
**Road vehicles — Measurement methods
for exhaust gas emissions during
inspection or maintenance**

*Véhicules routiers — Méthodes de mesure des émissions gazeuses au
cours des inspections ou de la maintenance*

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Published in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 3929 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 5, *Engine tests*.

This third edition cancels and replaces the second edition (ISO 3929:1995), which has been technically revised.

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Road vehicles — Measurement methods for exhaust gas emissions during inspection or maintenance

1 Scope

This International Standard specifies methods for the direct measurement of the concentration of exhaust gas emissions from road vehicles during inspection or maintenance. It is applicable to vehicles having a maximum authorized total mass (ISO-M08, as defined in ISO 1176) not exceeding 3,5 t, equipped with controlled ignition engines, but excluding those supplied with a fuel/oil mixture (with or without automatic mixer). The methods can be used, either totally or partially, for

- periodic inspections in official garages,
- official roadside checks (e.g. by police), 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 3930/OIML R 99¹⁾, *Instruments for measuring vehicle exhaust emissions*

ISO 16247²⁾, *Road vehicles — Detection of exhaust system leaks — Helium test method and detection device specification*

3 Terms and definitions

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

3.1

idle speed rotational frequency

engine rotational frequency with

- fuel system controls (accelerator, choke, etc.) non-operative,
- the gearshift lever in neutral and the clutch engaged for vehicles with manually operated or semi-automatic transmission,
- the gear selector in neutral or park for vehicles with automatic transmission, and
- accessories and optional equipment that modify the rotational frequency used in accordance with the manufacturer's recommendations or regulatory requirements

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

2) To be published.

- 3.2 accelerated idle speed rotational frequency**
engine rotational frequency specified by the manufacturer or regulatory requirements with
- fuel system controls (accelerator, choke, etc.) in the position to run at accelerated idle,
 - the gearshift lever in neutral and the clutch engaged for vehicles with manually operated or semi-automatic transmission,
 - the gear selector in neutral or park for vehicles with automatic transmission, and
 - accessories and optional equipment that modify the rotational frequency used in accordance with the manufacturer's recommendations or regulatory requirements

- 3.3 exhaust emission treatment system**
additional device intended to reduce the exhaust emission level

4 Instrumentation

- 4.1 Analyser** in accordance with ISO 3930/OIML R 99, suitable for the concentrations of exhaust gas emission from the vehicle under test.
- 4.2 Engine oil temperature meter** in the sump or lubricant reservoir with a measurement accuracy of at least ± 2 K between 343 K and 373 K. Readings outside this range shall also be possible.
- 4.3 Pulse revolution counter** for measuring engine rotational frequency. Under control conditions the measurement accuracy shall be at least ± 20 min⁻¹ between 600 min⁻¹ and 1 000 min⁻¹, and ± 50 min⁻¹ outside this range.
- 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 conform to the manufacturer's specifications.

Check that the instruments are ready for testing according to the manufacturer's operating instructions given in the owner's handbook or, at least,

- at the beginning of a day of tests,
- when the ambient conditions have changed, or
- at the beginning of the tests at each new test site, in the case of official roadside checks.

For the analyser, perform the zero and span calibration check with reference gases or using electronic or electromechanical methods (see ISO 3930/OIML R 99).

5.2 Maintenance periodicity

All periodical checks shall be carried out in accordance with national regulations.

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 3930/OIML R 99.

The working area shall not be directly exposed to

- rain, snow or sunlight,
- interfering vibration,
- a corrosive and/or polluted atmosphere which might influence the measurement results, or
- electromagnetic interference that might influence measurement results.

6 General vehicle verification

The exhaust system of the vehicle shall be leak-proof. Verify this condition in accordance with ISO 16247 or by sealing the exhaust pipe outlet while the engine is idling. No significant leakage of exhaust gases from pipe connections shall be found.

All accessories and optional equipment that modify the rotational frequency to the required different speeds shall be used in accordance with the manufacturer's recommendations or regulatory requirements.

7 Normal conditioning of vehicle

7.1 Warming up

The engine shall have attained normal thermal conditions, i.e. the temperature attained by the engine and its drive-line after running at least 15 min under normal urban traffic conditions over a minimum of 5 km or in accordance with manufacturer's specifications. A minimum lubricant temperature of 353 K in the sump or the lubricant reservoir shall be achieved.

7.2 Test conditions

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

The air inlet ductwork shall be positioned in accordance with the manufacturer's instructions.

The oil sump dipstick hole shall be blocked during exhaust gas emission measurements.

The vehicle shall be located on a substantially horizontal site.

The sampling probe shall be inserted at least 300 mm into the exhaust outlet pipe. If the exhaust pipe shape does not allow such insertion, an exhaust extension pipe shall be provided.

In the case of several exhaust pipes, these shall be connected in 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 used. In all cases, the device exhaust adaptor used shall not influence engine running.

Any disconnectable fan shall be stationary.

8 Measured value corrections

For an engine fitted with a secondary air injection system, CO and HC emission measurements shall be corrected in accordance with national requirements.

9 Measurement methods for exhaust gas emission

9.1 Vehicles without exhaust emission treatment systems or with non-controlled exhaust emission treatment systems

See Table 1.

9.2 Vehicles with controlled exhaust emission treatment systems (checking in the context of Directive 92/55/EEC^[2])

See Table 2.

Table 1 — Vehicles without exhaust emission treatment systems or with non-controlled exhaust emission treatment system

Step	Operations	Time lapse			
1	Warm up the vehicle in accordance with 7.1.	See 7.1			
2	Equip the vehicle with — a revolution counter (see 4.3); — a lubricant temperature meter (see 4.2), and — an exhaust extension pipe, if necessary. Select the highest analyser scale (see 4.1).	—	—	≤ 4 min	≤ 6 min
3	Warm up the motor in accordance with the manufacturer's specifications or at $3\ 000\ \text{min}^{-1} \pm 100\ \text{min}^{-1}$, then go to idle speed.	60 s	15 s		
4	Put the analyser in measurement mode.	10 s			
5	Insert the probe into the exhaust pipe or its extension.				
6	Check that the appropriate scale has been selected and change if necessary.	≤ 30 s	—		
7	Over sufficient time, but not exceeding 30 s, carry out the measurements to obtain minimum and maximum values. Calculate the arithmetic mean of these two values. If the result is printed, print the mean value.		—	—	
8	If one step fails, repeat steps 3 to 7.	—	—	—	—

Table 2 — Vehicles with controlled exhaust emission treatment systems

Step	Operations	Time lapse		
1	Warm up the vehicle in accordance with 7.1.	See 7.1		
2	Equip the vehicle with — a revolution counter (see 4.3), — a lubricant temperature meter (see 4.2), and — an exhaust extension pipe, if necessary. Select the highest analyser scale (see 4.1).	—	≤ 4 min	≤ 6 min
3	Condition the motor in accordance with the manufacturer's specifications or at $3\,000\text{ min}^{-1} \pm 100\text{ min}^{-1}$, then go to the accelerated idle speed, which shall be at least equal to $2\,000\text{ min}^{-1}$.	60 s		
4	Put the analyser in measurement mode.	10 s		
5	Insert the probe into the exhaust pipe or its extension.	40 s		
6	Check that the appropriate scale has been selected and change if necessary.			
7	Over sufficient time but not exceeding 30 s, carry out the measurements to obtain minimum and maximum values. Calculate the arithmetic mean of these two values. If the result is printed, print the mean value.			
8	If one step fails or if the result is greater than the specified limit values, repeat steps 3 to 7.		—	
9	Go to idle speed.	—	≤ 2 min	—
10	Check that the appropriate scale has been selected and change if necessary.			
11	Over sufficient time but not exceeding 30 s, carry out the measurements to obtain minimum and maximum values. Calculate the arithmetic mean of these two values. If the result is printed, print the mean value obtained in phase 7 and phase 11.	40 s		
12	If one step fails, repeat steps 3, 9, 10 and 11.			