TECHNICAL REPORT

ISO/TR 22521

First edition
2005-01-15

Portable hand-held forestry machines — Vibration emission values at the handles — Comparative data in 2002

Machines forestières portatives à main — Valeurs d'émission de vibrations aux poignées — Données comparatives en 2002

Reference number
ISO/TR 22521:2005(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.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 22521 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 vibration level as low as practicable. Owing to the complex interaction with other technical parameters, achieving this lowest possible vibration level is not always feasible. Conflicts can arise from the negative results of excessive vibration 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 vibration level at the handles of chain saws, grass-trimmers and brush-cutters.

The determination of vibration-emission characteristics are primarily used for

— declarations by manufacturers of the vibration emitted,

— comparison of the vibration emitted by machines in the family concerned, and

— purposes of vibration control at the source at the design stage.

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

Values given in this document are not limit values of vibration 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 — Vibration emission values at the handles — Comparative data in 2002

1 Scope

ISO/TR 22521 provides comparative data, obtained from various manufacturers and other official sources, for the year 2002, on the vibration emission values at the handles of portable hand-held forestry machinery. It is applicable to chain saws, brush-cutters and grass-trimmers in the full range of engine sizes. International Standards ISO 11681-1, ISO 11681-2 and ISO 11806 require that these machines be designed, based on the state of the art and existing vibration emission data, to generate vibration values as low as practicable, and ISO/TR 22521 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 7505:1986, *Forestry machinery — Chain saws — Measurement of hand-transmitted vibration*

ISO 7916:1989, *Forestry machinery — Portable brush-saws — Measurement of hand-transmitted vibration*

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)]

1) American National Standards Institute standard.

2) Canadian Standards Association standard.

3) Standards Australia standard. Superseded by AS 2726.1:2004.

3 Evaluation of vibration emission data

Vibration emission values for chain saws were measured in accordance with ISO 7505:1986, 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 7916:1989.

ISO 22867 is to replace ISO 7505 and ISO 7916, after which, as soon as sufficient data have been gathered, it is intended that a new report be prepared, based on test data gathered in accordance with ISO 22867.

The test data are presented in the diagrams (see Figures 1 to 24) 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 vibration emission levels indicates three different classes.

a) Vibration emission values above the regression line L_1 indicate a low level of vibration design: 90 % of all the machines considered are below this line.

b) Vibration emission values between the regression lines L_1 and L_2 cover those machines having an average level of vibration design.

c) Vibration emission values below the regression line L_2 indicate a high level of vibration design: 20 % of all the machines considered are below this line.

NOTE Horizontal regression lines have been chosen in cases where there was not enough data or insufficient correlation with the engine displacement.

The machines selected for this evaluation

— fulfil existing national vibration regulations, and

— represent models on the market in 2002.

The design parameters of a machine include other characteristics such as power, weight, noise, 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 survey had to be conducted separately for individual countries due to diverging test procedures, different designs, market requests or limits. These aspects have led to differences in the presentation of the vibration values.

Specific subclasses of machine were defined for chain saws with an engine displacement, D, below and above 80 cm^3.

The scale for the axis is identical for all diagrams. This was requested in order to facilitate the comparison of data in different charts.

4 Chain saws

4.1 Range of emission data measured according to ISO 7505:1986 — Chain saws with a displacement of $D < 80$ cm^3

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

— The saw was equipped with the standard guide bar.

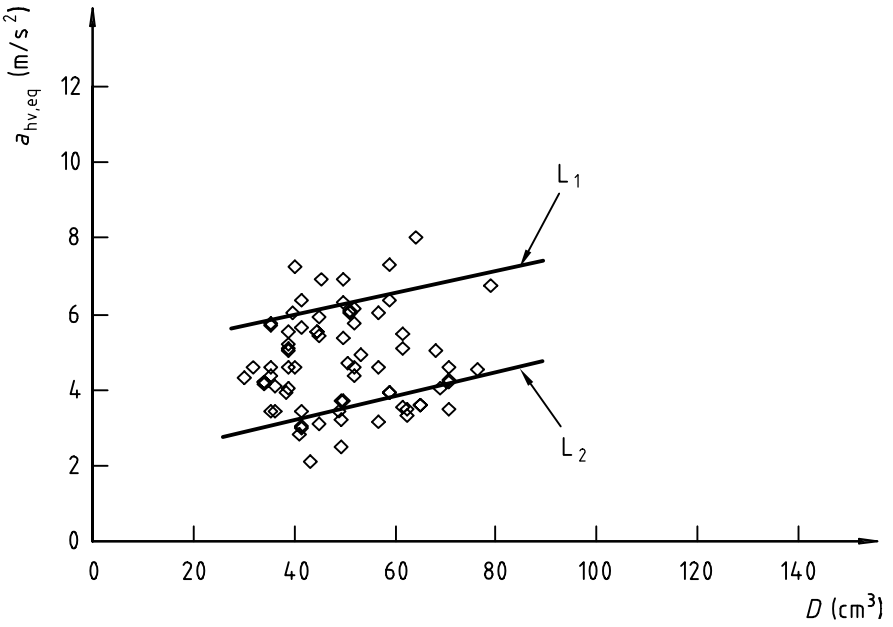
— Tests were conducted with the operator.

— The test modes were *idling*, *full load* and *racing*.

— The test load was applied by cutting wood.

— The survey included 73 models from six manufacturers, with seven models falling above regression line L_1 and 15 models below regression line L_2

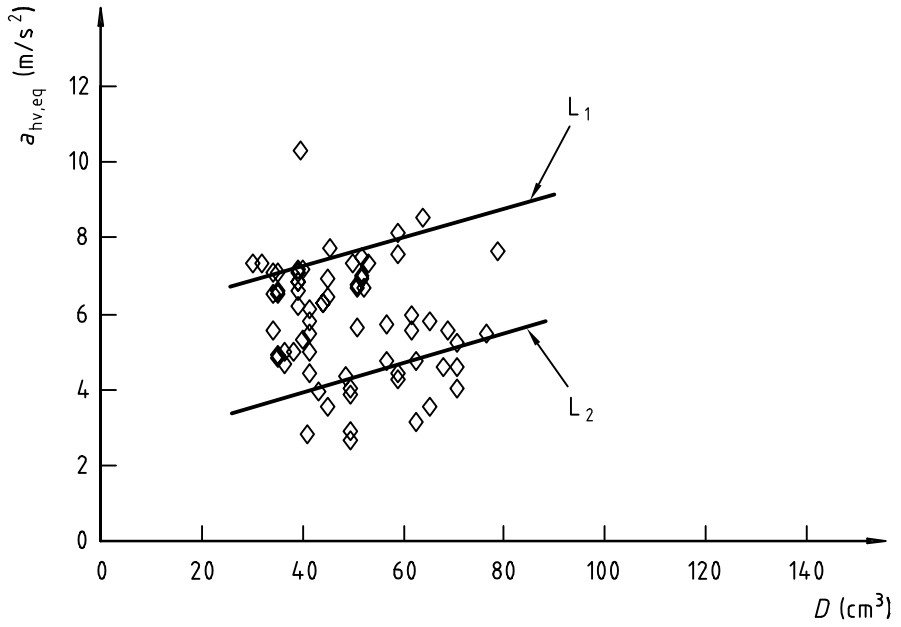
— The test data presented in Figures 1 and 2 represent the equivalent emission vibration level, $a_{hv,eq}$, at the handles.



Equation for L_1: $y = 0{,}03x + 4{,}8$

Equation for L_2: $y = 0{,}03x + 2{,}0$

Figure 1 — $a_{hv,eq}$ measured according to ISO 7505 — Chain saws D < 80 cm^3 — Front handle



Equation for L_1: $y = 0{,}038x + 5{,}6$

Equation for L_2: $y = 0{,}038x + 2{,}3$

Figure 2 — $a_{hv,eq}$ measured according to ISO 7505 — Chain saws D < 80 cm^3 — Rear handle

4.2 Range of emission data measured according to ISO 7505:1986 — Chain saws with a displacement of $D \geqslant 80$ cm^3

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

— The saw was equipped with the standard guide bar.

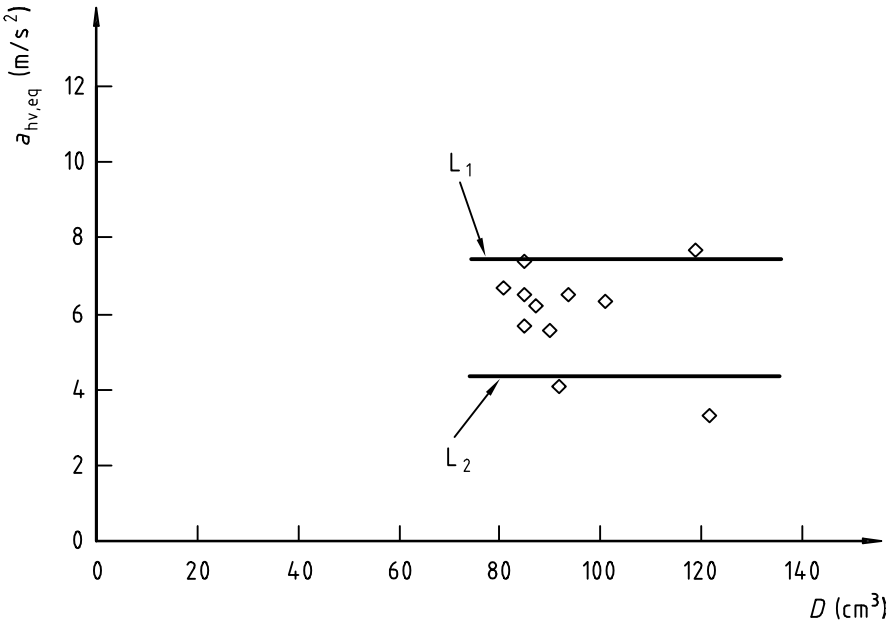
— Tests were conducted with the operator.

— The test modes were *idling* and *full load*.

— The test load was applied by cutting wood.

— The survey included 11 models from five manufacturers for the front handle, while for the rear handle, because data are missing for three machines, there were eight models from four manufacturers. One model fell above regression line L_1 and two models fell below regression line L_2.

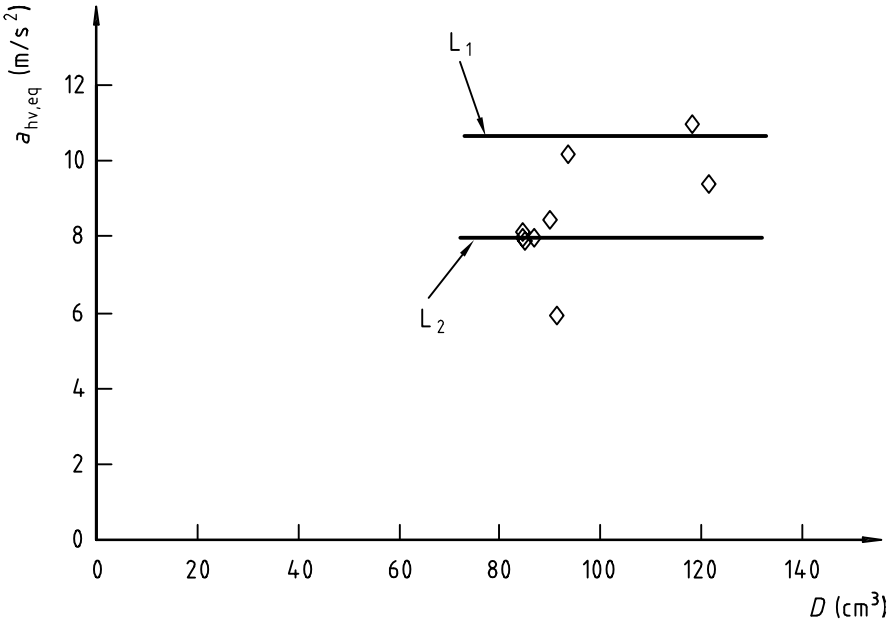
— The test data presented in Figures 3 and 4 represent the equivalent emission vibration level, $a_{hv,eq}$, at the handles.



Equation for L_1: $y = 7{,}5x$

Equation for L_2: $y = 4{,}3x$

Figure 3 — $a_{hv,eq}$ measured according to ISO 7505 — Chain saws $D \geqslant 80$ cm^3 — Front handle



Equation for L_1: $y = 10{,}5x$

Equation for L_2: $y = 8{,}0x$

Figure 4 — $a_{hv,eq}$ measured according to ISO 7505 — Chain saws $D \geqslant 80$ cm^3 — Rear handle

4.3 Range of emission data measured according to ISO 7505:1986 — Tree-service chain saws

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

— The saw was equipped with the standard guide bar.

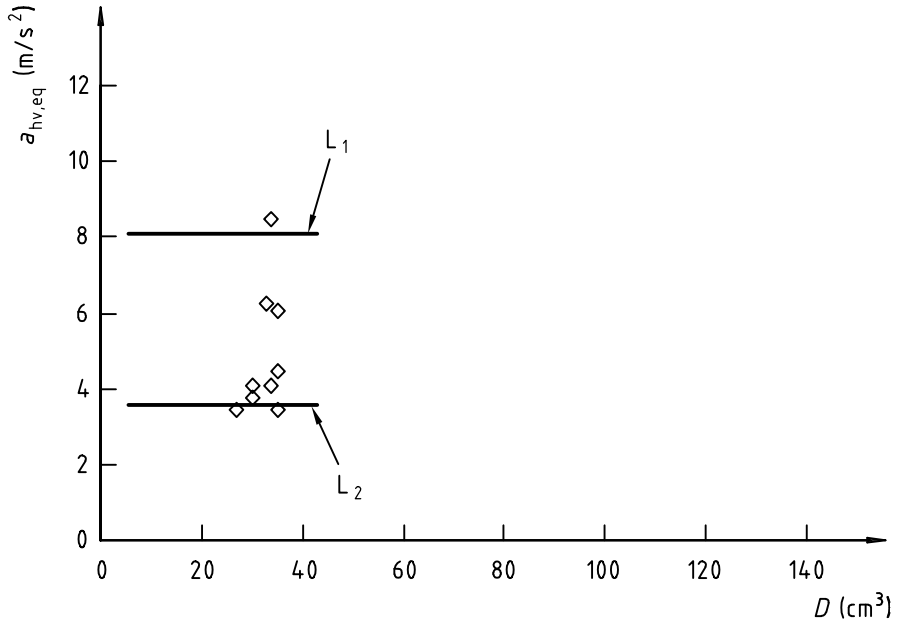
— Tests were conducted with the operator.

— The test modes were *idling*, *full load* and *racing*.

— The test load was applied by cutting wood.

— The survey included nine models from six manufacturers, with one model falling above regression line L_1 and two models falling below regression line L_2.

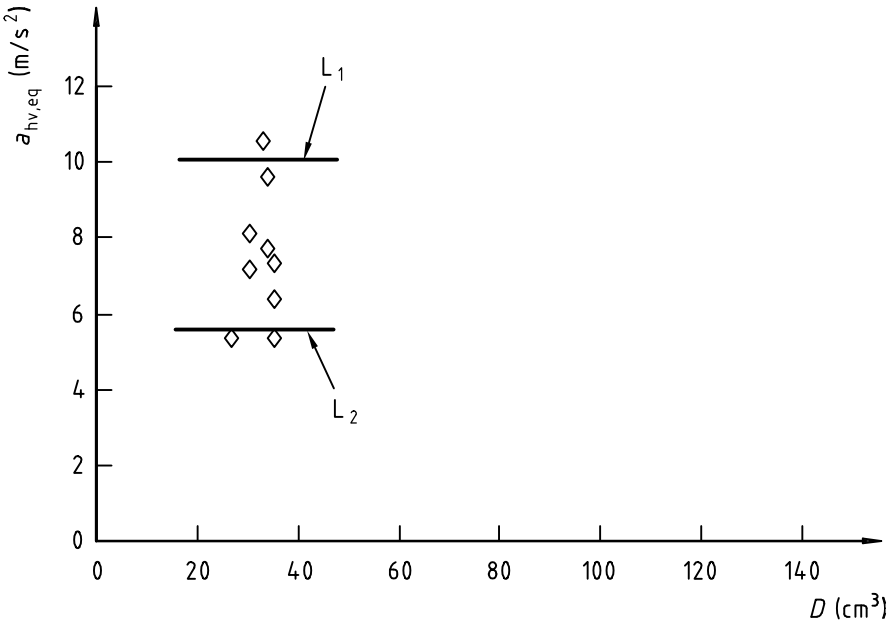
— The test data presented in Figures 5 and 6 represent the equivalent emission vibration level, $a_{hv,eq}$, at the handles.



Equation for L_1: $y = 8{,}0x$

Equation for L_2: $y = 3{,}6x$

Figure 5 — $a_{hv,eq}$ measured according to ISO 7505 — Tree-service chain saws — Front handle



Equation for L_1: $y = 10{,}0x$

Equation for L_2: $y = 5{,}7x$

Figure 6 — $a_{hv,eq}$ measured according to ISO 7505 — Tree-service chain saws — Rear handle

4.4 Range of emission data 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 the operator.

— The test mode was *full load* (with best cutting speed).

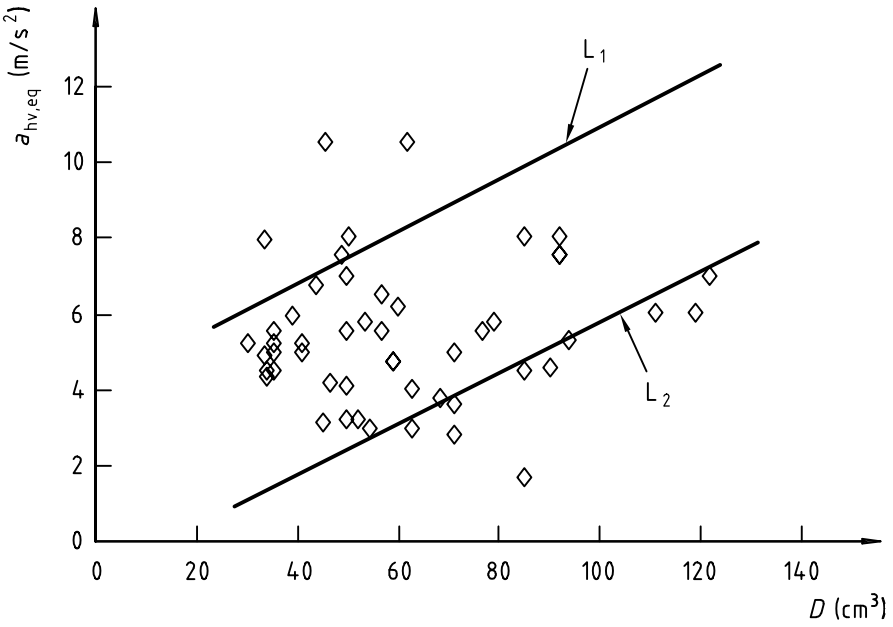
— The test load was applied by cutting of wood.

— The survey included 50 models from five manufacturers, with five models falling above regression line L_1 and 10 models falling below regression line L_2.

— The engine displacement, D, was between 33,4 cm^3 and 121,6 cm^3.

— The test data presented in Figures 7 and 8 represent the average emission vibration level at full load, $\overline{a}_{hv,Fl}$, at the handles.

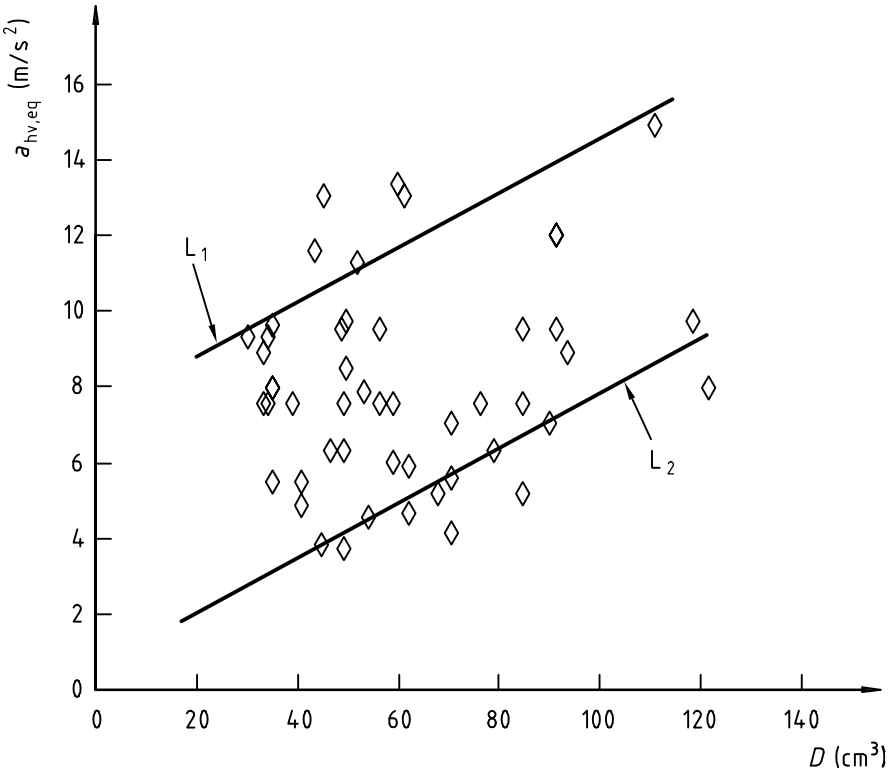
NOTE CSA Z 62.1 and ANSI B 175.1 are technically identical.



Equation for L_1: $y = 0{,}07x + 4{,}0$

Equation for L_2: $y = 0{,}07x - 1{,}1$

Figure 7 — $\overline{a}_{hv,Fl}$ measured according to ANSI B 175.1/CSA Z 62.1 — Chain saws — Full load, cutting wood, best cutting speed — Front handle



Equation for L_1: $y = 0{,}07x + 7{,}3$

Equation for L_2: $y = 0{,}07x + 0{,}6$

Figure 8 — $\overline{a}_{hv,Fl}$ measured according to ANSI B 175.1/CSA Z 62.1 — Chain saws — Full load, cutting wood, best cutting speed — Rear handle

4.5 Range of emission data measured according to AS 2726.1 — Chain saws with a displacement of $D < 80$ cm^3

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

— The saw was equipped with the standard guide bar.

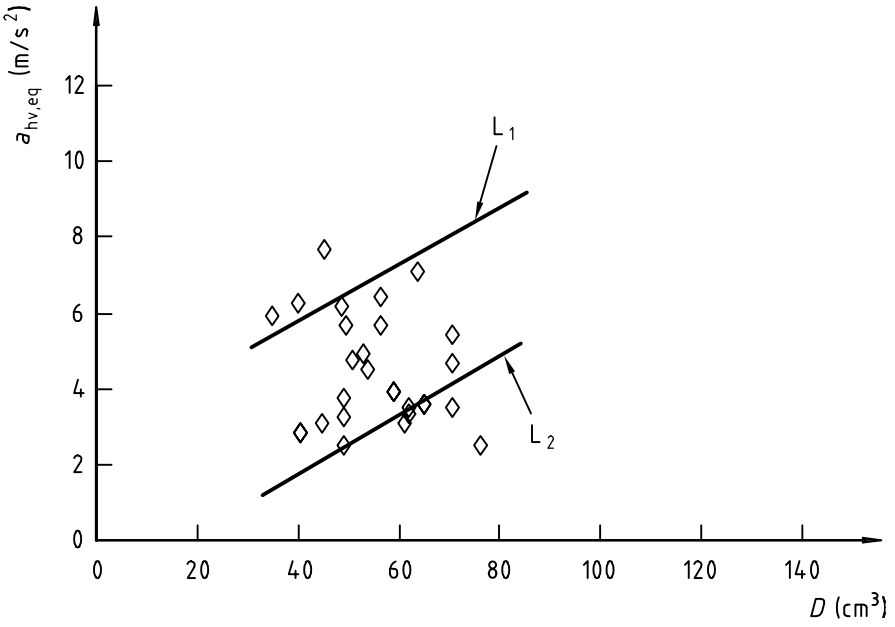
— Tests were conducted with the operator.

— The test modes were *idling*, *full load* and *racing*.

— The test load was applied by cutting of wood.

— The survey included 28 models from three manufacturers, with three models falling above regression line L_1 and five models falling below regression line L_2.

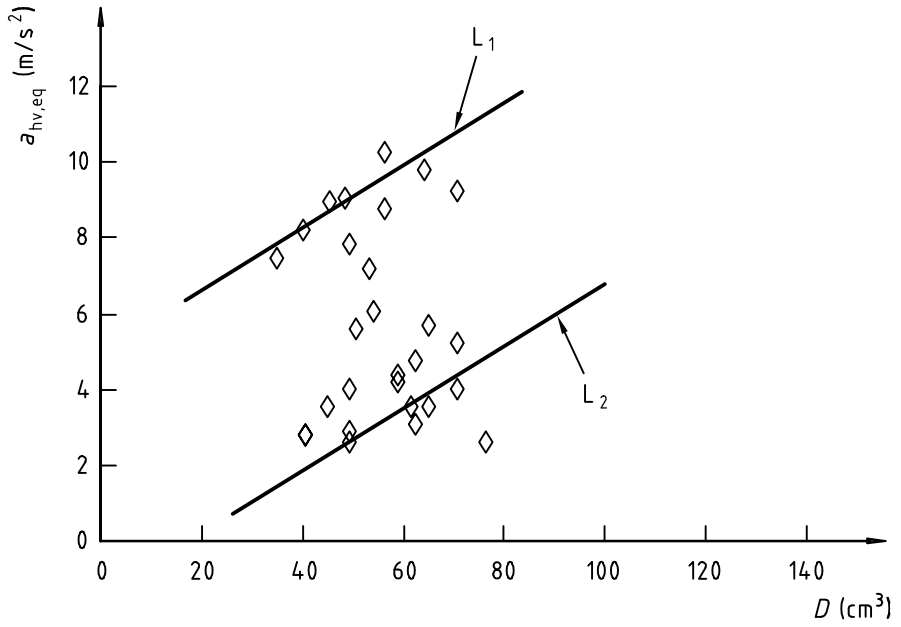
— The test data presented in Figures 9 and 10 represent the equivalent emission vibration level, $a_{hv,eq}$, at the handles.



Equation for L_1: $y = 0{,}075x + 2{,}6$

Equation for L_2: $y = 0{,}075x - 1{,}3$

Figure 9 — $a_{hv,eq}$ measured according to AS 2726.1 — Chain saws $D < 80$ cm^3 — Front handle



Equation for L_1: $y = 0{,}08x + 5{,}0$

Equation for L_2: $y = 0{,}08x - 1{,}3$

Figure 10 — $a_{hv,eq}$ measured according to AS 2726.1 — Chain saws D < 80 cm^3 — Rear handle

4.6 Range of emission data measured according to AS 2726.1 — Chain saws with a displacement of $D \geqslant 80$ cm^3

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

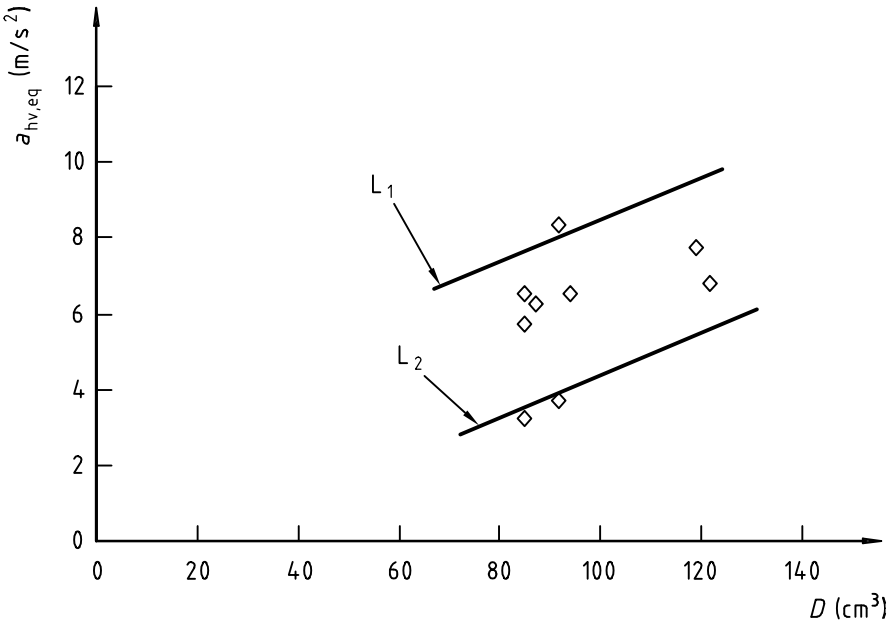
— The saw was equipped with the standard guide bar.

— Tests were conducted with the operator.

— The test modes were *idling* and *racing*.

— The survey includes nine models from three manufacturers, with one of the models falling above the regression line L_1 and the other two models falling below regression line L_2.

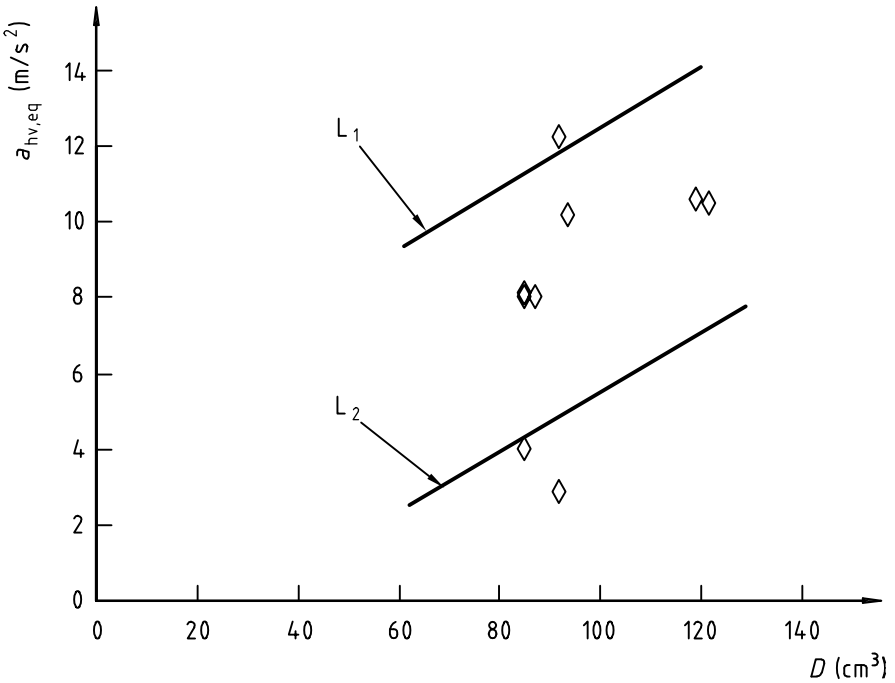
— The test data presented in Figures 11 and 12 represent the equivalent emission vibration level, $a_{hv,eq}$, at the handles.



Equation for L_1: $y = 0{,}055x + 2{,}9$

Equation for L_2: $y = 0{,}055x - 1{,}2$

Figure 11 — $a_{hv,eq}$ measured according to AS 2726.1 — Chain saws $D \geqslant 80$ cm^3 — Front handle



Equation for L_1: $y = 0{,}08x + 4{,}3$

Equation for L_2: $y = 0{,}08x + 4{,}3$

Figure 12 — $a_{hv,eq}$ measured according to AS 2726.1 — Chain saws $D \geqslant 80$ cm^3 — Rear handle

5 Brush-cutters and grass-trimmers — Range of emission data according to ISO 7916

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

— The brush-cutters and grass-trimmers were equipped with flexible lines, flails or metal blades.

— Tests were conducted with operators.

— The test modes were *idling* with full open throttle and with flexible lines and *racing* with the defined maximum speed for tests with flails and metal blades, which were then combined into $a_{hv,eq}$.

— The survey included 281 models from six manufacturers, as follows.

1) 85 models with bullhorn-shaped handles and metal blades, of which eight fell above regression line L_1 and 17 below regression line L_2. The engine displacement, D, was from 22,0 cm^3 to 65,1 cm^3.

2) 36 models with loop-shaped handles and metal blades, of which four fell above regression line L_1 and seven below regression line L_2. The engine displacement, D, was from 20,0 cm^3 to 50,9 cm^3.

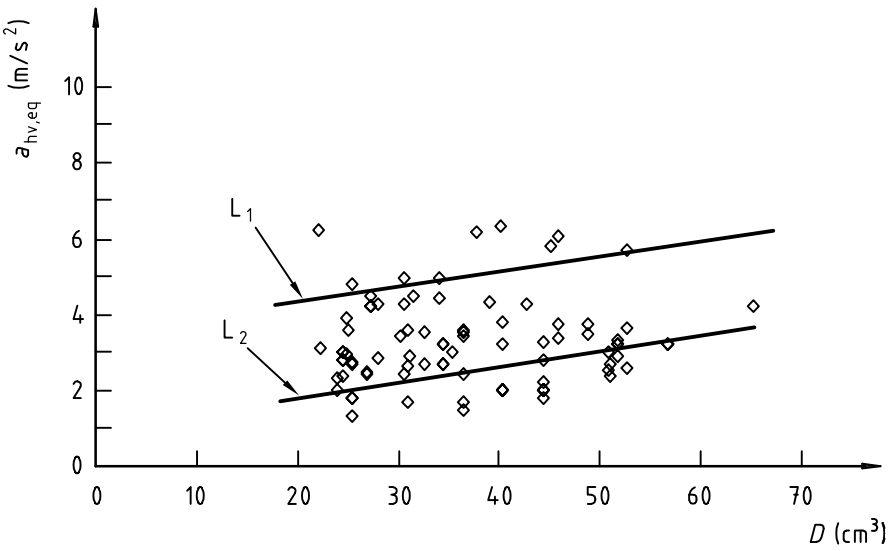
3) 51 models with bullhorn-shaped handles and flails, of which five fell above regression line L_1 and 10 below regression line L_2. The engine displacement, D, was from 22,2 cm^3 to 56,5 cm^3.

4) 24 models with loop-shaped handles and flails, of which two fell above regression line L_1 and five below regression line L_2. The engine displacement, D, was from 22,2 cm^3 to 40,2 cm^3.

5) 45 models with bullhorn-shaped handles and lines, of which five fell above regression line L_1 and nine below regression line L_2. The engine displacement, D, was from 22,0 cm^3 to 65,1 cm^3.

6) 40 models with loop-shaped handles and lines, of which four fell above regression line L_1 and eight below regression line L_2. The engine displacement, D, was from 20,0 cm^3 to 50,9 cm^3.

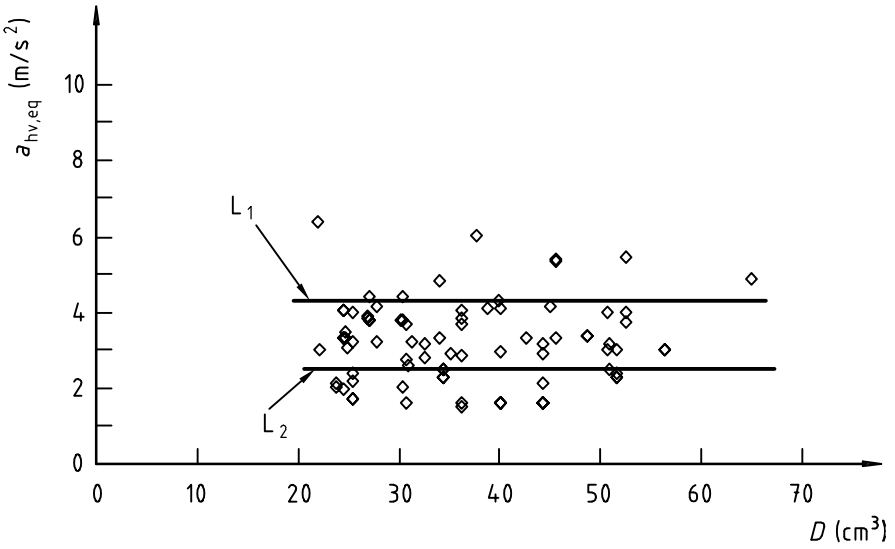
— The test data presented in Figures 13 to 24 represent the equivalent emission vibration level, $a_{hv,eq}$, at the handles.



Equation for L_1: $y = 0{,}04x + 1{,}0$

Equation for L_2: $y = 0{,}04x + 3{,}5$

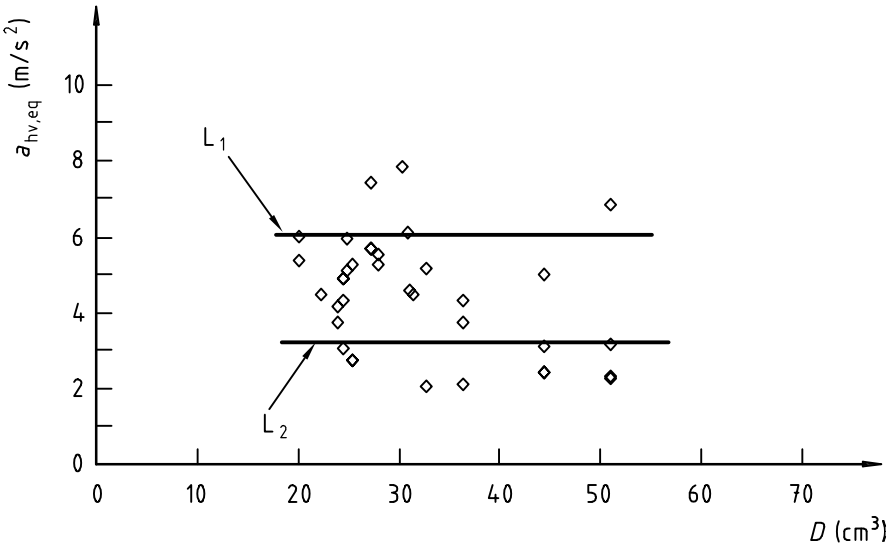
Figure 13 — $a_{hv,eq}$ measured according to ISO 7916 — Brush-cutters — Metal blades, bullhorn-type handles — Left handle



Equation for L_1: y = 4,3

Equation for L_2: y = 2,5

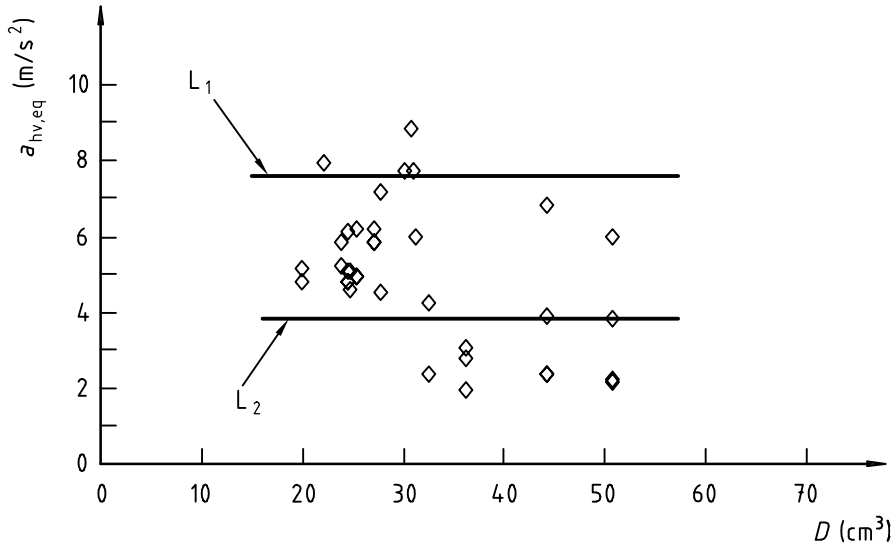
Figure 14 — $a_{hv,eq}$ measured according to ISO 7916 — Brush-cutters — Metal blades, bullhorn-type handles — Right handle



Equation for L_1: y = 6,0

Equation for L_2: y = 3,2

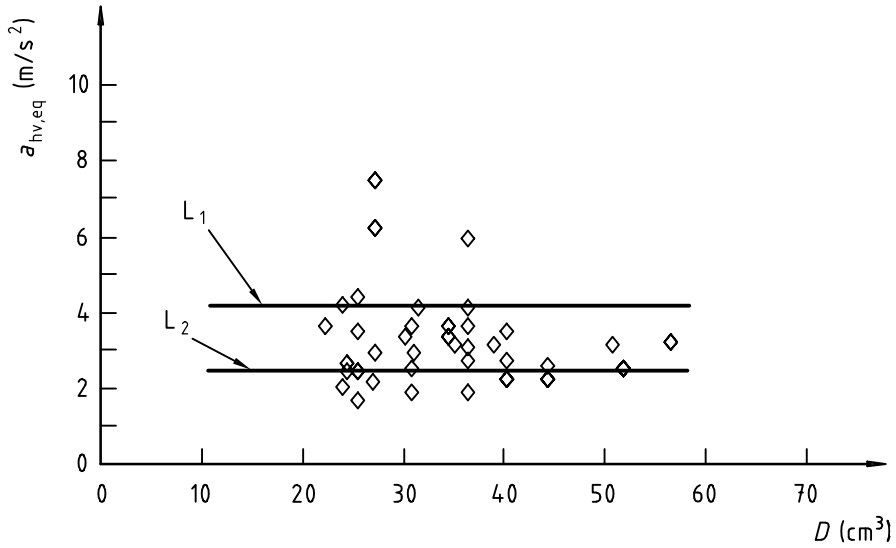
Figure 15 — $a_{hv,eq}$ measured according to ISO 7916 — Brush-cutters — Metal blades, looped-type handles — Front handle



Equation for L_1: y = 7,6

Equation for L_2: y = 3,8

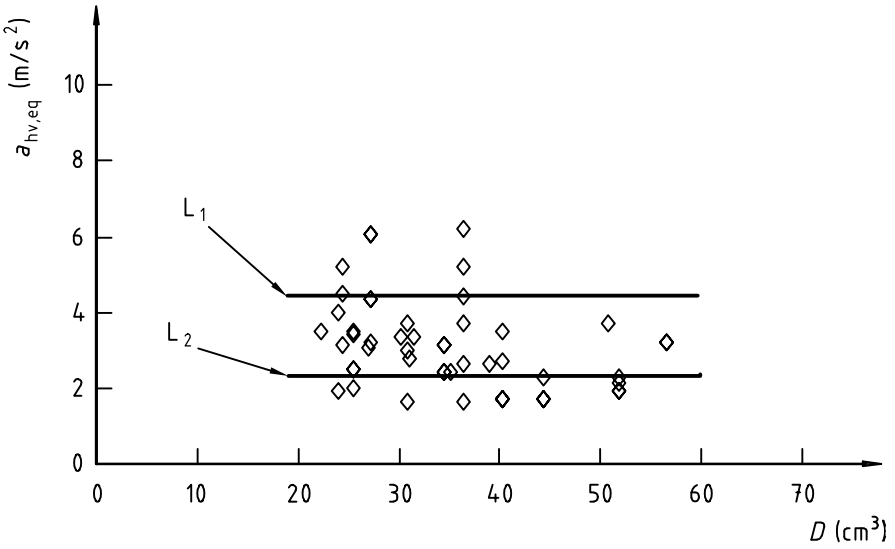
Figure 16 — $a_{hv,eq}$ measured according to ISO 7916 — Brush-cutters — Metal blades, looped-type handles — Rear handle



Equation for L_1: y = 4,1

Equation for L_2: y = 2,4

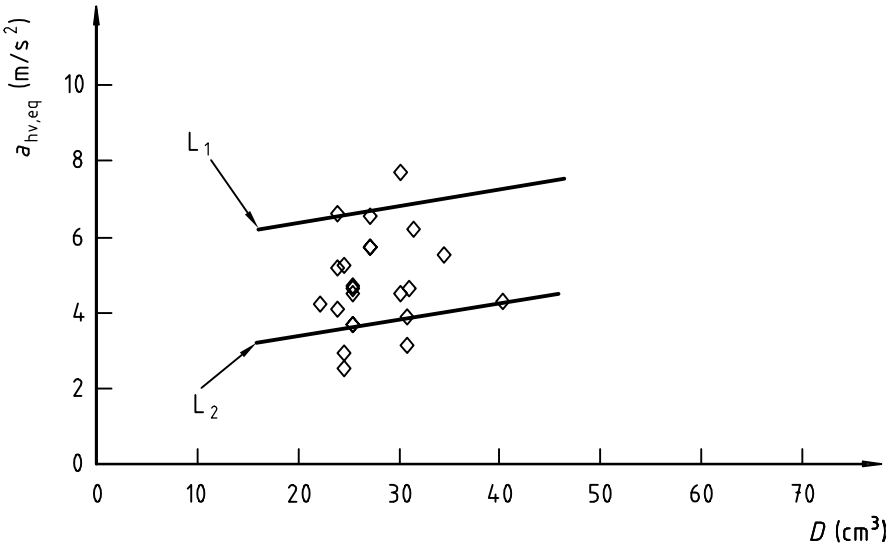
Figure 17 — $a_{hv,eq}$ measured according to ISO 7916 — Grass-trimmers — Flail cutting attachment, bullhorn-type handles — Left handle



Equation for L_1: $y = 4{,}4$

Equation for L_2: $y = 2{,}3$

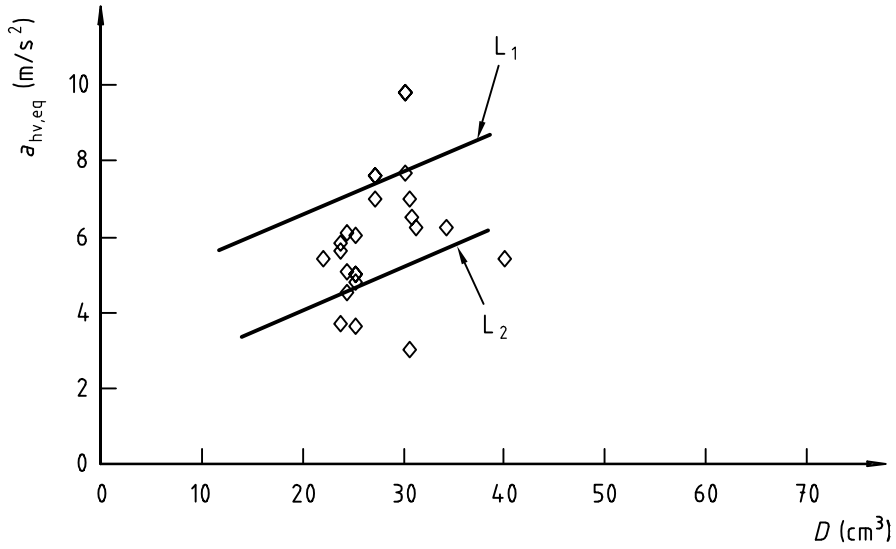
Figure 18 — $a_{hv,eq}$ measured according to ISO 7916 — Grass-trimmers — Flail cutting attachment, bullhorn-type handles — Right handle



Equation for L_1: $y = 0{,}05x + 5{,}3$

Equation for L_2: $y = 0{,}05x + 2{,}3$

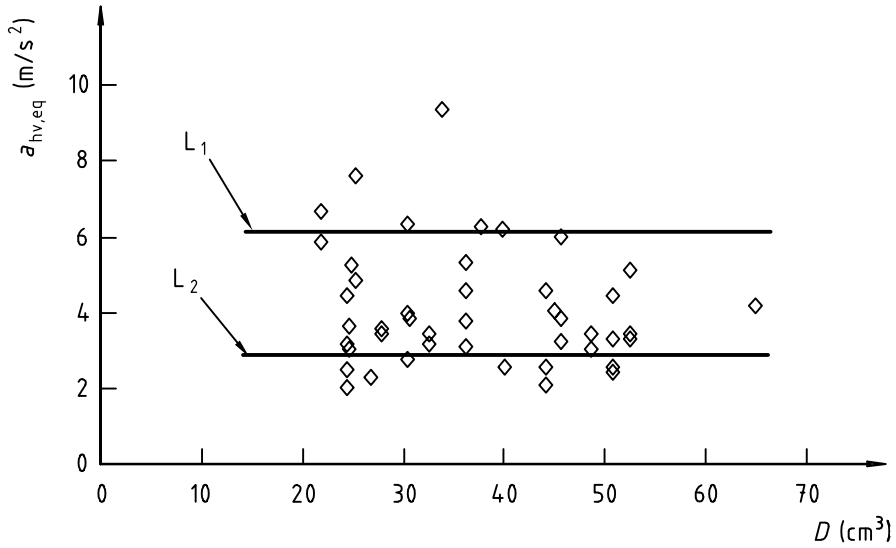
Figure 19 — $a_{hv,eq}$ measured according to ISO 7916 — Grass trimmers — Flail cutting attachment, looped-type handles — Front handle



Equation for L_1: $y = 0{,}115x + 4{,}2$

Equation for L_2: $y = 0{,}115x + 1{,}8$

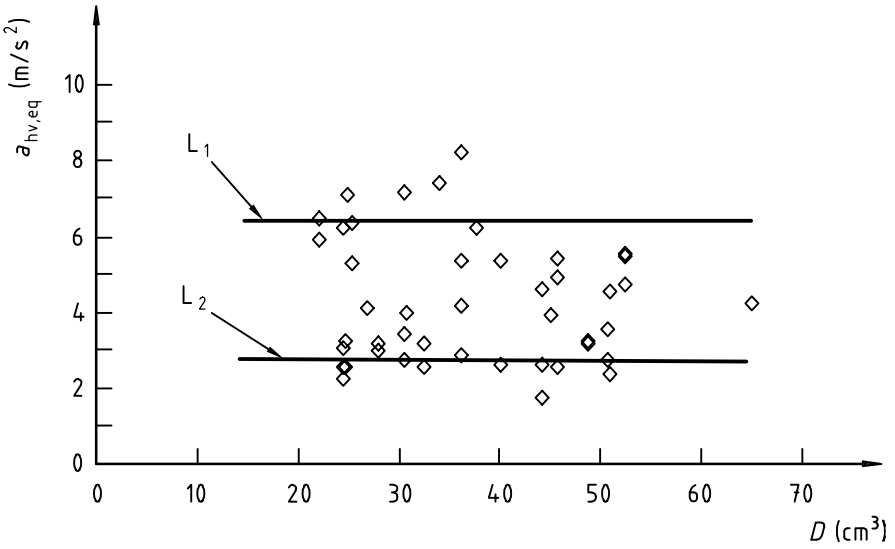
Figure 20 — $a_{hv,eq}$ measured according to ISO 7916 — Grass trimmers — Flail cutting attachment, looped-type handles — Rear handle



Equation for L_1: $y = 6{,}2$

Equation for L_2: $y = 2{,}7$

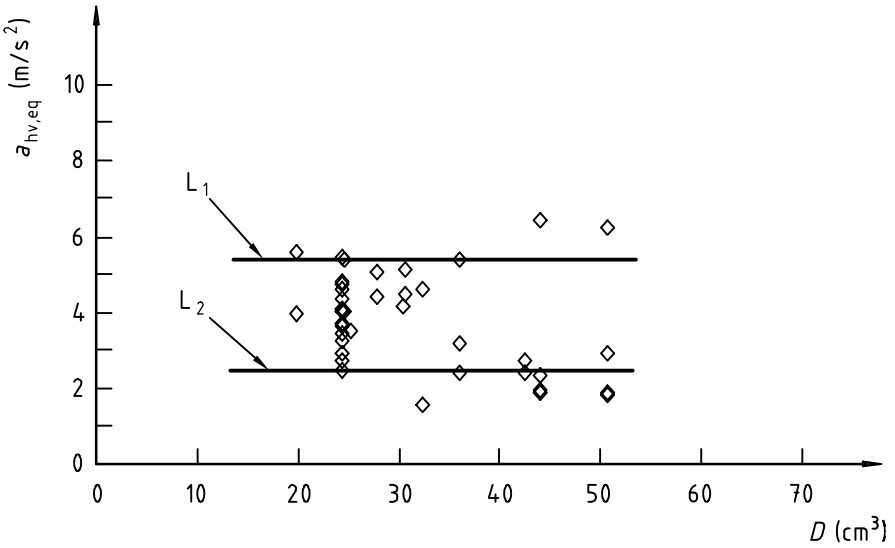
Figure 21 — $a_{hv,eq}$ measured according to ISO 7916 — Grass-trimmers — Line cutting attachment, bullhorn-type handles — Left handle



Equation for L_1: y = 6,4

Equation for L_2: y = 2,8

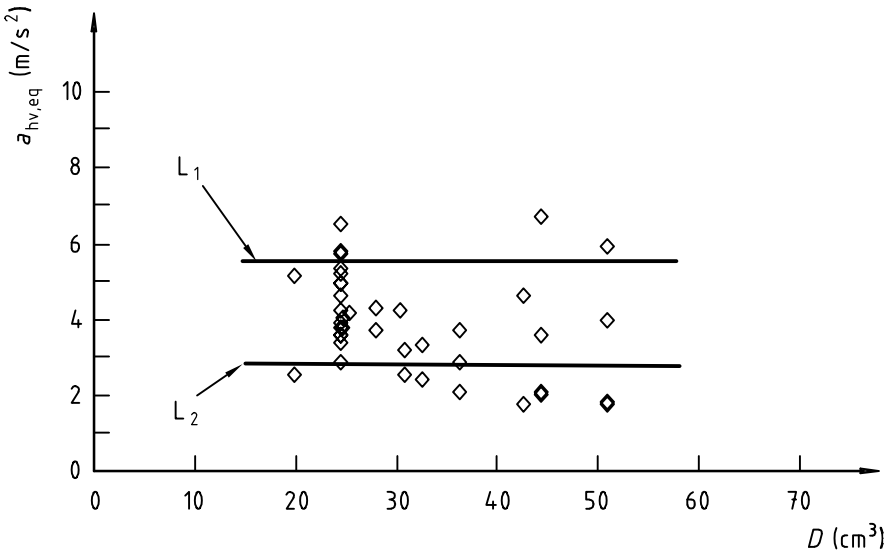
Figure 22 — $a_{hv,eq}$ measured according to ISO 7916 — Grass-trimmers — Line cutting attachment, bullhorn-type handles — Right handle



Equation for L_1: y = 5,4

Equation for L_2: y = 2,4

Figure 23 — $a_{hv,eq}$ measured according to ISO 7916 — Grass-trimmers — Line cutting attachment, looped-type handles — Front handle



Equation for L_1: y = 5,5

Equation for L_2: y = 2,8

Figure 24 — $a_{hv,eq}$ measured according to ISO 7916 — Grass-trimmers — Line cutting attachment, looped-type handles — Rear handle

Bibliography

[1] ISO 22867, *Forestry machinery — Vibration test code for portable hand-held machines with internal combustion engine — Measurement of vibration at the handles*[4)]

4) To be published. (Revision of ISO 7505:1986 and ISO 7916:1989)

ICS 13.160; 65.060.80

Price based on 19 pages