INTERNATIONAL STANDARD

ISO 11393-1

First edition
1998-10-15

Protective clothing for users of hand-held chain-saws —

Part 1:
Test rig driven by a flywheel for testing resistance to cutting by a chain-saw

Vêtements de protection pour utilisateurs de scies à chaîne tenues à la main —

Partie 1: Banc d'essai à volant d'inertie pour les essais de résistance à la coupure par une scie à chaîne

Contents

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Printed in Switzerland

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 3.

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 11393-1 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*.

ISO 11393 consists of the following parts, under the general title *Protective clothing for users of hand-held chain-saws*:

— *Part 1: Test rig driven by a flywheel for testing resistance to cutting by a chain-saw*

— *Part 2: Test methods and performance requirements for leg protectors*

— *Part 3: Test methods for footwear*

— *Part 4: Test methods and performance requirements for protective gloves*

— *Part 5: Test methods and performance requirements for protective gaiters*

— *Part 6: Test methods and performance requirements for jackets with protection against cuts*

Annexes A and B of this part of ISO 11393 are for information only.

Introduction

This part of ISO 11393 forms part of a series concerned with personal protective equipment designed to protect against the risks arising from the use of hand-held chain-saws.

No personal protective equipment can ensure a 100 % protection against cutting from a hand-held chain-saw. Nevertheless, experience has shown that it is possible to design personal protective equipment which offers a certain degree of protection.

Different functional principles may be applied in order to give protection. These include:

a) chain slipping: on contact the chain does not cut the material;

b) clogging: fibres are drawn by the chain into the drive sprocket and block chain movement;

c) chain braking: fibres have a high resistance to cutting and absorb rotational energy, thereby reducing the chain speed.

Often more than one principle is applied.

Protective clothing for users of hand-held chain-saws —

Part 1:
Test rig driven by a flywheel for testing resistence to cutting by a chain-saw

1 Scope

This part of ISO 11393 specifies the test rig to be used to assess the resistance of personal protective equipment to cutting by hand-held chain-saws. It also describes the calibration procedure.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of part of ISO 11393. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 11393 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3386-1, *Polymeric materials, cellular flexible — Determination of stress-strain characteristics in compression — Part 1: Low-density materials.*

ISO 4915:1991, *Textiles — Stitch types — Classification and terminology.*

ISO 11393-2, *Protective clothing for users of hand-held chain-saws — Part 2: Test methods and requirements for leg protectors.*

ISO 11393-3, *Protective clothing for users of hand-held chain-saws — Part 3: Test methods for footwear.*

3 Terms and definitions

For the purposes of this part of ISO 11393, the following terms and definitions apply.

3.1
chain-saw
saw with teeth on an endless chain

3.2
resistance to cutting
general term for the various ways in which a protective material can reject or decelerate the chain of a chain-saw

NOTE It is measured by applying a moving saw chain with a certain chain speed and energy and studying whether the chain cuts through.

3.3
cut-through
term used when a saw chain has penetrated through a sample so that the cut is longer than 10 mm in the layer nearest to the body

3.4
chain stopping time
period of time taken for the saw chain to decelerate from a specified speed to complete rest, when the saw unit is not under power

3.5
free-running stopping time
chain stopping time when the chain is not brought into contact with a test piece

3.6
threshold chain speed
maximum speed which a sample can withstand during testing without cut-through occurring

3.7
chain slipping
protective effect whereby the saw chain slides over the surface of the protective material without cutting it

3.8
clogging
effect whereby fibres, yarns or other materials are drawn by the saw chain into the saw unit, thereby stopping the movement of the saw chain

3.9
chain braking
effect whereby fibres or other materials of the personal protective equipment slow the speed of the saw chain sufficiently to prevent its advancement

3.10
cutting line
tangent to the curve made by teeth of the saw chain at the point where it is in contact with a test specimen

4 Principles

The test rig described in this part of ISO 11393 has been designed to apply a moving saw chain to personal protective equipment in such a way that both the speed of the chain and the amount of kinetic energy available for cutting are controllable.

This standardization is achieved by ensuring that the chain is not under power at the moment of test. Instead the chain is moving solely under the influence of its own momentum, together with that of a flywheel of known inertia to which it is coupled.

In order to conduct a test, the chain is first driven up to the required speed by means of any convenient motor. At the moment of test, the motor is then physically disconnected from the chain and flywheel. Simultaneously the chain is allowed to pivot down from a minimal height onto the test sample. The chain subsequently continues to move (and under normal circumstances, to cut into the sample) until all of its kinetic energy has been dissipated.

The result of the test is then reported as to whether or not the sample shows a cut-through at the test speed.

5 Apparatus

5.1 Test rig

The test rig consists of the following major components:

— a power unit and a connecting device that transfers rotational energy to the saw unit;

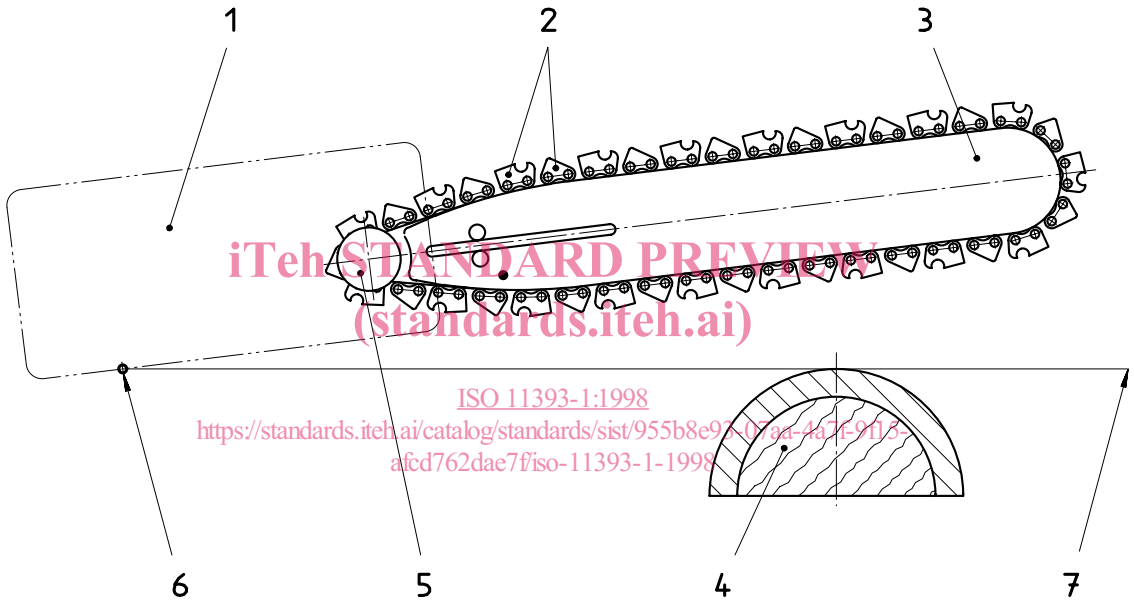
— a saw unit with a defined moment of inertia including shaft, flywheel, sprocket, chain and bar;

— fixture for saw unit;

— test piece mounts for samples;

— instrumentation.

The general arrangement of the test rig is shown in Figure 1.



Key
1 Mounting for sprocket bar
2 Chain
3 Guide bar
4 Sample mount
5 Sprocket
6 Pivot
7 Horizontal plane

5.2 Power unit and connecting device

The power unit shall be able to drive the saw chain at the required range of chain speed.

For calibration purposes the test rig shall be able to drive the chain with speeds of between 19 m/s and 21 m/s.

For testing purposes, the test rig shall also be able to drive the chain with speeds as required in ISO 11393-2 and ISO 11393-3. Future parts of ISO 11393 are under preparation.

NOTE For future development, a higher speed possibility is recommended.

It shall be possible to disconnect the power unit from the saw unit.

5.3 Saw unit

The saw unit shall be able to turn freely in the vertical plane around the horizontal pivot at least in the range

— up 20 mm,
— down 100 mm,

measured 360 mm from the pivot.

NOTE It is allowed to include certain stops in order to prevent the saw chain damaging the test piece mount.

The moment of inertia of the saw unit around the pivot shall be (0,30 ± 0,05) kg·m^2.

5.3.1 Components[1)] of saw unit

5.3.1.1 Bar, such as the Sandvik symmetrical 11-tooth sprocket nosed, nominal groove width 1,50 mm, nominal length 330 mm (13").

The lateral stiffness of the guide bar, measured by the centre of the nose wheel, shall be less than 10,0 mm at a lateral force of 50 N.

The chain tension shall be adjustable.

5.3.1.2 Chain drive sprocket, such as the Oregon 7-tooth rim sprocket.

The dimensions of the sprocket surround shall be as indicated in Figure 2.

The machine shall not be fitted with a chain drive sprocket cover.

This requirement does not preclude a guard to protect the operator. Such a guard shall not interfere with the testing.

5.3.1.3 Flywheel

Moment of inertia of rotating parts around output shaft, including shaft, flywheel and all retaining devices but excluding chain and sprocket, shall be $0{,}47 \times 10^{-3}$ kg·m^2, with a tolerance of ±1 %.

The free-running stop time without chain shall exceed 25 s.

5.3.1.4 Saw chain, such as the Oregon 8,25 mm (0,325") pitch, 21 LP, 56 chain links.

Chains shall be conditioned according to 7.5.1.

5.3.1.5 Clutch

5.3.1.6 Lubricating system, comprising a device providing a continuous stream of oil to the guide bar and saw chain.

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1) Sandvik and Oregon are examples of suitable products available commercially. This information is given for the convenience of users of this part of ISO 11393 and does not constitute an endorsement by ISO of these products.

Dimensions in millimetres

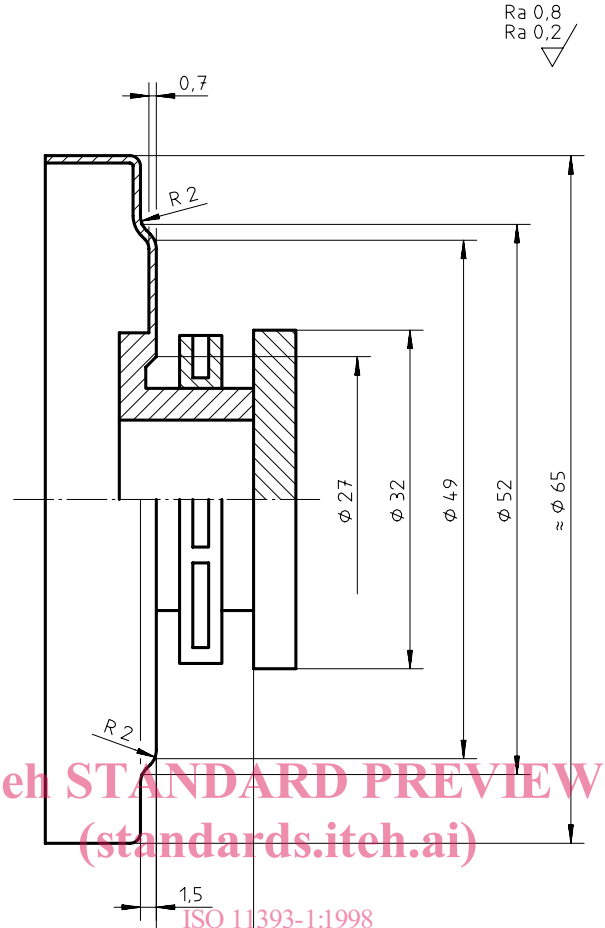

Figure 2 — Dimensions of sprocket surround

The rate of application shall be (2 ± 0,5) ml/min.

Oil type:	White oil
Viscosity at 40 °C:	155 mm^2/s
Viscosity at 100 °C:	15,5 mm^2

3

5.3.2 Release system, comprising a device allowing disconnection of the power from the saw unit at the same moment as, or momentarily before, the saw unit is released and allowed to pivot downwards.

5.3.3 Instrumentation, comprising

a) a tachometer for the measurement of chain speed with an accuracy of 0,1 m/s; it shall be possible to record the speed at the time of release;

b) an instrument for measuring chain stopping time, with an accuracy of 0,1 s.

5.3.4 Fixture for saw unit

The arrangement shall be such that the centre of gravity of the saw unit shall be offset from the pivot of the saw unit in such a way that, at a distance of (360 ± 2) mm from the pivot, the gravitational force shall be (15,0 ± 0,5) N. This