normative)

Exhaust emission test after cold start at normal temperature (type I test)

C.1 Test procedure and test conditions

This Appendix describes the test procedures and test conditions for type I tests specified in 5.3.1. For vehicles burning LPG or NG, the terms of Appendix L shall also be applied.

C.1.1 Test description

C.1.1.1 In the specified type I test cycle, determine the gaseous contaminants, particulate matter mass (PM), particulate matter number (particle number or PN), and CO_2 emissions.

C.1.1.1.1 Tests shall use the method described in this Appendix. The gas, particulate and particle number shall be subject to sampling analysis by the specified method. Hybrid vehicle testing is performed using the method specified in Appendix R.

C.1.1.2 The number of tests is determined in accordance with Figure C.1.

C.1.1.2.1 The process specified in Figure C.1 applies to a complete type I test cycle, it does not apply to a single speed segment of a type I test cycle.

C.1.1.2.2 The test result is the result after the REESS energy change, Ki, and the deterioration factor correction.

C.1.1.2.3 Determination of test results

C.1.1.2.3.1 If any of the test results has a certain pollutant exceeding the standard, the test vehicle emission is determined as disqualified.

C.1.1.2.3.2 The vehicle manufacturer shall declare the CO_2 emissions of the test vehicle during the entire test cycle in accordance with Table C.1.

C.1.1.2.3.3 If, after the first test, the test results meet the requirements of the first test in Table C.2, the value of the type test shall be the value of the public information of the manufacturer. Otherwise, a second test shall be conducted.

C.1.1.2.3.4 After the second test, calculate the arithmetic mean of the two test results. If the arithmetic mean meets the requirements of the second test in Table C.2, the type test value shall use the information disclosure value of the

C.1.2.1.3.1.3 Determine the background particulate level in the dilution channel by collecting the dilution air passing through the particulate background gas filter. The sampling point is the same as the particle sampling point. If a secondary dilution is used for background level measurement, the secondary dilution system shall be in working condition, and one background particle level measurement shall be performed on the day of the test. The measurement of background particles can be carried out either before the test or after the test.

C.1.2.1.3.2 Background particle number (PN) determination

C.1.2.1.3.2.1 It is allowed to perform background correction by subtracting the number of particles in the dilution air or dilution channel from the emission measurement results. The method for determining the number of background particulates is as follows:

C.1.2.1.3.2.1.1 Background values can be calculated or actually measured. The maximum allowable corrected background concentration is related to the maximum allowable leakage (0.5/cm^3) of the quantitative measurement system which is corrected by the particle concentration reduction factor (PCRF), and the CVS flow used in the actual test.

C.1.2.1.3.2.1.2 As required by the manufacturer, it may also use the actually measured background concentration for correction.

C.1.2.1.3.2.1.3 If the result after subtracting background particles is negative, the background particle number is considered to be zero.

C.1.2.1.3.2.2 The dilution air background particle number concentration shall be determined by collecting dilution air which passes through the particulate sampling filter. The sampling point shall be located as close to the dilution air filter as possible within the PN measurement system. The background gas concentration level is represented by the number of particles/m^3 and shall be determined by rolling the arithmetic mean of at least 14 times. The background concentration is measured at least once a week.

C.1.2.1.3.2.3 Dilution channel background particle concentration shall be determined by collecting dilution air which passes through a particulate sampling filter. The sampling point shall be the same as the particle sampling point. If a secondary dilution is used to measure the background level, the secondary dilution system shall be in normal operation. A background measurement shall be conducted on the day of the test, and it can be performed before and after the emission test. The flow rate settings for the PCRF and CVS during the background measurement shall be the same as those for the actual test.

C.1.2.2 Environmental requirements and parameters

requires, the charging process can be omitted before the pre-cycle. The REESS must not be recharged before the formal test.

C.1.2.6.3 Move the vehicle into the laboratory and follow the requirements below.

C.1.2.6.3.1 Drive or push the test vehicle to the dynamometer, follow the cycling requirements to operate. At this time, the vehicle does not need to be a cold vehicle, and the dynamometer load setting can be performed.

C.1.2.6.3.2 Dynamometer load setting follows the provisions in Appendix CC.

C.1.2.6.3.3 During the pretreatment phase, the temperature of the laboratory shall be the same as that specified in this Appendix for type I test.

C.1.2.6.3.4 Tire pressure shall be set in accordance with the provisions of C.1.2.4.5.

C.1.2.6.3.5 The bi-fuel vehicle shall be subject to pretreatment again before performing the second reference fuel test.

C.1.2.6.3.6 Pretreatment shall be carried out in accordance with the applicable test cycle. Start the engine and drive the vehicle as specified in C.1.2.6.4.

C.1.2.6.3.7 Additional WLTC cycles may be carried out at the request of the manufacturer or the competent department of environmental protection, so that the vehicle and the control system can reach a stable working condition.

C.1.2.6.3.8 Additional pretreatment cycles shall be recorded.

C.1.2.6.3.9 If there is a possibility of residual particulate emissions, pretreatment of sampling equipment is required. It is recommended to use the vehicle for a pretreatment of 20 minutes of continuous operation under steady driving conditions at 120 km/h. If necessary, pre-treatment can be performed for a longer time or at a higher speed. If required, it shall, after the dilution channel pretreatment, measure the dilution channel background concentration before the vehicle test.

C.1.2.6.4 The start of the power system shall be performed by the starter device in accordance with the manufacturer's instructions.

Unless otherwise specified, the initial starting operating mode of the vehicle cannot be switched.

C.1.2.6.4.1 If the vehicle is not started successfully or if a start error is indicated, the test is invalid. The pretreatment shall be repeated and a new test shall be conducted.

pretreatment or type I test is not valid.

C.1.2.6.10 After the cycle is completed, the engine shall be shut down. Vehicles that have completed pre-treatment must not restart the engine until they are tested.

C.1.2.7 Vehicle immersion

C.1.2.7.1 The vehicle after pretreatment shall be placed in a vehicle-immersed environment specified in this Appendix before the formal test.

C.1.2.7.2 The vehicle shall be immersed for 6 to 36 hours, and the hood may be opened or closed. If there is no special requirement, the vehicle can be cooled to the set temperature point by forced cooling. When using a fan for accelerated cooling during the vehicle immersion, pay attention to the location of the fan so that the drive train, engine, and exhaust aftertreatment system can be cooled uniformly.

C.1.2.8 Emission test (type I test)

C.1.2.8.1 The temperature of the laboratory shall be controlled at 23 °C ± 5 °C. The temperature shall be continuously measured and recorded at a frequency not lower than 1 Hz. Prior to the start of the formal test, the engine oil temperature or coolant temperature shall be in the range of 23 °C ± 2 °C.

C.1.2.8.2 Push the test vehicle onto the dynamometer.

C.1.2.8.2.1 Fix the vehicle drive wheel to the dynamometer without starting the engine.

C.1.2.8.2.2 Set tire pressure as specified in C.1.2.4.5.

C.1.2.8.2.3 Close the engine hood.

C.1.2.8.2.4 Before starting the engine, connect the connecting pipe to the exhaust pipe of the test vehicle.

C.1.2.8.3 Starting power transmission system

C.1.2.8.3.1 Use a starter to start the power transmission system in accordance with the manufacturer’s instructions.

C.1.2.8.3.2 In accordance with the provisions of C.1.2.6.4 ~ C.1.2.6.10 of this Appendix, the test vehicle shall be driven in accordance with the test cycle requirements.

C.1.2.8.4 In accordance with the provisions of Appendix CF, measure and record the REESS cell balance (RCB) for each speed segment.

C.1.2.10.1.2.1 At least 2 hours before the test, the filter paper is placed in a tray with dust-proof openings and placed in a weighing chamber for stabilization.

After the stabilization process is completed, the filter paper is weighed and the weight is recorded. Before use in the test, the filter paper shall be placed in a closed lidded container or in a sealed filter holder. The filter paper shall be used within 8 hours after it is removed from the weighing chamber.

Within 1 hour after the end of the test, the filter paper shall be placed in a stable room for at least 1 hour and then weighed.

C.1.2.10.1.2.2 Carefully install the filter paper on the filter paper holder, only use pliers or tweezers to pick and place the filter paper. The rough handling of the filter paper will cause the error of the weight measurement result. The filter paper holder shall be installed in the sampling line without airflow.

C.1.2.10.1.2.3 Within 24 hours before the start of each weighing, it is recommended that the microbalance be calibrated with a reference weight of 100 mg. It shall be weighed three times and the average value recorded. If the difference between the average value and the weighing value at the previous inspection is within ±5 μg, the weighing and balance are considered valid.

C.1.2.11 Particles number (PN) measurement sampling

C.1.2.11.1 The following steps shall be completed before each test:

C.1.2.11.1.1 It shall activate the particle-specific dilution systems and measuring equipment before sampling, and make the sampling system be ready;

C.1.2.11.1.2 Validate the particle number counter (PNC) and volatile particle remover (VPR) calibration functions in the particle sampling system as described below.

C.1.2.11.1.2.1 Leakage inspection: Place a high-efficiency air filter at the entrance of the entire particle sampling system (volatile particle remover and particle number counter) (at least reaching the grade H13 as specified in EN 1822), the measured concentration as displayed on the particle number counter shall be less than 0.5 cm^{-3}.

C.1.2.11.1.2.2 Zero inspection: When a high-efficiency air filter (at least reaching grade H13 or the corresponding grade as specified in EN 1822) is installed at the inlet of the whole particle sampling system, the measured concentration value of the particle number counter shall be ≤ 0.2 cm^{-3}. After the filter is changed to ambient air, the measured concentration value displayed by the particle number counter shall be increased to at least 100 cm^{-3}. If the high efficiency air filter is installed again, the measured concentration value shall be analysis of ambient air bags and diluted exhaust bags.

C.1.2.14.3 Particle sampling filter paper weighing

C.1.2.14.3.1 Particle sampling filter paper shall be sent to the weighing chamber within one hour after the completion of the test. The filter paper shall be placed in a dish with dust-proof openings for at least 1 hour and then weighed. Record the total mass of the filter paper.

C.1.2.14.3.2 Weigh at least two unused reference filter papers within 8 hours. It is more appropriate to be able to weigh them together with the sampling filter paper. The size and material of the reference filter paper sampling filter paper shall be the same.

C.1.2.14.3.3 If the change in the test mass of any of the reference filter papers differs by more than ±5 μg, the sampling filter paper and reference filter paper shall be re-pretreated and reweighed in the weighing chamber.

C.1.2.14.3.4 The weighing comparison of the reference filter paper shall be performed between the test mass and the moving average of the test mass of the reference filter paper. The moving average shall be calculated from the test mass obtained during the time after the reference filter paper is placed in the weighing chamber. The average interval shall be at least 1 day but no more than 15 days.

C.1.2.14.3.5 Within 80 hours after the emission test is completed, it is allowed to perform multiple re-pretreatment and reweighing of the sampling filter paper and the reference filter paper. Before or at 80 hours, if more than half of the multiple measurement results of the reference filter can satisfy the requirement of ±5 μg, the weighing of the sampling filter paper is considered valid. At 80 hours, if two reference filter papers are used and one of them does not meet the requirement of ±5 μg, the filter paper weighing can be considered valid only when the sum of the test mass of the two reference filter papers and the absolute average value of the movement average value is less than or equal to 10 μg.

C.1.2.14.3.6 If only less than half of the reference filter paper meets the requirement of ±5 μg, the emission test shall be repeated. All reference filter paper shall be discarded and replaced within 48 hours. In other cases, the reference filter paper shall be replaced at least every 30 days, and ensure that the sampling filter paper weighed can be compared with the reference filter paper that has been placed in the weighing chamber for at least 1 day.

C.1.2.14.3.7 If the requirements for the stability of the weighing chamber specified in the Appendix CD have not been met, but if the weighing of the reference filter paper satisfies the above requirements, the manufacturer may choose to accept the sampling filter paper mass or consider the test to be invalid, is t_{high} + $n_{add,medium}$.

5) Compensate the vehicle speed condition with $v_i = v_{cap}$, the time is $n_{add,high}$, and the end time of the condition is (t_{high} + $n_{add,medium}$ + $n_{add,high}$).

6) Continue to run the rest of the base cycle until the end of the high speed segment. The end time is (1477 + $n_{add,medium}$ + $n_{add,high}$).

7) Run the extra-high speed segment until the last $v = v_{cap}$ condition of the high speed segment. This condition corresponds to the test time of the base cycle which is t_{exhigh}, and the operating time of the correction cycle is (t_{exhigh} + $n_{add,medium}$ + $n_{add,high}$).

8) Compensate the vehicle speed condition with $v_i = v_{cap}$, the time is $n_{add,exhigh}$, and the end time of the condition is (t_{high} + $n_{add,medium}$ + $n_{add,high}$ + $n_{add,exhigh}$).

9) Continue to run the rest of the base cycle until the extra-high speed segment ends. The end time is (1800 + $n_{add,medium}$ + $n_{add,high}$ + $n_{add,exhigh}$).

The test time of the correction cycle is equal to the sum of the base cycle time and $n_{add,medium}$, $n_{add,high}$ and $n_{add,exhigh}$.

CA.5.2.3.2 When $v_{max,medium} <= v_{cap} < v_{max,high}$

1) Run the test cycle to the last $v = v_{cap}$ condition of the high speed segment. This condition corresponds to the test time t_{high} of the base cycle.

2) Compensate the vehicle speed condition with $v_i=v_{cap}$, the time is $n_{add,high}$, and the end time of the condition is (t_{high} + $n_{add,high}$).

3) Continue to run the rest of the base cycle until the end of the high speed segment. The end time is (1477 + $n_{add,high}$).

4) Run the extra-high speed segment until the last $v = v_{cap}$ condition of the high speed segment. This condition corresponds to the test time t_{exhigh} of the base cycle, and the operation time of the correction cycle is (t_{exhigh} + $n_{add,high}$).

5) Compensate the vehicle speed condition with $v_i = v_{cap}$, the time is $n_{add,exhigh}$, and the end time of the condition is (t_{high} + $n_{add,high}$ + $n_{add,exhigh}$).

6) Continue to run the rest of the base cycle until the end of the extra-high speed segment. The end time is (1800 + $n_{add,high}$ + $n_{add,exhigh}$).

The test time of the correction cycle is equal to the sum of the base cycle time and $n_{add,high}$ and $n_{add,exhigh}$.

CA.5.2.3.3 When $v_{max,high} <= v_{cap} < v_{max,exhigh}$

Attachment CB

(Normative)

Gear shift selection and shift point calculation method of manual gear vehicles

CB.1 General methods

CB.1.1 The gear shift procedures described in this Appendix apply to manual shift vehicles.

CB.1.2 The gears and gear shift points of this Appendix are determined in a specific cycle speed segment based on a balance between the power required to overcome the running resistance and acceleration and the power that the engine can provide under all possible gear positions.

The CB.1.3 The gear is calculated based on the engine speed and the engine's external characteristic power curve.

CB.1.4 For vehicles using dual-mode gearboxes (low and high), only the normal road driving mode is used when determining the gear position.

CB.1.5 If the clutch is operated automatically and does not require the driver to engage or disengage, the clutch must not be manually operated.

CB.1.6 This Appendix does not apply to vehicles tested in accordance with Appendix R.

CB.2 Data and pretreatment calculations

When testing on a chassis dynamometer, the following data needs to be provided to determine the gear:

(a) P_{rated}, maximum rated engine power, kW;

(b) n_{rated}, the rotation speed corresponding to engine's maximum rated power corresponding, if the maximum power covers a range of engine speed, n_{rated} shall be the minimum speed in the range, min^{-1};

(c)n_{idle}, idling speed, min^{-1};

Test conditions determined by the idling speed n_{idle}: when the gearbox is in neutral position, clutch is engaged, sampling frequency is 1 Hz, make measurement for at least 1 min, the engine shall be fully warmed up, the engine temperature, external equipment, accessories, etc., shall be the

CC.4.1.1.1.2 Wind speed conditions using an on-board anemometer

When using the on-board anemometer for testing, the equipment shall be used in accordance with the provisions of CC.4.3.2. During the test, the total average wind speed shall be less than 7 m/s, the peak wind speed shall be less than 10 m/s, and the lateral wind speed vector of the test road shall be less than 4 m/s.

CC.4.1.1.2 Atmospheric temperature

When the atmospheric temperature is in the range of 5 °C ~ 40 °C, the road load coast-down test can be conducted.

If during the coast-down test, the temperature difference between the highest temperature measured and the lowest temperature is greater than 5 °C, each coast-down must be corrected individually based on the arithmetic mean of the measured temperature in the test.

At this time, each coast-down shall be calculated separately, the road load factors f_0, f_1, and f_2 shall be individually corrected. The final road load factor shall be calculated in accordance with the arithmetic average of the f_0, f_1, and f_2 that are individually corrected as described above.

Vehicle manufacturers can also choose to perform the coast-down test within the temperature range of 1 °C ~ 5 °C.

CC.4.1.2 Test road

The surface of the test road shall be flat, clean, dry, and there are no obstructions or wind barriers that can impede the road load measurement. The road texture and composition shall be representative of the current typical urban road and highway pavement. The longitudinal slope of the test road shall not be more than ±1%. The slope difference between any 3 m on the test road cannot exceed 0.5%. If two-way coast-down test cannot be performed on the same road (e.g. one-way driving oval test road), the sum of the longitudinal slopes of the bidirectional parallel test segments shall be in the range of 0 ~ 0.1%, the maximum arc of the test road shall not exceed 1.5%.

CC.4.2 Test preparation

CC.4.2.1 Test vehicle

All parts of each test vehicle shall be consistent with the mass production vehicle. If there are differences, complete records shall be made.

CC.4.2.1.1 Without interpolation

For the selection of the test vehicle (vehicle H), it shall be based on the relevant characteristics of the road load (such as mass, aerodynamic drag, type of rolling

The following principles shall be followed in determining the test mass, rolling resistance and frontal area of the vehicle H_M and vehicle L_M: In the road load matrix family, the vehicle H_M has the largest cycle energy demand, and the vehicle L_M has the smallest cycle energy demand.

The road load for all individual vehicles (including H_M and L_M) in the road load matrix shall be calculated in accordance with CC.5.1.

CC.4.2.1.5 Adjustable body aerodynamic components

During the road load test, the operation of all adjustable components of the test vehicles affecting the aerodynamics of the vehicle body shall be consistent with the type I test conditions (test temperature, speed and acceleration range, engine load, etc.).

Every system that dynamically corrects the vehicle aerodynamics, such as vehicle height control, shall be considered as an adjustable component that affects the aerodynamics of the vehicle body. For vehicles that may optionally have adjustable components that can affect aerodynamic properties, the environmental protection authority has the right to increase the relevant requirements.

CC.4.2.1.6 Vehicle weighing

Before and after the road load test, the test vehicle, driver and equipment all need to be weighed, to determine the average mass m_{av}. The mass of the test vehicle shall be greater than or equal to the mass of vehicle H or vehicle L at the beginning of the road load determination.

CC.4.2.1.7 Test vehicle configuration

The configuration of the test vehicle shall be recorded and used for subsequent coast-down tests.

CC.4.2.1.8 Test vehicle condition

CC.4.2.1.8.1 Run-in

In order to carry out subsequent tests, the test vehicle shall be properly run-in. The test vehicle mileage shall be at least 10000 km, but it shall not exceed 80000 km.

CC.4.2.1.8.1.1 If required by the vehicle manufacturer, vehicles with a mileage of more than 3000 km can also be selected.

CC.4.2.1.8.2 Manufacturer's instructions

Tire pressure, front wheel positioning, ground clearance, vehicle height, power the correction factor of vehicle blockage due to relative wind speed and slip angle. Record the test warmup phase vehicle speed v, relative wind speed v_r, slip angle Y, and the uniform speed of 80 km/h along the test road to perform the v, v_r and Y arithmetic mean of each test during the two-way coast-down phase. Select the correction factor that has the total minimum error of the front and side wind of all tests. that is, select the minimum sum of $(head_i - head_{i+1})^2$, where $head_i$ and $head_{i+1}$ refer to the wind speed and wind direction of the two-way test in the warm-up/stabilization phase before the vehicle test.

CC.4.3.2.6.2 Extracting second-by-second data

The data obtained from the coast-down test shall be corrected in accordance with CC.4.3.2.1.3 and CC.4.3.2.1.4, to determine the values of v, (dh/ds), (dv/dt), v_r^2 and Y, and to adjust the data sample to 1 Hz through data filtering.

CC.4.3.2.6.3 Preliminary analysis

Use a linear least-squares regression method to analyze all data points immediately, and determine the values of A_m, B_m, C_m, a_0, a_1, a_2, a_3, and a_4 based on the given M_e, (dv/dt), v, v_r, and ρ.

CC.4.3.2.6.4 Marking of out-of-range values

It shall calculate the predicted resistance m_e(dv/dt), compare it with the observed data points, and mark the data points with excessive deviations (for example, more than three times the standard deviation).

CC.4.3.2.6.5 Data filtering

If necessary, appropriate data filtering methods can be used to smoothen the data.

CC.4.3.2.6.6 Invalid data

Mark data points that deviate more than ±20 degrees from the driving direction of the vehicle, and mark the data points whose relative wind speed is less than +5 km/h (to prevent the tail wind speed from being greater than the vehicle speed). The data analysis shall be limited to the range of vehicle speeds selected in CC.4.3.2.2 of this Attachment.

CC.4.3.2.6.7 Final data analysis

In accordance with the linear least squares regression method, to perform analysis and calculation against all the data which is not marked; in accordance with the measured M_e, (dv/dt), v, v_r, and ρ, determine A_m, B_m, C_m, a_0, a_1, a_2, a_3, and a_4.

CC.4.3.2.6.8 Constrained analysis (optional) wheel, to measure the amount of drive torque the test vehicle needs to maintain constant speed.

The torque meter shall be calibrated at least once a year. It shall be traceable to national or international standards to meet the accuracy and precision requirements.

CC.4.4.2 Measurement procedure and data sampling

CC.4.4.2.1 Selecting the reference speed for determining the road running resistance

In accordance with the provisions of CC.2.2 of this Attachment in this standard, select the reference speed for determining the road running resistance.

Measurements shall be made at each reference speed point in accordance with the coast-down method. If required by the vehicle manufacturer, a stabilization time is allowed between measurements at each reference speed point, but the stable speed cannot be higher than the next test reference speed.

CC.4.4.2.2 Data collection

The data to be collected includes the actual speed v_{ji}, the actual torque C_{ji}, the sampling frequency for each speed point v_j is at least 10 Hz, each point shall be measured and recorded for at least 5 s, the data collected at each speed point v_j serves as a measurement result.

CC.4.4.2.3 Vehicle torque meter measurement procedure

Before using a torque meter for measurement, the test vehicle shall be warmed up in accordance with CC.4.2.4 of this Attachment.

During the test measurement, the steering wheel shall not be turned as much as possible, and vehicle braking cannot be performed.

The test shall be repeated until the measured running resistance meets the measurement accuracy requirements in CC.4.4.3.2 of this Attachment.

Although it is recommended that each test shall be completed without interruption, if the measurement of all the reference speed points cannot be completed at once, it is allowed to perform test by dividing speed segments. In the test at different speed segments, it shall be ensured that the vehicle status is as stable as possible at each speed segment point.

CC.4.4.2.4 Speed deviation

During the test, at each reference speed point, the speed deviation v_{ji}-v_{jm} calculated in accordance with CC.4.4.3 shall meet the requirements specified met, in addition to the following requirements:

(a) The solid blockage ratio in CC.3.2.4 shall be less than 25%;

(b) When the surface of the flat belt dynamometer is in contact with the tire, the contact area shall be at least 20% of the length of the tire's contact area, and at least as wide as the vehicle's contact area on the actual road;

(c) The standard deviation of the total air pressure at the air outlet shall be less than 1% as described in CC.3.2.8;

(d) As described in CC.3.2.10, the blockage ratio of the restraint system shall be less than 3%.

CC.6.4.2 Wind tunnel measurement

CC.6.4.2.1 The test vehicle shall be placed in the environment required by CC.6.3 for presetting.

CC.6.4.2.2 The location of the test vehicle shall be parallel to the longitudinal centerline of the wind tunnel, the maximum deviation from the centerline shall not exceed 10 mm. The test vehicle shall be placed at a deflection angle of 0° with a maximum deviation of ±0.1°.

CC.6.4.2.3 The aerodynamic resistance measurement time is at least 60 s and the measurement frequency is at least 5 Hz. Alternatively, if the minimum frequency is 1 Hz, it shall make continuous measurement for at least 300 s. The test result shall be the arithmetic mean of the test data.

CC.6.4.2.4 If the test vehicle has adjustable body components and is related to vehicle speed, it shall measure the aerodynamic characteristics of the adjustable components in different positions in the wind tunnel, and submit the data on the relationship between the reference speed and adjustable component position and (C_D x A_f) to the competent department of environmental protection.

CC.6.5 Application of flat belt dynamometer in wind tunnel method

CC.6.5.1 Flat belt dynamometer criteria

CC.6.5.1.1 Description of flat belt dynamometer

The vehicle running on the flat belt dynamometer shall be able to represent the rolling resistance and frictional resistance characteristics on the actual road, and the force in the x direction shall include the friction of the transmission system.

CC.6.5.1.2 Vehicle restraint system

CC.6.6.1 Criteria

In addition to the requirements of CD.1 and CD.2, the requirements of CC.6.6.1.1 ~ CC.6.6.1.6 shall also be met.

CC.6.6.1.1 Chassis dynamometer

The front and rear axles are equipped with a single drum. The diameter of the drum does not exceed 1.2 m. The force measured in the x direction includes the friction loss of the drive system.

CC.6.6.1.2 Vehicle restraint system

The dynamometer shall be equipped with a centering system. In a coast-down test to determine the road load, the restraint system shall ensure that the centering accuracy of the drive wheel position is within the specified limits.

CC.6.6.1.2.1 Vehicle location

The test vehicle shall be installed on the drum of the chassis dynamometer in accordance with the requirements in CC.7.3.3.

CC.6.6.1.2.2 Vertical force

The vehicle restraint system shall meet the requirements of CC.6.5.1.2.3.

CC.6.6.1.3 Force measurement accuracy

The force measurement accuracy shall meet the requirements of CC.6.5.1.3, and the measurement accuracy of x-direction force shall meet the requirements of CD.2.4.1.

CC.6.6.1.4 Dynamometer speed control

Rolling speed control accuracy shall be within ±0.2 km/h.

CC.6.6.1.5 Drum surface

The drum surface shall meet the requirements of CC.6.5.1.5.

CC.6.6.1.6 Cooling

The cooling fan shall meet the requirements of CC.6.5.1.6.

CC.6.6.2 Dynamometer measurement

Dynamometer measurements are performed in accordance with CC.6.5.2.

CC.6.6.3 Chassis dynamometer drum curve correction

Figure CD.2 -- Fan with circular air outlet

When measuring, there shall be no vehicles or other obstructions before the fan, the distance between the air line-speed test device and the air outlet shall be between 0 - 20 cm.

CD.1.1.3 Fans shall meet the following characteristics:

- Air outlet area: at least 0.3 m^2, and;

- At least 0.8 m in width or diameter.

CD.1.1.4 The location of the fan shall meet the following requirements:

- Low end from the ground height: about 20 cm;

- Distance from the front end of the vehicle: about 30 ~ 60 cm.

CD.1.1.5 If required by the vehicle manufacturer and agreed by the competent department of environmental protection, the height and lateral position of the cooling fan can be adjusted. In this case, the position (height and distance) of the fan shall be recorded in the test report, and the same requirements shall be used in subsequent related tests.

CD.2 Chassis dynamometer

CD.2.1 General requirements

CD.2.1.1 The dynamometer shall be able to use three road load parameters to simulate road resistance and may adjust and fit the load curve.

CD.2.1.2 The chassis dynamometer has one or two drums. The drums of a dual-drum chassis dynamometer shall be permanently coupled to each other, or use the front drum to directly or indirectly drive all inertia and power absorption devices.

CD.2.2 Specific requirements

Test dynamometers shall meet the following specific requirements;

CD.2.2.1 The circumferential runout of the drum at all measuring points shall be less than 0.25 mm.

CD.2.2.2 The deviation of the diameter and nominal diameter of the drum at all measuring points shall be within ±1.0 mm.

CD.2.2.3 The dynamometer shall have a time measurement system for calculating acceleration or measuring the coast-down time of the vehicle or dynamometer. The accuracy is at least ±0.001% and shall be verified during the equipment, and 370 days before the test, it shall verify the accuracy and linearity.

CD.2.4.2 Dynamometer parasitic loss calibration and inspection

If the difference between the parasitic power of the dynamometer and the existing loss curve exceeds 9.0 N, the parasitic loss of the dynamometer shall be measured again and updated. Parasitic power inspection shall be performed after initial installation, critical maintenance, and within 35 days before testing.

CD.2.4.3 Road load simulation verification without vehicle placement

After the initial installation of the dynamometer, important maintenance and within 7 days before the test, the unladen coast-down test of the dynamometer shall be carried out, to verify the performance of the dynamometer. At all reference speed points, the error of the arithmetic mean value of the coast-down resistance shall be less than 10 N, or 2%, whichever is greater.

CD.3 Exhaust dilution system

CD.3.1 System requirements

CD.3.1.1 Overview

CD.3.1.1.1 It shall use a full-flow exhaust dilution system, a constant volume sampling system, to continuously dilute all vehicle exhausts with background air under controlled conditions. It may use a critical flow venturi (CFV) or a plurality of critical flow venturis in parallel distribution, positive displacement pumps (PDP), subsonic venturis (SSV), or ultrasonic flow meters (UFM). The total volume of the mixture of exhaust gas and dilution air shall be measured, and the mixture gas shall be continuously collected in volumetric proportions for analysis. The mass of exhaust emissions is calculated from the sample gas concentration and the total flow during the test, where the sample gas concentration must be corrected by the concentration of the corresponding pollutant in the dilution air.

CD.3.1.1.2 The exhaust dilution system shall include at least a connecting pipe, a mixing device, a dilution channel, a dilution air treatment device, a suction device and a flow measurement device. The sampling probe shall be installed in the dilution channel, as specified in CD.4.1, CD.4.2, CD.4.3.

CD.3.1.1.3 The mixing device shall be a container as described in Figure CD.3, in which the vehicle exhaust and dilution air are mixed together to produce a uniform mixture at the sampling location.

CD.3.2 General requirements

CD.3.2.1 In any case during the test, there shall be a sufficient amount of ambient air to dilute the vehicle's exhaust to prevent condensate formation in system, it shall be controlled at ±6 °C; and when using the SSV CVS system, it shall be controlled at ±11 °C.

CD.3.3.5.2 If necessary, some methods can be used to protect the volume measuring device, such as cyclones, large flow filters, etc.

CD.3.3.5.3 A temperature sensor shall be installed immediately upstream of the volumetric measuring device. The temperature sensor shall have an accuracy and accuracy of ±1 °C and the response time reaching to 62% temperature change (measured in silicone oil) is 0.1 s.

CD.3.3.5.4 The pressure difference between ambient pressure shall be measured upstream of the volume measuring device. If necessary, another measuring point can be provided downstream of the measuring device.

CD.3.3.5.5 In the test, the accuracy and precision of the pressure measurement is ±0.4 kPa.

CD.3.3.6 Descriptions of recommended system

Figure CD.3 shows a schematic diagram of the recommended exhaust dilution system that meets the requirements of this Attachment.

It is recommended to include the following components:

- Dilution air filter (can be preheatable if required). The filter consists of the following filters: an optional activated carbon filter on the inlet side and a HEPA filter on the outlet side. A coarse particle filter is recommended, and the coarse particle filter shall be installed between the above two filters. The purpose of using an activated carbon filter is to reduce and stabilize the concentration of HC in the dilution air.

- Connecting pipe. Introduce exhaust gas into the dilution channel;

- Heat exchangers described in CD.3.3.5.1;

- Mixing device. Mix the exhaust gas and dilution air, it shall be as close to the vehicle as possible, to minimize the length of the connecting pipe;

- Dilution channel. A device for sampling the mass and quantity of particles;

- Measuring system protection device. Such as cyclone separators, filters, etc.;

- Suction device. Its working capacity shall be sufficient to handle all diluted air exhaust.

metering shall be made at different pressures and system control parameters. Flow metering devices (e.g., calibrated venturi, laminar flow meter LFE, calibrated rotameter, etc.) shall be dynamic and suitable for high flow rates encountered in constant volume sampling system tests. The accuracy and traceability of the device shall be certified by national or international standards.

CD.3.4.1.2 The following clauses of are to use laminar flowmeters to calibrate PDP, CFV, SSV, UFM. Through the statistical examination of the calibration results, to make the accuracy of the equipment meet the requirements.

CD.3.4.2 Calibration of positive displacement pump (PDP)

CD.3.4.2.1 The following calibration procedure outlines the test equipment, test layout, and various parameters that shall be measured to determine the flow rate of the CVS positive displacement pump. All pump-related parameters and parameters related to the flowmeter (connected in series with the pump) are measured simultaneously. The calculated flow curve corresponding to the relevant function can then be plotted (at the absolute pressure and temperature of the pump inlet, expressed in m^3/min). This function includes the parameters of the pump. From this, the linear equation of the pump flow and the correlation function can be determined. If the PDP has multiple driving speeds, then the calibration shall be performed for each of the used flow ranges.

CD.3.4.2.2 The above calibration procedure is based on the measurement of the absolute value of the pump and flow parameters for each point. To ensure the accuracy and completeness of the calibration curve, the following conditions shall be met:

CD.3.4.2.2.1 The pump pressure shall be measured at the fittings on the pump and not at the external piping of the pump inlet and outlet. Pressure fittings installed at the top and bottom centers of the pump's drive end cover are exposed to the actual pressure in the pump chamber, thus reflecting the absolute pressure difference.

CD.3.4.2.2.2 During the calibration period, temperature shall be kept stable. Laminar flow meters are sensitive to inlet temperature fluctuations, which can lead to dispersion of data points. It is acceptable to gradually change the temperature by ±1 °C within a few minutes.

CD.3.4.2.2.3 All joints between the flow meter and the positive displacement pump must not have any leakage.

CD.3.4.2.3 In the exhaust emission test, these parameters of the pump that have been measured are substituted into the calibration equation for flow calculation.

CD.3.4.2.4 Figure CD.6 shows an example of a calibration arrangement. Other

CD.4.1.4.5 Methane (CH_4) analyzer

CD.4.1.4.5.1 The analyzer shall be of gas chromatograph (GC) + flame ionization detector (FID) type, or non-methane cutter (NMC) + flame ionization detector (FID) type. It is calibrated with methane or propane gas and expressed as carbon atom (C_1) equivalents.

CD.4.1.4.6 Nitrogen oxide (NOx) analyzer

CD.4.1.4.6.1 The analyzer shall be of the chemiluminescence (CLD) type or non-diffusion ultraviolet resonant absorption (NDUVR) type, both of which shall have NOx-NO converters.

CD.4.1.4.7 Nitric oxide (NO) analyzer

CD.4.1.4.7.1 The analyzer shall be of chemiluminescence (CLD) or non-dispersive UV resonance absorption (NDUV) type.

CD.4.1.4.8 Nitrogen dioxide (NO_2) analyzer

CD.4.1.4.8.1 Continuous measurement of NO from diluted exhaust.

CD.4.1.4.8.1.1 The CLD analyzer can be used to continuously measure the NO concentration in diluted exhaust gas.

CD.4.1.4.8.1.2 The CLD analyzer shall be calibrated (zeroed/calibrated) in NO mode. Bypass the NOx converter (if any) and use the standard gas whose NO is calibrated for calibration.

CD.4.1.4.8.1.3 NO_2 concentration is obtained by subtracting the NO concentration from the NOx concentration.

CD.4.1.4.8.2 Continuous measurement of NO_2 in diluted exhaust gas.

CD.4.1.4.8.2.1 Use a dedicated NO_2 analysis device (non-dispersive UV analyzer (NDUV), quantum cascade laser (QCL)) to continuously measure the NO_2 concentration in diluted exhaust gas.

CD.4.1.4.8.2.2 Use the NO_2 standard gas to calibrate the analyzer in NO_2 mode (zeroing/calibration).

CD.4.1.4.9 Nitrous oxide (N_2O) analyzer (GC-ECD method) (if applicable)

CD.4.1.4.9.1 Use gas chromatograph and an electron capture detector (GC-ECD) to measure the concentration of N_2O in the diluted exhaust gas. This method samples and analyzes the sample gas in the exhaust and ambient airbags.

CD.4.1.4.10 Nitrous oxide (N_2O) analyzer (infrared absorption spectroscopy) (if be installed upstream of the filter assembly. At the volume flow rate selected for particulate matter mass discharge sampling, the pre-classifier's segmented particle size (staging efficiency is 50% particle diameter) shall be between 2.5 μm and 10 μm, and at least 99% (mass concentration) of particles with a particle size of 1 μm can enter and pass through the outlet.

CD.4.2.1.3.2 Particulate matter conduit (PTT)

CD.4.2.1.3.2.1 The curved pipe in PTT shall be smooth and the turning radius shall be as large as possible.

CD.4.2.1.3.3 Secondary dilution

CD.4.2.1.3.3.1 When measuring PM, the sample gas may be subject to secondary dilution. The secondary dilution system shall meet the following requirements:

CD.4.2.1.3.3.1.1 The secondary diluent gas shall first be filtered through a filter whose filter medium has the best penetrating power (for the medium) with a particle absorption capacity ≥ 99.95%; or the HEPA filter of grade H13 and above which complies with EN 1822:2009 standard. Before the diluted air enters the HEPA filter, it can be absorbed on activated carbon. It is recommended to add a strainer downstream the activated carbon adsorber and upstream the HEPA filter.

CD.4.2.1.3.3.1.2 The secondary dilution air shall enter into the PTT through the dilution emission outlet as close to the dilution channel as possible.

CD.4.2.1.3.3.1.3 The residence time from the secondary dilution air introduction point to the filter paper surface is at least 0.25 s, but not more than 5 s.

CD.4.2.1.3.3.1.4 If the secondary dilution sample gas is to be reintroduced into the CVS again, the sample gas introduction point shall be so located as not interfere with the sample gas extraction from CVS.

CD.4.2.1.3.4 Sampling pumps and flow meters

CD.4.2.1.3.4.1 Sample gas flow measurement device consists of a pump, gas flow regulator and flow measurement device.

CD.4.2.1.3.4.2 In addition to the following cases, the gas temperature fluctuation range in the flowmeter shall be within ±3 °C:

- Sampling flowmeter is equipped with real-time monitoring and flow control system, and operating frequency is at least above 1 Hz;
- The vehicle's periodic regeneration aftertreatment device regeneration test process.

CD.4.3.1.2.1.1 Particle transfer system (PTS) consists of a sampling probe or a particle sampling probe (PSP) and a particle transport tube (PTT). The particle transfer system can direct the sample gas from the dilution channel to the volatile particle remover (VPR). The particle transfer system shall meet the following conditions:

- The sampling probe shall be installed approximately 10 times the diameter of the gas inlet and in the downstream direction of the gas flow, facing the gas flow direction, the central axis of the sampling probe is parallel to the central axis of the dilution channel;

- Sampling probes shall be installed upstream of all regulating devices (such as heat exchangers);

- The sampling probe shall be located in the dilution channel so that the diluted exhaust gas sample can be collected evenly from the diluted exhaust gas.

CD.4.3.1.2.1.2 Sample gas delivered through PTS shall meet the following conditions:

- Full-flow exhaust dilution system Reynolds number Re shall be less than 1700;

- The Reynolds number Re in the PTT of the secondary dilution system shall be less than 1700 (i.e. the Reynolds number downstream of the sampling probe or sampling point shall be less than 1700);

- Residence time ≤ 3 s.

CD.4.3.1.2.1.3 If it can be demonstrated that particles with a particle size of 30 nm have equivalent permeability, other PTS can also be accepted.

CD.4.3.1.2.1.4 The outlet tube (OT) used to guide the dilution sample gas from the volatile particle remover to the particle number counter inlet shall have the following characteristics:

- Inner diameter ≥ 4 mm;

- Sample gas residence time ≤ 0.8 s.

CD.4.3.1.2.1.5 If it can be demonstrated that there is equivalent permeability to particles with a particle size of 30 nm, other outlet tube sampling structures are also acceptable.

CD.4.3.1.2.2 The volatile particle remover shall include a sample gas dilution device and a volatile particle removal device.

- When sampling electrostatically graded standard particles, use a standard air electrometer to calibrate by comparing the response of the particle number counter;

- Or use a secondary particle number counter (this counter has been directly calibrated by the above method) and calibrate by comparing the response of the particle number counter.

CD.5.7.1.3.1 For electrometer calibration, use at least 6 standard concentration values and distribute them as evenly as possible in the particle number counter's range.

CD.5.7.1.3.2 For the reference particle number counter, use at least 6 standard concentration values distributed in the particle number counter's range. Among them, at least 3 values shall be lower than the density value 1000/cm^3, and the remaining several density values shall be linearly distributed between 1000/cm^3 and the maximum range of the single particle number counter module.

CD.5.7.1.3.3 The selected measurement point shall include the nominal zero point produced by a high-efficiency air filter (at least meeting the H13 rating specified in EN1822) installed at the inlet of each instrument. When the particle number counter does not use the calibration factor during the calibration process, the measurement result for each used concentration value shall not exceed ±10% of the standard concentration value, with the exception of the zero point value, otherwise the calibration shall not pass. It shall calculate and record the slope of the linear regression of these two sets of data. In the calibration process, it shall use the same calibration factor as the reciprocal slope value. Calculate response linearity by using the square of the Pearson product-moment correlation factor (R^2) for two sets of data, this value shall be greater than or equal to 0.97. The slope of the linear regression and the R^2 value shall be calculated from the origin value (zero concentration of the two instruments).

CD.5.7.1.4 The calibration of shall also be checked in accordance with the requirements of CD.4.3.1.3.4, and use the particle having an electromigration particle size 23 nm to check the detection efficiency of the particle number counter. It is not necessary to check the counting efficiency of particles with a particle size of 41 nm.

CD.5.7.2 Calibration and determination of volatile particle remover

CD.5.7.2.1 After the new volatile particle remover has been subject to any major maintenance, the particle concentration attenuation factor shall be calibrated at full scale for the volatile particle remover at the operating temperature recommended by the equipment manufacturer. The periodic confirmation of the particle concentration attenuation factor of the volatile particle remover requires

Attachment CE

(Normative)

Emission calculation

CE.1 General requirements

This Attachment specifies the calculation method for emissions from vehicles using conventional internal combustion engines. Calculation of emissions of hybrid vehicles is as shown in Appendix R.

CE.1.1 Test results rounding-off rule

CE.1.1.1 Intermediate calculation results cannot be rounded off.

CE.1.1.2 The final result shall be rounded off at the last step, rounding off to one more significant digit after the decimal point of the standard limit.

CE.1.1.3 NOx humidity correction factor k_H shall be kept to two decimal places.

CE.1.1.4 Dilution factor DF shall be retained to two decimal places.

CE.1.1.5 Information irrelevant to emission standards shall be judged based on good engineering experience.

CE.1.1.6 The rounding off rules for CO_2 calculations is described in CE.1.2.

CE.1.2 Calculation method for test results of vehicle pollutants and CO_2 emissions from internal combustion engines

Calculation of pollutants and CO_2 emission test results shall be conducted in accordance with Table CE.1. All relevant results in the “Output” column shall be recorded. Abbreviations used in the calculation formulas and results in Table CE.1 are as follows:

c - Complete test cycle;

p - Each test cycle speed segment;

I - Other pollutants other than CO_2;

M_{CO2} - CO_2 emissions

The calculated single test results shall be corrected in accordance with the requirements of this standard by using the deterioration factor (correction value) to obtain the final pollutant and CO_2 emission results. The deterioration factor

Attachment CF
(Normative)
Power supply system monitoring test procedure

CF.1 Review

This Attachment specifies the CO_2 mass emission amendments for all REESS. NOVC-HEV and OVC-HEV vehicles are revised in accordance with Attachment RB and RC.

The correction of CO2 mass emissions shall be based on the principle of energy balance ($\Delta E_{REESS} = 0$) and be calculated using the following correction factors.

CF.2 Measuring equipment and instruments

CF.2.1 Current measurement

REESS consumption is defined as negative current.

CF.2.1.1 The REESS current shall be measured by a clamped or closed current sensor. The current measurement system shall meet the requirements specified in Table R.1 of Appendix R. The current sensor shall be able to handle the peak current at engine start and the temperature conditions at the measurement point.

CF.2.1.2 The current sensor shall be capable of being installed on any REESS through a cable connected to the REESS and shall include the total REESS current. In the case of shielded lines, appropriate methods shall be taken in accordance with the requirements of the competent department of environmental protection.

Manufacturers shall provide appropriate, safe and convenient connection points in the vehicle to facilitate the use of external measuring equipment to measure REESS currents. If such requirements cannot be met, the manufacturer shall assist in connecting the current sensor to the cable directly connected to REESS, with the consent of the competent department of environmental protection.

CF.2.1.3 The measured current shall be integrated with a frequency not less than 20 Hz to obtain the measured value Q(Ah), which may be accomplished in the current measuring device.

CF.2.2 Vehicle data

CF.2.2.1 It can also use the on-board data to determine the REESS current. The test vehicle shall provide the following information:

(a) The integrated charge balance after the last ignition operation, unit Ah;

(b) Integrated on-board data charging balance calculated at a frequency of provisions of D.2.1 and D.2.2, it shall be determined in advance whether the payload, environmental parameters and altitude can meet the RDE test requirements.

D.1.3.7 The competent department of environmental protection may propose a test route that meets the requirements of D.2.5 in urban areas, suburban areas and high-speed road sections. When selecting a route, the urban, suburban, and high-speed road sections shall be determined in advance in accordance with the map. The urban travel speed shall be limited to 60 km/h or even lower. If it is necessary to drive the vehicle speed to more than 60 km/h in a certain period of time on an urban road, the speed can be increased to 60 km/h.

D.1.3.8 If the competent department of environmental protection is not satisfied with the results of the PEMS test data quality inspection and validation conducted in accordance with Attachment DA and DD, the test result may be considered invalid. In this case, the competent department of environmental protection shall record the test result data and the reason for the test failure.

D.2 Boundary conditions

D.2.1 Vehicle load and test mass

D.2.1.1 The basic vehicle load shall include the driver, test personnel (if applicable) and test equipment, including equipment such as mounting brackets and power supplies.

D.2.1.2 The RDE test may include additional loads, but the sum of the basic and additional loads must not exceed 90% of the maximum vehicle load.

D.2.2 Environmental conditions

D.2.2.1 Test environment conditions shall comply with the provisions of this clause. If at least one of the ambient temperature and altitude conditions is extended, the environmental conditions will be “extended environmental conditions”. If some of the tests exceed the extended test conditions during the test, the test results are invalid.

D.2.2.2 Ordinary altitude conditions: The altitude is not more than 700 m.

D.2.2.3 Extended altitude conditions: The altitude is higher than 700 m and not higher than 1300 m.

D.2.2.4 Further extended altitude conditions: Altitude is greater than or equal to 1300 m, but not higher than 2400 m.

D.2.2.5 Ordinary temperature conditions: ambient temperature is higher than or equal to 0 °C, less than or equal to 30 °C.

D.2.2.6 Extended temperature conditions: The ambient temperature is greater than or equal to -7 °C and less than 0 °C, or greater than 30 °C and less than 35 °C.

D.2.5.2 The tests shall be carried out continuously in the sequence of urban-suburban-high-speed road sections. Tests shall be carried out continuously. The test results may include the trips which begin and end at the same place. Suburban driving can be interrupted by driving in the urban area (short travel distance). High-speed driving can also be interrupted by driving in urban areas or suburbs (short distances). If it is necessary to change the driving sequence due to actual test restrictions, manufacturers must make applications to the competent department of environmental protection.

D.2.5.3 Urban driving speed is below 60 km/h.

D.2.5.4 Suburban driving speed is between 60 km/h and 90 km/h.

D.2.5.5 High-speed road section speed is greater than 90 km/h.

D.2.5.6 In accordance with the speed classification of D.2.5.3, D.2.5.4 and D.2.5.5, the driving route shall include 34% urban road sections, 33% suburban road sections and 33% high-speed road sections. The error of each section of the above-mentioned driving ratio shall be controlled within ±10%, but the proportion of urban road sections cannot be less than 29% of the total driving distance.

D.2.5.7 Under normal circumstances, the speed of the vehicle shall not exceed 120 km/h, and the maximum speed may increase by up to 15 km/h within 3% of the travel time of the high-speed road section. In the road test, it must follow the road traffic speed regulations, but the PEMS test result will not be judged as invalid because of violation of the road traffic speed regulation.

D.2.5.8 In road driving tests, the average speed of the urban area (including parking) in urban road sections shall be between 15 km/h and 40 km/h. The parking phase refers to the period where the actual vehicle speed of less than 1 km/h, which accounts for 6 ~ 30% of the urban driving time. Urban driving can include a parking period of 10 s or longer. If the single parking time exceeds 180 s, it shall be removed during data processing, otherwise the trip is invalid.

D.2.5.9 The high-speed road section shall cover at least the speed range of 90 ~ 110 km/h, and the time for the speed higher than 100 km/h shall reach at least 5 minutes. For vehicles of category M2, if the speed is limited to 100 km/h or less, the driving along the high-speed road section shall cover at least the speed range of 90 ~ 100 km/h, and the time for the vehicle speed higher than 90 km/h shall reach at least 5 minutes.

D.2.5.10 The duration of the entire RDE test shall be between 90 ~ 120 minutes.

D.2.5.11 The difference in altitude between the start and end points of the test shall not exceed 100 m, and the cumulative positive altitude increase of the test vehicle shall not be greater than 1200 m/100 km. The calculation method of the cumulative altitude shall be as shown in Attachment DH.

D.2.5.12 The minimum travel distance of test vehicles in urban areas, suburbs and high-speed road sections is 16 km.

(c) ECU; if the vehicle speed is determined by the ECU, verify the total travel distance and the adjusted vehicle speed signal in accordance with the requirements of Attachment DC.2 to meet the requirements of Attachment DC.2.3. Or compare the total travel distance determined by the ECU with the reference distance. The reference distance can be obtained from the digital map. The deviation between the total travel distance determined by the ECU and the reference distance must not exceed ±4%.

DA.3.8 Checking PEMS settings

It shall check whether the connection to all sensors and ECU is correct. If it needs to obtain the engine operating parameters, it shall confirm that the ECU can correctly report the data.

When the PEMS is working, the OBD system shall have no warning signal or fault indication signal.

DA.4 Emission test

DA.4.1 Test start

The sampling, measurement and recording shall begin before the engine starts. To facilitate time calibration, it is recommended to use a separate data recording device to record the parameters or set a synchronization time stamp. Before starting and after starting the engine, it shall be immediately confirmed that the data recording device has recorded all the necessary parameters.

DA.4.2 Test run

Samples, measurements and records shall be continuously taken during the entire vehicle road test. The engine may be shut down and restarted during the test, but sampling and recording shall be performed continuously. All warnings and recommended faults of the PEMS shall be recorded and verified. The recorded data shall reach 99% of the complete signal. Due to the accidental loss of signals or maintenance of the PEMS system, the interruption time for measuring and recording data cannot exceed 1% of the total driving time, and the continuous interruption time does not exceed 30 seconds. The interruption process shall be directly recorded by the PEMS. It is not allowed for artificially interrupt the pretreatment, transformation or aftertreatment of the test data. Automatic zeroing of the instrument shall use traceable zero gas similar to analyzer zeroing. Maintenance of the PEMS system shall be performed at zero vehicle speed.

DA.4.3 Test end

The test shall be completed after the vehicle completes the entire trip and the engine is shut down. At this point, it shall continue recording the data until reaching the response time of the sampling system. At the end of the test run, it shall avoid the vehicle from long periods of idling.

DA.5 Test aftertreatment program

(a) The analyzer is checked at least once every three months. After the analyzer system is repaired, or changes made to the analyzer may affect calibration, calibration shall also be performed.

(b) For other related equipment (such as PN analyzers, exhaust flow meters, and traceable sensors), if the instrument is damaged, it shall be performed in accordance with the internal inspection procedures or the requirements of the manufacturer; however, it shall be performed at least once a year.

In accordance with the linearity requirement of DB.3.2, sensors or ECU signals that cannot be traced directly shall be calibrated on the chassis dynamometer by a traceable calibrated device every time the PEMS system is set up.

DB.3.4 Linearity check procedure

DB.3.4.1 General requirements

The relevant analyzers, instruments, and sensors shall be adjusted to normal operating conditions as recommended by the manufacturer, and the analyzers, instruments, and sensors shall operate at their specified temperatures, pressures, and flows.

DB.3.4.2 General procedures

The linearity check shall be performed within each normal operating range by implementing the following steps:

(a) For analyzers, flow meters or sensors, the zero point shall be adjusted by introducing a zero signal. For gas analyzers, pure synthetic air or nitrogen shall be introduced into the analyzer port either directly or through as short a gas channel as possible.

(b) The analyzer, flow meter or sensor shall adjust the span point by introducing the span point signal. For gas analyzers, suitable span gas shall be introduced directly into the analyzer port or through a as short gas channel as possible.

(c) The zero adjustment procedure in (a) shall be repeated.

(d) Calibration shall be carried out by introducing at least 10 approximately equally spaced and valid reference values (including zeros). The reference value for the standard gas concentration, exhaust mass flow, or any other relevant parameter shall meet the expected range in the emission test. For the exhaust mass flow measurement, a calibration point that is 5% lower than the maximum calibration value shall not be included in the linearity verification check.

(e) For gas analyzers, standard gases of known gas concentrations shall be introduced into the analyzer port and sufficient time shall be given to stabilize the signal.

Any analyzer that does not meet the requirements of DB.4.1.1 of this standard can also be used if it meets the requirements of DB.4.2. When the test vehicle is tested in accordance with the provisions of DB.5, DB.6 and DB.7, within the pollutant concentration range that may occur under normal or extended conditions of effective road testing, the equipment supplier shall ensure that the alternative analyzer can achieve same or higher measurement accuracy than the standard analyzer. If the competent department of environmental protection requests it, the equipment manufacturer shall submit written supplementary information, to prove that the performance of the alternative analyzer is consistent and reliable with the standard analyzer. The information that needs to be supplemented includes:

(a) A description of the working principle and composition of alternative analyzers;

(b) For vehicles equipped with ignition and compression ignition engines, within the range of pollutant concentrations and environmental conditions expected in the type inspection tests and confirmation tests described in DC.3.2, the materials proving the equivalence between the alternative analyzer and the standard analyzer as specified in DB.4.1.1; the analyzer manufacturer shall demonstrate its equivalence within the tolerances specified in DC.3.3.

(c) The equivalence of the effect of atmospheric pressure on the analyzer compared to the corresponding standard analyzer specified in DB.4.1.1; the proof test shall determine the analyzer's response at different ranges to the span gases of different concentrations, to check the effect of atmospheric pressure on the analyzer under normal and extended altitude conditions as specified in D.2.2. The test can be conducted in an altitude environmental chamber.

(d) Compared with the standard analyzers specified in DB.4.1.1, at least three road tests shall be conducted to demonstrate that the alternative analyzer can meet the conformance requirements specified in this Attachment.

(e) Evidence that the effects of vibration, acceleration, and ambient temperature on analyzer readings do not exceed the analyzer noise requirements as specified in DB.4.2.4.

If the test results do not prove that the alternative analyzer is equivalent to the standard analyzer, the competent department of environmental protection may request the supplier to provide additional information to verify its equivalence or to reject the alternative analyzer.

DB.4.2 Analyzer specifications

DB.4.2.1 Basic requirements

In addition to the analyzer linearity requirements defined in DB.3, the analyzer manufacturer shall also specify the type of analyzer, the analyzer shall meet the requirements of DB.4.2.2 ~ DB.4.2.8. The analyzer shall have a suitable manufacturer's instructions for use; the analyzer and cooler shall be properly adjusted to optimize performance;

(ii) Calibrate the span and zero calibration of the analyzer based on the expected concentration of the actual emission test;

(iii) Select the NO_2 standard gas that matches the maximum NO_2 concentration that may be encountered in the emission test;

(iv) At the sampling probe position of the analyzer, charge it full of NO_2 for calibration, until the analyzer NOx response stabilizes;

(v) Calculate and record the steady average NOx concentration over 30 s and record it as $NO_{x,ref}$;

(vi) Stop the flow of the NO_2 standard gas, use a dew point generator with a dew point set at 50 °C to fill the sampling system and saturate it. The dew point generator output is sampled through the sampling system and cooler for at least 10 minutes, until the cooler removes a constant rate of water.

(vii) After completing step (iv), the NO_2 standard gas used to establish $NO_{X,ref}$ will again fill the sampling system, until the NOx response stabilizes.

(viii) Calculate the average NO_X concentration that is stable for 30 seconds and record it as $NO_{x,m}$.

(ix) Calibrate NO_X to $NO_{X,dry}$ based on the residual water vapor passing through the cooler at the cooler outlet temperature and pressure conditions.

The calculated $NO_{x,dry}$ shall be at least 95% of $NO_{x,ref}$.

(e) Sample dryer

If the sampler dryer is removed of moisture, it may affect the NOx measurement results. For dry-based CLD analyzers, it shall be demonstrated that when the highest expected water vapor concentration is Hm, the sample dryer can maintain the dry air at a CLD humidity ≤ 5g H_2O/kg (less than 5 g water per 1000 g of dry air) (or 0.008% H2O), i.e. 100% relative humidity at 3.9 °C, 101.3 kPa; or 25 % relative humidity at 25°C, 101 kPa. The conformity shall be demonstrated by measuring the outlet temperature of the hot dehumidifier or measuring the humidity at a point upstream of the CLD. If the airflow entering the CLD comes from the dehumidifier, the CLD exhaust humidity can also be measured.

(f) Infiltration of dry NO_2 sample gas

In some poorly designed dryers, residual liquid water may remove NO_2 from the sample gas. If a dryer and an NDUV analyzer are used at the same time, and there is no NO_2/NO converter upstream, residual liquid

Attachment DC
(Normative)
PEMS and untraceable exhaust mass flow verification

DC.1 Foreword

This Attachment describes the basic functions of PEMS under transient conditions, as well as verification requirements for correctness of exhaust mass flow calculated from untraceable exhaust mass flow meters or ECU signals.

DC.2 PEMS verification procedure

DC.2.1 PEMS verification cycle

It is recommended that after each PEMS is installed on the vehicle, the PEMS can be verified before the test is started or after the end of the test. During the road test and verification period, the installation of the PEMS shall be maintained.

DC.2.2 PEMS verification procedure

DC.2.2.1 Installing PEMS

The PEMS shall be installed and prepared in accordance with the requirements of Attachment DA. During the completion of the verification test and road test, the installation status of PEMS shall be maintained.

DC.2.2.2 Test conditions

Verification tests shall be performed on a chassis dynamometer and it is verified in accordance with the type I test drive cycle.

It is advisable to add the exhaust gas extracted by the PEMS during the verification test to the CVS. If this is technically not feasible, the exhaust gas mass results shall be corrected in the CVS calculation results. If an exhaust mass flow meter is used to verify the exhaust gas mass flow rate, cross-inspections of the exhaust mass flow rate measurements shall be made using data obtained from sensors or ECU.

DC.2.2.3 Data analysis

The specific emission [g/km] measured by all laboratory equipment shall be calculated in accordance with the type I test requirements. Calculate the emission rate measured by PEMS in accordance with DD.8. Add the test results to get the total mass of pollutant discharge [g], and then divide the test vehicle running distance of chassis dynamometer. The difference between the specific pollutant emission [g/km] obtained by the PEMS and the reference laboratory system shall meet the requirements of DC.2.3, and the humidity correction shall be performed when verifying the NOx emission measurement results.

Attachment DD
(Normative)
Emission calculation

DD.1 Foreword

This Attachment describes procedures for determining the instantaneous mass of pollutants and the emission of particulate matter [g/s; #/s], for the evaluation of driving dynamics and the calculation of final emissions results.

The following symbols apply to this clause.

α - Hydrogen molar ratio (H/C)

β - Carbon molar ratio (C/C)

γ - Sulfur molar ratio (S/C)

δ - Nitrogen molar ratio (N/C)

$\Delta t_{t,i}$ - Analyzer transmission time [s]

$\Delta t_{t,m}$ - Exhaust mass flowmeter conversion time [s]

ε - Oxygen molar ratio (O/C)

ρ_e - Exhaust gas density

ρ_{gas} - Exhaust gas pollutant “gas” density

λ - Excess air ratio

λ_i - Instantaneous excess air ratio

A/F_{st} - Theoretical air-fuel ratio [kg/kg]

c_{CO} - Dry base CO concentration [%]

c_{CO2} - Dry base CO_2 concentration [%]

c_{dry} - Dry base pollutant concentration, in ppm or volume percentage

$c_{gas,i}$ - Pollutant “gas” instantaneous concentration [ppm]

$c_{i,c}$ - Concentration of pollutant i after time correction [ppm]

$c_{i,r}$ - Pollutant i original concentration [ppm]

c_{wet} - Pollutant wet base concentration, in ppm or volume percentage

E_E - Ethane efficiency

start emissions.

DD.4 Engine off period emission measurement

It shall record the instantaneous emission or exhaust flow for all engine off periods during the test. In a separate step, the recorded emissions or flow data shall be set to zero in subsequent data tracking processes.

The engine is considered to be off if one of the following criteria is met:

(a) The recorded engine speed is less than 50 r/min;

(b) The measured exhaust mass flow rate is less than 3 kg/h;

(c) Measured value of exhaust mass flow rate is reduced to 15% of idling stable exhaust mass flow rate.

DD.5 Altitude consistency inspection

If the altitude of the driving route may be higher than that specified in D.2.2, or if only one GPS is used to measure the altitude, the consistency of the altitude data measured by the GPS shall be checked and, if necessary, corrected. The latitude, longitude, and altitude data obtained from the GPS shall be compared with the altitude indicated by the digital map. The consistency of the comparison data shall be checked, and manual corrections and markings shall be made for measurement values that deviate more than 40 m from the altitude of the map.

DD.6 Consistency inspection of GPS speed measurement

Determine the vehicle speed based on GPS, it shall calculate the total running distance, and compare it with the reference measurements obtained from sensors, active ECU, or digital maps for consistency inspection. Correct the GPS data with obvious errors, keep the original error data file, it shall mark all data subject to corrections. The corrected data shall not exceed 120 s continuously, or the total time does not exceed 300 s. The deviation of the total running distance calculated from the corrected GPS data from the reference value shall not exceed ±4%. If GPS data does not meet these requirements and there are no other reliable sources of speed, the test results are invalid.

DD.7 Emissions correction

DD.7.1 Dry-wet base correction

If the concentration of the measured pollutant is a dry-base concentration, the measured dry-base concentration shall be converted to a wet-base concentration:

$$c_{wet} = k_w * c_{dry}$$

Where:

c_{wet} - The wet-base concentration of pollutant, in ppm, or volume percentage;

Attachment DE
(Normative)
Moving average window method

DE.1 Foreword

The moving average window method is a method to analyze the real driving pollutant emissions (RDE). This method divides the test results into data subsets (different windows) and uses statistical data processing methods to identify valid RDE windows.

Compare the mileage-based CO_2 emissions (g/km) with the reference curve, evaluate the “normality” of the window, if the test results contain a sufficient number of windows, and the window covers different speed segments (urban, suburban, high-speed), the test results are considered complete and effective.

The entire data processing process is divided into the following 5 steps:

Step 1: Split test data and remove cold start emissions data;

Step 2: Calculate emissions based on a subset of data or “window” (DE.3);

Step 3: Identify the window normality (DE.4);

Step 4: Verify integrity and normality (DE.5);

Step 5: Emission calculation based on normal window (DE.6).

DE.2 Symbols, parameters and units

Index (i) - Time step

Index (j) - Window

Index (k) - category (t = all; u = urban area; r = urban area; m = high speed section) or CO_2 characteristic curve (cc)

Index (gas) - Exhaust emission components (e.g. NO_X, CO, PN)

a_1,b_1 - Carbon dioxide characteristic curve factor

a_2,b_2 - Carbon dioxide characteristic curve factor

d_j - Window j covered distance [km]

f_k - Share weighting factors for urban, suburban and high-speed sections

h - CO_2 characteristic curve window distance [%]

h_j - CO_2 characteristic curve window j distance [%]

Attachment DG
(Normative)
Verification of travel dynamics

DG.1 Introduction

This Attachment describes the calculation procedure for verifying the dynamic characteristics of each trip, to determine whether the overall dynamics of the urban, suburban and high-speed road sections are excessive or insufficient.

DG.2 Symbol

RPA - Relative positive acceleration;

T4253 - Represents 4253 digital filter;

(i) - Index, which refers to the time step;

(j) - Index, the time step of the positive acceleration data set;

(k) - Index, referring to category (t = all; u = urban area; r = suburban; m = highway road section);

a - Acceleration, m/s^2;

a_i - Acceleration of time step i, m/s^2;

a_{pos} - Positive acceleration greater than 0.1 m/s^2, m/s^2;

$a_{pos,i,k}$ - Considering the urban areas, suburban and high-speed road sections, positive accelerations greater than 0.1 m/s^2 in the time step i, m/s^2;

a_{res} - Acceleration resolution, m/s^2;

d_i - Travel distance within time step i, m;

$d_{i,k}$ - Considering the urban areas, suburban and high-speed road sections, the distance covered by the time step i, m;

M_k - Sample number of urban areas, suburban and high-speed road sections where the positive acceleration is greater than 0.1m/s^2;

N_k - Total number of samples for urban areas, suburban, high-speed road sections and all trips;

RPA_k - Relative positive acceleration in urban, suburban, and high-speed road sections, m/s^2 or kWs/(kg*km);

t_k - Duration of urban areas, urban, suburban, and high-speed road sections and all trips, s;

Attachment DH
(Normative)
Calculation procedure for trip cumulative positive altitude increase

DH.1 Foreword

This Attachment describes how to determine the cumulative altitude increase in the real driving emissions test trip.

DH.2 Symbol definition

d(0) - Distance at the beginning of the trip, m

d - Cumulative distance traveled at the considered discrete path point, m

d_0 - Cumulative distance traveled as measured just before the corresponding path point d, m

d_1 - Cumulative distance traveled as measured just after the corresponding path point d, m

d_a - Reference path point at d(0) [m]

d_e - Cumulative distance traveled before the last discrete path point, m

d_i - Instantaneous distance, m

d_{tot} - Total test distance, m

h(0) - Vehicle altitude after data quality screening and principle verification at the start of the trip, m

h(t) - Vehicle altitude after data quality screening and principle verification at t point, m

h(d) - Vehicle altitude at path point d, m

h(t-1) - Vehicle altitude after data quality screening and principle verification at t-1 point, m

$h_{corr}(0)$ - Corrected altitude just before the corresponding path point d, m

$h_{corr}(1)$ - Corrected altitude just after the corresponding path point d, m

$h_{corr}(t)$ - Corrected instantaneous vehicle altitude at data point t, m

$h_{corr}(t-1)$ - Corrected instantaneous vehicle altitude at data point t-1, m

$h_{GPS,i}$ - Instantaneous vehicle altitude measured by GPS, m

$h_{GPS}(t)$ - Instantaneous vehicle altitude measured by GPS at data point t, m h(t) - Vehicle altitude after data screening and correction at data point t, m;

$h_{GPS}(t)$ - Instantaneous vehicle altitude measured by GPS at data point t, m;

$h_{map}(t)$ - Vehicle altitude based on the contour map at the data point t, m.

DH.4.3 Correction of instantaneous vehicle positive altitude data

The elevation h(0) at the beginning of the trip d(0) obtained by GPS shall be corrected with the contour map information, and the deviation between the two shall not be greater than 40 meters.

If the altitude data h(t) in the trip satisfies with the formula below:

$$|h(t) - h(t - 1)| > (v(t)3.6 * \sin 45°),$$

It needs to correct the altitude so that: $h_{corr}(t) = h_{corr}(t - 1)$

Where:

h(t) - Vehicle altitude after data quality screening and correction at data point t, m;

h(t-1) - Vehicle altitude after data quality screening and correction at data point t-1, m;

v(t) - Vehicle speed at data point t, km/h;

$h_{corr}(t)$ - Corrected instantaneous vehicle altitude at data point t, m;

$h_{corr}(t-1)$ - Corrected instantaneous vehicle altitude at data point t-1, m.

After the data correction is completed, an effective data set of altitude is obtained, and then this effective data set is used in DH.4.4 to calculate the cumulative altitude increase.

DH.4.4 Calculate cumulative altitude increase

DH.4.4.1 Establish unified spatial resolution

The total travel distance d_{tot}[m] of the vehicle shall be the sum of the instantaneous distance d_i, and the instantaneous distance d_i shall be calculated in accordance with the following formula:

$$d_i = v_i / 3.6$$

Where:

d_i - Instantaneous distance, m;

v_i - Instantaneous vehicle speed, km/h.

The cumulative altitude increase starts from the first measured value d(0) at the beginning of the trip and is calculated with a constant spatial resolution of 1

F.4.8.17 Other relevant note materials.

F.5 Test procedure

F.5.1 Vehicle preparation and description

Before the test, the vehicle is mechanically prepared in accordance with the following requirements:

F.5.1.1 Before the test, the vehicle shall have at least 3000 km of running-in drive, during which the canister shall be properly connected and run normally. Alternatives shall not be used to allow the canister to be adsorbed and desorbed.

F.5.1.2 The vehicle exhaust system shall not have any leakage.

F.5.1.3 Before the test, steam can be used to clean the vehicle.

F.5.1.4 Additional connectors and adapters may be installed in the fuel system to empty the fuel in the fuel tank without changing the fuel tank installation.

F.5.1.5 Manufacturers may use the following methods to reduce the background value of non-fuel hydrocarbons. Manufacturers shall provide reports detailing their actions to reduce the background value of non-fuel hydrocarbons in vehicles. The report shall describe in detail the method used and how to determine that the non-fuel hydrocarbon has reached a stable condition. These methods include only:

(1) Baking the chassis and tire at a specified temperature and for a specified period of time to make it age;

(2) Use old tires and spare tires; it allows replacing tires not older than 12 months with used tires, spare tires can be replaced with old tires.

(3) Replace the windshield washer fluid with clean water.

Parts that do not require disassembly during normal maintenance of the vehicle cannot be replaced by old parts before this test.

F.5.1.6 When the vehicle with the original production date within 12 months is tested, the vehicle may be pretreated in accordance with the provisions of F.5.1.5; the vehicle with the original production date exceeding 12 months may also be tested. In this case, the vehicle shall not be pretreated.

F.5.1.7 Move the vehicle to the oil discharge and refueling area as specified in F.5.2. The ambient temperature in this area is 23 °C ± 5 °C.

F.5.1.8 F.5.6 applies only to vehicles equipped with an integrated canister and non-integral canister systems (except NIRCO). F.5.7 applies only to vehicles that are equipped with non-integrated refueling canister only (NIRCO).

F.5.2 Oil discharge and refueling to 40% of the tank nominal volume

F.5.2.1 In the process of refueling and oil discharging process, the evaporation

F.5.10.1 Before the completion of the test of F.5.9, open the mixing fan in the closed chamber and clean the closed chamber for several minutes, until the hydrocarbon background value is stable.

Warning: Once the concentration of hydrocarbons, methanol, ethanol, or mixed solutions of such chemicals (hydrocarbons, methanol, and ethanol) exceeds 15000 ppmC, clean the closed chamber immediately. This concentration can provide a 4:1 safety factor as relative to the lean-burn limit.

F.5.10.2 Prior to the test, the hydrocarbon analyzer and other analyzers are subject to zero point and span point calibration.

F.5.10.3 The initial temperature of the closed chamber shall be 38 °C ± 2 °C.

F.5.10.4 The test vehicle shall be moved into the closed chamber within 7 minutes after engine shutdown at operation completion as specified in F.5.9.1.4. Before any part of the vehicle enters the closed chamber, it is necessary to ensure that the engine stalls, the windows and the trunk are opened, the engine flameout time is recorded on the evaporative pollutant emission measurement data recording system, and the temperature of the closed chamber is recorded at the same time.

F.5.10.5 Close and seal the door of the closed chamber and start the hot immersion for 60 min ± 0.5 min. Within the first 5 minutes after closing the closed chamber door, the temperature of the closed chamber shall be maintained at 38 °C ± 5 °C; within the time thereafter, the closed chamber temperature shall be maintained at 37 °C ± 4 °C. Measure and record the initial state of the hot immersion test, including: hydrocarbon concentration $C_{HC,i}$, temperature T_i, atmospheric pressure P_i. These data will be used for the calculation of evaporative pollutant emissions in F.6.

F.5.10.6 Near the end of the 60 min ± 0.5 min hot immersion test, the hydrocarbon analyzer shall be subject to zero point and span point calibration.

F.5.10.7 At the end of the 60 min ± 0.5 min hot immersion test, measure and record the final hydrocarbon concentration of the hot immersion test $C_{HC,f}$, temperature T_f, and atmospheric pressure P_f. These data will be used for the calculation of evaporative pollutant emissions in F.6.

F.5.11 Normal temperature vehicle immersion

F.5.11.1 Within 2 hours after the completion of the hot immersion test, the engine is not started, and the vehicle is pushed out or transferred to the immersion area by other means and the vehicle is immersed for 6 ~ 36 hours. During this period, the temperature in the immersion zone is maintained at 20 °C ± 2 °C.

F.5.11.2 Move the vehicle from the immersion area (without starting the engine) to the closed chamber, prepare the day and night ventilation test as specified in F.5.12.

F.5.11.3 Room temperature vehicle immersion can also be carried out in a

F.7.2.6 At the request of the manufacturer, equivalent alternatives may be used to demonstrate its ability to ventilate. During the type inspection, the manufacturer shall prove to the competent department of environmental protection the rationality of its specific procedures and the test pressure adopted.

F.7.3 Desorption test

F.7.3.1 Install a flow meter with a measurable air flow rate of 1 L/min at the desorption inlet, connect the pressure vessel that is sufficiently large in volume to have no adverse effect on the desorption system through the on-off valve to a desorption inlet, or otherwise use alternative methods.

F.7.3.2 With the consent of the competent department of environmental protection, the manufacturer can select the flow meter by itself.

F.7.3.3 Operate the vehicle so that all structural features of the desorption system that may limit desorption are checked and recorded.

F.7.3.4 When the engine is operated as specified in F.7.3.3, the air flow shall be measured in one of the following ways:

F.7.3.4.1 Turn on the switch of the measuring device in F.7.3.1 and observe the pressure drop between the atmospheric pressure and the pressure at which 1 L of air flows into the evaporative emission control system within 1 min.

F.7.3.4.2 If alternative flow measuring devices are used, it shall be able to take the flow readings of not less than 1 L/min.

F.7.3.4.3 If, during the type inspection period, the manufacturer has submitted an alternative desorption test procedure to the competent department of environmental protection and such procedure is accepted, the alternative procedure may be adopted at the request of the manufacturer.

F.7.4 The competent department of environmental protection may check the consistency control method applied by each manufacturer at any time.

F.7.4.1 A sufficient number of samples shall be taken from the product line.

F.7.4.2 These vehicles may be tested in accordance with the provisions of F.7.2 ~ F.7.3.

F.7.4.3 If the results of the tests in accordance with F.7.2 ~ F.7.3 do not meet the requirements, the application of the type inspection procedure of 5.3.4 may be required for the determination.

F.7.4.3.1 The manufacturer is not allowed to make adjustments, repairs, or changes to any vehicle unless the vehicle does not meet the requirements of 5.3.4, or the work has been listed in the manufacturer's vehicle assembly and inspection program documentation.

F.7.4.3.2 If the emission characteristics of vehicle evaporative emissions may

Attachment FA

(Normative)

Evaporative emission test equipment calibration

FA.1 Calibration cycle and method

FA.1.1 All equipment shall be calibrated prior to initial use, and will be frequently calibrated as required. In any case, calibration shall be carried out in the month prior to the type inspection test. The calibration method used is shown in this Attachment.

FA.1.2 The ambient temperature at the time of calibration shall be in accordance with the provisions of the Attachment FB, the temperature series values of the table FB.1 shall be used preferentially.

FA.2 Calibration of closed chambers

FA.2.1 Initial determination of closed chamber internal volume

FA.2.1.1 Before initial use, determine the internal volume of the closed chamber in accordance with the following procedure:

Carefully measure the internal dimensions of the closed chamber and consider irregular parts such as pillars, beams, etc. The internal volume of the closed chamber is determined based on these measured dimensions.

For a variable-volume closed chamber, the closed chamber shall be locked to a fixed volume, and the closed chamber internal temperature shall be controlled at 30°C (or 29°C instead of the temperature cycle). The nominal volume repeatability shall be within ±0.5% of the reported value.

FA.2.1.2 Subtract 1.42 m^3 from the internal volume of the closed chamber, to determine the internal net volume of the closed chamber.

Note: Use 1.42 m^3 instead of the volume of the vehicle after opening the windows and the trunk.

FA.2.1.3 The volume of the closed chamber shall be verified in accordance with FA.2.3. If the calculated propane mass does not reach within ±2% of the propane injection amount, correction is required.

FA.2.2 Determination of closed chamber background emissions

Through this step, it is determined whether or not the closed chamber contains substances that release a large amount of hydrocarbons. This inspection shall be performed at least once a year when the closed chamber is put into use or after any work that affects the background emissions is performed indoors.

FA.2.2.1 The determination of the background emissions of a variable volume closed chamber may be carried out in fixed volume or variable volume

$M_{HC,in}$ - During day and night ventilation emissions test, the mass of hydrocarbons entering into a fixed volume closed chamber, g;

C_{HC} - Hydrocarbon concentration in a closed chamber, ppmC (Note: ppmC = ppm propane x 3);

V - Closed chamber volume, m^3;

T - Enclosed chamber temperature, K;

P - Atmospheric pressure, kPa;

K - 17.6;

i - Initial reading;

f - Final reading.

FA.3 Inspection of FID hydrocarbon analyzers

FA.3.1 Optimization of detector response

The FID analyzer shall be adjusted in accordance with the requirements of the instrument manufacturer. The propane gas (balance gas is air) is used to optimize the response performance in the most commonly used working range.

FA.3.2 Calibration of HC analyzer

The analyzer shall be calibrated with propane gas (balanced air as air) and pure synthetic air. See the requirements (calibration and span gas) in Attachment CD.

Establish calibration curves as described in FA.4.1 ~ FA.4.5.

FA.3.3 Oxygen interference inspections and recommendations

For a particular hydrocarbon, the response factor (R_f) is the ratio of the reading, C_1, of the FID to the gas concentration of the gas cylinder, expressed as $ppmC_1$.

The test gas concentration shall be close to 80% of the full scale of the range. The concentration shall be known, accurate to ±2% the weight measurement reference value expressed in volume. In addition, cylinders shall be pretreated at temperatures between 20°C ~ 30°C for 24 hours.

When the analyzer is put into use for the first time and subsequent regular major maintenance, the response factor shall be determined. When the reference gas is propane and the balance gas is pure air, the resulting response factor shall be 1.00.

The test gas and response factor (R_f) recommended for oxygen interference are as follows:

Propane and nitrogen: $0.95 \le R_f \le 1.05$.

data of the manufacturer.

G.3.3.4 Diesel engine bench aging duration. The bench aging duration is calculated from the following BAD equations:

Bench aging duration – Equivalent to the number of regeneration and/or desulfurization cycles (whichever is longer) that travels 160000 km or 200000 km.

G.3.3.5 Aging bench: The aging bench shall comply with the standard diesel bench cycle (SDBC) and transmit reasonable exhaust gas flow, exhaust gas composition, and exhaust temperature at the inlet of the aftertreatment system.

Manufacturers shall record the number of regeneration/desulfurization cycles (if applicable) to ensure that adequate aging does occur.

G.3.3.6 Tests required: In order to calculate the deterioration factor, at least two type I tests shall be carried out before the bench aging. After the bench aging test, the aged emission components shall be reinstalled on the vehicle to perform at least two type I tests.

Manufacturers can perform additional type I tests. The deterioration factor shall be calculated in accordance with the calculation method specified in G.2.5.

G.4 Evaporation/refueling durability test method

G.4.1 Vehicle requirements

Vehicles used for evaporation/refueling durability test must have been run-in and stabilized with an evaporative/refueling emission control system, and the non-fuel hydrocarbon emissions from the vehicle has been pretreated.

It allows the same vehicle to be used in exhaust, evaporation and refueling pollutant emission durability data tests.

Before the start of mileage accumulation, each vehicle subject to durability data test shall achieve a stable evaporation/refueling emission level, and at least cumulatively run 3000 km.

The durability data test vehicle must be a vehicle within the durability data test group, and the vehicle has the maximum emission increase with the vehicle aging or running cumulative mileage. For vehicle models used for durability data test, the vehicle's ratio of nominal tank volume to the canister BWC must be the highest.

If the manufacturer decides to choose to use the mileage accumulation method specified in G.4.2 of this Appendix to establish the deterioration factor, the manufacturer must select one to five vehicles in an evaporation/refueling emission family to form a durability data test group.

G.4.2 Test method for determination of durability factor by mileage accumulation

G.4.2.2.1 Manufacturers can use the following methods to evaluate the evaporation/refueling system durability and establish the deterioration factor through the emission data obtained by whole vehicle road durability evaluation.

G.4.2.2.2 Emission test results at the stability point and end point of 3000 ± 120 km must be within the emission limits. Otherwise, these data will not be used for the calculation of the deterioration factor unless agreed by the competent department of environmental protection.

G.4.2.3 Regular test and deterioration factor determination of 75% useful life

In accordance with this method, the durability data test vehicle needs to run on the road to accumulate mileage. The evaporation and refueling emission test of the vehicle is performed at the first test after the vehicle is stabilized at 3000 ± 120 km, and the evaporation and refueling emission test shall be performed at least five evenly distributed points.

G.4.2.3.1 Using this method, the test points are at 30000 km, 60000 km, 90000 km, 120000 km, 160000 km and 200000 km. The cumulative mileage for each test point allows ±2% error. More test points are allowed, but the intervals between test points shall be nearly equal. If the test is finished between regular points, the vehicle's evaporation and refueling emissions tests must be performed simultaneously, and the resulting data must be used to determine the deterioration factor.

G.4.2.3.2 The test points proposed are replaceable. The evaporation/refueling emission test can be performed by selecting the corresponding exhaust emission test point at the same time. In addition, the evaporation/refueling emission test must be carried out at the vehicle stability point and end point (75% or more of the effective use period).

G.4.2.3.3 Use linear regression (least square function) to use all available test data to establish an optimal straight line to represent the deterioration characteristics of each test vehicle for durability data. The calculation of the deterioration factor must project the best straight line representing the emission test data to the end of the effective use period 160000 km or 200000 km. The best straight line representing the emission test data is projected, to estimate the emission value of the 3000 km vehicle stability point and the effective use period end point of 160000 km or 200000 km. The deterioration factor is the difference between the emission value at the end of the effective use period as estimated using the best straight line and the emission value at the stable point of 3000 km.

G.4.2.3.4 If more than one durability data vehicle is being evaluated, the deterioration factor of the evaporation/refueling family is the average of all durability data test vehicles.

G.4.2.3.5 Emission value obtained at the end of the effective use period of 160000 km or 200000 km by regression method, the emission value of the stability point (3000 km) obtained by the regression method, and the deterioration factor must have the same accuracy as the emissions from temperature shall be stored digitally at the frequency of 1 Hz (measured once per second).

GA.3.4 Air-fuel ratio (A/F) measurements: Devices that measure A/F (such as wide-area oxygen sensors) shall be located as close as possible to the catalyst inlet and outlet edges. The information from these sensors shall be stored digitally at 1 Hz (measured once per second).

GA.3.5 Exhaust gas flow balance: Regulations shall be established to ensure a reasonable amount of exhaust gas (measured in terms of theoretical air-fuel ratio, g/s, with an error of ±5 g/s) flowing through the catalyst system on the bench where aging tests are being conducted.

A reasonable exhaust gas flow rate is determined based on the engine's steady speed and the exhaust gas flow that may occur under the load as determined by the aging test of the parent vehicle engine in GA.3.6.

GA.3.6 Setup: Select engine speed, load, and ignition timing to achieve a catalyst bed temperature of 800 °C (±10 °C) at steady-state theoretical air-fuel ratio.

An air injection system is set to provide the necessary airflow to produce 3.0% (±0.1%) of oxygen in the theoretical exhaust gas flow in front of the first catalyst. A typical reading at the upstream A/F measurement point (as per GA.3.4) is λ = 1.16 (approximately 3% oxygen).

When the air injection is turned on, set “thick” A/F to make the catalyst bed temperature reach 890 °C (±10 °C). A typical A/F value for this step is λ = 0.94 (about 2% carbon monoxide).

GA.3.7 Aging cycle: The standard bench aging procedure uses a standard bench cycle (SBC). The standard bench cycle (SBC) is repeated until the aging time calculated by the bench aging time equation (BAT) is reached.

GA.3.8 Quality assurance: During aging, the temperature and A/F ratios of GA.3.3 and GA.3.4 shall be reviewed periodically (at least every 50 hours). The necessary adjustments shall be made to ensure proper conformity with the standard bench cycle (SBC) throughout the aging process.

After the aging test is completed, the catalyst’s time-temperature data collected during the aging test shall be made into a histogram. This histogram shall be drawn with a temperature set no larger than 10 °C. Use the BAT equation used in accordance with the aging test cycle in G.3.2.4 and the calculated effective reference temperature to determine if the catalyst has experienced the appropriate thermal aging. If the thermal aging effect as generated by the calculated aging time is less than 95% of the target thermal aging, the bench aging test is extended.

GA.3.9 Starting and stopping: Ensure that the maximum temperature (e.g. 1050 °C) of the catalyst used for rapid aging does not occur during starting or stopping. Special cold start and stop procedures can be used to avoid this situation.

Attachment GB

(Normative)

Standard diesel engine cycle (SDBC)

GB.1 Overview

For particulate matter traps, the number of regenerations is critical to the aging process. This process is also important for systems that require desulphurization, such as NOx adsorption catalysis.

A standard diesel engine bench aging durability program includes aging an aftertreatment system on a bench, the aging test is performed in accordance with the standard diesel engine bench cycle (SDBC) as described in this Attachment. The SDBC requires the use of an aging bench equipped with an engine, which is used as the source of exhaust gas for the bench.

During standard diesel bench cycle (SDBC), the regeneration/desulfurization strategy of system shall remain in normal operation.

GB.2 The standard diesel bench cycle reproduces the engine speed and load conditions used in the SRC cycle and runs the appropriate time to verify the durability. In order to accelerate the aging process, the engine settings of the test bench can be adjusted to reduce system loading time, for example, fuel injection timing or EGR strategy can be adjusted.

GB.3 Aging bench equipment and procedures

GB.3.1 The standard aging bench includes an engine, an engine controller, and an engine dynamometer. As long as the inlet status and control characteristics of the aftertreatment system specified in this Attachment are satisfied, other configurations (complete vehicles on the chassis dynamometer or burners providing corresponding exhaust conditions) may be accepted.

If each exhaust branch meets the requirements of this Attachment, a single aging bench can divide the exhaust stream into some branches. If the bench has more than one exhaust stream, multiple catalyst systems can be simultaneously aged on the respective exhaust branch.

GB.3.2 Exhaust system installation: The entire aftertreatment system, together with the exhaust pipe connecting these components, shall be mounted on the bench. For engines with multiple exhaust systems (such as some V6 and V8 engines), each group of exhaust systems shall be installed in parallel to the bench for aging.

The entire aftertreatment system shall be installed as an aging unit. As an alternative, each individual component can be individually aged for an appropriate time.

GB.3.3 Aging cycle: The SDBC cycle is defined by the manufacturer and is proven to reproduce the engine speed and load at the time of the standard road

H.5.2.1.2 For vehicles with an engine front positioned, the fan shall be located within 300 mm of the front of the vehicle. If the engine is rear positioned, or if the above arrangement is not feasible, the fan shall be positioned to provide sufficient air to cool the vehicle.

H.5.2.1.3 The cooling fan shall also meet the requirements of Appendix C.

H.5.2.1.4 The speed measured from the drum of the chassis dynamometer shall be used as vehicle speed.

H.5.2.2 If required, an adaptive test cycle may be performed to determine how best to operate the accelerator and brake so that the actual cycle is within the specified tolerance of the theoretical cycle, or for adjustment of the sampling system. This shall be done before "start" in Figure H.1.

H.5.2.3 The air humidity shall be low enough to prevent condensation of water on the drum of the chassis dynamometer.

H.5.2.4 It shall, as recommended by the chassis dynamometer manufacturer and take the steps or control method to ensure the stability of the additional friction power, sufficiently preheat the chassis dynamometer.

H.5.2.5 If the chassis dynamometer bearing is not heated separately, the time between the start of the chassis dynamometer preheating and the emission test shall not be greater than 10 minutes. If the chassis dynamometer bearing is heated separately, after the chassis dynamometer is warmed up, the emissions test shall be started within 20 minutes.

H.5.2.6 If the chassis dynamometer power needs to be adjusted manually, the power shall be set within 1 h before the exhaust emission test phase. Do not use the test vehicle to set chassis dynamometer power. Using a chassis dynamometer that is pre-set by automatic control power, it can be set at any time before the emissions test begins.

H.5.2.7 Prior to the start of the test cycle of emission test, the test chamber temperature shall be within -7 °C ± 2 °C. This temperature shall be measured in the cooling fan air flow within 1.5 m from the vehicle.

H.5.2.8 The heating and defrosting devices shall be turned off during operation of the vehicle.

H.5.2.9 Record the total mileage or number of drum revolutions.

H.5.2.10 Four-wheel drive vehicles can be tested in two-wheel drive mode. When testing in two-wheel drive mode, the vehicle shall be operated in the original design drive mode (four-wheel drive) to determine the total road load for the chassis dynamometer setting.

H.5.3 Test

H.5.3.1 In addition to C.1.2.6.4.3, start the engine and perform the test in accordance with C.1.2.8. The sampling is started before the engine is started

Appendix I
(Normative)
Refueling pollutant emission test (type VII test)

I.1 Foreword

This Appendix describes the type VII test procedures as specified in 5.3.7.

This procedure describes the method of determining the refueling pollutant emission of the vehicles which are equipped with ignition engine.

This procedure applies to traditional gasoline-powered vehicles, hybrid electric vehicles (NOVC) and externally-charged hybrid electric vehicles (OVC).

The terms and definitions in Appendix F.1.1 apply to this Appendix.

I.2 Test description

This Appendix specifies the procedures for determining the refueling pollutant emissions to determine the amount of hydrocarbon emissions generated when the vehicle is refueled. The test procedures for pollutant emission in the refueling process for vehicles in the integrated control system are shown in Figure I.1. The test procedures for pollutant emissions in the refueling process for non-integrated control systems or non-integrated refueling canister only (NIRCO) systems are shown in Figure I.2.

The trial includes the following stages:

I.2.1 Vehicle pretreatment stage

The vehicle pretreatment stage includes oil discharge and refueling, vehicle immersion, pretreatment driving and pretreatment of canisters.

The pretreatment driving consists of low-speed, medium-speed, high-speed and extra-high-speed sections in the test cycle of type I test.

I.2.2 Type I test and refueling control system treatment driving stage

This stage includes: Type I test cycle driving, refueling control system treatment driving, fuel discharge and refueling, and vehicle immersion.

For the refueling control system treatment driving conditions, the integrated control system vehicle is composed of the low-speed and medium-speed of the test cycle of type I test. The non-integrated control system or the non-integrated refueling canister only (NIRCO) is a complete test cycle of type I test.

I.2.3 Refueling emission test

Place the vehicle in a closed chamber, perform vehicle refueling and measure the emission.