
**Motorcycles — Measurement methods
for gaseous exhaust emissions during
inspection or maintenance**

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

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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. www.iso.org/directives

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

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Introduction

This International Standard specifies methods for the direct measurement of the concentration of gaseous exhaust emissions from motorcycles 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 motorcycles.

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Motorcycles — 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 motorcycles 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 motorcycles having spark ignition engines (four-stroke engines or two-stroke engines). This 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 referenced documents are indispensable for the application 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/PAS 3930/OIML R99¹⁾, *Instruments for measuring vehicle exhaust emissions*

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 motorcycles with the manual transmission; the parking condition for motorcycles 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:

4.1 Analyser, in accordance with ISO/PAS 3930/OIML R99, suitable for the concentrations of gaseous exhaust emissions from the motorcycles under test.

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

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.

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/OIML R99).

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 a firm, horizontal surface. Ambient conditions shall be in accordance with ISO/PAS 3930/OIML R99.

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 motorcycle verification

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

7 Normal conditioning of motorcycle

7.1 Warming up

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

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

In cases 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 motorcycle 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 motorcycle in accordance with [7.1](#) and keep the idling condition.

9.2 Equip the motorcycle 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](#).

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Annex A
(normative)

Presentation of results

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A.1 Motorcycle

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: cm³

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. %

CO₂^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).

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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 reasons. The two methods are the gaseous exhaust emissions correction method for an engine fitted with a secondary air system for carbon monoxide and hydrocarbon, 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 Formula (B.1) and Formula (B.2), respectively,

$$c_{\text{COcorr}} = c_{\text{CO}} \times \frac{14,5}{a \times b \times c_{\text{HC}} \times 10^{-4} + 0,5 c_{\text{CO}} + c_{\text{CO2}}} \quad (\text{B.1})$$

$$c_{\text{HCcorr}} = c_{\text{HC}} \times \frac{14,5}{a \times b \times c_{\text{HC}} \times 10^{-4} + 0,5 c_{\text{CO}} + c_{\text{CO2}}} \quad (\text{B.2})$$

where

c_{CO}	is the measured concentration of carbon monoxide, in vol. %;
c_{CO2}	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 following formulae:

a) for two-stroke engines;

$$c_{\text{COcorr}} = 10 \times \frac{c_{\text{CO}}}{c_{\text{CO}} + c_{\text{CO2}}} \quad (\text{B.3})$$