INTERNATIONAL STANDARD

ISO
13772

First edition
1997-07-15

Forestry machinery — Portable chain-saws — Non-manually actuated chain brake performance

Matériel forestier — Scies à chaîne portatives — Performances du frein de chaîne automatique

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 13772 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 17, *Manually portable forest machinery*.

Annex A forms an integral part of this International Standard.

Introduction

This International Standard was developed in response to worldwide demand for a test method and criteria for acceptable initiation of non-manually actuated chain brakes.

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Forestry machinery — Portable chain-saws — Non-manually actuated chain brake performance

1 Scope

This International Standard specifies a method to check the function of the non-manually actuated chain brake on portable hand-held combustion engine driven chain-saws and gives performance requirements.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were 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 editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5347-0:1987, *Methods for the calibration of vibration and shock pick-ups — Part 0: Basic concepts.*

ISO 5348:—[1], *Mechanical vibration and shock — Mechanical mounting of accelerometers.*

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

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 6531 and the following definition apply.

3.1 non-manually actuated chain brake: Brake which is actuated irrespective of operator intervention when a kick-back occurs.

4 Performance requirements

The non-manually actuated chain brake function shall be checked on a normal production saw equipped with a specified guide bar. If no specification is given for the guide bar, the bar length shall be in accordance with table 1 and without a sprocket. The chain-saw shall be in a new and clean condition. Deviations shall be reported in the test report.

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1) To be published. (Revision of ISO 5348:1987)

**Table 1 — Corresponding values of engine displacement
and length of guide bar**

Engine displacement cm³	Effective length of guide bar L m
0 to 44	0,25 to 0,35
45 to 69	0,30 to 0,40
70 to 89	0,40 to 0,50
$\geqslant$ 90	> 0,50

The chain brake shall be considered to have an acceptable non-manually actuated function if each of the horizontal and vertical acceleration levels, a_x and a_y, at which the chain brake actuates (see clause 8) are below the appropriate limit line as given in figure 1.
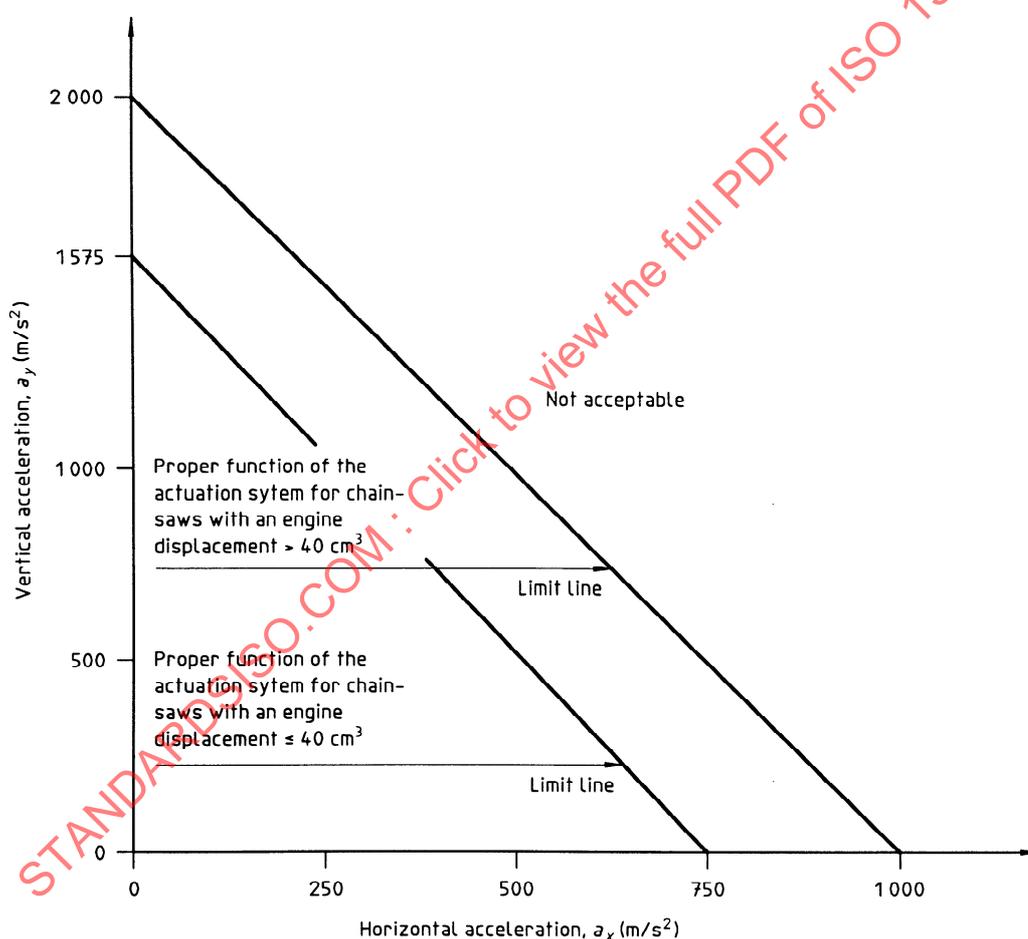

Figure 1 — Threshold level for actuation of non-manually actuated chain brakes

5 Principle

The chain-saw shall be mounted on a test rig as shown in figure 2. The drop mass falls from a defined height on the rocker and accelerates the chain-saw on the opposite side. The drop height shall be increased until an actuation of the non-manually actuated chain brake occurs.

Dimensions in millimetres

Figure 2 — Test rig with mounted chain saw
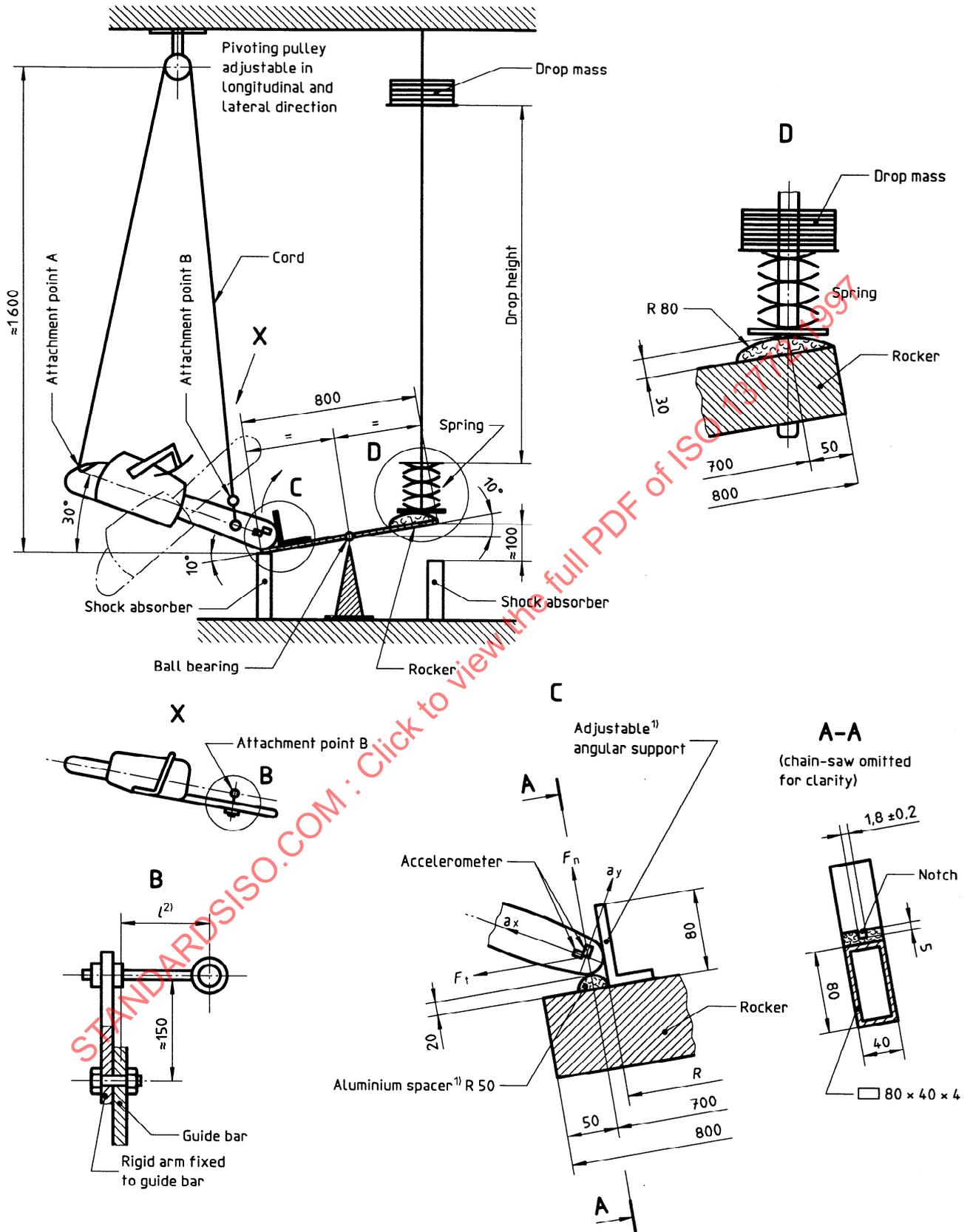
1) The acceleration of the chain-saw shall not be induced over the teeth of the sprocket into the guide bar. This can be avoided by a notch in the spacer and the angular support or by removing the sprocket (see detail A-A).

2) Adjustable distance *l* for attachment point B to coincidence with the vertical plane through the centre of gravity of the chain-saw.

The chain-saw is suspended in the test rig from cords at the guide bar and at the rear handle behind the throttle trigger in such a way that the chain saw can conduct an unhindered rotary and translatory motion after the impact pulse has been introduced into the bar tip. The bar tip acceleration needed to actuate the brake is determined and used as a value to evaluate the brake function.

6 Test equipment

6.1 Acceleration measuring equipment

The total mass of the accelerometer(s) shall be as low as possible and may not in any case exceed 50 g including the mounting but excluding the cables.

The signal from the accelerometer(s) shall be processed by a low-pass filter with characteristics as showing in annex A.

Care shall be taken when mounting the accelerometer so that the transfer function is flat up to 300 Hz for both measuring directions. For general considerations concerning accelerometer mounting, see ISO 5348.

NOTE — The transfer function can be considered flat if an addition of mass to the accelerometer equal to that of the accelerometer does not have any significant influence on a_x and a_y. (This additional mass should be placed between the accelerometer and its mounting, if the mass is of metal, or around the accelerometer if the mass consists of materials such as clay or wax.)

The accuracy of the measuring equipment, excluding accelerometer mounting and the filter shall be ± 5 % of registered value in the frequency range 0 Hz to 300 Hz. See ISO 5347-0 for calibration methods.

6.2 Test rig

The design principles of the test rig shall be as shown in figure 2.

The test rig cord length, as well as the longitudinal and lateral positioning of the pivoting pulley for the cord, shall be adjustable.

The test rig rocker shall be made of rectangular hollow steel section, 80 mm × 40 mm × 4 mm.

The drop weight device shall have a drop mass of 15 000 g ± 20 g. It shall be possible to select drop heights in steps of 10 mm or less, at least between a drop height of 200 mm to 1 400 mm. The accuracy of the drop height shall be ± 2 mm.

The spring in the drop weight device shall have a characteristic of 640 N/mm ± 20 N/mm for an increasing spring load.

NOTE — The specified spring rate can be achieved by 7 leaf springs (45 mm × 22,4 mm × 1,75 mm) with an adverse orientation to each other. The spring defines the length and the characteristic of the impulse. The pulse of the simulated kickback will then be approximately 10 ms.

7 Preparation

Check that the chain-saw is in accordance with the product specification. If no guide bar length has been specified, choose one according to table 1.

Precondition the saw by actuating the non-manually actuated chain brake 10 times, for example by dropping the saw, while holding the rear handle, so the bar tip hits a rigid, wooden surface.

Then adjust the chain tension adjuster to its mid-position and move the guide bar to its uppermost position, at the top of the bar, in order to eliminate the play, and fasten the guide bar on the saw.

The saw chain shall not be installed and the tanks shall be empty.

Attach the accelerometer(s) to measure the horizontal and vertical accelerations, a_x and a_y respectively. The centrelines of the active direction of the accelerometer shall intersect the guide bar tip radius centre point within ± 2 mm. For the other two orthogonal directions the centre of gravity of the respective accelerometers shall be within ± 10 mm from the guide bar tip radius centre point. The orientation of the accelerometer(s) shall be as shown in figure 2.

The chain-saw shall be mounted on the test rig by the cord at attachment point A and B (see figure 2), so that the longitudinal centreline for the guide bar is inclined downwards at $30° \pm 2°$ and is parallel to the longitudinal plane of the test rig rocker.

The attachment point A shall be on the grip area of the rear handle.

The attachment point B shall be laterally adjusted so that the guide bar plane is vertical within $\pm 3°$.

Attachment point B shall be chosen high enough to ensure stable suspension of the chain-saw, i.e. the straight line between point A and B shall pass above the centre of gravity of the chain-saw.

The attachment point B shall be along the longitudinal centre plane of the guide bar chosen so that the guide bar tip will be lifted off the aluminium spacer when a normal force, F_n, of 2 N $\pm$ 0,4 N is applied, see figure 2.

The angular support shall be adjusted so that the line perpendicular to the test rig rocker longitudinal centreline through the contact point between the rocker spacer and the guide bar tip will pass through the guide bar tip radius centre point within ± 1 mm. The pulley shall be longitudinally positioned so that the guide bar tip will be pulled off the angular support when a tangential force, F_t, of 2 N $\pm$ 0,4 N is applied, see figure 2.

8 Test procedure

The non-manually actuated chain brake shall be actuated by the acceleration which will occur after the drop mass has been released.

It is recommended to start at a drop height of 200 mm and to increase the height in steps of 100 mm to initiate actuation. After the first actuation, decrease the drop height again in steps of 20 mm to a point where the brake no longer actuates automatically.

Raise the drop height by 10 mm and repeat the test five times under the same conditions. If the brake is actuated five times, the conditions established shall be used to measure the accelerations, a_x and a_y, see figure 1.

If the brake is not actuated five times, raise the drop height by 10 mm and repeat the test five times. The procedure shall be repeated, if necessary, until the drop height at which the brake is actuated for all five tests is attained.

When the lowest drop height has been defined, measure and register the values of the bar tip accelerations, a_x and a_y, five times under the same conditions and calculate the average values of the accelerations.

9 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) date and place of measurement;

c) name of the operator;

d) description of the chain-saw:

— manufacturer;

— type, model and serial number;

— type and length of guide bar;

— mass of the chain-saw as measured (with bar, without chain, with tanks empty), in kilograms;

— release force of the chain brake (see ISO 6535), in newtons;

e) description of the measuring equipment;

f) description of accelerometer mounting;

g) values of the recorded bar tip accelerations, a_x and a_y, expressed in metres per second squared, and the calculated average accelerations, $a_{x,av}$ and $a_{y,av}$, respectively, at the chain brake actuation limit.

Annex A
(normative)

Frequency range and low-pass filter characteristics

The low-pass filter characteristics used when measuring the acceleration, a_x and a_y, shall be within the upper and lower boundaries defined in table A.1. Tolerance boundaries for the low-pass filter frequency response and theoretical filter characteristics for a cut-off frequency of 120 Hz and a − 12 dB/octave slope are shown in figure A.1.

Table A.1 — Filter frequency response boundaries

Frequency, f Hz	Lower tolerance boundary, a_l dB	Upper tolerance boundary, a_u dB
$f \leqslant 100$	$a_l = 20 \log\left[1/\sqrt{1 + (f/100)^4} \right] - 1$	$a_u = 20 \log\left[1/\sqrt{1 + (f/140)^4} \right] + 1$
$100 < f \leqslant 255$	$a_l = -\infty$	—
$f > 255$	$a_l = -\infty$	$a_u = -9,8 - 36,54 \log(f/255)$
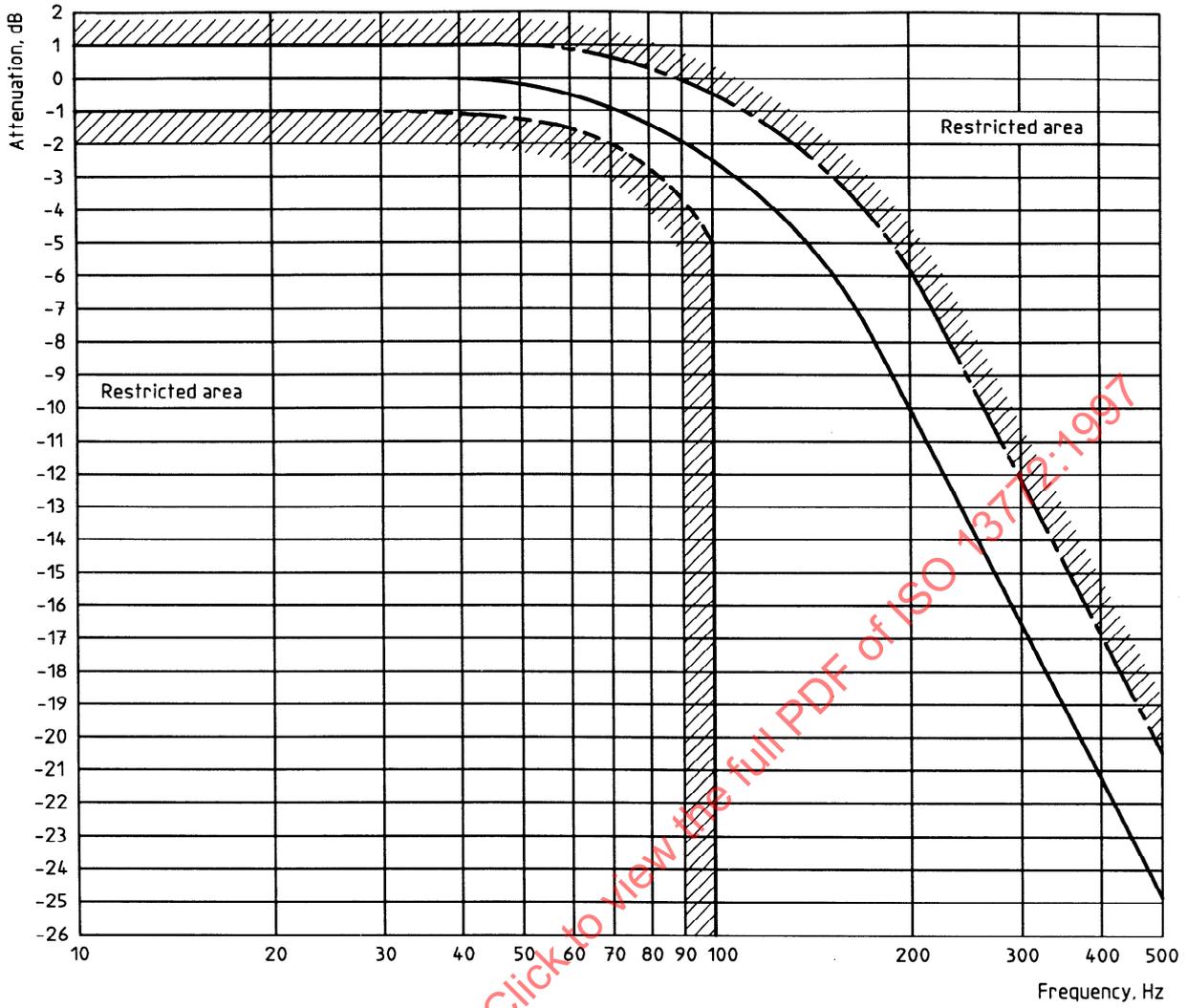
As an example a theoretical low-pass filter with cut-off frequency of 120 Hz and a slope of −12 dB/octave are shown.

Figure A.1 — Tolerance boundaries for the filter frequency response