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# International Standard



# 1585

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

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## Road vehicles — Engines test code — Net power

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

Second edition — 1982-05-15

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**Descriptors** : road vehicles, internal combustion engines, tests, determination, net power, testing conditions.

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

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.

International Standard ISO 1585 was developed by Technical Committee ISO/TC 22, *Road vehicles*, and was circulated to the member bodies in April 1981.

It has been approved by the member bodies of the following countries :

Australia	Iran	South Africa, Rep. of
Austria	Iraq	Spain
Belgium	Japan	Sweden
Brazil	Korea, Dem. P. Rep. of	Switzerland
Canada	Korea, Rep. of	United Kingdom
Czechoslovakia	Netherlands	USA
Egypt, Arab Rep. of	New Zealand	USSR
France	Poland	
Germany, F.R.	Romania	

The member body of the following country expressed disapproval of the document on technical grounds :

Italy

This second edition cancels and replaces the first edition (i.e. ISO 1585-1974).

# Road vehicles — Engines test code — Net power

## 1 Scope

This International Standard specifies a method for testing engines designed for automobile vehicles. It is applicable to the evaluation of their performances 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 the net power study.

## 2 Field of application

This International Standard concerns internal combustion engines used for propulsion of private cars and other motor vehicles [excluding motorcycles (see ISO 4106) and agricultural tractors (see ISO 2288)] normally travelling on roads and included in one of the following categories :

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

These engines may be naturally aspirated or pressure-charged

## 3 References

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

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

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

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

## 4 Definitions

**4.1 net power** : The power obtained on a test bed at the end of the crankshaft or its equivalent<sup>1)</sup> at the corresponding engine speed with the auxiliaries listed in table 1.

**4.2 standard production equipment** : Any equipment provided by the manufacturer for a particular engine application.

## 5 Accuracy of measuring equipment and instruments

### 5.1 Torque

± 1 % of measured torque<sup>2)</sup>

### 5.2 Engine speed

± 0,5 % of measured speed

### 5.3 Fuel consumption

± 1 % of measured consumption

### 5.4 Fuel temperature

± 2 K

### 5.5 Air temperature

± 2 K

### 5.6 Barometric pressure

± 100 Pa\*

### 5.7 Pressure in exhaust duct

[see note 1b) in table 1]

± 200 Pa

### 5.8 Pressure in intake duct

[see note 1a) in table 1]

± 50 Pa

1) If the power measurement can be carried out with a mounted gear box only, the efficiency of the gear box shall be taken into account.

2) The torque measuring system to be calibrated to take into account friction losses.

\* 1 Pa = 1 N/m<sup>2</sup>

Table 1 – Installation of auxiliaries during test for determination of net power of engine

No.	Auxiliaries	Fitted for net power test
1	Intake system Intake manifold Crankcase emission control system	Yes, standard production equipment
	Air filter Intake silencer Speed limiting device	
2	Induction heating device of intake 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 <sup>1b)</sup> Silencer <sup>1b)</sup> Tail pipe <sup>1b)</sup> Exhaust brake <sup>2)</sup>	Yes, standard production equipment
4	Fuel supply pump <sup>3)</sup>	Yes, standard production equipment
5	Carburettor Electronic control system, air-flow meter, etc ... (if fitted)	Yes, standard production equipment
	Pressure reducer Evaporator Mixer	
6	Fuel injection equipment (petrol and diesel) Prefilter Filter Pump High pressure pipe Injector Air intake valve. If fitted <sup>4)</sup> Electronic control system, air flow meter, 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 Engine bonnet Bonnet air outlet	No
	Radiator Fan <sup>5) 6)</sup> Fan cowl Water pump Thermostat <sup>7)</sup>	
8	Air cooling Cowl Fan <sup>5) 6)</sup>	Yes, standard production equipment
	Temperature regulating device	
9	Electrical equipment	Yes, <sup>8)</sup> standard production equipment
10	Pressure charging equipment (if fitted) Compressor driven either directly by the engine, and/or by the exhaust gases	Yes, standard production equipment
	Charge air cooler <sup>9)</sup> Coolant pump or fan (engine driven) Coolant flow control devices (if fitted)	
11	Auxiliary test bed fan	Yes, if necessary
12	Anti-pollution devices <sup>10)</sup>	Yes, standard production equipment

1a) 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-strokes 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 should be made to ascertain that intake pressure does not differ by more than 100 Pa from the limit specified by the manufacturer for a clean air filter.

1b) 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-strokes 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 exit of the engine exhaust system do not differ by more than 1 000 Pa from that specified by the manufacturer.

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

2) If an exhaust brake is incorporated in the engine, the throttle valve must be fixed in a fully open position.

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

4) 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 injected fuel.

5) The radiator, the fan, the fan cowl, the water pump and the 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.

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), must 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 paragraph 7.2 should be deducted from the corrected power.

6) Where a disconnectable or progressive fan is incorporated, the test shall be made with the disconnectable fan disconnected or with the progressive fan running at maximum slip.

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

8) 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.

9) 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 vehicle.

10) They may include for example EGR system, catalytic converter, thermal reactor, secondary air supply system and fuel evaporation protecting system.

## 6 Tests

- suspension compressor;
- air-conditioning system.

### 6.1 Auxiliaries

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

#### 6.1.1 Auxiliaries to be fitted

During the test the 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.

#### 6.1.3 Diesel engine starting auxiliaries

For the auxiliaries used in the starting of diesel engines, the two following cases shall be considered :

#### 6.1.2 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 a sample :

- 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.

- air compressor for brakes;
- power steering compressor;

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

## 6.2 Setting conditions

The setting conditions for the test for determination of 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	Ignition or injection timing (timing curve)	
4	Governor setting	
5	Anti-pollution devices	

## 6.3 Test conditions

6.3.1 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 diesel engines, the engine being equipped as specified in table 1.

6.3.2 Performance data shall be obtained under stabilized operating conditions, with an adequate fresh air supply to the engine. The engines must 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 7.2) as possible in order to minimize the magnitude of the correction factor.

6.3.3 The temperature of the inlet air to the engine (ambient air), shall be measured within 0,15 m upstream of the point of entry to the air cleaner, or, if no air cleaner 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.

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

6.3.5 The engine speed during a run or reading shall not deviate from the selected speed by more than  $\pm 1\%$  or  $\pm 10 \text{ min}^{-1}$ , whichever is greater.

6.3.6 Observed brake load, fuel consumption and inlet air temperature data shall be taken simultaneously and shall in each case be the average of two stabilized consecutive values which do not vary more than 2 % for the brake load and fuel consumption.

6.3.7 The temperature of the coolant at the outlet from the engine shall be kept within  $\pm 5 \text{ K}$  from the upper thermostatically-controlled temperature specified by the manufacturer. If no temperature is specified by the manufacturer, the temperature shall be  $353 \pm 5 \text{ K}$ .

For air-cooled engines, the temperature at a point indicated by the manufacturer shall be kept within  ${}^0_{-20} \text{ K}$  of the maximum value specified by the manufacturer in the reference conditions.

6.3.8 The fuel temperature shall be measured at the inlet to the carburettor or the fuel injection system and maintained within the limits established by the engine manufacturer.

6.3.9 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 established by the engine manufacturer.

6.3.10 An auxiliary regulation system may be used if necessary to maintain temperature within limits specified in 6.3.7, 6.3.8 and 6.3.9.

6.3.11 The fuel shall be one available on the market without any supplementary or smoke suppressant additives. In cases of dispute the reference fuel shall be :

- a) diesel engines as defined by CEC RF-03-A-80 (see annex B);
- b) spark ignition engines as defined by CEC RF.01-A-80 (see annex A);
- c) two-stroke engines as defined by CEC Standardization oils (RL-58/1) (see annex C);
- d) LPG engines as defined by CEC ...

## 6.4 Test procedure

Measurement shall be taken at a sufficient number of engine speeds to define the power curve completely between the lowest and the highest engine speeds recommended by the manufacturer. This range of speed must include the speed of revolution at which the engine produces its maximum power. The average of at least two stabilized measurements is to be determined.

## 6.5 Data to be recorded

Data to be recorded are those indicated in clause 9.

## 7 Correction factors

### 7.1 Definition of factor $\alpha$ for correction of the power

This is a factor by which the observed power must be multiplied to determine the engine power under the reference atmospheric conditions specified in 7.2 :

$$P_o = \alpha P$$

where

$P_o$  is the corrected power (i.e. power under reference conditions);

$\alpha$  is the correction factor ( $\alpha_a$  or  $\alpha_d$ );

$P$  is the measured power (first power).

### 7.2 Atmospheric conditions

#### 7.2.1 Reference atmospheric conditions

##### 7.2.1.1 Temperature ( $T_o$ )

298 K (25 °C)

##### 7.2.1.2 Dry pressure ( $p_{so}$ )

99 kPa

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

#### 7.2.2 Test atmospheric conditions

The atmospheric conditions shall be, during the test, within the following values.

##### 7.2.2.1 Temperature ( $T$ )

- For spark ignition engine :

$$288 \text{ K} < T < 308 \text{ K}$$

- For diesel engine :

$$283 \text{ K} < T < 313 \text{ K}$$

##### 7.2.2.2 Pressure ( $p_s$ )

For all engines :

$$80 \text{ kPa} < p_s < 110 \text{ kPa}.$$

### 7.3 Determination of correction factors<sup>1)</sup>

#### 7.3.1 Definition of the $T$ and $p_s$ in the correction factors $\alpha_a$ and $\alpha_d$

$T$  is the absolute temperature in kelvins (K) at the air inlet to the engine;

$p_s$  is the total dry atmospheric pressure, in kilopascals (kPa) that is to say, the total barometric pressure minus water vapour pressure.

#### 7.3.2 Naturally aspirated and pressure-charged spark ignition engines — Factor $\alpha_a$

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

This formula is only applicable if :

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

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.

#### 7.3.3 Diesel engines — Factor $\alpha_d$

The power correction factor for diesel engines at constant fuel delivery is obtained by applying the formula :

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

where

$f_a$  is the atmospheric factor;

$f_m$  is the characteristic parameter for each type of engine and adjustment.

##### 7.3.3.1 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 types of engines.

##### 7.3.3.1.1 Naturally aspirated and mechanically pressure charged engines

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

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

2) In the case of engines fitted with automatic air temperature control, if the device is fully closed at full load at 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 25 °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).

**7.3.3.1.2** Turbocharged engines with or without cooling of charge air

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

**7.3.3.2** Engine factor  $f_m$

$f_m$  is a function of  $q_c$  (fuel flow corrected) as follows :

$$f_m = 0,036 q_c - 1,14$$

where

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

where

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

$r$  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  $40 \text{ mg/(l.cycle)} < q_c < 65 \text{ mg/(l.cycle)}$ .

For  $q_c$  values lower than  $40 \text{ mg/(l.cycle)}$ , a constant value of  $f_m$  equal to  $0,3$  ( $f_m = 0,3$ ) will be taken.

For  $q_c$  values higher than  $65 \text{ mg/(l.cycle)}$ , a constant value of  $f_m$  equal to  $1,2$  ( $f_m = 1,2$ ) will be taken (see the figure) :

**7.3.3.3** Limitation in use of correction formula

This correction formula is only applicable if :

$$0,9 < \alpha_d < 1,1$$

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.

**8 Measurement of smoke value for diesel engines**

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

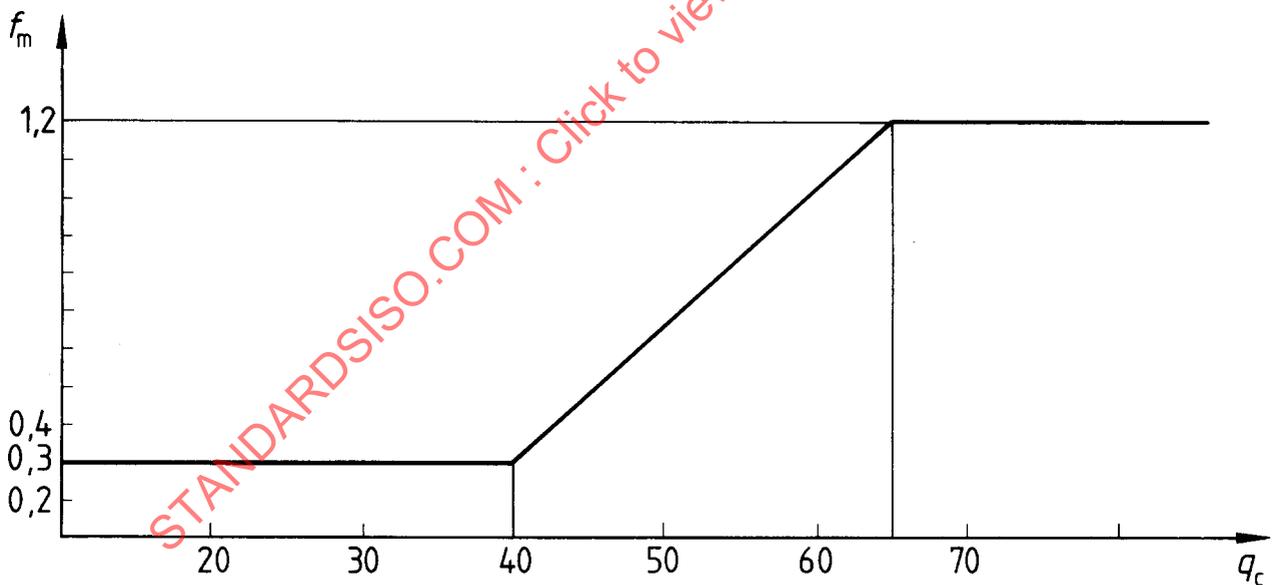


Figure – Engine factor ( $f_m$ ) as a function of the corrected fuel delivery ( $q_c$ )

**9 Test report**

(State "none" where not applicable, or delete)

**9.1 Diesel engines — Essential characteristics<sup>1)</sup>**

**9.1.1 Description of engine**

Make : .....

Type : .....

Cycle : four-stroke/two-stroke<sup>2)</sup>

Bore : ..... mm

Stroke : ..... mm

Number of cylinders .....

Layout of cylinders : ..... Firing order : .....

Engine swept volume : ..... litres

Compression ratio<sup>3)</sup> : .....

**System of cooling**

a) Liquid

Nature of liquid : .....

Circulating pumps : yes/no<sup>2)</sup>

Characteristics or make(s) : ..... Type(s) : .....

Drive ratio : .....

Thermostat : setting : .....

Radiator : drawing(s) or make(s) : ..... Type(s) : .....

Relief valve : .....

Fan : characteristics or make(s) : ..... Type(s) : .....

Fan drive system : .....

Drive ratio : .....

Fan cowl : .....

1) In the case of non-conventional engines and systems, particulars equivalent to those referred to here shall be supplied by the manufacturer.  
 2) Strike out what does not apply.  
 3) Specify the tolerance.

b) Air

Blower : characteristics or make(s) : ..... Type(s) : .....

Drive ratio : .....

Air ducting (standard production) : .....

Temperature regulation system : yes/no<sup>1)</sup>

Brief description : .....

c) Temperatures specified by the manufacturer

Liquid cooling

Maximum temperature at outlet ..... K

Air cooling

Reference point (description) : .....

Maximum temperature at reference point : ..... K

Maximum exhaust temperature : ..... K

Fuel temperature : min. : ..... K max. : ..... K

Lubricant temperature : min. : ..... K max. : ..... K

Pressure charger : with/without<sup>1)</sup>

Description of the system : .....

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

Compressor system : Make : ..... Type : .....

Cooling system : Make : ..... Type : .....

Intake system

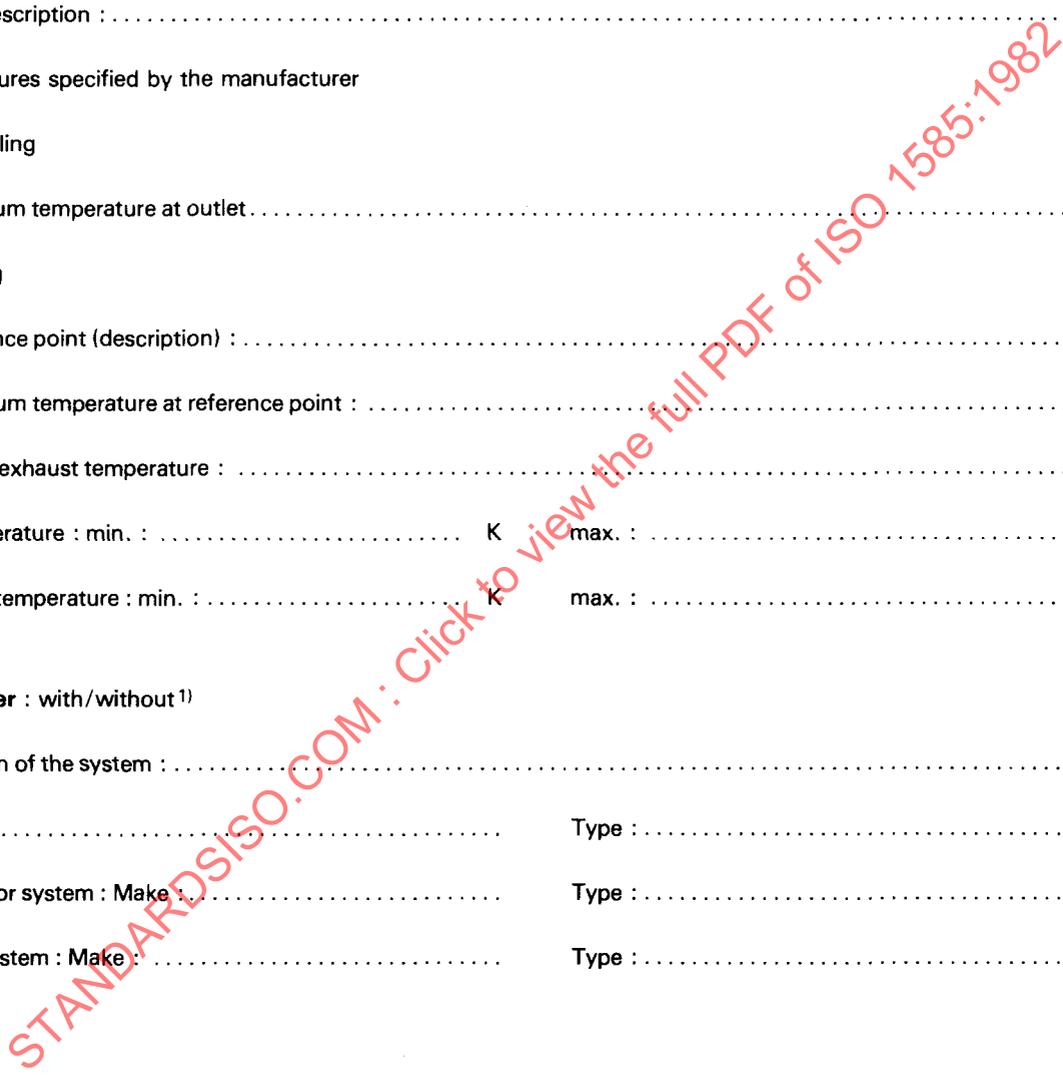
Description and diagrams of air intakes and their accessories (heating device, intake silencer, etc.) .....

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

Air filter : ..... Make : ..... Type : .....

Intake silencer : ..... Make : ..... Type : .....

1) Strike out what does not apply.



**9.1.2 Additional smoke control devices** (if any, and if not covered by another heading)

Description and diagrams : .....

**9.1.3 Fuel feed system**

Fuel feed : .....

Feed pump

Pressure : ..... kPa<sup>1)</sup> or characteristic diagram<sup>3)</sup> : .....

Injection system : .....

Pump

Make(s) : .....

Type(s) : .....

Delivery : ..... mm<sup>3</sup> per stroke<sup>1)</sup> at pump speed<sup>1)</sup> of ..... min<sup>-12)</sup> at full injection, or characteristic diagram<sup>3)</sup> .....

Mention the method used : on engine/on pump bench<sup>3)</sup>

Injection advance<sup>1)</sup> : .....

Injection advance curve .....

Timing .....

Injection piping

Length : ..... mm

Internal diameter : ..... mm

Injector(s)

Make(s) : .....

Type(s) : .....

Opening pressure : ..... kPa<sup>1)</sup> or characteristic diagram<sup>3)</sup> .....

Governor

Make(s) : .....

Type(s) : .....

Speed at which cut-off starts under full load : ..... min<sup>-1</sup>

Maximum no-load speed : ..... min<sup>-1</sup>

1) Specify the tolerance.

2) 1 min<sup>-1</sup> = 1 rpm.

3) Strike out what does not apply

Idling speed : ..... min<sup>-1</sup>

Cold-start system

Make(s) : .....

Type(s) : .....

Description : .....

**9.1.4 Valve timing**

Maximum lift of valves and angles of opening and closing in relation to dead centres : .....

Reference and/or setting ranges <sup>1)</sup> .....

**9.1.5 Exhaust system**

Description of exhaust manifold : .....

Description of other parts of the exhaust equipment if the test is made with the complete exhaust equipment provided by the manufacturer, or indication of the maximum back-pressure at maximum power specified by the manufacturer <sup>1)</sup> : .....

**9.1.6 Lubrication system**

Description of system : .....

Position of lubricant reservoir : .....

Feed system (circulation by pump, injection into intake, mixing with fuel, etc.) : .....

Circulating pump

Make : .....

Type : .....

Mixture with fuel

Percentage : .....

Oil cooler : with/without <sup>1)</sup>

Drawing(s) or make(s) : ..... Type(s) : .....

**9.1.7 Electrical equipment**

Generator/Alternator <sup>1)</sup>

Characteristics or make(s) : ..... Type(s) : .....

**9.1.8 Other engine-driven equipment** (Enumeration and brief description if necessary) .....

1) Strike out what does not apply

**9.2 Spark ignition engines — Essential characteristics<sup>1)</sup>**

**9.2.1 Description of engine**

Make : .....

Type : .....

Cycle : four-stroke/two-stroke<sup>2)</sup>

Bore : ..... mm

Stroke : .....mm

Number of cylinders : .....

Layout of cylinders : ..... Firing order : .....

Engine swept volume : ..... litres

Compression ratio<sup>3)</sup> : .....

**System of cooling**

a) Liquid

Nature of liquid : .....

Circulating pump : yes/no<sup>2)</sup>

Characteristics or make(s) : ..... Type(s) : .....

Drive ratio : .....

Thermostat : setting : .....

Radiator : drawing(s) or make(s) : ..... Type(s) : .....

Relief valve : pressure setting : .....

Fan : characteristics or make(s) : ..... Type(s) : .....

Fan drive system : .....

Drive ratio : .....

Fan cowl : .....

1) In the case of non-conventional engines and systems, particulars equivalent to those referred to here shall be supplied by the manufacturer.

2) Strike out what does not apply.

3) Specify the tolerance.

b) Air

Blower : characteristics or make(s) : ..... Type(s) : .....

Drive ratio : .....

Air ducting (standard production) : .....

Temperature regulating system : yes/no<sup>1)</sup>

Brief description : .....

c) Temperatures specified by the manufacturer

Liquid cooling

Maximum temperature at engine outlet : ..... K

Air cooling

Reference point (description) : .....

Maximum temperature at reference point : ..... K

Fuel temperature : min. : ..... K max. : ..... K

Lubricant temperature : min. : ..... K max. : ..... K

**Pressure charger** : with/without<sup>1)</sup>

Description of the system : .....

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

Compressor system : make : ..... Type : .....

Cooling system : make : ..... Type : .....

**Intake system**

Description and diagrams of air intakes and their accessories (dash-pot, heating device, additional air intakes, etc.) : .....

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

.....

Air filter : ..... Make : ..... Type : .....

Intake silencer : Make : ..... Type : .....

**9.2.2 Additional anti-pollution devices** (if any, and if not covered by another heading)

Description and diagrams : .....

**9.2.3 Fuel feed system**

Fuel feed

By carburettor(s)<sup>1)</sup> : ..... Number : .....

1) Strike out what does not apply.

Make : .....

Type : .....

**Adjustments**

Jets : .....

Venturis : .....

Float-chamber level : .....

Weight of float : .....

Float needle : .....

or { Curve of fuel delivery plotted against air flow, and settings required to keep to the curve<sup>1)</sup>

**Manual/automatic choke<sup>1)</sup>**

Closure setting<sup>2)</sup> : .....

**Feed pump**

Pressure : ..... kPa<sup>2)</sup> or characteristic diagram<sup>1)</sup> : .....

**By fuel injection<sup>1)</sup>**

Make(s) : .....

Type(s) : .....

Description (general) : .....

Calibration : ..... kPa<sup>2)</sup> or characteristic diagram<sup>1)</sup> : .....

**9.2.4 Valve timing**

Maximum lift of valves and angles of opening and closing in relation to dead centres : .....

Reference and/or setting ranges<sup>1)</sup> : .....

**9.2.5 Ignition systems**

**Ignition distributor**

Make : .....

Type : .....

Ignition advance curve<sup>2)</sup> : .....

Ignition timing<sup>2)</sup> : .....

Contact-point gap<sup>2)</sup> and dwell-angle<sup>1)</sup> : ..... degree

**Spark plugs**

Make : .....

1) Strike out what does not apply.

2) Specify the tolerance.

Type : .....

Spark-gap setting : .....

Ignition coil

Make : .....

Type : .....

Ignition condenser

Make : .....

Type : .....

Radio interference suppression equipment

Make : .....

Type : .....

**9.2.6 Exhaust system**

Description and diagrams : .....

**9.2.7 Lubrication system**

Description of system

Position of lubricant reservoir : .....

Feed system (circulation by pump, injection into intake, mixing with fuel, etc.) : .....

Circulating pump<sup>1)</sup>

Make : .....

Type : .....

Mixture with fuel<sup>1)</sup>

Percentage : .....

Oil cooler : with/without<sup>1)</sup>

Drawing(s) or make(s) : ..... Type(s) : .....

**9.2.8 Electrical equipment**

Generator/alternator<sup>1)</sup>

Characteristics or make(s) : ..... Type(s) : .....

**9.2.9 Other auxiliaries fitted on the engine** (Enumeration and brief description if necessary) : .....

1) Strike out what does not apply.

**9.3 Statement of the results of tests for measuring engine net power**

Trade name or mark of the engine : .....

Type and identification number of engine : .....

**Test conditions**

Pressures measured at maximum power : .....

Total barometric pressure : ..... kPa

Water vapor pressure : ..... kPa

Exhaust pressure measured at the point adjacent to the outlet flange(s) of the exhaust manifold(s) : ..... kPa

Inlet depression : ..... Pa, at engine intake system

**Temperatures measured at maximum power**

a) of the intake air : ..... K

b) at the outlet of the engine intercooler : ..... K

c) of the cooling fluid

— at the engine cooling fluid outlet : ..... K<sup>1)</sup>

— at the reference point in the case of air cooling : ..... K<sup>1)</sup>

d) of the lubricating oil : ..... K (indicate point of measurement)

e) of the fuel

— at the carburettor inlet/fuel injection system inlet<sup>1)</sup> : ..... K

— in the fuel-consumption measuring device : ..... K

**Characteristics of the dynamometer**

Make : ..... Model : .....

Type : .....

Rating : .....

**Characteristics of the opacimeter**

Make : ..... Model : .....

Type : .....

**Fuel**

**For spark ignition engines operating on liquid fuel**

Make : .....

Specification : .....

Anti-knock additive (lead, etc.) : .....

1) Strike out what does not apply.

Type : .....

Content : ..... mg/l

Octane number **RON** : ..... (ASTM D 2699-70)

Density : ..... g/cm<sup>3</sup> at 288 K

Lower calorific value : ..... kJ/kg

Fuel consumption measuring apparatus : gravimetric or volumetric<sup>1)</sup>

For spark ignition engines operating on gaseous fuel

Make : .....

Specification : .....

Storage pressure : ..... kPa

Utilization pressure : ..... kPa

Lower calorific value : ..... kJ/kg

For diesel engines operating on gaseous fuels

Feed systems : gas : .....

Specification of gas used : .....

Fuel oil/gas proportion : .....

Lower calorific value : ..... kJ/kg

For diesel engines operating on liquid fuel

Make : .....

Specification of fuel used : .....

Cetane index (ASTM D 976-71) .....

Density : ..... g/cm<sup>3</sup> at 288 K

Lower calorific value : ..... kJ/kg

**Lubricant**

Make : .....

Specification : .....

SAE viscosity : .....

1) Strike out what does not apply.

9.4 Statement of results\*

Engine speed, min <sup>-1</sup>		
Measured torque, N.m		
Measured power, kW		
Measured fuel flow, g/h		
Measured smoke, m <sup>-1</sup> 2)		
Barometric pressure, kPa		
Water vapor pressure, kPa		
Inlet air temperature, K		
Power to be added for auxiliaries in excess of table 1 (see 9.1.8 and 9.2.9), kW	No. 1	
	No. 2	
	No. 3	
Power correction factor		
Corrected brake power, kW (with/without 1) fan)		
Power of fan, kW (to be subtracted if fan not fitted)		
Net power, kW		
Net torque, N.m		
Corrected specific fuel consumption, g/(kW.h) 3)		
Cooling liquid temperature at outlet, K		
Lubricating oil temperature at measuring point, K		
Air temperature after pressure-charger, K 4)		
Fuel temperature at injection pump inlet, K		
Air temperature after charge air cooler, K 4)		
Pressure after pressure-charger, kPa 4)		
Pressure after charge air cooler, kPa		

- 1) Strike out what does not apply.
- 2) Only for diesel engines.
- 3) Calculated with net power for diesel and spark ignition engines, in the latter case multiplied by the power correction factor.
- 4) Delete where inapplicable.

9.5 Results summary

Specific fuel consumption

Maximum net power : ..... kW at ..... min<sup>-1</sup> — at maximum net power : ..... g/(kW.h)

Maximum net torque : ..... N.m at ..... min<sup>-1</sup> — at maximum net torque : ..... g/(kW.h)

\* The characteristic curves of the net power and net torque, of the specific fuel consumption and of the exhaust smoke values shall be drawn as a function of the engine speed.