

Road vehicles — Engine test code — Gross power

ICS 43.060.01

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee MCE/22, Engines for road vehicles, which has the responsibility to:

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- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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Cross-references

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the ISO title page, page ii, pages 1 to 28 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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INTERNATIONAL STANDARD

**ISO
2534**

Second edition
1998-08-15

Road vehicles — Engine test code — Gross power

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



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.

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.

International Standard ISO 2534 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 5, *Engine tests*.

This second edition cancels and replaces the first edition (ISO 2534:1974), of which it constitutes a technical revision.

NOTE This International Standard is consistent with ISO 1585:1992, Road vehicles — Engine test code — Net power.

Descriptors: Road vehicles, motor vehicles, internal combustion engines, tests, determination, gross power, mechanical power measurement.

1 Scope

This International Standard specifies a method for testing internal combustion engines for propulsion of road vehicles as defined in ISO 3833. It is applicable 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 International Standard is applicable to gross power assessment.

This International Standard 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 may be naturally aspirated or pressure-charged, either using a mechanical supercharger or turbocharger.

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

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of the publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on the International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

ISO 3104:1994, *Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity*.

ISO 3173:1974, *Road vehicles — Apparatus for measurement of the opacity of exhaust gas from diesel engines operating under steady state conditions*.

ISO 3675:1998, *Crude petroleum and liquid petroleum products — Laboratory determination of density — Hydrometer method*.

ISO 3833:1977, *Road vehicles — Types — Terms and definitions*.

ISO 5163:1990, *Motor and aviation-type fuels — Determination of knock characteristics — Motor method*.

ISO 5164:1990, *Motor fuels — Determination of knock characteristics — Research method*.

ISO 5165:1998, *Petroleum products — Determination of the ignition quality of diesel fuels — Cetane engine method*.

ISO 7876-1:1990, *Fuel injection equipment — Vocabulary — Part 1: Fuel injection pumps*.

ISO 7967-1:1987, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 1: Structure and external covers*.

ISO 7967-2:1987, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 2: Main running gear*.

ISO 7967-3:1987, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 3: Valves, camshaft drive and actuating mechanisms*.

ISO 7967-4:1988, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 4: Pressure charging and air/exhaust gas ducting systems*.

ISO 7967-5:1992, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 5: Cooling systems*.

¹⁾ To be published. (Revision of ISO 2710:1978)

ISO 7967-8:1994, *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 gas²⁾*.

ASTM D 240-92e1, *Standard test method for heat of combustion of liquid hydrocarbon fuels by bomb calorimeter*.

ASTM D 3338-95, *Standard test method for estimation of net heat of combustion of aviation fuels*.

3 Definitions

For the purposes of this International Standard, the 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.

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 If the power measurement can only be carried out with a mounted gear-box, the losses in the gear-box 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 $\pm 1\%$ 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 $\pm 1\%$.

4.4 Fuel temperature

The fuel temperature measuring system shall have an accuracy of $\pm 2\text{ K}$.

4.5 Air temperature

The air temperature measuring system shall have an accuracy of $\pm 2\text{ K}$.

4.6 Barometric pressure

The barometric pressure measuring system shall have an accuracy of $\pm 100\text{ Pa}$ ³⁾.

4.7 Back pressure in exhaust system

Subject to footnote b of Table 1, the system used to measure the back pressure in the exhaust system shall have an accuracy of $\pm 200\text{ Pa}$.

4.8 Depression in inlet system

Subject to footnote a of Table 1, the system used to measure the depression in the inlet system shall have an accuracy of $\pm 50\text{ Pa}$.

4.9 Absolute pressure in inlet duct

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

²⁾ To be published. (Revision of ISO 3173:1974 and ISO/TR 4011:1976)

³⁾ $1\text{ Pa} = 1\text{ N/m}^2$

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 Exhaust manifold Pressure-charging devices Connecting pipes ^b Silencer ^b Tail pipe ^b Exhaust brake ^c	Yes, standard production equipment Optional, may use minimum loss bench system No
4	Fuel supply pump ^d	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 Filter Pump High-pressure pipe Injector Air inlet valve (if fitted) ^e Electronic control system, etc. (if fitted) Governor/control system: automatic full-load stop for the control depending on atmospheric conditions	Optional Optional Yes, standard production equipment

Table 1 — Installation of equipment and auxiliaries during test

No.	Equipment and auxiliaries	Fitted for gross power test
7	Liquid cooling equipment Radiator Fan ^f Fan cowl Water pump Thermostat ^h	No Yes, standard production equipment Optional
8	Air cooling Cowl Fan or blower ^f Temperature regulating device	No
9	Electrical or electronic equipment Generator ⁱ Spark distribution system Coil(s) Wiring Spark-plugs Electronic control system including knock sensor/spark retard system ^l	Yes, standard production equipment

Table 1 — Installation of equipment and auxiliaries during test

No.	Equipment and auxiliaries	Fitted for gross power test
10	Pressure-charging equipment (if fitted) Compressor driven either directly by the engine, and/or by the exhaust gases Boost control ^m Charge-air-cooler ^{figi} Coolant pump of ran (engine-driven) Coolant flow control devices (if fitted)	Yes, standard production equipment
11	Auxiliary test bed fan	Yes, if necessary
12	Anti-pollution devices ^k	Yes, standard production equipment

^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 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.

^c If an exhaust brake is incorporated in the engine, the throttle valve shall be fixed fully open.

^d 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)

^e 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.

^f 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.

^g 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.

^h The thermostat may be fixed in the fully open position

ⁱ Minimum power of the generator; the power of the generator 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.

^j 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 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 is 6.3.2.1 a) is to be used.

^k They may include for example EGR system, catalytic converter, thermal reactor, secondary air supply system and fuel evaporating protecting system.

^l The spark advance shall be representative of in-use conditions established with the minimum octane fuel recommended by the manufacturer.

^m 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.