



DRAFT INTERNATIONAL STANDARD ISO/DIS 1585.2

ISO/TC 22/SC 5

Secretariat: **AFNOR**

Voting begins on:
2008-08-22

Voting terminates on:
2008-10-22

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Road vehicles — Engine test code — Net power

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

[Revision of third edition (ISO 1585:1992)]

ICS 43.060.01

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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 1585 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 5, *Engine tests*.

This fourth edition cancels and replaces the third edition of which it constitutes a technical revision.

NOTE This international standard is also the basis for ISO 2534: 1974, *Road vehicles – Engine test code – Gross power*, provides a similar test code for gross power.

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Introduction

The users of this standard are informed that tests conducted outside of the Range of Authority (ROA) of the Engine Control Module (ECM) are primarily made for the Conformity of Production (COP). The test and correction factors to be used are agreed between parties.

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Road vehicles — Engine test code — Net power

1 Scope

This International Standard specifies a method for testing engines designed for automotive vehicles. 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.

It applies only to net power assessment¹⁾.

This International Standard concerns internal combustion engines used for propulsion of passenger cars and other motor vehicles, excluding motorcycles, mopeds and agricultural tractors (see the note in the foreword), 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.

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NOTE The users of this standard are informed that tests made outside of the Range of Authority (ROA) of the Engine Control Module (ECM) are primarily made for the conformity of Production (COP) and the test and correction factors to be used are agreed between parties.

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 2710: 1978, *Reciprocating internal combustion engines – Vocabulary*.

ISO 3104: 1976, *Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity*.

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

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*.

1) The net power assessment obtained according to this Standard, are not to be considered equivalent to transient power developed by SAE J1349.

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ISO 5165: 1992, *Diesel fuels – Determination of ignition quality – Cetane method.*

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 – 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.*

ISO 7967-8: 1990, *Reciprocating internal combustion engines – Vocabulary of components and systems – Part 8: Starting systems.*

ISO 11614: 1999, *Reciprocating internal combustion compression-ignition engines - Apparatus for measurement of the opacity and for determination of the light absorption coefficient of exhaust gas.*

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

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

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3 Terms and definitions

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For the purposes of this document, the terms and definitions given in ISO 2710, 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 engine parameter
any parameter considered by the engine manufacturer to influence the peak power and/or torque ratings or curves, for example, the fuel quality, boost pressure, spark advance, etc.

3.2 net power
power obtained on a test bed at the end of the crankshaft or its equivalent²⁾ at the corresponding engine speed with the equipment and auxiliaries listed in table 1.

3.3 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.

2) 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 (see table 1, number 13).

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 ± 2 K.

4.6 Barometric pressure

The barometric pressure measuring system shall have an accuracy of ± 100 Pa³⁾

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 a2 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 a1 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.

3) 1 Pa = 1 N/m²

Table 1 — Installation of equipment and auxiliaries during test

No	Auxiliaries	Fitted for net power test
1	<p>Inlet system</p> <ul style="list-style-type: none"> Inlet manifold Crankcase emission control system Control devices for dual induction inlet manifold system Air flow meter Air inlet ductwork ^{a1} Air filter ^{a1} Inlet silencer ^{a1} Speed-limiting device ^{a1} 	Yes, standard production equipment
2	Induction heating device of inlet manifold	Yes, standard production equipment. If possible, to be set in the most favourable position.
3	<p>Exhaust system</p> <ul style="list-style-type: none"> Exhaust purifier Exhaust manifold Pressure-charging devices Connecting pipes ^{a2} Silencer ^{a2} Tail pipe ^{a2} Exhaust brake^b 	Yes, standard production equipment
4	Fuel supply pump ^c	Yes, standard production equipment
5	<p>Fuel supply equipment</p> <p>Carburation equipment (if fitted)</p> <ul style="list-style-type: none"> Carburettor Electronic control system, air-flow meter, etc. (if fitted) Equipment for gaseous fuel engines Pressure reducer Evaporator Mixer 	Yes, standard production equipment
	<p>Fuel injection equipment [Spark-ignition and compression-ignition (diesel)]</p> <ul style="list-style-type: none"> Prefilter Filter Pump High-pressure pipe Injector Air inlet valve (if fitted)^d Electronic control system, etc. (if fitted) Governor/control system – automatic full-load stop for the control depending on atmospheric conditions 	Yes, standard production equipment

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No	Auxiliaries	Fitted for net power test
6	Liquid cooling equipment Radiator Fan ^{e, f} Fan cowl Water pump Thermostat ^g	Yes, ^{e)} standard production equipment
7	Air cooling Cowl Fan or blower ^{e, f} Temperature regulating device	Yes, standard production equipment
8	Electrical or electronic ignition equipment Generator ^h Spark distribution system Coil or coils Wiring Spark-plugs Electronic control system including knock sensor/spark-retard system ^k	Yes, standard production equipment
9	Pressure-charging equipment (if fitted) Compressor driven either directly by the engine, and/or by the exhaust gases Boost control ^l Charge-air-cooler ^{e, f, i} Coolant pump or fan (engine-driven) Coolant flow control devices (if fitted)	Yes, standard production equipment
10	Auxiliary test bed fan	Yes, if necessary
11	Anti-pollution devices ^j	Yes, standard production equipment
12	Lube oil pan Lube oil level	Yes, standard production equipment Yes, standard production fill The fully equipped engine closed loop lubrication system shall be fitted. The production oil pan is mandatory. Oil fill shall be at the manufacturer's recommended full level as marked on the oil indicator. Oil temperatures shall reflect the in-service temperatures indicative of ambient conditions.
13	Transmission	Not required, nor recommended. If fitted for the test, the correction of the engine power and torque are permitted to account for the transmission losses. If such a correction is performed, the supporting test data for the correction values shall be supplied and accepted by all parties involved
14	Auxiliaries Power steering pump	Recommended. If all vehicles for the engine are equipped with power steering, it is recommended that the in-service fully operational pump should be fitted for the test. The pump may be set for a minimum parasitic

	Air Conditioning compressor	loss. Recommended. If all vehicles for the engine are equipped with cabin air conditioning, it is recommended that the in-service air conditioning compressor be fitted for the test. The compressor clutch may be disengaged."
<p>^{a1} Except in the case where 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. Air inlet ductwork begins at the point where air enters from the atmosphere and ends where the air enters the engine assembly at the throttle body, inlet manifold, or turbocharger, as appropriate. If part of this ductwork, the air cleaner and tuning devices shall be fitted</p> <p>^{a2} Except in the case where 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.</p> <p>^b If an exhaust brake is incorporated in the engine, the throttle valve shall be fixed fully open.</p> <p>^c 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).</p> <p>^d 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.</p> <p>^e The radiator, fan, fan cowl, water pump and thermostat shall be located on the test bed in the same relative positions that they will occupy on the vehicle. The cooling liquid circulation shall be operated by the engine water pump only.</p> <p>Cooling of the liquid may be produced either by the engine radiator or by an external circuit, provided that the pressure loss of this circuit and the pressure at the pump inlet remain substantially the same as those of the engine cooling system. The radiator shutter, if incorporated, shall be in the open position.</p> <p>Where the fan, radiator and cowl system cannot conveniently be fitted to the engine, the power absorbed by the fan when separately mounted in its correct position in relation to the radiator and cowl (if used), shall be determined at the speeds corresponding to the engine speeds used for measurement of the engine power either by calculation from standard characteristics or by practical tests. This power corrected to the standard atmospheric conditions defined in 6.2 shall be deducted from the corrected power.</p> <p>^f Where a disconnectable or progressive fan or blower is incorporated, the test shall be made with the disconnectable fan or blower disconnected or with the progressive fan running at maximum slip.</p> <p>^g The thermostat may be fixed in the fully open position.</p> <p>^h 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. It is recommended to include electrical fuel pump losses. If the connection of a battery is necessary, a fully charged battery in good order shall be used.</p> <p>ⁱ 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.</p> <p>The correction factors shown in 6.3.3 may be used as appropriate.</p> <p>^j They may include for example EGR system, catalytic convertor, thermal reactor, secondary air supply system and fuel evaporation protecting system.</p> <p>^k The spark advance shall be representative of in-use conditions established with the minimum octane fuel recommended by the manufacturer.</p> <p>^l 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.</p>		

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;
- suspension 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.

NOTE It is recommended to fit power steering pump and air-conditioning system (see table 1). If fitted, condition should be reported.

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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 is fitted and supplies, where necessary, the auxiliaries 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 is fitted to supply these accessories. Otherwise, it is removed.

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

5.2 Setting conditions

The setting conditions of the engine parameters and/or accessory settings shall be according to the manufacturer's specifications for the intended application. Whenever there is an opportunity for interpretation of this standard, a good faith effort shall be made to obtain the engine's typical in-service performance, avoiding obtaining the best possible performance under the best possible conditions

5.3 Test conditions

5.3.1 The net power test shall consist of a run at full throttle for spark-ignition engines at the fixed full-load fuel injection pump setting for compression-ignition engines, the engine being equipped as specified in table 1.

For engine equipped with electronic control system, the net power test shall be run under condition representative of a maximum driver operating condition, the engine being equipped as specified in table 1.