
**Road vehicles — Engine test code —
Gross power**

Véhicules routiers — Code d'essai des moteurs — Puissance brute

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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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 34, *Propulsion, powertrain and powertrain fluids*.

This third edition cancels and replaces the second edition (ISO 2534:1998), which has been technically revised. The main changes compared to the previous edition are as follows:

- a requirement for exhaust particulate filter restriction has been added;
- a requirement for engine cooling active thermal management system settings has been added;
- a power correction factor for turbocharged engines with a system compensating the ambient conditions has been added.

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.

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Road vehicles — Engine test code — Gross power

1 Scope

This document specifies a method for testing internal combustion engines for propulsion of road vehicles as defined in ISO 3833. It applies to the evaluation of their performance with a view, in particular, to presenting curves of power and specific fuel consumption at full load as a function of engine speed.

This document is applicable to gross power assessment.

This document concerns internal combustion engines used for propulsion of passenger cars, trucks and other motor vehicles, excluding motorcycles, mopeds and agricultural tractors normally travelling on roads, and included in one of the following categories:

- reciprocating internal combustion engines (spark-ignition or compression-ignition) but excluding free piston engines;
- rotary piston engines.

These engines can be naturally aspirated or pressure charged, either using a mechanical supercharger or turbocharger.

This document is primarily intended for the communication between the engine manufacturer and the manufacturer of the vehicle. If used for advertising purposes, the ratings will clearly state that they are gross power in accordance with 9.2.

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 2710-1, *Reciprocating internal combustion engines — Vocabulary — Part 1: Terms for engine design and operation*

ISO 7876-1, *Fuel injection equipment — Vocabulary — Part 1: Fuel injection pumps*

ISO 7967-1, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 1: Structure and external covers*

ISO 7967-2, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 2: Main running gear*

ISO 7967-3, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 3: Valves, camshaft drives and actuating mechanisms*

ISO 7967-4, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 4: Pressure charging and air/exhaust gas ducting systems*

ISO 7967-5, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 5: Cooling systems*

ISO 7967-8, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 8: Starting systems*

ISO 11614, *Reciprocating internal combustion compression-ignition engines — Apparatus for measurement of the opacity and for determination of the light absorption coefficient of exhaust gas*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2710-1, ISO 7876-1, ISO 7967-1, ISO 7967-2, ISO 7967-3, ISO 7967-4, ISO 7967-5 and ISO 7967-8 and the following definitions apply.

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

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 gross power
power obtained on a test bed at the end of the crankshaft or its equivalent at the corresponding engine speed with the equipment and auxiliaries listed in [Table 1](#)

Note 1 to entry: If the power measurement can only be carried out with a mounted gearbox, the losses in the gearbox should be added to the measured power to give the engine power.

3.2 standard production equipment
any equipment provided by the manufacturer for a particular engine application

4 Accuracy of measuring equipment and instruments

4.1 Torque
The dynamometer torque-measuring system shall have an accuracy within ± 1 % in the range of scale values required for the test.

4.2 Engine speed (rotational frequency)
The engine speed (rotational frequency) measuring system shall have an accuracy of $\pm 0,5$ %.

4.3 Fuel flow
The fuel flow measuring system shall have an accuracy of ± 1 %.

4.4 Fuel temperature
The fuel temperature measuring system shall have an accuracy of ± 2 K.

4.5 Air temperature
The air temperature measuring system shall have an accuracy of ± 1 K.

4.6 Barometric pressure
The barometric pressure measuring system shall have an accuracy of ± 100 Pa.

NOTE 1 Pa = 1 N/m².

4.7 Back pressure in exhaust system

The system used to measure the back pressure in the exhaust system shall have an accuracy of ± 200 Pa. The measurement shall be made subject to footnote b of [Table 1](#).

4.8 Depression in inlet system

The system used to measure the depression in the inlet system shall have an accuracy of ± 50 Pa. The measurement shall be made subject to footnote a of [Table 1](#).

4.9 Absolute pressure in inlet duct

The system used to measure the absolute pressure in the inlet duct shall have an accuracy of ± 2 % of the measured pressure.

Table 1 — Installation of equipment and auxiliaries during test

No.	Equipment and auxiliaries	Fitted for gross power test
1	Inlet system Inlet manifold Crankcase emission control system Control devices for dual induction inlet manifold system Air flow meter Air inlet ductwork ^a Air filter ^a Inlet silencer ^a Speed-limiting device ^a	Yes, standard production equipment Optional Yes, standard production equipment Yes, standard production equipment Optional No
2	Induction heating device of inlet manifold	Yes, standard production equipment If possible, to be set in the most favourable position
3	Exhaust system Exhaust purifier (s) ^b Exhaust manifold Pressure-charging devices Connecting pipes ^c Silencer ^b Tail pipe ^b Exhaust brake ^d	Yes, standard production equipment Optional, may use minimum loss bench system No
4	Fuel supply pump ^e	Yes, standard production equipment
5	Carburation equipment Carburettor Electronic control system, air-flow meter, etc. (if fitted) Equipment for gaseous fuel engines Pressure reducer Evaporator Mixer	Yes, standard production equipment
6	Fuel injection equipment [spark-ignition and compression ignition (diesel)] Prefilter	Optional

Table 1 (continued)

No.	Equipment and auxiliaries	Fitted for gross power test
	Filter Pump High-pressure pipe Injector Air inlet valve (if fitted) ^f Electronic control system, etc. (if fitted) Governor/control system: automatic full-load stop for the control depending on atmospheric conditions	Optional Yes, standard production equipment
7	Liquid cooling equipment Radiator Fan ^g Fan cowl Water pump Thermostat or thermal management system ⁱ	No Yes, standard production equipment Optional
8	Air cooling Cowl Fan or blower ^g Temperature regulating device	No
9	Electrical or electronic equipment Generator/alternator ^j Spark distribution system Coil(s) Wiring Spark plugs Electronic control system including knock sensor/spark retard system ^m	Yes, standard production equipment
10	Pressure-charging equipment (if fitted) Compressor driven either directly by the engine, and/or by the exhaust gases Boost control ⁿ Charge-air-cooler ^{g,h,k} Coolant pump or fan (engine driven) Coolant flow control devices (if fitted)	Yes, standard production equipment
11	Auxiliary test bed fan	Yes, if necessary
12	Anti-pollution devices ^l	Yes, standard production equipment

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Table 1 (continued)

No.	Equipment and auxiliaries	Fitted for gross power test
a	Except when there is a risk of the system having a noticeable influence upon engine power, an equivalent system may be used. In this case, a check should be made to ascertain that inlet depression does not differ by more than 100 Pa from the limit specified by the manufacturer for a clean air filter.	
b	For the case of an exhaust filter, the restriction shall represent the clean state.	
c	Except when there is a risk of the system having a noticeable influence upon engine power, an equivalent system may be used. In this case, a check should be made to ascertain that the back pressure in the engine exhaust system does not differ by more than 1 000 Pa from that specified by the manufacturer. However, a minimum loss system may be used.	
d	If an exhaust brake is incorporated in the engine, the throttle valve shall be fixed fully open.	
e	The fuel feed pressure may be adjusted, if necessary, to reproduce the inlet pump pressure conditions consistent with the particular engine application (particularly where a "fuel return" system, e.g. to tank or filter, is used).	
f	The air inlet valve is the control valve for the pneumatic governor of the injection pump. The governor of the fuel injection equipment may contain other devices which may affect the amount of fuel injected.	
g	When the cooling fan or blower is a fixed type, that is neither disconnectable nor progressive, and is fitted for the test, then the power absorbed shall be added to the test results. The fan or blower power shall be determined at the speeds corresponding to the engine speeds used for the measurement of engine power either by calculation from standard characteristics or by practical tests.	
h	Where a separate disconnectable or progressive fan or blower, the test shall be made with the disconnectable fan or blower disconnected or with the progressive fan running at the maximum slip.	
i	The thermostat may be fixed in the fully open position. For the case of an active thermal management system, control settings shall be representative of full load operation.	
j	Minimum power of the generator/alternator: the power of the generator/alternator shall be limited to that necessary for the operation of accessories which are indispensable for engine operation. If the connection of a battery if necessary, a fully charged battery in good order shall be used.	
k	Charge-air-cooled engines shall be tested complete with charge-air-cooling whether liquid or air-cooled but if the engine manufacturer prefers, a test bed system may replace the air-cooled cooler. In either case the measurement of power at each speed shall be made with the pressure drop and temperature drop of the engine air across the charge air cooler in the test bed the same as those specified by the manufacturer for the system on the complete vehicle.	
	If a test bed system is used on a compression-ignition engine without a wastegate, or with the wastegate not operating the correction factor given in 6.3.2.1 b) is to be used. If a wastegate is both fitted and operating, then the correction factor in 6.3.2.1 a) is to be used.	
l	They may include for example EGR system, catalytic converter, particulate filter, thermal reactor, secondary air supply system and fuel evaporating protecting system.	
m	The spark advance shall be representative of in-use conditions established with the minimum octane fuel recommended by the manufacturer.	
n	For engines equipped with variable boost as a function of charge or inlet air temperature, octane rating and/or engine speed, the boost pressure shall be representative of in-vehicle conditions established with the minimum octane fuel as recommended by the manufacturer.	

5 Tests

5.1 Auxiliaries

5.1.1 Auxiliaries to be fitted

During the test, auxiliaries necessary to make engine acceptable for service in the intended application (as listed in Table 1) shall be installed on the test bed as far as possible in the same position as in the intended application.

5.1.2 Auxiliaries to be removed

Certain vehicle accessories necessary only for the operation of the vehicle, and which may be mounted on the engine, shall be removed for the test. The following non-exhaustive list is given as an example:

- air compressor for brakes;
- power-steering pump;
- suspension compressor;
- air-conditioning system compressor.

Where accessories cannot be removed, the power absorbed by them in the unloaded condition may be determined and added to the measured engine power.

5.1.3 Compression-ignition engine starting auxiliaries

For auxiliaries used to start compression-ignition engines, the two following cases shall be considered:

- a) electrical starting: the generator/alternator is fitted and supplies, where necessary, electricity to the accessories indispensable to the operation of the engine;
- b) starting other than electrical: if there are any electrically operated accessories indispensable to the operation of the engine, the generator/alternator is fitted to supply these accessories; otherwise, it is removed.

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In either case, the system for producing and accumulating the energy necessary for starting is fitted and operates in the unloaded condition. standards.iteh.ai

5.2 Setting conditions

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The setting conditions for the test for determination of gross power are indicated in [Table 2](#).

Table 2 — Setting conditions

1	Setting of fuel delivery system	In accordance with the manufacturer's production specifications and used without further alteration for the particular application
2	Setting of injection pump delivery system	
3	Ignition or injection timing (timing curve)	
4	Governor setting	
5	Anti-pollution devices	
6	Boost control	

5.3 Test conditions

5.3.1 The gross power test shall consist of a run at full throttle for spark-ignition engines and at the fixed full-load fuel injection pump setting for compression-ignition engines, the engine being equipped as specified in [Table 1](#).

5.3.2 Performance data shall be obtained under stabilized operating conditions, with an adequate fresh air supply to the engine.

Engines shall have been run-in, started and warmed up in accordance with the manufacturer's recommendations. Combustion chambers may contain deposits, but in limited quantity. Test conditions such as inlet air temperature shall be selected as near to reference conditions (see [6.2](#)) as possible in order to minimise the correction factor.