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# International Standard



# 7293

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

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## Forestry machinery — Portable chain saws — Engine performance and fuel consumption

*Machines forestières — Scies à chaîne portatives — Puissance et consommation du moteur*

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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 developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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 7293 was developed by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, and was circulated to the member bodies in December 1981.

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

Australia	Germany, F.R.	Portugal
Austria	India	Romania
Belgium	Iraq	South Africa, Rep. of
Canada	Italy	Spain
Czechoslovakia	Korea, Dem. P. Rep. of	Sweden
Denmark	Korea, Rep. of	Turkey
Egypt, Arab Rep. of	Mexico	USA
Finland	New Zealand	USSR
France	Poland	

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

United Kingdom

# Forestry machinery — Portable chain saws — Engine performance and fuel consumption

## 1 Scope and field of application

This International Standard specifies a method for testing the performance and fuel consumption of internal combustion engines used to power portable chain saws.

## 2 Apparatus

**2.1 Brake power test bench** with a torque accuracy of  $\pm 2\%$  of the measured value.

**2.2 Tachometer** with an accuracy of  $\pm 0,5\%$  of the measured value.

**2.3 Fuel consumption measuring device** with an accuracy of  $\pm 3\%$  of the measured value.

**2.4 Thermometer** with an accuracy of  $\pm 1\text{ K}$ .

**2.5 Barometer** with an accuracy of  $\pm 0,5\%$  of the measured value.

**2.6 Humidity test device** with an accuracy of  $\pm 2\%$ .

## 3 Test conditions

**3.1 Ambient temperature**, measured at a distance of 15 cm from the air intake: 15 to 27 °C.

**3.2 Atmospheric pressure**: 97,5 to 105 kPa.

**3.3 Correction to reference atmospheric conditions** shall be made according to the following formula:

$$P_r = K_r P_x$$

$$M_r = K_r M_x$$

$$C_r = K_r C_x$$

$$K_r = \frac{P_r}{P_x} \left( \frac{T_x}{T_r} \right)^{0,5}$$

where

index *r* is the standard reference conditions;

index *x* is the actual measured conditions;

*C* is the fuel consumption, in kilograms per hour;

*P* is the brake power, in kilowatts;

*M* is the torque, in newton metres;

*K<sub>r</sub>* is the reference adjustment factor;

*p<sub>r</sub>* is the reference dry atmospheric pressure, in kilopascals;

*p<sub>x</sub>* is the measured dry atmospheric pressure (i.e. total pressure minus the water vapour pressure) in kilopascals;

*T* is the ambient temperature, in kelvins.

**3.4** The standard reference conditions shall be the following:

— *T<sub>r</sub>* = 298 K (dry bulb),

— *p<sub>r</sub>* = 99 kPa, (based on a total barometric pressure of 100 kPa and a water vapour pressure of 1 kPa).

**3.5** The values *T<sub>x</sub>* and *p<sub>x</sub>* shall be calculated as the average of the values resulting from the tests in 5.2.3 and 5.2.7.

**3.6** The variation of *T<sub>x</sub>* during the measurements shall not exceed  $\pm 3\text{ K}$ .

**3.7** Power consuming auxiliaries (for example, electrical handle heating) shall be turned off.

**3.8** The exhaust outlet shall operate against a pressure equal to that at the air intake.

**3.9** No extra cooling or air supply is allowed.

**3.10** The engine shall be coupled to the power brake in such a manner that the engine crankshaft is aligned with the brake shaft and connected to it with a flexible coupling. The use of the engine clutch is optional.

**3.11** The governor of the rotational frequency can sometimes be influenced by the power brake set-up. Therefore the maximum free rotational frequency of the complete saw in hand-held operation should be checked first. If this frequency cannot be reached in the power brake set-up, the governor of the rotational frequency shall be disengaged.

**3.12** The fuel should consist of petrol with a minimum octane number (RON) of 90<sup>1)</sup>, (and if it is a two stroke engine) mixed with two stroke oil according to the manufacturer's recommendation. The density of the fuel should be  $740 \pm 15 \text{ kg/m}^3$ .

## 4 Conditions of measurement

**4.1** Measurements shall be carried out on three different, standard equipped, new saws of the same model.

**4.2** The engines shall be complete (except chain and guide bar) with all standard production auxiliaries for its operation (filter, silencer, cooling system, etc.).

**4.3** The engines shall be run in accordance with the manufacturer's instructions.

## 5 Operating method

### 5.1 General

With the throttle fixed in the fully open position, record the brake power, torque and fuel consumption as a function of the rotational frequency in steps of  $10 \text{ s}^{-1}$  (r/s). No adjustments on the saw are allowed during the test.

Take the readings during the 10 s interval between 50 and 60 s after application of full load.

Take the readings at least over a rotational frequency range limited by the rotational frequency for maximum torque minus  $15 \text{ s}^{-1}$  and the rotational frequency for maximum power plus  $15 \text{ s}^{-1}$ .

### 5.2 Procedure

Carry out the measurement according to the following procedure:

**5.2.1** Warm up the engine and set the idle speed adjuster and low speed mixture adjuster for best idling at the speed recommended by the manufacturer.

**5.2.2** Run the engine at full throttle at the maximum power speed specified by the manufacturer. Set the high speed mixture adjuster for maximum power within 1 min.

**5.2.3** Run the engine for 5 min at half load at maximum power speed in order to warm it up. Record the ambient temperature and pressure during the end of this period.

**5.2.4** Run the engine at idling for 1 min.

**5.2.5** Run the engine at the speed of maximum torque minus  $15 \text{ s}^{-1}$  and take the readings in accordance with 5.1.

**5.2.6** Repeat 5.2.4 and 5.2.5 over the stated speed range up to the speed of maximum power plus  $15 \text{ s}^{-1}$ .

**5.2.7** Record the ambient temperature and pressure.

## 6 Test report

The test report shall include the following information:

a) Basic information specifying:

- 1) reference to this International Standard;
- 2) date and place of measurement;
- 3) names of the petitioner and the issuer of the report.

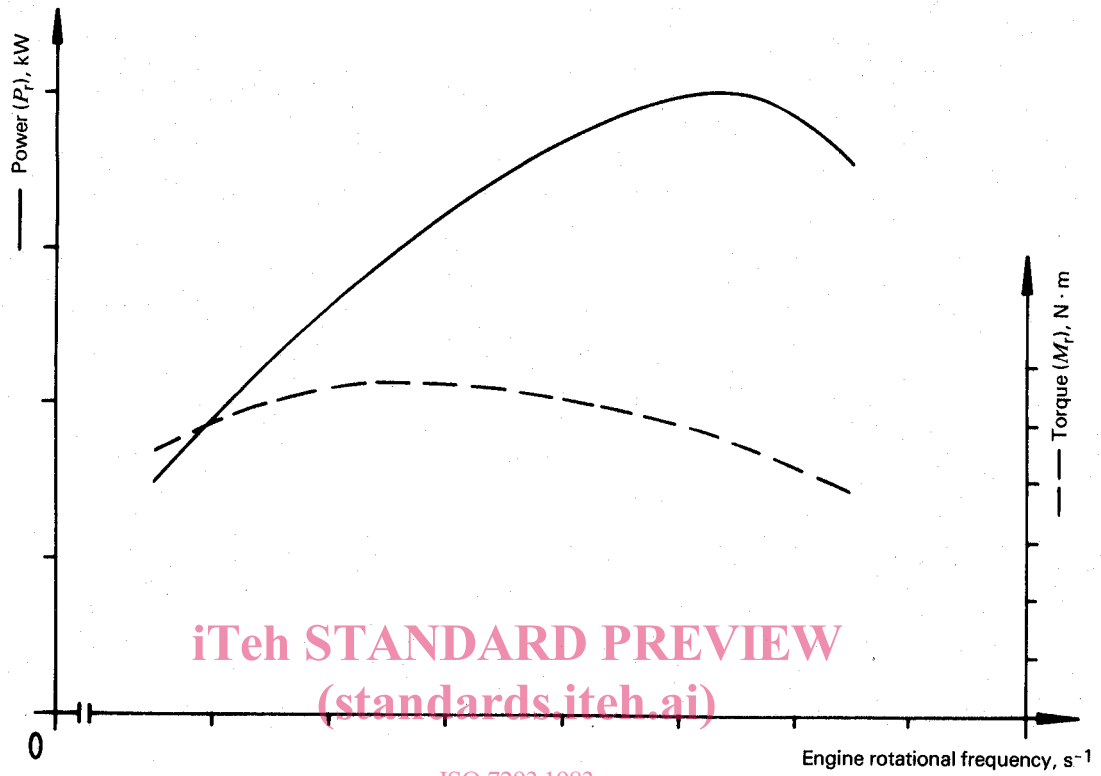
b) Description of the saw including:

- 1) manufacturer's name or make or brand name;
- 2) model (type);
- 3) serial number;
- 4) working cycle (for example, two stroke);
- 5) bore, stroke and swept volume of the engine;
- 6) fuel density;
- 7) oil mixture ratio;
- 8) petrol octane number (RON);
- 9) measuring equipment;
- 10) ambient air temperature;
- 11) ambient air pressure.

c) The following parameters shall be given, individually as well as mean values for the different saws, as a function of the engine rotational frequency (see examples in the figure):

- 1) power in kilowatts;
- 2) torque in newton metres;
- 3) fuel consumption in kilograms per hour;
- 4) specific fuel consumption in grams per kilowatt hour.

1) If the fuel does not comply with the specifications given in this paragraph, full details shall be given in the test report.



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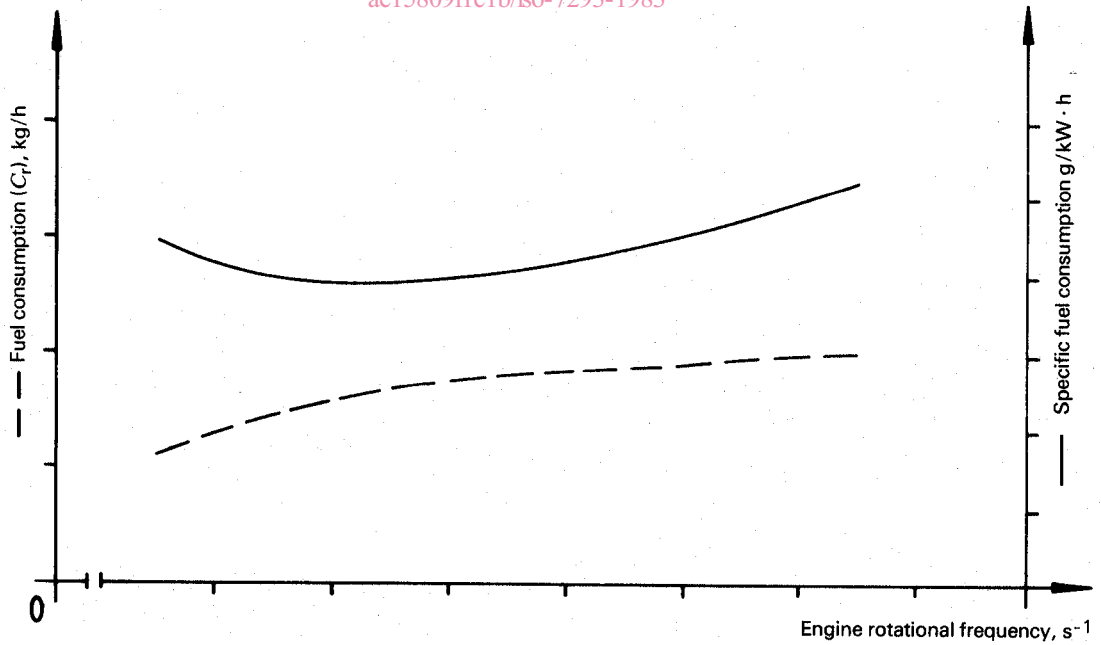


Figure — Examples of characteristic curves