INTERNATIONAL STANDARD

ISO 9249

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Earth-moving machinery — Engine test code — Net power

Engins de terrassement — Code d'essai des moteurs — Puissance nette

Reference number
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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 9249 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*.

Annexes A, B, C and D of this International Standard are for information only.

NOTE — ISO 1585, the terminology of which is based on ISO 2710 : 1978, *Reciprocating internal combustion engines — Vocabulary,* is also the basis for the following parallel documents:

ISO 2288 : 1979, *Agricultural tractors and machines — Engine test code (bench test) — Net power.*

ISO 4106 : 1978, *Road vehicles — Motorcycles — Engine test code — Net power.*

ISO 4164 : 1978, *Road vehicles — Mopeds — Engine test code — Net power.*

International Organization for Standardization
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Earth-moving machinery — Engine test code — Net power

1 Scope

This International Standard specifies a method for testing internal combustion engines intended for propulsion of earth-moving machinery as defined in ISO 6165. 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.

NOTE — This International Standard is in conformity with ISO 1585; it relates to tests on an engine capable of being fitted into earth-moving machinery.

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 1585 : 1982, *Road vehicles — Engine test code — Net power.*

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

ISO 6165 : 1987, *Earth-moving machinery — Basic types — Vocabulary.*

3 Definitions

For the purposes of this International Standard, 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 auxiliaries listed in table 1. If the power measurement can be carried out only with the gear-box mounted, the efficiency of the gear-box shall be taken into account.

3.2 auxiliaries : Equipment and devices listed in table 1.

3.3 standard production equipment : Any equipment provided by the manufacturer for the particular engine application.

4 Accuracy of measurements

4.1 Torque

The dynamometer torque-measuring system shall give an accuracy within ± 1 % in the range of scale values required for the test. It shall be calibrated to take friction losses into account.

4.2 Engine rotational frequency

Engine rotational frequency shall be measured preferably with a revolution counter and an automatically synchronized chronometer (or counter timer). The accuracy of the measured value shall be ± 0,5 %.

4.3 Fuel consumption

Accuracy of fuel consumption measurements shall be ± 1 % overall for the apparatus used.

4.4 Fuel temperature

Accuracy of fuel temperature measurements shall be to within ± 2 K (± 2 °C).

4.5 Air temperature

The accuracy of this temperature measurement shall be ± 2 K (± 2 °C).

4.6 Barometric pressure

Barometric pressure shall be measured to ± 100 Pa (± 1 mbar[1)]).

4.7 Pressure in exhaust duct

Subject to footnote 2) to table 1, this pressure shall be measured to ± 200 Pa (± 2 mbar[1)]).

4.8 Pressure in intake duct

Subject to footnote 1) to table 1, this pressure shall be measured to ± 50 Pa (± 0,5 mbar[1)]).

1) 1 bar = 10^5 Pa

Table 1 — Installation of auxiliaries during test

No.	Auxiliaries	Fitted for net power test
1	Intake system Intake manifold Crankcase emission control system Air filter[1] Intake silencer and duct work[1] Speed-limiting device[1]	Yes, standard production equipment
2	Induction-heating device of intake manifold	Yes, standard production equipment. If possible, to be set in the most favourable condition.
3	Exhaust system Exhaust purifier Manifold Connecting pipes[2] Silencer[2] Tail pipe[2] Exhaust brake[3]	Yes, standard production equipment
4	Fuel supply pump[4]	Yes, standard production equipment
5	Carburettor Electronic control system, air-flow meter, etc. (if fitted) Pressure reducer Evaporator Mixer	Yes, standard production equipment Equipment for gas engine
6	Fuel injection equipment Prefilter Filter Pump High-pressure pipe Injector Air intake valve (if fitted)[5] Governor (if fitted)	Yes, standard production equipment

1) The complete intake systems shall be fitted as provided for the intended application :

- where there is a risk of noticeable influence upon engine power;
- in case of two-stroke and spark-ignition engines;
- when the manufacturer requests that this should be done.

In other cases an equivalent system may be used and a check made to ascertain that intake pressure does not differ by more than ± 100 Pa (± 1 mbar) from the limit specified by the manufacturer for a clean air filter.

2) The complete exhaust system shall be fitted as provided for the intended application :

- where there is a risk of noticeable influence upon engine power;
- in case of two-stroke and spark-ignition engines;
- when the manufacturer requests that this should be done.

In other cases, an equivalent system may be installed providing pressure measurement at the outlet of the engine exhaust system does not differ by more than ± 1 000 Pa (± 10 mbar) from that specified by the manufacturer.

The outlet from the engine exhaust system is defined as a point 150 mm downstream from the termination of that part of the exhaust system mounted on the engine.

3) If an exhaust brake is incorporated in the engine, the throttle valve shall be fixed in the fully open position.

4) The fuel feed pressure shall be adjusted, if necessary, to reproduce pressures existing in the particular engine application (particularly where a fuel return system is used).

5) The air intake 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.

Table 1 — (*concluded*)

No.	Auxiliaries	Fitted for net power test
7	Liquid cooling equipment[6]	
	Engine bonnet Bonnet air outlet	No
	Radiator Fan[6), 7)] Fan cowl Water pump Thermostat[8)]	Yes, standard production equipment
8	Air cooling	
	Cowl Fan or blower[6), 7)]	Yes, standard production equipment
	Auxiliary test bed fan	Yes, if necessary
	Temperature regulating device	Yes, standard production equipment
9	Electrical equipment[9)]	Yes, standard production equipment
10	Pressure-charging equipment (if fitted)	
	Compressor — driven either directly or indirectly by the engine (supercharger), and/or by the exhaust gases (turbocharger) Intercooler[10)] Coolant pump or fan (engine-driven) Coolant flow control device (if fitted)	Yes, standard production equipment
11	Anti-pollution devices	Yes, standard production equipment

6) The radiator, fan, fan cowl, water pump and thermostat shall be located on the test bed in the same relative positions as those they will occupy on the machine. The cooling liquid circulation shall be operated by the engine water pump only.

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.

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 condition defined in 6.2 should be deducted from the corrected power.

7) Where a disconnectable or progressive fan or blower is incorporated, the test shall be made with it disconnected or running at maximum slip, as appropriate.

8) The thermostat may be fixed in the fully open position.

9) 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 the operation of the engine. If the connection of a battery is necessary, a fully charged battery in good order shall be used.

10) 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 or test bed system the same as those specified by the manufacturer for the system on the complete machine.

5 Tests

5.1 Auxiliaries

5.1.1 Auxiliaries to be fitted

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

— machine hydraulic system(s) pumps;

— air compressor for brakes;

— power-steering pump;

— air-conditioning system.

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 in the starting of 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 for the test to determine net power are indicated in table 2.

Table 2 — Setting conditions

1	Setting of carburettor(s)	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	Injection timing (timing curve)	
4	Governor setting	
5	Anti-pollution devices	

5.3 Test conditions

5.3.1 The net power test shall consist of a run at full throttle for spark-ignition engines and at 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. The engine shall have been run-in 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 minimize the magnitude of the correction factor.

5.3.3 The temperature of the inlet air to the engine (ambient air) shall be measured not more than 0,15 m upstream of the point of entry to the air filter, or, if no air filter is used, within 0,15 m of the air inlet horn. The thermometer or thermocouple shall be shielded from radiant heat and located directly in the air stream. It shall also be shielded from fuel spray-back. A sufficient number of locations shall be used to give a representative average inlet temperature.

5.3.4 No data shall be taken until torque, rotational frequency and temperature have been maintained substantially constant for at least 1 min.

5.3.5 The engine rotational frequency during a run or reading shall not deviate from the selected rotational frequency by more than ± 1 % or ± 10 r/min, whichever is greater.

5.3.6 Observed brake load, fuel consumption and inlet air temperature data shall be recorded simultaneously and shall in each case be the average of two stabilized sustained readings which do not vary by more than 2 % for the brake load and fuel consumption.

5.3.7 The temperature of the coolant at the outlet from the engine shall be kept within ± 5 K (± 5 °C) of the upper thermostatically controlled temperature specified by the manufacturer. If no temperature is specified by the manufacturer, the temperature shall be 353 K ± 5 K (80 °C ± 5 °C). For air-cooled engines, the temperature at a point indicated by the manufacturer shall be kept within $^{0}_{-20}$ K ($^{0}_{-20}$ °C) of the maximum value specified by the manufacturer for the reference conditions.

5.3.8 The fuel temperature shall be controlled at the inlet to the fuel injection system to a temperature of 313 K ± 3 K (40 °C ± 3 °C). Where the test facility cannot maintain this fuel inlet temperature, a correction factor as calculated by 6.4 shall be applied.

5.3.9 The temperature of the lubricating oil measured in the oil sump or at the outlet from the oil cooler, if fitted, shall be maintained within the limits set by the engine manufacturer.

5.3.10 An auxiliary regulation system may be used if necessary to maintain temperatures within limits specified in 5.3.7, 5.3.8 and 5.3.9.

5.3.11 For compression-ignition engines, the fuel shall be one supplied and delivered by the refinery to the customer without any smoke-suppressant additives. In cases of dispute, tests shall be made with the CEC[1] reference fuel CEC RF-03-A-84 (see annex B). For spark-ignition engines, in cases of dispute, tests shall be carried out using CEC reference fuel CEC RF-01-A-80 or CEC RF-08-A-85 (see annex A or C).

5.4 Test procedure

Record data at a sufficient number of engine rotational frequencies to define the engine torque curve between the manufacturer's rated engine rotational frequency and the engine rotational frequency at which maximum torque is developed. The average of at least two stabilized measurements is to be determined.

5.5 Data to be recorded

Data to be recorded are those indicated in clause 8.

1) Co-ordinating European Council for the Development of Performance Tests for Lubricants and Engine Fuels. These fuels can be obtained from the Council at
61 New Cavendish Street
London W1M 8AR
United Kingdom

This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

6 Correction factors

6.1 Definition of factor α

This is the factor by which the observed power shall be multiplied to determine the corrected engine power, P_o, under the reference atmospheric conditions specified in 6.2 :

$$P_o = \alpha P$$

where

α is the correction factor (α_a or α_d);

P is the measured (observed) power.

6.2 Atmospheric conditions

6.2.1 Reference atmospheric conditions

The reference atmospheric conditions are taken to be as given in 6.2.1.1 and 6.2.1.2.

6.2.1.1 Temperature

The reference temperature, T_o, is 298 K (25 °C).

6.2.1.2 Dry pressure

The reference dry pressure, p_{so}, is 99 kPa.[1)]

6.2.2 Test atmospheric conditions

The test atmospheric conditions shall be within the values given in 6.2.2.1 and 6.2.2.2 during the test.

6.2.2.1 Temperature, T

For spark-ignition engines

$$288 \text{ K } (15 \text{ °C}) \leqslant T \leqslant 308 \text{ K } (35 \text{ °C})$$

For compression-ignition engines

$$283 \text{ K } (10 \text{ °C}) \leqslant T \leqslant 313 \text{ K } (40 \text{ °C})$$

6.2.2.2 Dry pressure, p_s

For all engines

$$80 \text{ kPa} \leqslant p_s \leqslant 110 \text{ kPa}$$

6.3 Determination of correction factors

NOTE — The test may be carried out in air-conditioned test rooms where the atmospheric conditions may be controlled.

6.3.1 Definition of T and p_s in correction factors α_a and α_d

T is the absolute temperature in kelvins at the air inlet to the engine;

p_s is the total dry atmospheric pressure, in kilopascals, i.e. the total barometric pressure minus water vapour pressure.

6.3.2 Compression-ignition engines — Factor α_d

The power correction factor for compression-ignition engines at constant fuel delivery, α_d, is obtained by applying the formula:

$$\alpha_d = (f_a)^{f_m}$$

where

f_a is the atmospheric factor (see 6.3.2.1);

f_m is the characteristic parameter for each type of engine and adjustment (see 6.3.2.2).

6.3.2.1 Atmospheric factor, f_a

This factor indicates effect of environmental conditions (pressure, temperature and humidity) on the air drawn in by the engine. The atmospheric factor formula differs according to the type of engine, and shall be calculated from the formula in a) or b):

a) naturally aspirated and mechanically pressure-charged engines :

$$f_a = \left(\frac{99}{p_s}\right) \quad \left(\frac{T}{298}\right)^{0,7}$$

b) turbocharged engines with or without cooling of charge air :[2)]

$$f_a = \left(\frac{99}{p_s}\right)^{0,7} \quad \left(\frac{T}{298}\right)^{1,5}$$

where T and p_s are as defined in 6.3.1.

6.3.2.2 Engine factor, f_m

f_m is a function of corrected fuel flow, q_c, and shall be calculated from the formula :

$$f_m = 0{,}036\, q_c - 1{,}14$$

where

$$q_c = \frac{q}{r}$$

in which

q is the fuel flow in milligrams per cycle per litre of engine swept volume [mg/(l·cycle)];

1) The dry pressure is based on a total pressure of 100 kPa and a vapour pressure of 1 kPa.

2) The correction factor should be regarded as provisional. Studies are in progress to establish a more accurate formula.

r is the pressure ratio of compressor outlet and compressor inlet ($r = 1$ for naturally aspirated engines).

This formula is valid for a value interval of q_c included between 40 mg/(l·cycle) $\leqslant q_c \leqslant$ 65 mg/(l·cycle).

For q_c values lower than 40 mg/(l·cycle), a constant value of f_m equal to 0,3 ($f_m = 0,3$) shall be taken.

For q_c values higher than 65 mg/(l·cycle), a constant value of f_m equal to 1,2 ($f_m = 1,2$) shall be taken (see figure 1).

6.3.2.3 Limitation in use of correction formula

This correction formula is only applicable if

$$0,9 \leqslant \alpha_d \leqslant 1,1$$

If these limits are exceeded the corrected value obtained shall be given, and the test conditions (temperature and pressure) precisely stated in the test report.

6.3.3 Spark-ignition engines (naturally aspirated and pressure-charged)

Factor α_a is calculated by use of the following formula :

$$\alpha_a = \left(\frac{99}{p_s}\right)^{1,2} \quad \left(\frac{T}{298}\right)^{0,6}$$

where T and p_s are as defined in 6.3.1.

This formula is only applicable if

$$0,93 \leqslant \alpha_a \leqslant 1,07$$

If these limits are exceeded, the corrected value obtained shall be given, and the test conditions (temperature and pressure) precisely stated in the test report.

In the case of engines fitted with automatic air temperature control, if the device is fully closed at full load at 298 K (25 °C) (no heated air added to the intake air) the test shall be carried out with the device fully closed and the normal correction factor applied. If the device is still operating at 299 K (26 °C), then the test is made with the device operating normally and the exponent of the temperature term in the correction factor shall be taken as zero (no temperature correction).

6.4 Correction for fuel temperature outside the specified value of 313 K ± 3 K (40 °C ± 3 °C)

The fuel consumption, G_f, in litres per hour, and g_f, in grams per kilowatt hour, are given by the following formulae respectively :

$$G_f = \frac{3,6\,b}{t}\,[1 + \beta\,(T_r - T_f)]$$

and

$$g_f = \frac{F_r}{P} \times 1\,000$$

where

b is the fuel consumption within a unit of time in cubic centimetres;

t is the fuel consumption measuring time, in seconds;

P is the output;

F_r is the specific gravity of fuel at temperature T_r, in grams per cubic centimetre;

T_r is the temperature of fuel at which specific gravity of fuel is measured, in kelvins or degrees Celsius;

T_f is the temperature of fuel at which fuel consumption is measured, in kelvins or degrees Celsius;

β is the coefficient of cubic expansion of fuel in the reciprocal of kelvins or degrees Celsius.

7 Measurement of smoke value for compression-ignition engines

The smoke value shall be measured and recorded at every test point. The opacity meter used, and its installation shall be designed in accordance with ISO 3173.

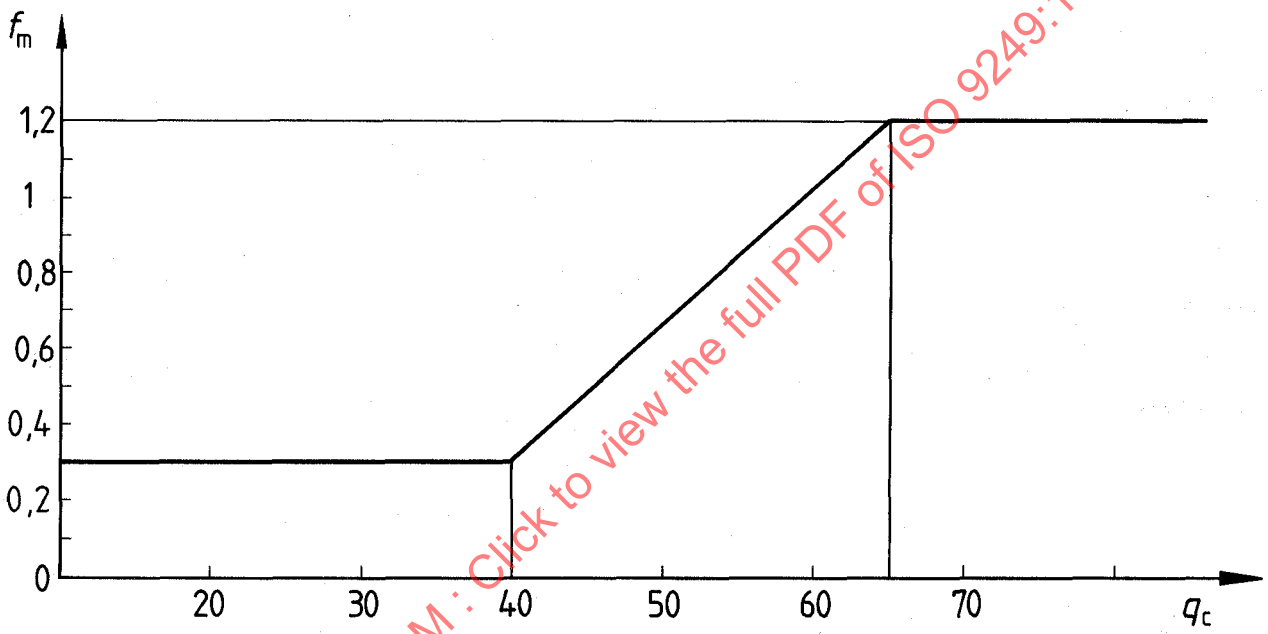

Figure 1 — Engine factor, f_m, as a function of corrected fuel flow, q_c

8 Test report

(State "none" where inapplicable, or delete)

8.1 Engine data

Make : ..... Type : .....

Bore : ..... Stroke : .....

Number of cylinders : .....

Total swept volume of the cylinders : .....

Compression ratio : .....

Pressure-charging device — Make : .....

Serial No. (in the series type) : .....

Swept volume of one cylinder : .....

Arrangement of cylinders : .....

Ignition : compression/spark [1)]
firing or injection order : .....

Cycles : 2/4 [1)] stroke

Type : ..... Serial No. : .....

8.2 Fuel supply

Pump — Make : .....

Type : ..... Serial No. : .....

Prefilter : yes/no [1)]

Filter : yes/no [1)]

8.3 Carburettor

Make : ..... Type : .....

Number : .....

Serial No. : .....

Detailed specification : .....

8.4 Injection pumps or devices

Make : ..... Type : .....

Static timing : .....

Manufacturer's code : .....

Serial No. : .....

Advance device : .....

8.5 Injection nozzles and nozzle holders

Make : ..... Type : .....

Setting pressure : .....

Serial No. : .....

Injection high pressure pipes { lengths : .....
inside diameter : .....

8.6 Governor

Make : ..... Type : .....

Cutting-in rotational frequency under load : .....r/min

Maximum no-load rotational frequency : .....r/min

Serial No. : .....

1) Delete where inapplicable.

8.7 Ignition distributor

Make : ..... Type : ..... Serial No. : .....

Static timing : ..... Advance device : .....

Timing at ..... r/min : ..... (as specified by the manufacturer)

Maximum range of advance device : .....

Distributor contact breaker gap : .....

8.8 Spark-plugs

Make : ..... Type or No. : .....

Number per cylinder : ..... Electrode gap : .....

8.9 Ignition coils

Make : ..... Type : ..... Serial No. : .....

Number : .....

8.10 Glow-plugs

Make : ..... Type or No. : ..... Number : .....

8.11 Interference suppressor

Make : ..... Type : ..... Serial No. : .....

8.12 Intake system

Intake manifold : ..... Description : .....

Air filter — Make : ..... Type : ..... Serial No. : .....

Intake silencer — Make : ..... Type : ..... Serial No. : .....

Inlet maximum depression at full flow recommended by the manufacturer : ..... kPa

8.13 Valve gear

Type : ..... Brief description : .....

Valve timing : ..... Tappet clearances (hot/cold[1]) : .....

8.14 Crankcase emission control system

Brief description : .....

Make : ..... Type : ..... Serial No. : .....

1) Delete where inapplicable.

8.15 Induction heating device

Type : ..... Brief description : .....

8.16 Exhaust system

Pipes and other components : standard/not standard[1)]

Brief description if not standard : .....

Exhaust brake — Make : ..... Type : ..... Serial No. : .....

Silencer — Make : ..... Type : ..... Serial No. : .....

8.17 Cooling system

8.17.1 Liquid

Nature of liquid : .....

Circulating pump — Make : ..... Type : ..... Serial No. : .....

Drive ratio : .....

Thermostat — Make : ..... Type ..... Serial No. : .....

Setting : .....

Radiator — Make : ..... Type : ..... Serial No. : .....

Pressurizing valve — Make : ..... Type : ..... Pressure setting : .....

Fan — Make : ..... Type : ..... Serial No. : .....

Fan drive system : ..... Drive ratio : .....

Fan cowl : yes/no[1)]

8.17.2 Air

Fan — Make : ..... Type : ..... Serial No. : .....

Drive ratio : .....

Air ducting (standard production) : yes/no[1)]

Auxiliary test bed fan : yes/no[1)]

Temperature regulating system : yes/no[1)] Brief description : .....

8.18 Oil cooler : yes/no[1)]

Make : ..... Type : ..... Serial No. : .....

8.19 Electrical equipment

Generator/alternator[1)] — Make : ..... Type : ..... Serial No. : .....

8.20 Anti-pollution systems

Brief description : .....

1) Delete where inapplicable.

8.21 Other test equipment

(Enumerate, with brief description if necessary.)

8.22 Specific test conditions

Barometric pressure : ..... kPa

Relative humidity : ..... %

Temperature of test laboratory : ..... K

Cooling liquid outlet temperature specified by the manufacturer : ..... K

Oil temperature range specified by the manufacturer : ..... K to ..... K

Fuel temperature range specified by the manufacturer at inlet of the carburettor or of the injection pump : ..... K to ..... K

Exhaust temperature [measured at a point in the exhaust pipe(s) adjacent to the outlet flange(s) of the exhaust manifold(s)] recommended by the manufacturer : ..... K to ..... K

Idling speed : ..... r/min

Laboratory extraction system for the exhaust gases : .....

Overpressure or maximum depression at full load : ..... kPa ± ..... kPa

Dynamometer — Make : ..... Type : ..... Serial No. : .....

Constant : .....

Fuel consumption measuring apparatus : gravimetric/volumetric[1)]

Smoke opacity or index measuring apparatus (for compression-ignition engines) — Make : ..... Type : .....

Measuring point of installation : .....

8.23 Fuels and lubricants

8.23.1 Liquid fuel

Make : ..... Type : ..... RON[2)] .....

Cetane No. : .....

Distillation — Temperature at which the distillate volume is equal to : 10 % : ..... °C

50 % : ..... °C

90 % : ..... °C

End point : ..... °C

Density : ..... g/cm^3 at ..... °C

Lower calorific value (net specific energy) : ..... kJ/kg

8.23.2 Other fuels

Characteristics : .....

8.23.3 Lubricant

Make : ..... Type : ..... SAE viscosity : .....

1) Delete where inapplicable.

2) RON : Research octane number.

9 Statement of results

The characteristic curves of net torque, net power and specific fuel consumption values shall be drawn as a function of the engine speed according to the example shown in figure 2.

Engine speed : ..... r/min

Measured torque : ..... N·m

Calculated power : ..... kW

Measured fuel flow : ..... g/h

Measured smoke : ..... m^{-1}/smoke number

Barometric pressure : ..... kPa

Water vapour pressure : ..... kPa

Inlet air temperature : ..... K

Power to be added for auxiliaries in excess of table 1 —

No. 1 : ..... kW

No. 2 : ..... kW

No. 3 : ..... kW

Power correction factor : .....

Corrected brake power, with/without fan : ..... kW

Power of fan (to be subtracted if fan not fitted) : ..... kW

Net power : ..... kW

Net torque : ..... N·m

Corrected specific fuel consumption
(calculated with net power for compression-ignition engines) : ..... g/(kW·h)

Cooling liquid temperature at outlet : ..... K

Lubricating oil temperature at measuring point : ..... K

Air temperature after pressure-charger : ..... K

Fuel temperature at injection pump inlet : ..... K

Air temperature after charge air cooler : ..... K

Pressure after pressure-charger : ..... kPa

Pressure after charge air cooler : ..... kPa

10 Expression of results

10.1 Designation

When the performances (power curves, torque and specific fuel consumption) of a heat engine are measured according to the specification of this International Standard, reference shall be made to the method used by stating "measured according to ISO 9249".

10.2 Indication of net power

Qualify "net power" by the word "ISO".

EXAMPLE

ISO net power : ..... kW at ..... r/min (measured according to ISO 9249).

10.3 Indication of net torque

Qualify "net torque" by the word "ISO".

EXAMPLE

ISO net torque : ..... N·m at ..... r/min (measured according to ISO 9249).

10.4 Indication of specific fuel consumption

Quote "net power to ISO 9249" between parentheses after "specific fuel consumption".

EXAMPLE

ISO specific fuel consumption (net power to ISO 9249) : ..... g/(kW·h)

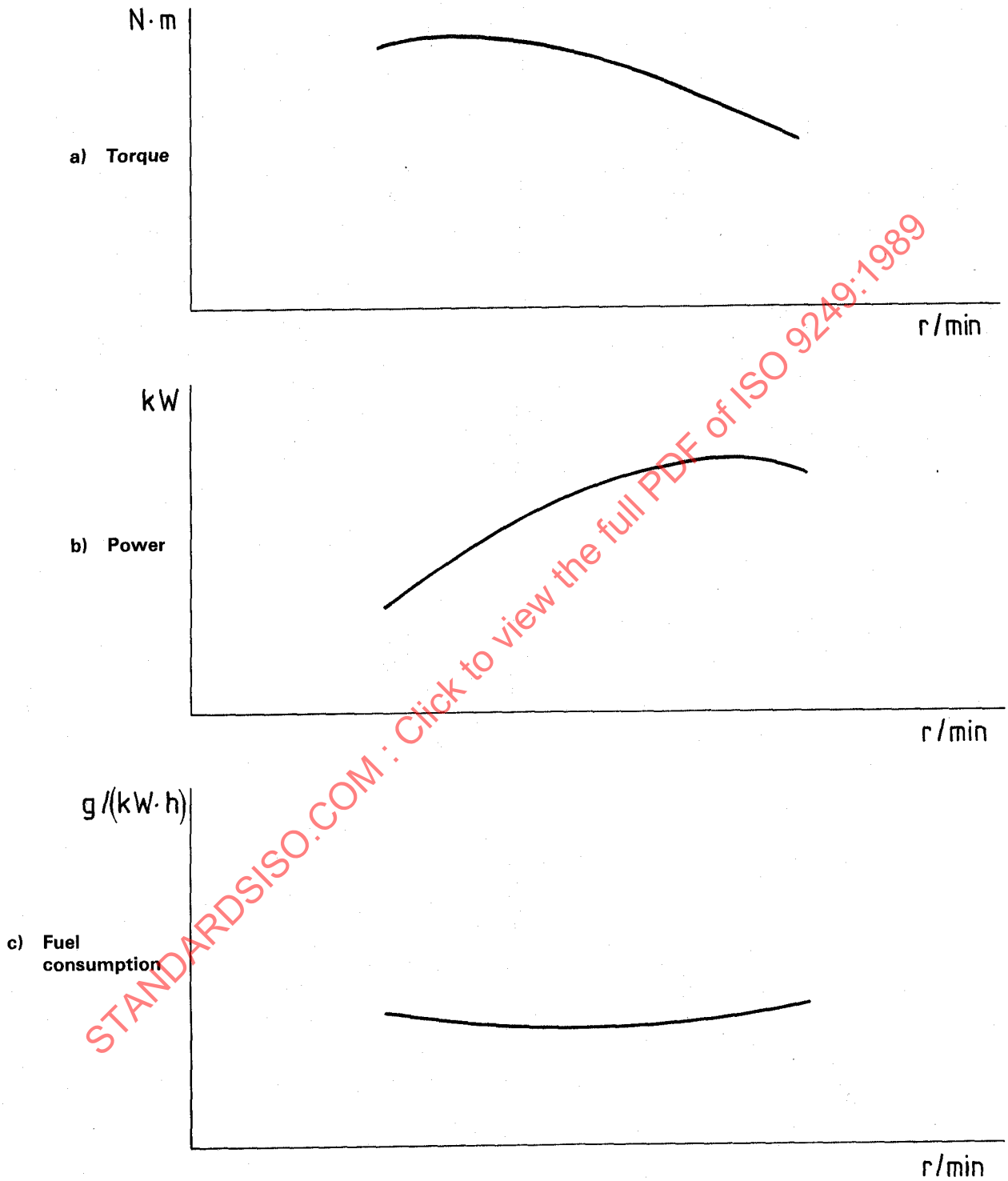

Figure 2 — Characteristic curves of torque, power and fuel consumption