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Machinery for forestry — Portable chain-saws — Safety requirements and testing —

Part 1:
Chain-saws for normal forest work

Matériel forestier — Scies à chaîne portatives — Exigences de sécurité et essais —

Partie 1: Scies à chaîne pour travaux forestiers normaux

Reference number
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Contents

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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 voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 11681-1 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Sub-committee 17, *Manually portable forest machinery*.

ISO 11681 consists of the following parts, under the general title *Machinery for forestry — Portable chain-saws — Safety requirements and testing*:

— *Part 1: Chain-saws for normal forest work*

— *Part 2: Chain-saws for tree service*

Annex A forms an integral part of this part of ISO 11681.

Introduction

This part of ISO 11681 has been prepared in close cooperation with the European committee CEN/TC 144, *Tractors and machinery for agriculture and forestry*. Within CEN the standard EN 608 has been prepared under a mandate given to CEN by the Commission of the European Communities and the European Free Trade Association, and it supports essential requirements of EC Directive(s).

This part of ISO 11681 is equivalent to EN 608 with the following exceptions:

— subclause 4.9: note 2 has been added;

— table 1: note 3 has been added;

— table 2: note 2 has been added;

— subclause 6.4: note 4 has been added.

The extent to which hazards are covered is indicated in clause 1.

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Machinery for forestry — Portable chain-saws — Safety requirements and testing —

Part 1:
Chain-saws for normal forest work

1 Scope

This part of ISO 11681 specifies safety requirements, and their verification for design and construction, of portable combustion-engined, hand-held chain-saws designed for use by one operator (see figure 1) and intended for normal forest work.

It describes methods for the elimination or reduction of hazards arising from their use. In addition it specifies the type of information on safe working practices to be provided by the manufacturer. It does not however give any technical requirement to reduce noise and vibration hazards. Indeed, the different means available to reduce these hazards are a matter for the rule book to which the manufacturer may resort, through specialized books or specific bodies.

The list of significant hazards which require action to reduce the risk is given in annex A.

The environmental aspects are not covered.

This part of ISO 11681 applies primarily to machines which are manufactured after the date of publication.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 11681. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 11681 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3767-5:1992, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 5: Symbols for manual portable forestry machinery.*

ISO 3864:1984, *Safety colours and safety signs.*

ISO 6531:1982, *Machinery for forestry — Portable chain saws — Vocabulary.*

ISO 6533:1993, *Forestry machinery — Portable chain-saw front hand-guard — Dimensions.*

ISO 6534:1992, *Portable chain-saws — Hand-guards — Mechanical strength.*

ISO 6535:1991, *Portable chain-saws — Chain brake performance.*

ISO 7182:1984, *Acoustics — Measurement at the operator's position of airborne noise emitted by chain saws.*[1)]

ISO 7293:1983, *Forestry machinery — Portable chain-saws — Engine performance and fuel consumption.*

ISO 7505:1986, *Forestry machinery — Chain saws — Measurement of hand-transmitted vibration.*

ISO 7914:1986, *Forestry machinery — Portable chain-saws — Minimum handle clearance and sizes.*

ISO 7915:1991, *Forestry machinery — Portable chain-saws — Determination of handle strength.*

1) Equivalent to EN 27182:1991.

ISO 8334:1985, *Forestry machinery — Portable chain-saws — Determination of balance.*

ISO 9207:1995, *Manually portable chain-saws with internal combustion engine — Determination of sound power levels — Engineering method (grade 2).*

ISO 9467:1993, *Forestry machinery — Portable chain-saws and brush-cutters — Exhaust system-caused fire risks.*

ISO 9518:1992, *Forestry machinery — Portable chain saws — Kickback test.*

ISO 10726:1992, *Portable chain saws — Chain catcher — Dimensions and mechanical strength.*

ISO/TR 12100-1:1992, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology.*[2)]

ISO/TR 12100-2:1992, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles and specifications.*[3)]

3 Definitions

For the purposes of this part of ISO 11681, the definitions given in ISO 6531 apply (see figure 1).

4 Safety requirements

The safe running of chain-saws depends on both the safety requirements as described in this clause and a safe environment associated with the use of personal protection equipment such as gloves, leg protection, boots, and eye and ear protection equipment.

Machinery shall comply as appropriate with ISO/TR 12100-1 and ISO/TR 12100-2 for hazards which are not covered by this part of ISO 11681.

4.1 Handles

Chain-saws shall have a handle for each hand. These handles shall be designed so that they can be fully gripped by an operator when wearing protective gloves, provide the necessary sureness of grip by their shaping and surface, and conform to the dimensions and clearances given in ISO 7914.

The strength of both handles shall at least comply with ISO 7915.

The operator shall be able to stop the chain-saw in a controlled manner even in case of failure of any vibration isolation system.

4.2 Hand protection

4.2.1 Protection at front handle

A guard shall be fitted in the vicinity of the front handle (see figure 1), to protect the operator's fingers from injury by contact with the saw chain.

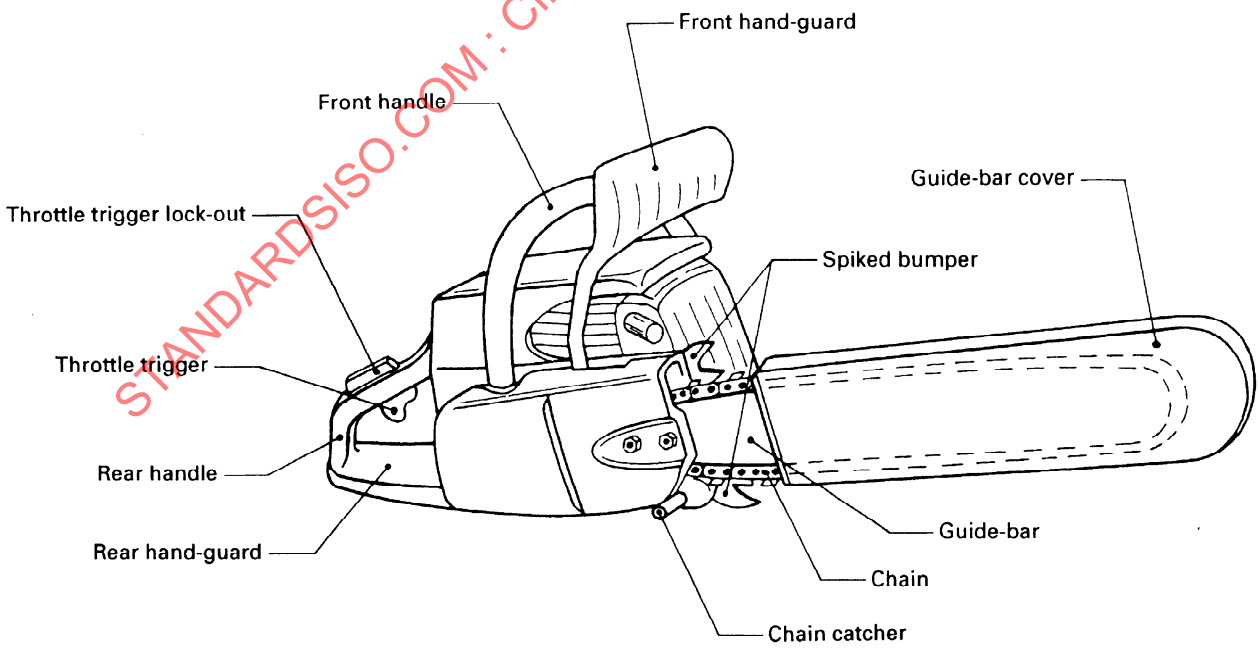

Figure 1 — Chain-saw

2) Equivalent to EN 292-1:1991.

3) Equivalent to EN 292-2:1991.

The dimensions of this front hand-guard shall comply with ISO 6533. Its strength shall comply with ISO 6534.

4.2.2 Protection at rear handle

A hand-guard shall be provided along the length of the right side of the bottom of the rear handle. This guard shall extend from the right edge of the handle for at least 30 mm at the guide-bar side and at least 100 mm lengthwise (see figure 2).

This requirement can also be fulfilled by parts of the machine.

The strength of the rear handle-guard shall comply with ISO 6534.

4.3 Balance

There shall be means to evenly balance the chain-saw when fitted with the manufacturer's recommended guide-bars. The balance shall be tested in accordance with ISO 8334. The maximum angle between the centreline of the guide-bar and the horizontal shall not exceed 30°.

4.4 Protection against injury by kickback

4.4.1 The chain-saw shall be fitted with a chain brake. It shall be possible to activate the chain brake manually by means of the front hand-guard.

There shall also be a non-manual system which operates the chain brake when kickback occurs. See ISO 13772[4].

The computed kickback angle and chain stop angle shall be determined with cutting attachments as recommended by the manufacturer and in accordance with ISO 9518.

The computed kickback angle or chain stop angle, whichever is less, shall not exceed 45° for saws with combustion engine displacement up to 80 cm^3.

NOTE 1 Sufficient information to set a limit is not available for saws over 80 cm^3.

4.4.2 The chain brake release force shall be between 20 N and 60 N.

The average braking time shall not exceed 0,12 s and the maximum braking time shall not exceed 0,15 s.

Measurements of release force and braking times shall be carried out in accordance with ISO 6535.

4.5 Chain catcher

The chain-saw shall be fitted with a chain catcher that conforms to the dimensions and strength requirements in ISO 10726.

4.6 Spiked bumper

The chain-saw shall be equipped with a spiked bumper (see figure 1) or with provision to mount a spiked bumper.

4.7 Chip discharge

The chain-saw shall be designed so that wood particles are directed below the underside of the saw when it is in an upright position [see ISO 6531:1982, figure 2b)].

4.8 Guide-bar cover

The chain-saw shall be provided with a guide-bar cover for safe transport (see figure 1).

Dimensions in millimetres

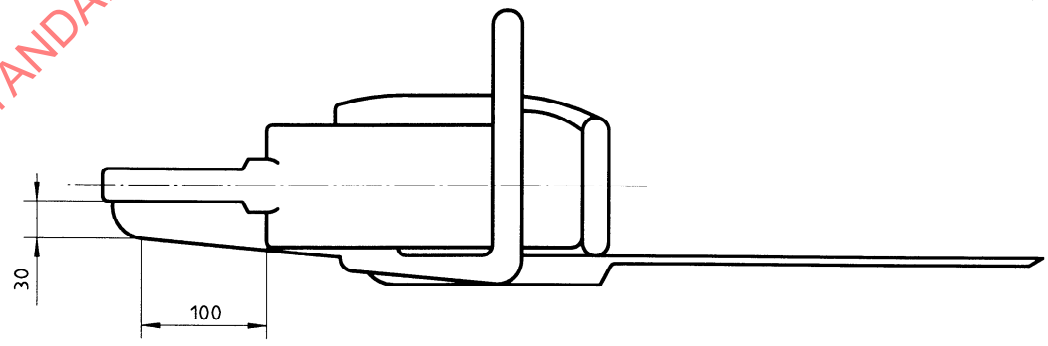

Figure 2 — Minimum dimensions of protection at rear handle

4) ISO 13772:—, *Forestry machinery — Portable chain-saws — Non-manually actuated chain brake performance.* (To be published.)

Table 1 — Achievable sound pressure levels

Operating mode	Sound pressure level dB (A-weighted)		
	Engine displacement cm^3		
	≤ 40	> 40 but ≤ 80	> 80
Idling	85	85	85
Racing	102	105	—
Full load	100	103	105

NOTES

1 These values do not constitute personal exposure limits, but the emission values from a machine under defined test conditions (for example speed, load, material to be used) and according to the measurement of the corresponding noise levels.

2 These values are not a barrier to innovation, and they should not prevent the achievement of better values. With this in view, they will be revised as the state of the art evolves.

3 For chain-saws with muffler provided with a spark arrester as specified in ISO 9467, an additional 3 dB (A-weighted) should be acknowledged.

4.9 Noise emission

The time-averaged emission sound pressure levels at the operator's ear shall be measured in accordance with ISO 7182.

The sound power levels from the chain-saw shall be measured in accordance with ISO 9207.

NOTE 2 The sound power levels are for information purposes and will appear in the instruction handbook (see 6.2).

Achievable sound pressure levels are given in table 1.

4.10 Vibration

The weighted acceleration sum shall be measured and calculated in accordance with ISO 7505.

Achievable values are given in table 2.

4.11 Throttle trigger

A chain-saw shall be provided with a constant pressure throttle trigger that automatically reverts to the idling position and is retained in that position by the automatic engagement of a throttle trigger lock-out.

The throttle trigger shall be positioned so that it can be pressed and released with a gloved hand while holding the handle.

The throttle control linkage shall be so designed that a force equal to three times the weight of the chain-saw unit (without cutting attachment and with empty tanks), applied on the rear handle in any direction, shall not increase the engine speed to a point where the clutch engages and chain movement begins.

Table 2 — Achievable vibration values

Engine displacement cm^3	Handle	Idling m/s^2	Racing m/s^2	Full load m/s^2
≤ 80	Front	12,5	12,5	12,5
	Rear	—	12,5	12,5
> 80	Front	15	15	15
	Rear	—	15	15

NOTES

1 These values do not constitute personal exposure limits, but the emission values from a machine under defined test conditions (for example speed, load, material to be used) and according to the measurement of the corresponding vibration levels.

2 These values are advisory only and they may vary depending on local conditions such as long guide-bars.

3 These values are not a barrier to innovation, and they should not prevent the achievement of better values. With this in view, they will be revised as the state of the art evolves.

If a throttle lock is provided for cold starting, it shall be such that the lock has to be set manually and is automatically released when the throttle trigger is operated.

4.12 Ignition switch

The machine shall be fitted with an ignition switch which brings it to a final stop and does not depend on sustained manual effort for its operation. This device shall be so positioned that it can be operated while the saw is being held with both hands by an operator wearing protective gloves. The purpose and method of operation of the device shall be clearly and durably marked.

The colour of the ignition switch shall clearly contrast with the background.

4.13 Protection against contact with parts under high voltage

All parts of the motor which are under high voltage shall be so insulated that the material under high voltage cannot be touched.

4.14 Clutch

The clutch shall be so designed that the chain does not run when the engine rotates at 1,25 times the idling speed.

4.15 Carburettor adjustment

The elements of carburettor adjustment shall be clearly and indelibly marked, for example by symbols as given in ISO 3767-5. The markings used shall be illustrated and explained in the instruction handbook.

4.16 Protection against contact with hot parts

Hot parts such as the cylinder or parts in direct contact with the cylinder or silencer shall be guarded against unintentional contact during normal operation of the machine. This applies to hot parts which are less than 120 mm away from the far side of the nearest handle (see figures 3 and 4) and less than 80 mm from the sides of the front handle (see figure 5).

A laterally mounted silencer shall be provided with a guard as protection against contact with the spread-out hand, i.e. hot areas shall not exceed 10 cm^2, if they can be reached by the test cone specified in figure 6.

Dimensions in millimetres

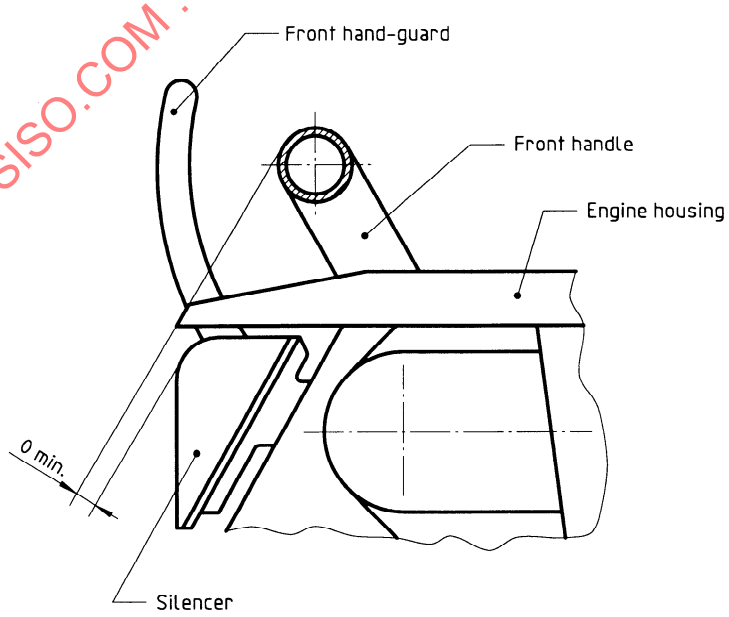

Figure 3 — Guarding against contact with silencer

Dimensions in millimetres

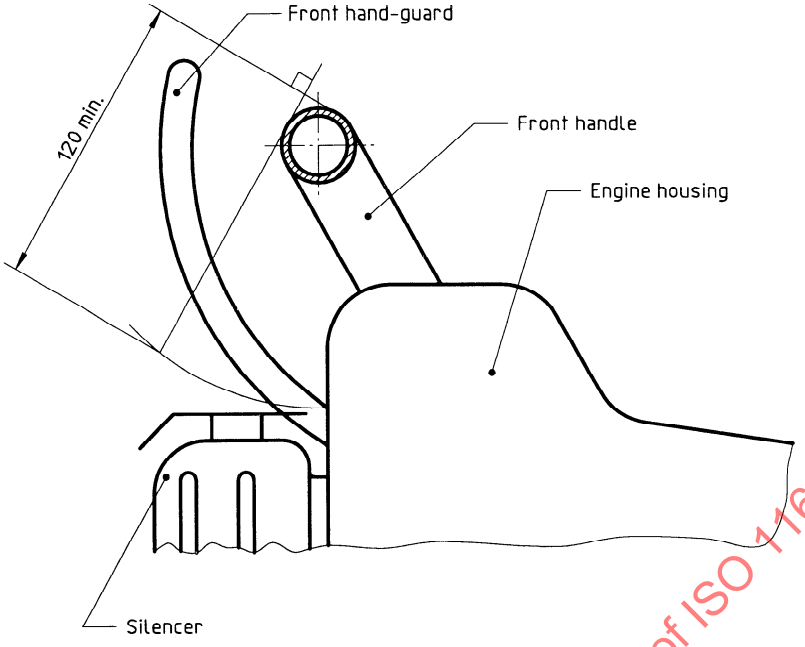

Figure 4 — Required distance between front handle and unprotected silencer

Dimensions in millimetres

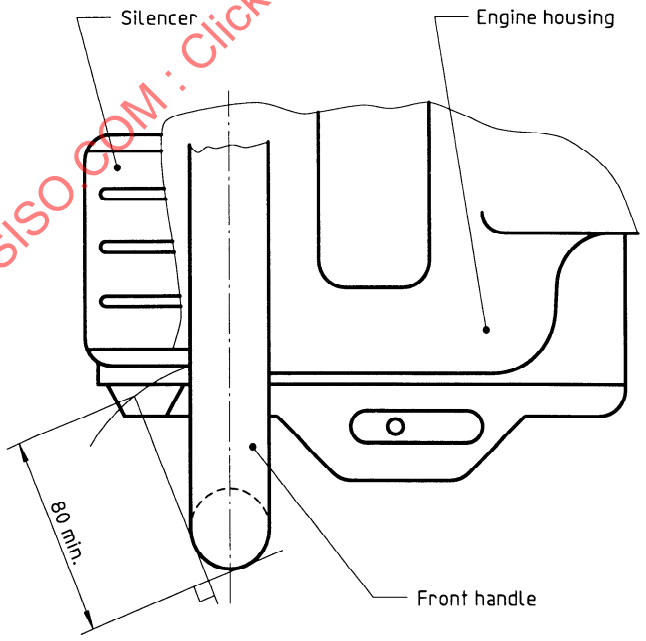

Figure 5 — Required lateral distance between front handle and unprotected silencer (plan view)

Dimensions in millimetres

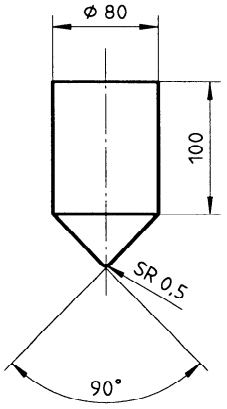

Figure 6 — Test cone

4.17 Exhaust gases

The exhaust outlet shall be located to direct emissions away from the operator's face in normal working positions.

4.18 Chain lubrication

The cutting attachment shall be automatically lubricated.

If additionally a manual oiler is provided, it shall be located so it can be operated while holding the saw in the normal operating position.

4.19 Tank openings

The fuel cap shall have a retainer.

The fuel tank opening shall be at least 20 mm diameter and the oil tank opening at least 15 mm diameter.

Each opening or cap shall be clearly marked. If only caps are marked, they shall not be interchangeable.

The design of the cap shall be such that no apparent leakage occurs while the saw is at the normal operating temperature, in all working positions and while being transported.

The filler openings shall be so located that the filling of the tanks with a suitable funnel is not obstructed by other components.

4.20 Chain tensioning

Chain-saws shall be provided with the means of adjustement to provide chain tension according to the manufacturer's recommendation.

5 Verification of safety requirements

The compliance with safety requirements shall be verified according to table 3.

Table 3 — Safety requirements and test method

Subclause	Safety requirements	Test method			
		Inspection	Function test	Measurement	Reference
4.1	Handles	×		×	ISO 7914 ISO 7915
4.2.1	Protection at front handle	×		×	ISO 6533 ISO 6534
4.2.2	Protection at rear handle	×		×	ISO 6534
4.3	Balance	×		×	ISO 8334
4.4.1	Protection against injury by kickback (chain brake), kickback angle or chain stop angle		×	×	ISO 9518 ISO 13772
4.4.2	Protection against injury by kickback (chain brake), release force, braking time		×	×	ISO 6535
4.5	Chain catcher	×		×	ISO 10726
4.6	Spiked bumper	×			
4.7	Chip discharge	×	×		
4.8	Guide-bar cover	×			
4.9	Noise emission			×	ISO 7182 ISO 9207
4.10	Vibration			×	ISO 7505
4.11	Throttle trigger	×	×		
4.12	Ignition switch	×	×		
4.13	Protection against contact with parts under high voltage	×			
4.14	Clutch		×	×	
4.15	Carburettor adjustment	×			
4.16	Protection against contact with hot parts	×		×	
4.17	Exhaust gases	×	×		
4.18	Chain lubrication		×		
4.19	Tank openings	×	×	×	
4.20	Chain tensioning	×	×		

6 Information for use

6.1 General

Every chain-saw shall be supplied with information about the use for which it is designed or has been tested and about any conditions necessary to ensure that it will be safe and without risk to health at all times when it is being adjusted, used, cleaned or maintained.

6.2 Technical data

6.2.1 The following technical information shall be made available to the user for each chain-saw model:

Mass
Saw without guide-bar and chain, empty tanks: .....kg

Volumes
Fuel tank: ..... cm^3

Tank for chain lubricating oil: ..... cm^3

Cutting length
All specified usable cutting lengths of guide-bar, specified by the manufacturer: .....cm

Chain
Specified pitch: ..... mm

Specified gauge (thickness of drive links): ..... mm

NOTE 3 The pitch and the gauge may also be given in inches.

Type of chain and guide-bar: .....

Sprocket
Specified number of teeth: .....

Engine
Engine displacement: ..... cm^3

Maximum shaft brake power (in accordance with ISO 7293): ..... kW

Recommended maximum speed with cutting attachment: ..... min^{-1}

Recommended speed at idling: ..... min^{-1}

Fuel consumption (in accordance with ISO 7293)
Fuel consumption at maximum engine power (on request): .....kg/h

Specific fuel consumption at maximum engine power (on request): ..... g/kWh

Chain brake (in accordance with ISO 6535)
Mean braking time at racing speed (on request): .....s

Vibrations (in accordance with ISO 7505): ..... m/s^2

6.2.2 Data from the following calculations shall also be made available.

Sound pressure level (in accordance with ISO 7182)

a) Chain-saws with an engine displacement ≤ 80 cm^3

$$\overline{L}_p = 10 \lg \left[\frac{1}{3} \left(10^{0,1 L_{pI}} + 10^{0,1 L_{pFL}} + 10^{0,1 L_{pR}} \right) \right]$$

b) Chain-saws with an engine displacement > 80 cm^3

$$\overline{L}_p = 10 \lg \left[\frac{1}{2} \left(10^{0,1 L_{pI}} + 10^{0,1 L_{pFL}} \right) \right]$$

where

L_{pI} is the A-weighted time-averaged emission sound pressure level at idling, in decibels;

L_{pFL} is the A-weighted time-averaged emission sound pressure level at full load, in decibels;

L_{pR} is the A-weighted time-averaged emission sound pressure level at racing, in decibels;

$\overline{L}_p$ is the mean of the three or two previous quantities.

Octave band analysis (on request).

Sound power level (in accordance with ISO 9207)

a) Chain-saws with an engine displacement ≤ 80 cm^3

$$\overline{L}_W = 10 \lg \left[\frac{1}{3} \left(10^{0,1 L_{WI}} + 10^{0,1 L_{WFL}} + 10^{0,1 L_{WR}} \right) \right]$$

b) chain-saws with an engine displacement > 80 cm^3

$$\overline{L}_W = 10 \lg \left[\frac{1}{2} \left(10^{0,1 L_{WI}} + 10^{0,1 L_{WFL}} \right) \right]$$

where

L_{WI} is the A-weighted sound power level at idling, in decibels;

L_{WFL} is the A-weighted sound power level at full load, in decibels;

L_{WR} is the A-weighted sound power level at racing, in decibels;

$\overline{L}_W$ is the mean of the three or two previous quantities.

6.3 Instruction handbook

Comprehensive instructions and information on all aspects of operator/user maintenance and the safe use of the chain-saw, including safety clothing and personal protective equipment requirements and

the need for training in all manual chain-saw operations shall be provided in the instruction handbook. They shall comply with subclause 5.5 of ISO/TR 12100-2:1992. The instructions shall take into account that the chain-saw may be used by a first-time inexperienced operator.

Extensive use should be made of photographs and/or diagrams.

The importance of reading the instruction handbook thoroughly before using the chain-saw shall be stressed on the cover of the instruction handbook.

Terms used in all documentation shall be in accordance with ISO 6531.

The instruction handbook shall cover at least information relating to

a) transport, handling and storage of the chain-saw, such as
   - the use of guide-bar cover during transport and storage,
   - cleaning and maintenance before storage;

b) commissioning of the chain-saw, such as
   - assembling instructions, initial adjustments and checks,
   - filling of fuel and oil, especially concerning fire precautions,
   - explanation of symbols and safety signs;

c) the chain-saw itself, such as
   - description, identification and nomenclature of principal parts including the safety devices and explanations of their functions and necessary personal protection equipment,
   - information regarding appropriate use of the spiked bumper,
   - regular maintenance task, pre-operating measures and daily maintenance techniques,
   - application of the chain-saw and how it is intended to be used, including prohibited applications,
   - data about sound pressure and power levels and vibration levels (see 6.2.2). An octave band analysis shall be supplied upon request, to enable the selection of correct hearing protection;

d) the use of the chain-saw, such as
   - operating instructions and instructions for common cutting tasks, including the use of personal protection equipment,
   - hazards which may be encountered whilst using the saw and how to avoid them while doing typical tasks,
   - starting and stopping, with particular reference to safety,
   - guide-bar and chain adjustment with the engine stopped, including regular testing of chain brake,
   - chain tensioning and sharpening techniques, including use of gloves,
   - warning about the emission of exhaust gases, lubrication oil mist and saw dust, explanation of white finger risks, and means for self-protection;

e) maintenance instructions, such as
   - servicing and replacement tasks for the user,
   - drawings or diagrams to allow user maintenance and fault-finding tasks.

6.4 Marking

All chain-saws shall be marked legibly and indelibly with the following minimum information:

- name and address of the manufacturer;
- year of construction;
- designation of series or type;
- serial number, if any.

In addition, the chain-saw shall bear the following additional information:

- identification of the on/off control, oiler control, fuel and/or oil caps, choke control, primer control, heated handle switch (if provided);
- a symbol indicating that eye and hearing protection is necessary;
- a prominent mark "WARNING: SEE INSTRUCTION HANDBOOK!".

NOTE 4 This text may be replaced by a pictorial.

The marking shall be located in a readily visible position on the unit and shall resist the anticipated service conditions, e.g. the effects of temperature, moisture, petrol, oil, abrasion and weathering exposure.

All controls should be marked with an appropriate symbol, if available, in accordance with ISO 3767-5. Symbols relating to safety should be in accordance with the shape and colour requirements of ISO 3864.