INTERNATIONAL STANDARD

ISO 8893

Third edition
2021-10

Forestry machinery — Portable brush-cutters and grass-trimmers — Engine performance and fuel consumption

Machines forestières — Débroussailleuses et coupe-herbe portatifs — Puissance et consommation de carburant du moteur

Reference number
ISO 8893:2021(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Accuracy of measurements **1**
5 Power correction factors **2**
5.1 Definition 2
5.2 Reference atmospheric conditions 2
5.3 Test atmospheric conditions 2
5.4 Determination of correction factor α 2
6 Conditions of measurement **3**
7 Operating method **3**
7.1 General 3
7.2 Procedure 4
7.2.1 Determination of the peak power and peak torque engine speed 4
7.2.2 Determination of the power curve and fuel consumption curve 4
8 Test report **4**

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry,* Subcommittee SC 17, *Manually portable (hand-held) powered lawn and garden equipment and forest machinery*.

This third edition cancels and replaces the second edition (ISO 8893:1997), which has been technically revised.

The main changes compared to the previous edition are as follows:

— the normative references have been updated;

— the mandatory terms and definitions clause has been added and subsequent clauses have been renumbered;

— the “Apparatus” clause has been replaced with “Accuracy of measurements”;

— the "Test conditions" have been replaced with “Power correction factors”;

— the conditions of measurement have been revised;

— the operating method has been revised;

— a new Table 1, Sample test data record sheet, has been added.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete list of these bodies can be found at www.iso.org/members.html.

Introduction

This document is a type-C standard as stated in ISO 12100.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

— machine manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organisations, market surveillance, etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

— machine users/employers (small, medium and large enterprises);

— machine users/employees (e.g. trade unions, organizations for people with special needs);

— service providers, e.g. for maintenance (small, medium and large enterprises);

— consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the scope of this document.

When requirements of this type-C standard are different from those which are stated in type A or type B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type C standard.

Forestry machinery — Portable brush-cutters and grass-trimmers — Engine performance and fuel consumption

1 Scope

This document specifies a method for testing the performance and fuel consumption of internal combustion engines used to power portable brush-cutters and grass trimmers.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5164, *Petroleum products — Determination of knock characteristics of motor fuels — Research method*

ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Accuracy of measurements

4.1 Torque: ±2 % of measured torque. The torque measuring system shall be calibrated to take friction losses into account.

4.2 Engine speed: ±2 % of measured speed.

4.3 Fuel consumption: ±2 % of measured consumption.

4.4 Fuel temperature: ±2 °C.

4.5 Engine inlet air temperature: ±2 °C.

4.6 Barometric pressure: ±100 Pa.

5 Power correction factors

5.1 Definition

The power correction factor is the coefficient to determine the engine power under the reference atmospheric conditions specified in 5.2. It can be calculated using Formula (1):

$$P_o = \alpha P \tag{1}$$

where

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

α is the correction factor;

P is the measured power (test power).

5.2 Reference atmospheric conditions

5.2.1 Temperature (T_o): 25 °C

5.2.2 Dry pressure (P_{so}): 99 kPa

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

5.3 Test atmospheric conditions

5.3.1 Temperature (T): 14,85 °C ≤ T ≤ 34,85 °C

5.3.2 Pressure (P_s): 90 kPa < P_s < 110 kPa

5.4 Determination of correction factor α

The correction factor, α, is obtained by applying Formula (2):

$$\alpha = \left[\frac{99}{P_s}\right]^{1,2} \times \left[\frac{T + 237,15}{298}\right]^{0,6} \tag{2}$$

where

P_s is the total dry atmospheric pressure in kilopascals (kPa); i.e. the total barometric pressure minus water vapour pressure;

T is the absolute temperature in degree Celsius (°C) of the air drawn in by the engine.

Conditions are complied with in the laboratory.

For a test to be valid, the correction factor shall be such that

$$0,93 \leq \alpha \leq 1,07$$

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.

6 Conditions of measurement

6.1 Measurements shall be carried out on a machine with its standard equipment.

6.2 The machine shall be complete (except shaft tube, power transmission shaft, and engine transmission) with all standard production auxiliaries for its operation (filter, silencer, cooling system, etc).

6.3 The engine shall be adjusted according to the manufacturer's recommendations as stated in the operator's instructions for normal operating conditions. If an adjustment of the fuel/air mixture by the operator is foreseen in the instructions, an according adjustment to achieve the maximum possible power is allowed.

6.4 Power-consuming auxiliaries shall be turned off.

6.5 No extra engine cooling or air supply is allowed.

6.6 The fixture used to mount the engine to the dynamometer should be verified that it does not influence the performance on the unit compared to an "in-use" condition.

6.7 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.

6.8 The engine shall be run in, in accordance with the manufacturer's instructions. If the engine was previously run in, this operation shall be omitted.

6.9 The fuel shall consist of petrol with a minimum octane (R+M)/2 of 87, 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 680 kg/m^3 to 790 kg/m^3 at 15 °C.

7 Operating method

7.1 General

With the throttle in a fully open position, record the brake power, torque and fuel consumption as a function of the rotational frequency in steps of 300 r/min, starting from 900 r/min above peak power speed and decreasing down to 900 r/min below the peak torque speed.

Take the readings during the 10 s interval after the temperature has stabilized at each step, Table 1 is an example of how to record the data at each step. The engine temperature is stable when the engine coolant, block or head absolute temperature has settled within ±3 °C for at least 30 s.

Take the readings at least over a rotational frequency range limited by the engine speed for maximum torque minus 900 r/min, and the engine speed for maximum power plus 900 r/min.

If the engine speed is limited below the speed of maximum power plus 900 r/min, measure at the maximum speed achievable. If the engine does not run with a stable speed, carry out the test at the maximum possible stable speed. This speed shall, however, not be more than 480 r/min below the maximum achievable speed.