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Motorcycles — Measurement method for evaporative emissions —

Part 1: SHED test procedure

Motocycles — Méthode de mesure pour les émissions par évaporation —

Partie 1: Procédure d'essai SHED

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 38, *Motorcycles and mopeds*.

A list of all parts in the ISO 21755 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Recently, exhaust emissions from tailpipes of motorcycles have been dramatically reduced. Accordingly, evaporative emissions have begun to attract attention. Therefore, measurement methods for evaporative emissions are specified as an international standard for multi-application, e.g. certification, research, developments. This document specifies the basic measurement method by using the SHED (Sealed Housing for Evaporative Determination) test procedure for evaporative emissions from motorcycles.

Motorcycles — Measurement method for evaporative emissions —

Part 1: SHED test procedure

1 Scope

This document specifies a basic measurement method by using the SHED (Sealed Housing for Evaporative Determination) test procedure for evaporative emissions from motorcycles. It is applicable to motorcycles equipped with a spark ignition engine (four-stroke engine, two-stroke engine or rotary piston engine).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6460-1, *Motorcycles — Measurement method for gaseous exhaust emissions and fuel consumption — Part 1: General test requirements*

ISO 6460-2, *Motorcycles — Measurement method for gaseous emissions and fuel consumption — Part 2: Test cycles and specific test conditions*

ISO 9277:2010, *Determination of the specific surface area of solids by gas adsorption — BET method*

ISO 11486, *Motorcycles — Methods for setting running resistance on a chassis dynamometer*

ISO 7117, *Motorcycles — Measurement method for determining maximum speed*

ISO 4106, *Motorcycles — Engine test code — Net power*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
evaporative emissions
hydrocarbon vapours lost from the fuel storage and supply system of a motorcycle and not those from tailpipe emissions

3.2
SHED test
motorcycle test in a constant temperature sealed house for evaporation determination, in which a special evaporative emission test is conducted

3.3
tank diurnal breathing loss
hydrocarbon emissions caused by temperature changes in the fuel storage

3.4
hot soak loss
hydrocarbon emissions arising from the fuel system of a stationary motorcycle after a period of driving

3.5
non-exposed type fuel tank
fuel tank and fuel delivery system, except the fuel tank cap, which are not directly exposed to radiation of sunlight

3.6
rated capacity
fuel capacity of the fuel tank as declared by the manufacturer

4 Evaporative emissions, SHED test

4.1 Description of SHED test

The evaporative emission SHED (Sealed Housing for Evaporative Determination) test consists of a conditioning phase and a test phase (see Figure 1):

a) conditioning phase:

1) test cycle;

2) motorcycle soak;

b) test phase:

1) tank diurnal breathing loss test;

2) test cycle;

3) hot soak loss test.

Running loss test may be conducted during the test cycle and if it is conducted, the test procedure shall be in accordance with Annex A.

Mass emissions of hydrocarbons from the tank diurnal breathing loss and the hot soak loss phases are added together to provide an overall result for the test. If running loss test is conducted in the test cycle, mass emissions of hydrocarbons from the diurnal breathing loss, the running loss and the hot soak loss phases are summed to provide an overall result for the test.

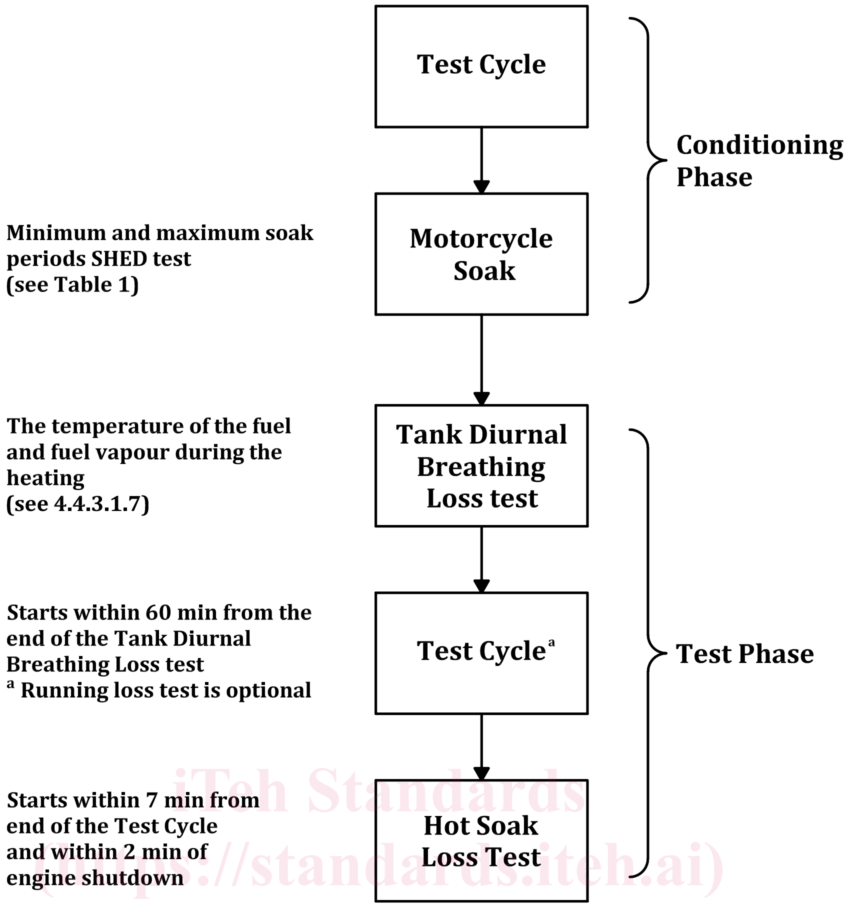

Figure 1 — Flow chart of evaporative emission SHED test

4.2 Test motorcycles and test fuel

4.2.1 Test motorcycles

The test motorcycle shall be run in at least 1 000 km after first start on the production line.

4.2.2 Test fuel

The test fuel shall be selected in accordance with agreement among the parties involved or the manufacturer's requirements, and the specifications of test fuel shall be reported. The record form is given in Annex C.

NOTE This test is influenced by the vapour pressure of the fuel property greatly, therefore the test vapour pressure is decided among the parties because the market fuel vapour pressure largely varies according to the season depending on the area.

4.3 Test equipment

4.3.1 Chassis dynamometer

The dynamometer shall have a single roll with a diameter of at least 0,400 m.

The dynamometer shall be equipped with a roll revolution counter for measuring actual distance travelled.

The methods for setting running resistance on a chassis dynamometer shall be in accordance with ISO 11486.

4.3.2 Evaporative emission measurement enclosure (SHED)

The evaporative emission measurement enclosure shall be a gas-tight rectangular measuring chamber able to contain the motorcycle under test. The motorcycle shall be accessible from all sides when inside and the enclosure when sealed shall be gas tight. The inner surface of the enclosure shall be impermeable and non-reactive to hydrocarbons. At least one of the surfaces shall incorporate with a flexible impermeable material or other devices to allow the equilibration of pressure changes resulting from small changes in temperature. Wall design shall be such as to promote good dissipation of heat, and if artificial cooling is used, interior surface temperatures shall not be less than 293 K.

4.3.3 Analytical systems

4.3.3.1 Hydrocarbon analyser

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

4.3.3.1.2 The hydrocarbon analyser shall have a response time to 90 % of final reading of less than 1,5 seconds. Its stability shall be better than 2 % of full scale at zero and at 80 % ± 20 % of full scale over a 15 minute period for all operational ranges.

4.3.3.1.3 The repeatability of the analyser expressed as one standard deviation shall be better than 1 % of full-scale deflection at zero and at 80 % ± 20 % of full scale on all ranges used.

4.3.3.1.4 The operational ranges of the analyser shall be chosen to give best resolution over the measurement, calibration and leak checking procedures. The leak checking procedure shall be accordance with analyser manufacture.

4.3.3.2 Hydrocarbon analyser data recording system.

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

4.3.4 Fuel tank heating

4.3.4.1 The fuel tank heating system shall consist of two separate heat sources with two temperature controllers. Typically, the heat sources will be electric heating strips, but other sources may be used at the request of the manufacturer. Temperature controllers may be manual, such as variable transformers, or automated. Since vapour and fuel temperature are to be controlled separately, an automatic controller is recommended for the fuel. The heating system shall not cause hot-spots on the wetted surface of the tank which would cause local overheating of the fuel. Heating strips for the fuel should be located as low as practicable on the fuel tank and shall cover at least 10 % of the wetted surface. The centre-line of the heating strips shall be below 30 % of the fuel depth as measured from the bottom of the fuel tank, and approximately parallel to the fuel level in the tank. The centre line of the vapour heating strips, if used, shall be located at the approximate height of the centre of the vapour volume. The temperature controllers shall be capable of controlling the fuel and vapour temperatures to the heating function described in 4.4.3.1.7.

4.3.4.2 With temperature sensors positioned as in 4.3.5.2, the fuel heating device shall make it possible to evenly heat the fuel and fuel vapour in the tank in accordance with the heating function described in 4.4.3.1.7. The heating system shall be capable of controlling the fuel and vapour temperatures to ±1,7 K of the required temperature during the tank heating process.

4.3.4.3 Notwithstanding the requirements of 4.3.4.2, if a manufacturer is unable to meet the heating requirement specified, due to use of thick-walled plastic fuel tanks for example, then the closest possible alternative heat slope shall be used, and the-alternative heat slope shall be reported.

4.3.5 Temperature recording

4.3.5.1 The temperature in the enclosure is recorded at two points by temperature sensors, which are connected so as to show a mean value. The measuring points are extended approximately 0,1 m into the enclosure from the vertical centre line of each side wall at a height of 0,9 m ± 0,2 m.

4.3.5.2 The temperatures of the fuel and fuel vapour shall be recorded by means of sensors positioned in the fuel tank as described in 4.4.2. When sensors cannot be positioned as specified in 4.4.2, e.g. where a fuel tank with two ostensibly separate enclosures is used, sensors shall be located at the approximate mid-volume of each fuel or vapour containing enclosure. In this case, the average of these temperature readings shall constitute the fuel and vapour temperatures.

4.3.5.3 Throughout the evaporative emission measurements, temperatures shall be recorded or entered into a data processing system at a frequency of at least once per minute.

4.3.5.4 The accuracy of the temperature recording system shall be within ±1,7 K and capable of resolving to 0,4 K.

4.3.5.5 The recording or data processing system shall be capable of resolving time to ±15 s.

4.3.6 Fans

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

4.3.6.2 The enclosure shall have one or more fans or blowers of likely capacity 0,1 to 0,5 m^3/s with which to thoroughly mix the atmosphere in the enclosure. It shall be possible to attain an even temperature and hydrocarbon concentration in the enclosure during measurements. The motorcycle in the enclosure shall not be subjected to a direct stream of air from the fans or blowers.

4.3.7 Gases

4.3.7.1 The following pure gases shall be available for calibration and operation:

a) purified synthetic air (purity: <1 ppm C_1 equivalent, ≤1 ppm CO, ≤400 ppm CO_2, ≤0,1 ppm NO); oxygen content between 18 % and 21 % by volume;

b) hydrocarbon analyser fuel gas (40 % ± 2 % hydrogen, and balance helium with less than 1 ppm C_1 equivalent hydrocarbon, less than 400 ppm CO_2);

c) propane (C_3H_8): 99,5 % minimum purity.

4.3.7.2 Calibration and span gases shall be available containing mixtures of propane (C_3H_8) and purified synthetic air. The true concentrations of a calibration gas shall be within ±2 % of the stated figures. The accuracy of the diluted gases obtained when using a gas divider shall be to within ±2 % of

