INTERNATIONAL STANDARD

ISO 7293

Second edition
1997-12-15

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

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

ISO 7293:1997(E)

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 7293 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 17, *Manually portable forest machinery*.

This second edition cancels and replaces the firt edition (ISO 7293:1983), of which it constitutes a technical revision (see Introduction).

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Printed in Switzerland

Introduction

The first edition of ISO 7293 was elaborated from 1979 to 1980 according to the special conditions of chain-saws at that time. Extensive measurement experiences not only at manufacturers but also at test stations revealed that the test procedure given in ISO 7293:1983 is no longer appropriate due to advanced developments.

The test procedure given in ISO 7293:1983 required an intermittent test run repeated over a specified range of rotational frequency. Within this range, one data print had to be recorded at every 10 s^{-1} increment. The necessary reading had to be recorded within 50 s to 60 s after the application of full load. This sequence was then followed by 1 min of running with idling.

According to gathered experiences, this intermittent procedure has several disadvantages:

— the repeatability is poor due to the unstable test conditions: the temperature, and therefore the performance, is not steady within the defined time frame in which the test data have to be recorded;

— some machines have problems during idling due to the coupled masses of the dynamometer;

— the measuring time is lengthened due to the additional idling modes.

In the steady-state procedure given in this International Standard, the power curve is measured over the same range of rotational frequency. After the torque and temperature have stabilized, all necessary data for the performance and the fuel consumption measurement have to be taken.

After recording the data, the next point on the power curve has to be measured without returning to idling. Due to the close temperature correlation from the previous point to the subsequent point, the stabilized conditions are reached in a much shorter time than in the previous procedure.

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

1 Scope

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

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was 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 edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5164:1990, *Motor fuels — Determination of knock characteristics — Research method.*

3 Apparatus

3.1 Brake power test bench with a torque accuracy of ± 2 % of the measured value.

3.2 Tachometer with an accuracy of ± 0,5 % of the measured value.

3.3 Fuel consumption measuring device with an accuracy of ± 3 % of the measured value.

3.4 Thermometer with an accuracy of ± 1 K.

3.5 Barometer with an accuracy of ± 0,5 % of the measured value.

3.6 Humidity test device with an accuracy of ± 2 %.

4 Test conditions

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

4.2 Atmospheric pressure: 97,5 kPa to 105 kPa.

4.3 Correction to reference atmospheric conditions shall be made according to the following formulas:

$$P_r = K_r P_x$$

$$M_r = K_r M_x$$

$$C_r = K_r C_x$$

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

where

r is the index for the standard reference conditions;

x is the index for 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_r is the reference adjustment factor;

p_r is the reference dry atmospheric pressure, in kilopascals;

p_x is the measured dry atmospheric pressure (i.e. total pressure minus the water vapour pressure), in kilopascals;

T is the ambient temperature, in kelvins.

4.4 The standard reference conditions shall be the following:

— T_r = 298 K (dry bulb);

— p_r = 99 kPa (based on a total barometric pressure of 100 kPa and a water vapour pressure of 1 kPa).

4.5 The values T_x and p_x shall be calculated as the average of the values resulting from the tests in 6.2.3 and 6.2.6.

4.6 The variation of T_x during the measurements shall not exceed ± 3 K.

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

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

4.9 No extra cooling or air supply is allowed.

4.10 The engine shall be coupled to the brake power test bench 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.

4.11 The governor of the rotational frequency can sometimes be influlenced by the brake power test bench. Therefore the maximum free rotational frequency of the complete saw in hand-held operation shall be checked first. If this frequency cannot be reached in the bench, the governor of the rotational frequency shall be disengaged.

4.12 The fuel shall consist of petrol with a minimum octane number (RON) of 90, measured according to ISO 5164, and, if it is a two stroke engine, mixed with two stroke oil according to the manufacturer's recommendation. The density of the fuel shall be 725 kg/m^3 to 755 kg/m^3 at 15 °C.

If the fuel does not comply with these specifications, full details shall be given in the test report.

5 Conditions of measurement

5.1 Measurements shall be carried out on a saw with its standard equipment.

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

5.3 The engine shall be run in accordance with the manufacturer's instructions.

6 Operating method

6.1 General

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

Take the readings during the 10 s interval after the temperature has stabilized.

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

6.2 Procedure

Carry out the measurement according to the procedure given in 6.2.1 to 6.2.6.

6.2.1 Prior to mounting the engine on the power test bench, warm up the engine and set the idle speed adjuster and low speed mixture adjuster for best idling at the rotational frequency recommended by the manufacturer.

6.2.2 Run the engine at fully open throttle on the power test bench at the maximum power rotational frequency specified by the manufacturer. Set the high speed mixture adjuster for maximum power.

6.2.3 Record the ambient air temperature and pressure.

6.2.4 Run the engine with fully open throttle at the rotational frequency of maximum torque minus 15 s^{-1}; wait for temperature stabilization and take the readings in accordance with 6.1.

6.2.5 Repeat 6.2.4 by increasing the test rotational frequency by maximum 10 s^{-1} over the rotational frequency as stated in 6.1.

6.2.6 Record the ambient air temperature and pressure.

7 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 temperatures;

11) ambient air pressures;

c) the following parameters, given as a function of the engine rotational frequency (see examples given in figure 1):

1) power, in kilowatts;

2) torque, in newton meters;

3) fuel consumption, in kilograms per hour;

4) specific fuel consumption, in grams per kilowatt hour.

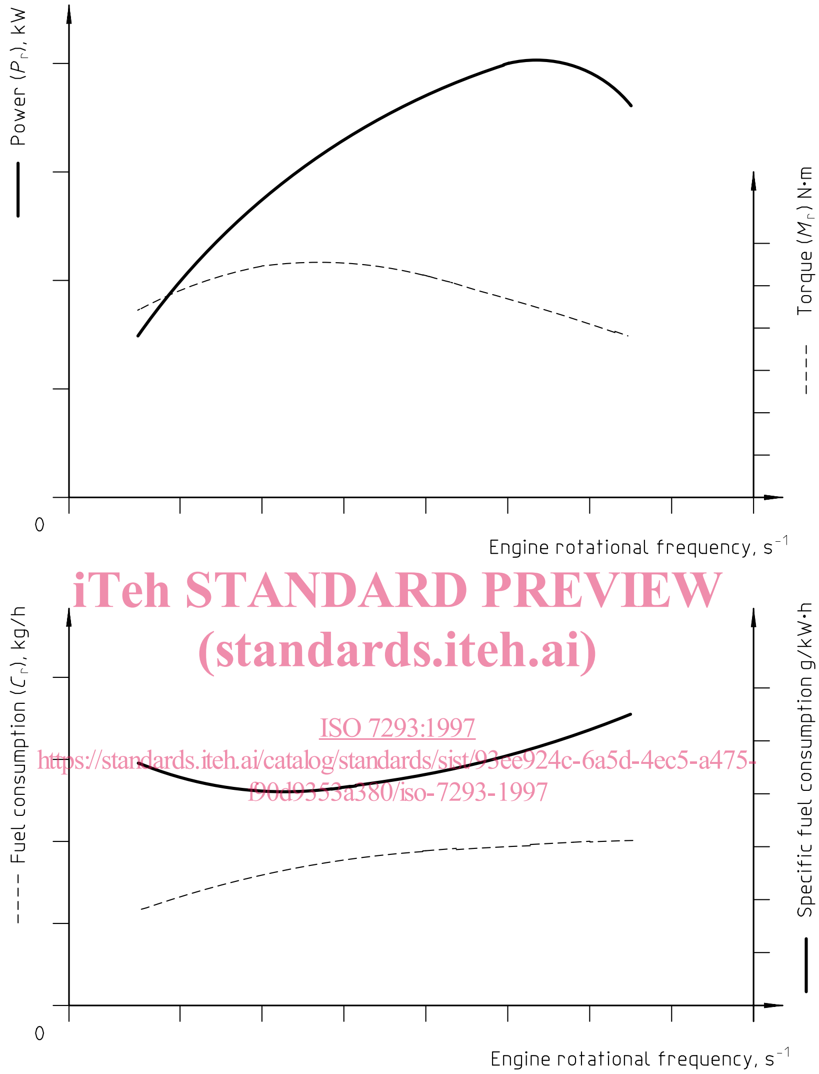

Figure 1 — Examples of characteristic curves