

Agricultural tractors and machines — Engine test code — Net power

ICS 65.060.10

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee AGE/6, Agricultural tractors and forestry machinery, which has the responsibility to:

- aid enquirers to understand the text;
- 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.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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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, pages ii to iv, pages 1 to 27 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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Agricultural tractors and machines — Engine test code — Net power

*Tracteurs et machines agricoles — Code d'essai des moteurs —
Puissance nette*



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Descriptors: Agricultural machinery, agricultural tractors, internal combustion engines, tests, performance tests, determination, net power, fuel consumption, power measurement.

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 2288 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 2, *Common tests*.

This third edition cancels and replaces the second edition (ISO 2288:1989), which has been technically revised.

1 Scope

This International Standard specifies a method for testing internal combustion engines intended for propulsion of agricultural tractors and machines. It applies to evaluation of performance with a view, in particular, to presenting curves of power and specific fuel consumption at full load as a function of engine speed. The engines may be naturally aspirated or pressure-charged.

It applies to net power assessment.

This International Standard concerns internal combustion engines used in agricultural tractors and machines 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 pressurecharger or turbocharger.

NOTE This International Standard provides engine power correction factors in conformity with ISO 1585:1992.

2 Normative references

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

ISO 789-1:1990, *Agricultural tractors — Test Procedures — Part 1: Power tests for power take off.*

ISO 1585:1992, *Road vehicles — Engine test code — Net power.*

ISO 2710:1978, *Reciprocating internal combustion engines — Vocabulary.*

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 3675:1993, *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.*

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

ISO 7967-8:1994, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 8: Starting systems.*

ASTM D 240-87, *Standard test method for heat of combustion of liquid hydrocarbon fuels by bomb calorimeter.*

ASTM D 3338-88, *Standard test method for estimation of heat of combustion of aviation fuels.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 2710, 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

net 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 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 $\pm 100\text{ Pa}$.

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 $\pm 200\text{ Pa}$. The measurement shall be made subject to footnote b of Table 1.

4.8 Depression in inlet system

Subject to footnote a of Table 1, this pressure shall be measured to $\pm 50\text{ Pa}$.

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.

Table 1 — Equipment and auxiliaries to be installed for the test to determine net engine power

No.	Equipment & auxiliaries	Fitted for engine net power test
1	Inlet system Inlet manifold Crankcase emission control system Control devices for dual induction inlet manifold system Air flow meter ^a , Air inlet ductwork ^a , Air filter ^a , Inlet silencer ^a Speed limiting device ^a	Yes, standard production equipment
2	Induction heating device of inlet manifold	Yes, standard production equipment if possible to be set in the most favorable 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
4	Fuel supply pump ^d	Yes, standard production equipment
5	Carburation equipment Carburettor, Electronic control system, air-flow, 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	Yes, standard production equipment
7	Liquid cooling equipment Radiator, Fan ^{f, g} , Fan cowl, Water pump, Thermostat ^h	Yes, standard production equipment
8	Air cooling Cowl, Fan or blower ^{f, g} , Temperature regulating device	Yes, standard production equipment
9	Electrical or electronic ignition equipment Generator ⁱ , Spark distribution system, Coil or coils, Wiring, Spark-plugs, Electronic control system including knock sensor/spark-retard system ^l	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 ^m , Charge-air-cooler ^{f, g, j} , 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 ^k	Yes, standard production equipment

^a 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.

^b 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 the upper limit specified by the manufacturer.

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