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Mopeds — Measurement methods for gaseous exhaust emissions during inspection or maintenance

Mopeds — Méthode de mesure des émissions gazeuses au cours des inspections ou de la maintenance

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International Organization for Standardization

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

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The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 38, *Motorcycles and mopeds*.

Introduction

This International Standard specifies methods for the direct measurement of the concentration of gaseous exhaust emissions from mopeds during inspections, official roadside checks or maintenance. Although ISO 3929 specifies methods for the direct measurement of the concentration of gaseous exhaust emissions from road vehicles, this International Standard is the adaptation of ISO 3929 to comply with needs specific to mopeds.

Mopeds — Measurement methods for gaseous exhaust emissions during inspection or maintenance

1 Scope

This International Standard specifies methods for the direct measurement of the concentration of gaseous exhaust emissions from mopeds as defined in ISO 3833 during inspection or maintenance. The results measured by this International Standard show the concentration of gaseous exhaust emissions in the no-load engine operating condition. It is applicable to mopeds having spark ignition engines (four-stroke engines or two-stroke engines). These methods can be used, either totally or partially, for

— periodic inspections in official garages,

— official roadside checks, and

— maintenance and diagnostic operations.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/PAS 3930[1)], *Instruments for measuring vehicle exhaust emissions — Metrological and technical requirements; Metrological control and performance tests*

3 Terms and definitions

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

3.1
idling condition
no-load operating condition of engine warmed up in accordance with 7.1 with

— no manual operation with fuel system controls (throttle, choke, etc.),

— the gear in neutral, and the manual clutch engaged for mopeds with the manual transmission,

— the parking condition for mopeds with the automatic transmission, and

— standard production equipment, accessories and optional equipment that modify the engine speed used in accordance with the manufacturer's recommendations or regulatory requirements

Note 1 to entry: Automatically operated headlamps are standard production equipment. There is a possibility that headlamp operation influences the test results of gaseous exhaust emissions.

3.2
idling speed
engine speed (range) specified by the manufacturer under the idling condition.

4 Instrumentation

The instruments listed below shall be prepared:

1) Joint ISO/OIML (International Organization of Legal Metrology) document.

4.1 Analyser, in accordance with ISO/PAS 3930, suitable for the concentrations of gaseous exhaust emissions from the mopeds under test,

4.2 Surface temperature meter, with a measurement accuracy of at least ±2 K between 323 K and 373 K,

4.3 Pulse revolution counter, for measuring engine speed. The measurement accuracy shall be at least ±20 min^{-1} between 600 min^{-1} and 2 000 min^{-1}, and shall be at least ±50 min^{-1} between over 2 000 min^{-1} and 6 000 min^{-1}, and

4.4 Ambient temperature meter, with a measurement accuracy of at least ±2 K between 278 K and 313 K.

5 Check, maintenance periodicity and precautions for use of instruments

5.1 Check before use

The power supply to the instruments shall be in accordance with the manufacturer's specifications.

Check that the instruments are ready for testing in accordance with the manufacturer's operating instructions, or at least,

— at the beginning of tests of a day,

— when the ambient conditions have changed, or

— at the beginning of tests at each new test site in the case of official roadside checks.

For the analyser, the zero and span calibration check shall be performed with reference gases or using electronic or electromechanical methods (see ISO/PAS 3930).

5.2 Maintenance periodicity

All periodical checks shall be carried out in accordance with national regulations. If national regulations do not specify maintenance periodicity, those shall be carried out in accordance with manufacturer's instructions.

Maintenance shall be carried out in accordance with the manufacturer's instructions. Operations shall be recorded.

5.3 Precautions for use

The working area shall be firm, horizontal surface. Ambient conditions shall be in accordance with ISO/PAS 3930.

The working area shall not be directly exposed to

— rain, snow or sunlight,

— interfering vibration,

— a corrosive and/or polluted atmosphere that might influence the measurement results, or

— electromagnetic interference that might influence measurement results.

6 General moped verification

The exhaust system of the moped shall be leak-proof.

7 Normal conditioning of moped

7.1 Warming up

The moped shall be warmed up in accordance with manufacturer's specifications. If no warmed up condition is specified by the manufacturer, the moped shall be warmed up in accordance with following methods:

a) for mopeds equipped with four-stroke engines, the surface temperature of head of lubrication oil drain bolt shall be achieved between 328 K and 343 K by maintaining the engine speed between 3 000 min^{-1} and 6 000 min^{-1}. If the engine is over heated, the temperature may be adjusted with the external cooling fan under idling condition;

b) for mopeds equipped with two-stroke engines, the moped shall be warmed up by running at least 15 min or at least 5 km under normal urban traffic conditions.

In case where the automatic choke is still on at the end of the warming up procedure, attention shall be paid in order to extend the warming up procedure to bring the automatic choke to switch off.

7.2 Test conditions

The choke shall be non-operative or no longer operative.

The moped shall be located on a substantially horizontal site.

The sampling probe shall be inserted at least 600 mm into the exhaust outlet pipe. If the exhaust pipe shape does not allow such insertion, an extension exhaust pipe shall be provided.

In the case of plural exhaust pipes, these shall be connected into a single outlet unless specified otherwise by the manufacturer. If this type of connection is not practicable, the arithmetic average of the concentration values, measured at each outlet, shall be adopted. In any case, the exhaust adaptor used shall not influence engine running and measurement results.

8 Gaseous exhaust emissions and corrections

The gaseous exhaust emissions which are measured shall be in accordance with national requirements and the measured values shall be corrected in accordance with national requirements. Examples of correction methods are described in Annex B. For the case of no national requirement, the correction method in B.2 is recommended.

9 Measurement methods for gaseous exhaust emissions

9.1 Warm up the moped in accordance with 7.1 and keep the idling condition.

9.2 Equip the moped immediately with

— a revolution counter, and

— an extension exhaust pipe, if necessary.

9.3 Check that the engine speed measured at idling condition is within the manufacturer's specification range (i.e. idling speed). If the engine speed is different from idling speed, adjust the engine speed to idling speed. If it is not possible to meet the manufacture's specification, the measurement may be continued. The measured idling speed shall be described in the test report.

9.4 Select the highest analyser scale and put the analyser in measurement mode.

9.5 Insert the probe into the exhaust pipe or its extension.

9.6 Check that the appropriate scale has been selected and change if necessary.

9.7 After at least 15 s from insertion of the probe, carry out the measurements over sufficient time but not exceeding 30 s to obtain minimum and maximum values. Calculate the arithmetic mean of these two values.

9.8 If one step between 9.1 and 9.7 fails, repeat steps from 9.1 to 9.7.

9.9 If all test procedures are successfully completed, the measured maximum, measured minimum and arithmetic mean values of gaseous exhaust emissions shall be described in the test report in Annex A.

Annex A
(normative)

Presentation of results

A.1 Moped

Category: two wheeler/three wheeler (*delete as applicable*)

Tradename (-mark): _____

Model: _____

Engine model: _____

Cycle: two stroke/four stroke (*delete as applicable*)

Number and layout of cylinders: _____

Engine displacement: _____cm^3

Gear-box: manual/automatic (*delete as applicable*)

Secondary air system: with/without (*delete as applicable*)

Others, if there is any alternation: _____

A.2 Gaseous exhaust emissions analyser

Tradename (-mark): _____

Model: _____

A.3 Test conditions

Climate: _____

Test ambient temperature: _____K

Surface temperature of head of lubrication oil drain bolt (for four-stroke engine only): _____K

A.4 Measurement results

Idling speed specified by manufacturer: _____min^{-1}

Measured engine speed: _____min^{-1}

	Measured minimum value	Measured maximum value	Arithmetic mean value
CO[a]:	_____vol. %	_____vol. %	_____vol. %
HC[ab]:	_____vol. ppm	_____vol. ppm	_____vol. ppm

Only for an engine fitted with a secondary air system:

	Measured minimum value	Measured maximum value	Arithmetic mean value
CO[a]:	_____vol. %	_____vol. %	_____vol. %
CO_2[a]:	_____vol. %	_____vol. %	_____vol. %
HC[ab]:	_____vol. ppm	_____vol. ppm	_____vol. ppm

If measured values are corrected, the correction method: _____

	Corrected arithmetic mean value
CO[a]:	_____vol. %
HC[ab]:	_____vol. ppm

a Delete as applicable.

b n-hexane equivalent/methane equivalent (delete as applicable).

Annex B
(informative)

Examples of gaseous exhaust emissions correction method

B.1 General

Two kinds of gaseous exhaust emissions correction methods are specified by national bodies in countries. Two correction methods are introduced in this Annex for informative reason. Two methods are the gaseous exhaust emissions correction method for an engine fitted with a secondary air system for carbon monoxide and hydro carbon, and the gaseous exhaust emissions correction method for carbon monoxide.

B.2 Gaseous exhaust emissions correction method for an engine fitted with a secondary air system

For an engine fitted with a secondary air system, carbon monoxide and hydrocarbon emissions are corrected by Formulae (B.1) and (B.2), respectively,

$$c_{\mathrm{COcorr}} = c_{\mathrm{CO}} \times \frac{14,5}{a \times b \times c_{\mathrm{HC}} \times 10^{-4} + 0,5\, c_{\mathrm{CO}} + c_{\mathrm{CO_2}}} \tag{B.1}$$

$$c_{\mathrm{HCcorr}} = c_{\mathrm{HC}} \times \frac{14,5}{a \times b \times c_{\mathrm{HC}} \times 10^{-4} + 0,5\, c_{\mathrm{CO}} + c_{\mathrm{CO_2}}} \tag{B.2}$$

where

c_{CO} is the measured concentration of carbon monoxide, in vol. %;

$c_{\mathrm{CO_2}}$ is the measured concentration of carbon dioxide, in vol. %;

c_{COcorr} is the corrected concentration for carbon monoxide, in vol. %;

c_{HC} is the measured concentration of hydrocarbon, in vol. ppm;

c_{HCcorr} is the corrected concentration for hydrocarbon, in vol. ppm, expressed by methane CH_4 equivalent;

a is 1,8 when concentration of hydrocarbon is measured by NDIR (Non-Dispersion Infra Red), and a is 1 when the concentration of hydrocarbon is measured by FID (Flame Ionization Detector);

b is m when the concentration of hydrocarbon is expressed by ppm C_m (for example b is 6 for n-hexane C_6H_{14} equivalent or b is 1 for methane C_1H_4 equivalent).

B.3 Gaseous exhaust emissions correction method for carbon monoxide

The corrected concentration for carbon monoxide, c_{COcorr}, in percent volume is calculated by the Formulae (B.3) and (B.4):

a) for two-stroke engines;

$$c_{\mathrm{COcorr}} = 10 \times \frac{c_{\mathrm{CO}}}{c_{\mathrm{CO}} + c_{\mathrm{CO_2}}} \tag{B.3}$$

b) for four-stroke engines;

$$c_{\mathrm{COcorr}} = 15 \times \frac{c_{\mathrm{CO}}}{c_{\mathrm{CO}} + c_{\mathrm{CO_2}}} \tag{B.4}$$

The concentration of c_{CO} measured according to Clause 9 need not be corrected if the total of the concentrations measured $\left(c_{\mathrm{CO}} + c_{\mathrm{CO_2}}\right)$ is at least 10 for two-stroke engines and 15 for four-stroke engines.

Bibliography

[1] ISO 1176, *Road vehicles — Masses — Vocabulary and codes*

[2] ISO 3833, *Road vehicles — Types — Terms and definitions*

[3] ISO 3929, *Road vehicles — Measurement methods for exhaust gas emissions during inspection or maintenance*

[4] Council Directive 92/55/EEC of 22 June 1992 amending Directive 77/143/EEC on the approximation of the laws of the Member States relating to roadworthiness tests for motor vehicles and their trailers (exhaust emissions)

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