

First edition
2005-01-15

**Portable hand-held forestry machines —
A-weighted emission sound pressure
levels at the operator's station —
Comparative data in 2002**

*Machines forestières portatives à main — Niveaux de pression
acoustique d'émission pondérés A à la position de l'opérateur —
Données comparatives en 2002*



Reference number
ISO/TR 22520:2005(E)

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Published in Switzerland

Foreword

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The main task of technical committees is to prepare International Standards. 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.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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.

ISO/TR 22520 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 17, *Manually portable forest machinery*.

Introduction

During revision of ISO 11681 and ISO 11806, the so-called achievable values were eliminated and replaced by a more general provision stating that machines are to generate a sound level as low as practicable. Owing to the complex interaction with other technical parameters, achieving this lowest possible sound level is not always feasible. Conflicts can arise from the negative results of excessive sound level reductions, such as increased weight, loss of power or increased design volume of the entire machine. These aspects have a predominant influence on safety and ergonomic conditions when chain saws, brush-cutters and grass-trimmers are used.

Because of these conflicting parameters, ISO/TC 23, SC 17 decided to elaborate a Technical Report providing information on the determined A-weighted emission sound pressure level of chain saws, brush-cutters and grass-trimmers.

The determination of noise emission characteristics are primarily used for

- declarations by manufacturers of the noise emitted,
- comparison of the noise emitted by machines in the family concerned, and
- purposes of noise control at source at the design stage.

The accumulated sound data can serve as a basis for the design of new machines. It is foreseen that this Technical Report will be updated when test procedures and the emission values change and more data on the sound pressure emission are available. The data presented here are based on information provided by the manufacturers and are considered representative of the respective regional markets.

Values given in this document are not limit values of noise emission that a portable forestry machine is not to exceed when placed on the market, nor are they exposure values for persons using the machines.

Portable hand-held forestry machines — A-weighted emission sound pressure levels at the operator's station — Comparative data in 2002

1 Scope

ISO/TR 22520 provides comparative data, obtained from various manufacturers and other official sources, for the year 2002, on the A-weighted emission sound pressure levels of portable hand-held forestry machinery. It is applicable to chain saws (for which the existing emission sound pressure levels were for the full range of engine sizes) and to brush-cutters and grass-trimmers. International Standards ISO 11681-1, ISO 11681-2 and ISO 11806 require that these machines be designed to generate noise levels as low as practicable, based on the existing noise emission data, and ISO/TR 22520 is intended to assist in determining compliance with that requirement.

2 Normative references

The following referenced documents are indispensable for the application 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 7182:1984, *Acoustics — Measurement at the operator's position of airborne noise emitted by chain saws*

ISO 7917:1987, *Acoustics — Measurement at the operator's position of airborne noise emitted by brush saws*

ISO 11681-1, *Machinery for forestry — Portable chain-saw safety requirements and testing — Part 1: Chain-saws for forest service*

ISO 11681-2, *Forestry machinery — Portable chain-saw safety requirements and testing — Part 2: Chain-saws for tree service*

ISO 11689:1996, *Acoustics — Procedure for the comparison of noise-emission data for machinery and equipment*

ISO 11806, *Agricultural and forestry machinery — Portable hand-held combustion engine driven brush cutters and grass trimmers — Safety*

ANSI B 175.1:2000, *Safety requirements for gasoline powered chain saws*¹⁾

CSA Z 62.1:1995, *Chain saws*²⁾

AS 2726.1:1995, *Chainsaws — Safety requirements — Chainsaws for general use*³⁾

SAE J335b, *Multi-positioned small engine exhaust fire ignition suppression*⁴⁾

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- 1) American National Standards Institute standard.
 - 2) Canadian Standards Association standard.
 - 3) Standards Australia standard. Superseded by AS 2726.1:2004.
 - 4) Society of Automotive Engineers standard.

3 Evaluation of A-weighted emission sound pressure data

A-weighted emission sound pressure levels for chain saws were measured in accordance with ISO 7182:1984, ANSI B 175.1:2000, CSA Z 62.1:1995 and AS 2726.1:1995. For brush-cutters and grass-trimmers, test data are based on ISO 7917:1987.

ISO 22868 is to replace ISO 7182 and ISO 7917, after which, as soon as sufficient data has been gathered, it is intended that a new report be prepared, based on test data gathered in accordance with ISO 22868.

The test data are presented in the diagrams (see Figures 1 to 5) as a function of the engine displacement and according to the method given in ISO 11689. The data points do not include uncertainties as, at the time of collection, no such information was available.

The evaluation of the A-weighted emission sound pressure levels indicates three different classes.

- a) A-weighted emission sound pressure levels above the regression line L_1 indicate a low level of acoustical design: 90 % of all the machines considered are below this line.
- b) A-weighted emission sound pressure levels between the regression lines L_1 and L_2 cover those machines having an average level of acoustical design.
- c) A-weighted emission sound pressure levels below the regression line L_2 indicate a high level of acoustical design: 20 % of all the machines considered are below this line.

The machines selected for this evaluation

- fulfil existing national noise regulations, and
- represent models on the market in 2002.

The design parameters of a machine include other characteristics such as power, weight, vibration, exhaust emissions, ergonomics and fire-prevention measures. The intended mode of operation of the machine will influence the priorities of these parameters when a new machine is designed.

The different clusters should not be used for comparison purposes, as the basic standards and the tested machines were different.

Specific subclasses of machine were defined for chain saws with an engine displacement, D , below and above 80 cm³, and for trimmers and brush-cutters with an engine displacement below and above 35 cm³ in order to address the specific design, the different usage and diverging cutting attachments for these machines.

4 Chain saws

4.1 Range of emission data measured according to ISO 7182:1984 — Chain saws with a displacement of $D < 80$ cm³

The basic key parameters of these test data are the following.

- The saw was equipped with the standard guide bar.
- Tests were conducted with the operator.
- The test modes were *idling*, *full load* and *racing*.
- The test load was applied by cutting wood.
- The distance between the saw and the operator's ear was 70 cm.

- The tested models did not incorporate so-called fire-screen mufflers as required in fire-sensitive areas of the world.
- The survey included 69 models from six manufacturers, with seven models falling above regression line L_1 and 14 models falling below regression line L_2 .
- An engine displacement, D , of between 29 cm³ and 77 cm³.

The test data presented in Figure 1 represent the equivalent A-weighted emission sound pressure level, L_{pAeq} , at the operator's position, determined as follows:

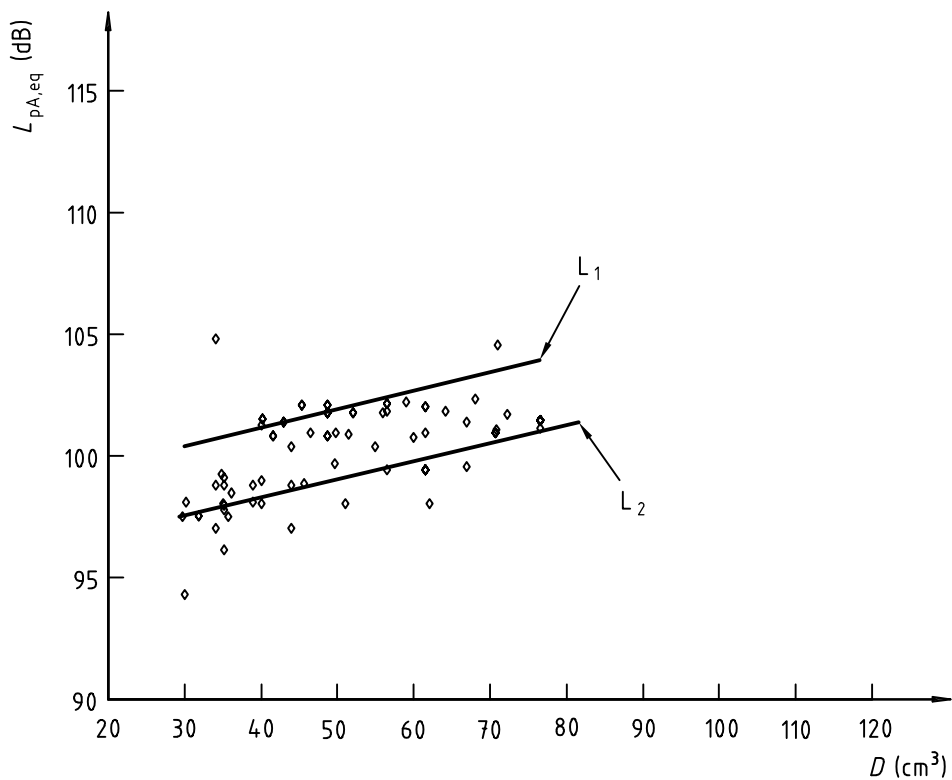
$$L_{pA,eq} = 10 \lg \frac{1}{3} \left(10^{0,1\bar{L}_{pA,Id}} + 10^{0,1\bar{L}_{pA,Fl}} + 10^{0,1\bar{L}_{pA,Ra}} \right)$$

where

$\bar{L}_{pA,Id}$ is the average sound pressure level for the idling operating condition;

$\bar{L}_{pA,Fl}$ is the average sound pressure level for the full-load operating condition;

$\bar{L}_{pA,Ra}$ is the average sound pressure level for the racing operating condition.



Equation for L_1 : $y = 0,074x + 98,3$

Equation for L_2 : $y = 0,074x + 95,3$

Figure 1 — L_{pAeq} at operator's position, measured according to ISO 7182— Chain saws $D < 80$ cm³

4.2 Range of emission data measured according to ISO 7182:1984 — Chain saws with a displacement of $D \geq 80 \text{ cm}^3$

The basic key parameters of these test data are the following.

- The saw was equipped with the standard guide bar.
- Tests were conducted with the operator.
- The test modes were *idling* and *full load*.
- The test load was applied by cutting wood.
- The distance between the saw and the operator's ear was 70 cm.
- The models tested did not incorporate “fire-screen mufflers”, required in fire-sensitive areas of the world.
- The survey included 14 models from five manufacturers, with one model falling above regression line L_1 and three models falling below regression line L_2 .
- An engine displacement, D , of between 80 cm^3 and 119 cm^3 .

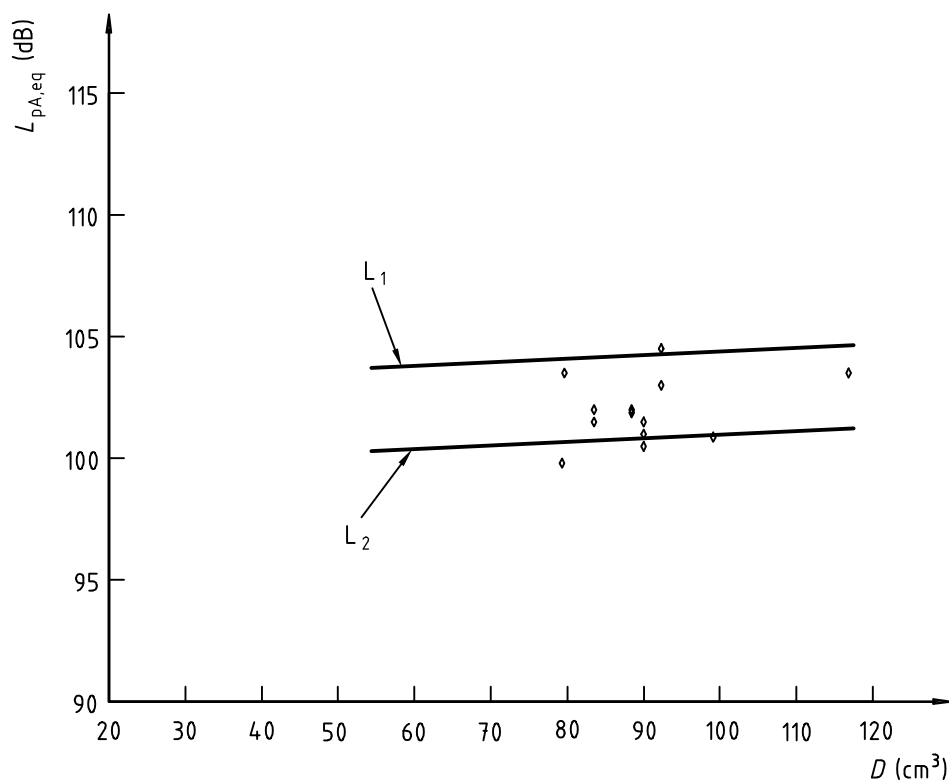
The test data presented in Figure 2 represent the equivalent A-weighted emission sound pressure level, $L_{pA,eq}$, at the operator's position, determined as follows:

$$L_{pA,eq} = 10 \lg \frac{1}{2} \left(10^{0,1 \bar{L}_{pA,Id}} + 10^{0,1 \bar{L}_{pA,Fl}} \right)$$

where

$\bar{L}_{pA,Id}$ is the average sound pressure level for the idling operating condition;

$\bar{L}_{pA,Fl}$ is the average sound pressure level for the full-load operating condition.



$$\text{Equation for } L_1: y = 0,015x + 102,8$$

$$\text{Equation for } L_2: y = 0,015x + 99,4$$

Figure 2 — L_{pAeq} at operator's position, measured according to ISO 7182 — Chain saws $D \geq 80$ cm³

4.3 Range of emission data measured according to ANSI B 175.1/CSA Z 62.1

The basic key parameters of these test data are the following.

- The saw was equipped with the shortest guide bar.
- Tests were conducted with operator.
- The test mode was full load (best cutting speed).
- The test load was applied by cutting of wood.
- The distance between the saw and the operator's ear was 70 cm.
- The models tested incorporated “fire-screen mufflers”, in accordance with ANSI B 175.1 and SAE J335b.
- The survey included 47 models from six manufacturers, with five models falling above the regression line L_1 and nine models falling below regression line L_2 .
- An engine displacement, D , of between 30 cm³ and 92 cm³.

NOTE CSA Z 62.1 and ANSI B 175.1 are technically identical.

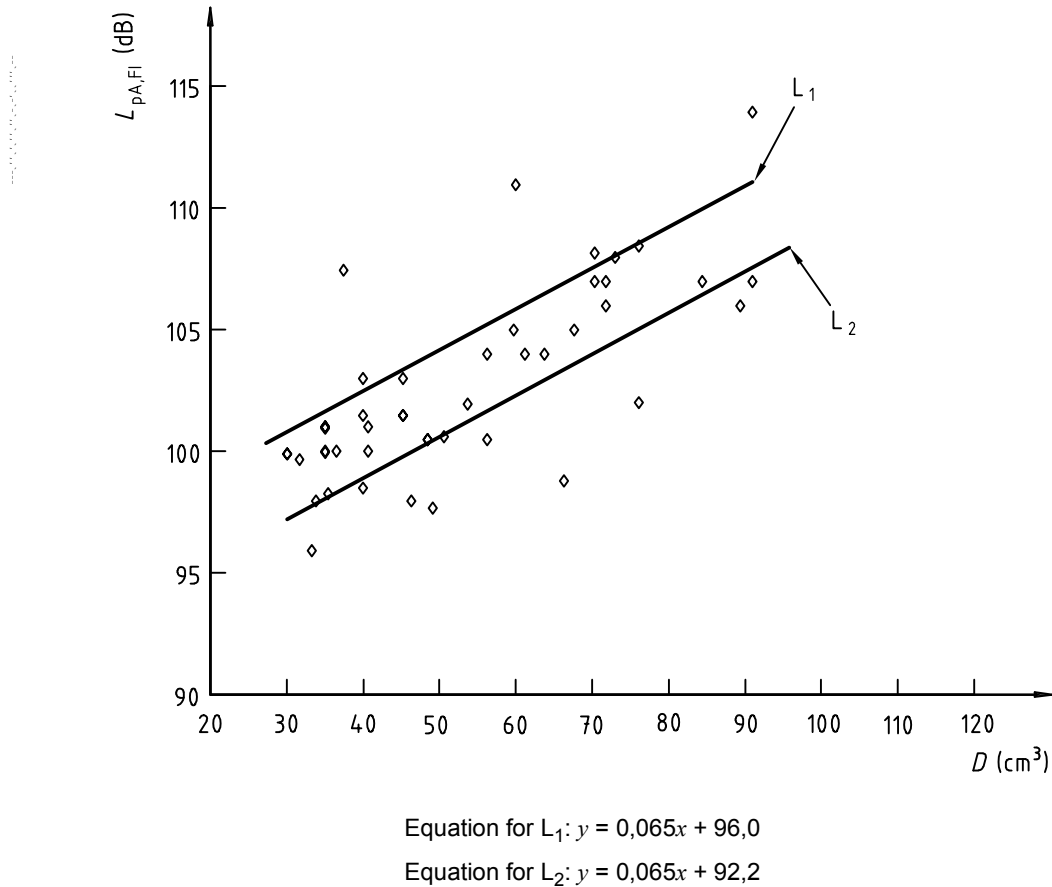
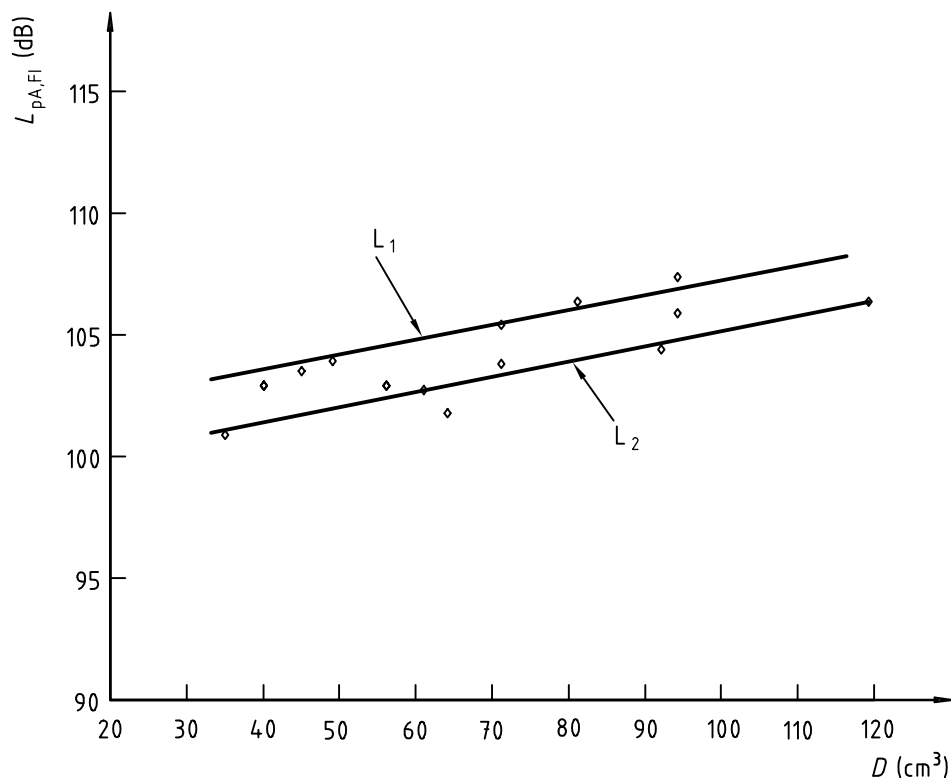


Figure 3 — $\bar{L}_{pA,FI}$ at operator's position, measured according to ANSI B 175.1/CSA Z 62.1 — Chain saws — Full load, cutting wood, best cutting speed

4.4 Range of emission data measured according to AS 2726.1

The basic key parameters of these test data are the following.

- The saw was equipped with the standard guide bar.
- Tests were conducted with an operator.
- The test mode was *full load*.
- The test load was applied by cutting of wood.
- The distance between the saw and the operator's ear was 70 cm.
- The models tested incorporated “fire-screen mufflers”, required in fire-sensitive areas of the world, according to SAE J335b.
- The survey included 17 models from two manufacturers, with two models falling above regression line L₁ and four models falling below regression line L₂.
- An engine displacement, *D*, of between 35 cm³ and 122 cm³.



$$\text{Equation for } L_1: y = 0,06x + 101,3$$

$$\text{Equation for } L_2: y = 0,06x + 99,3$$

Figure 4 — $\bar{L}_{pA,FI}$ at operator's position, measured in accordance with AS 2726.1 — Chain saws — Full load

5 Brush-cutters and grass-trimmers — Range of emission data measured according to ISO 7917 — Machines with a displacement of D from 22 cm to 68 cm

The basic key parameters of these test data are the following.

- The brush-cutters and grass-trimmers were equipped with flexible lines or metal blades.
- A differentiation between cutting attachments was not possible due to the way in which the data were presented.
- Tests were conducted with operators.
- The test modes were *idling* and *racing*, with racing being full-throttle open with machines having flexible lines and being the maximum speed defined for tests with metal blades, which were then combined to yield $L_{pA,eq}$, as follows:

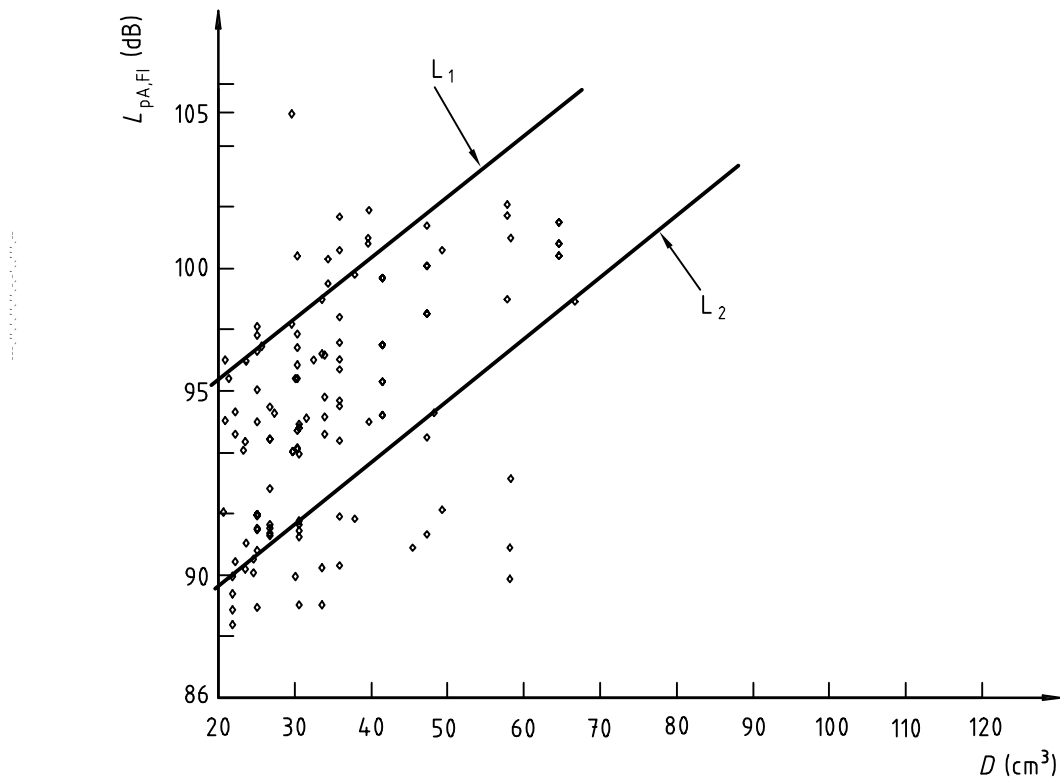
$$L_{pA,eq} = 10 \lg \frac{1}{2} \left(10^{0,1 \bar{L}_{pA,Id}} + 10^{0,1 \bar{L}_{pA,Ra}} \right)$$

where

$\bar{L}_{pA,Id}$ is the average sound pressure level for the idling operating condition;

$\bar{L}_{pA,Ra}$ is the average sound pressure level for the racing operating condition.

- The models tested did not incorporate “fire screen mufflers”, required in fire-sensitive areas of the world.
- The survey included 135 models from six manufacturers, with 14 models falling above regression line L_1 and 26 models falling below regression line L_2 .
- An engine displacement, D , of between 22 cm³ and 68 cm³.



Equation for L_1 : $y = 0,2x + 92,4$

Equation for L_2 : $y = 0,2x + 85,6$

Figure 5 — L_{pAeq} at operator's position, measured in accordance with ISO 7917 — Brush-cutters and grass-trimmers (worldwide models)

Bibliography

- [1] ISO 22868, *Forestry machinery — Noise test code for portable hand-held machines with internal combustion engine — Engineering method (Grade 2 accuracy)*⁵⁾

5) To be published. (Revision of ISO 7182:1984 and ISO 7917:1987)

ICS 17.140.20; 65.060.80

Price based on 9 pages