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## Cross-country skis — Determination of fatigue indexes — Cyclic loading test

*Skis de fond — Détermination des indices de fatigue — Essai en  
flexion alternée*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 83, *Sports and other recreational facilities and equipment*, Subcommittee SC 4, *Snowsports equipment*.

This second edition cancels and replaces the first edition (ISO 7798:1984), which has been technically revised.

# Cross-country skis — Determination of fatigue indexes — Cyclic loading test

## 1 Scope

This document specifies a method for the determination of the fatigue indexes of cross-country skis (i.e. the resistance of the skis to changes of bottom camber height or irreversible damage) after a bending test with cyclic loading.

It is applicable to cross-country skis with a nominal length of 160 cm to 215 cm.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 7139, *Cross-country skis — Determination of elastic properties*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

### 3.1

#### original weighted bottom camber

$h_B$

maximum distance between the bottom surface of the ski in the binding mounting area and a flat and horizontal surface, measured under the influence of the ski's own mass, determined prior to the test

### 3.2

#### final weighted bottom camber

$h'_B$

maximum distance between the bottom surface of the ski in the binding mounting area and a flat and horizontal surface, measured under the influence of the ski's own mass, determined after the test

### 3.3

#### spring constant of the deflected part of the ski

$c_F$

ratio of the force,  $F$ , applied midway between two supports, to the corresponding deflection,  $f$ , when the ski is placed on the supports as shown in [Figure 4](#)

$$c_F = \frac{F}{f}$$

**3.4**  
**stroke length**

$s$

deflection of the ski during cyclic loading measured from a plane tangent to the supports, midway between the two supports

**3.5**  
**frequency**

$f$

number of deflections of the ski per second

**3.6**  
**recovery time**

time between the end of the test and the measurement of  $h'_B$  which is necessary to eliminate temporary changes in bottom camber

**3.7**  
**fatigue index**

$K_h$

percentage change of bottom camber height of the ski after cyclical loading and recovery time

## **4 Principle**

The ski is subjected to cyclic loading and recovery. The fatigue indexes are determined by calculation of the percentage permanent change in bottom camber height.

## **5 Apparatus**

### **5.1 Cyclic bending machine.**

The cyclic bending machine shall be constructed essentially as shown in [Figure 1](#). The machine has two supports which are vertically and horizontally adjustable. The support rolls shall have a diameter of approximately 5 cm. The supports shall have spring loaded clamping rolls in order to prevent lifting of the ski.

The driving mechanism consists of a disk fly wheel with adjustable crank pin, a connecting rod and a push rod with clamping fixture. The disk fly wheel shall have sufficient mass and driving power to effect a smooth sinusoidal flexing. The distance between crank pin and rotation axis shall be adjustable in order to be able to adjust the proper stroke length with respect to the spring constant of the deflected part of the ski (see [Figure 3](#)).

The frequency of the stroke shall be between 2 Hz and 3 Hz. The clamping fixture shall have a pitting joint and jaws with elastic rubber layers, as shown in [Figure 2](#), in order to avoid stress concentration at the clamp.

Dimensions of the rubber layer shall be as follows.

- Thickness:  $(4 \pm 1)$  mm
- Width: 40 mm
- Hardness:  $(95 \pm 5)$  Shore A

In addition, a counter shall be fixed to the push rod in order to record the number of cycles.

### **5.2 Measuring device for bottom camber height.**

For measuring the weighted bottom camber, a flat surface plate and a dial indicator with indicator holder shall be used.

### 5.3 Measuring device for spring constant of the deflected part of the ski.

For measuring the spring constant of the deflected part of the ski, a device as described in ISO 7139 shall be used.

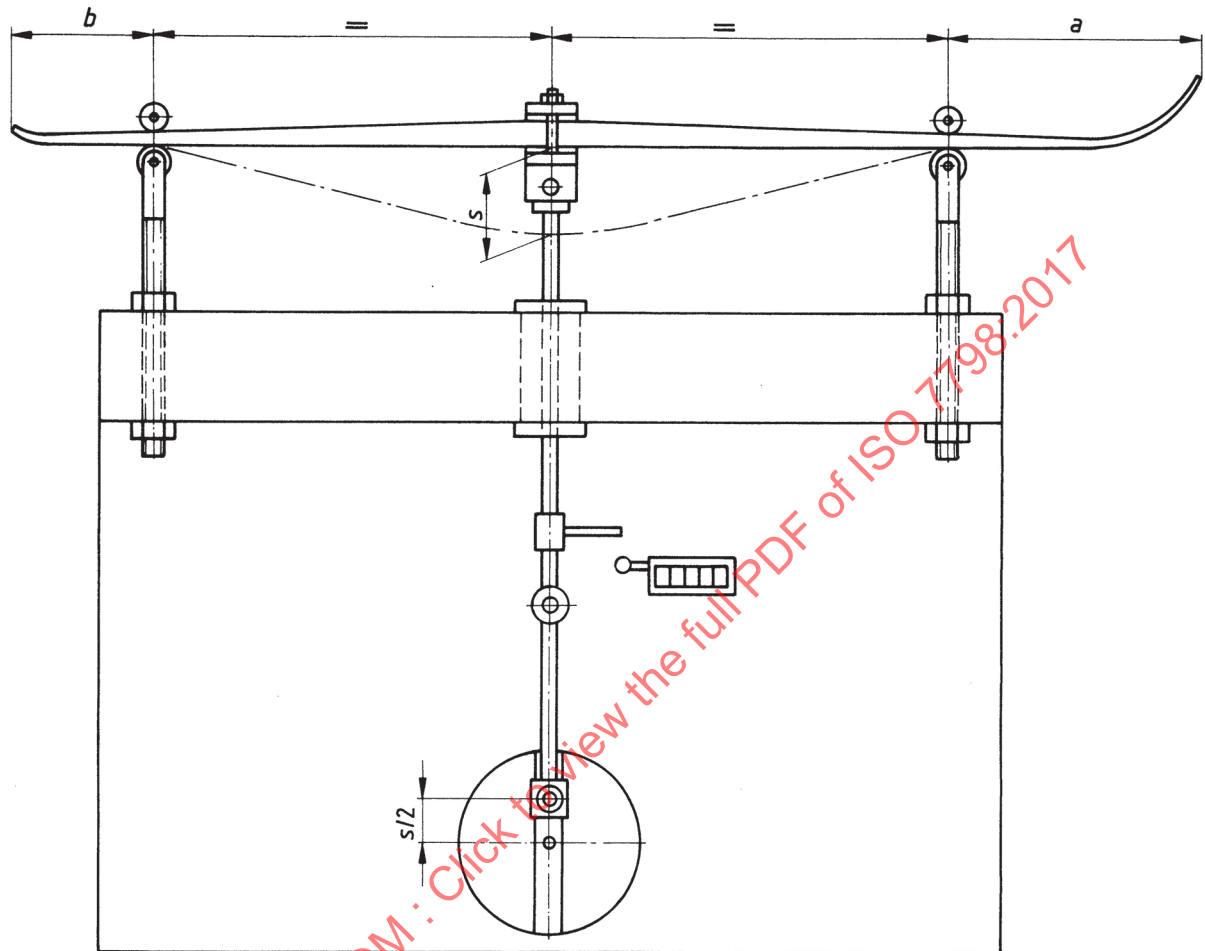


Figure 1 — Cyclic bending machine

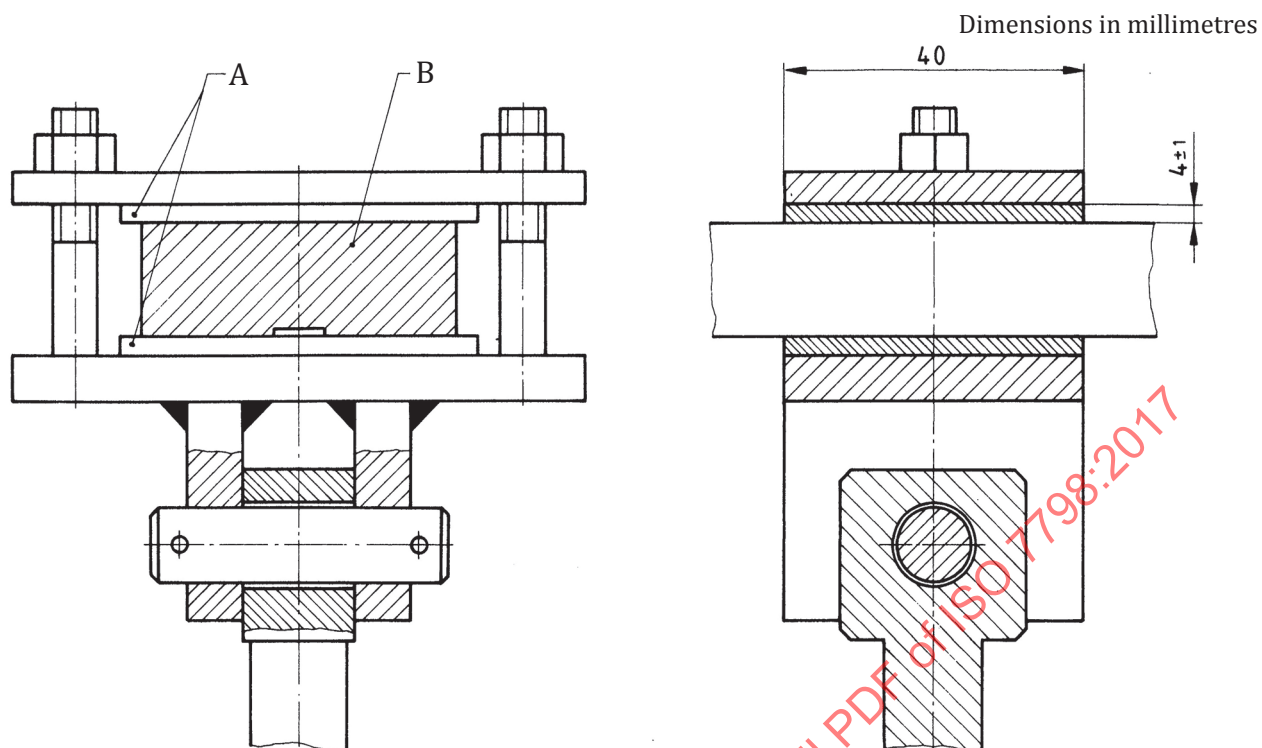


Figure 2 — Clamping fixture

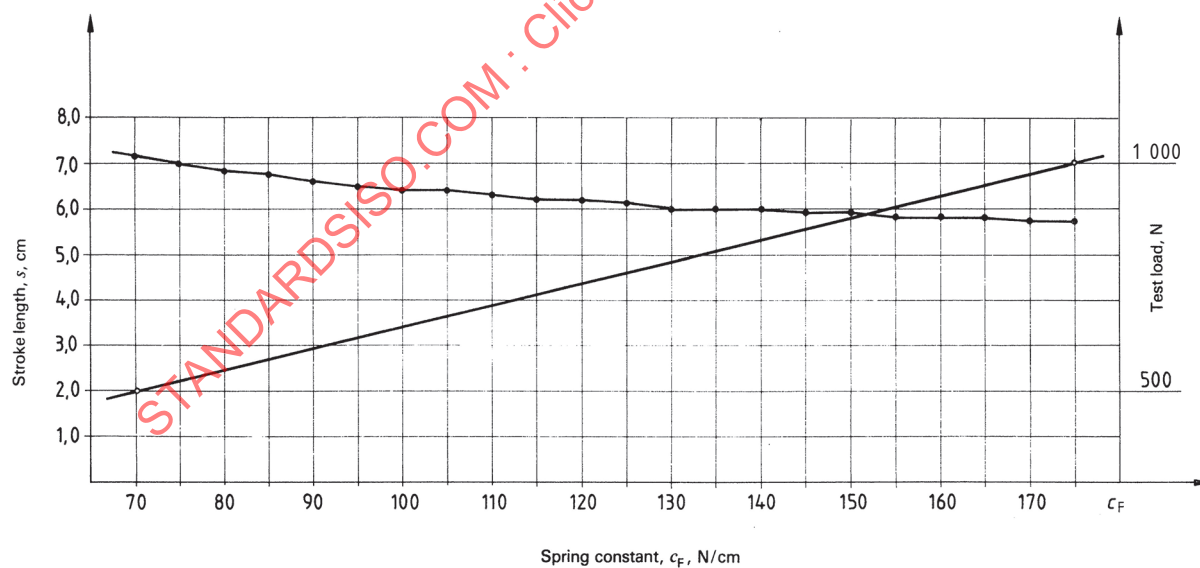


Figure 3 — Diagram for determination of stroke length



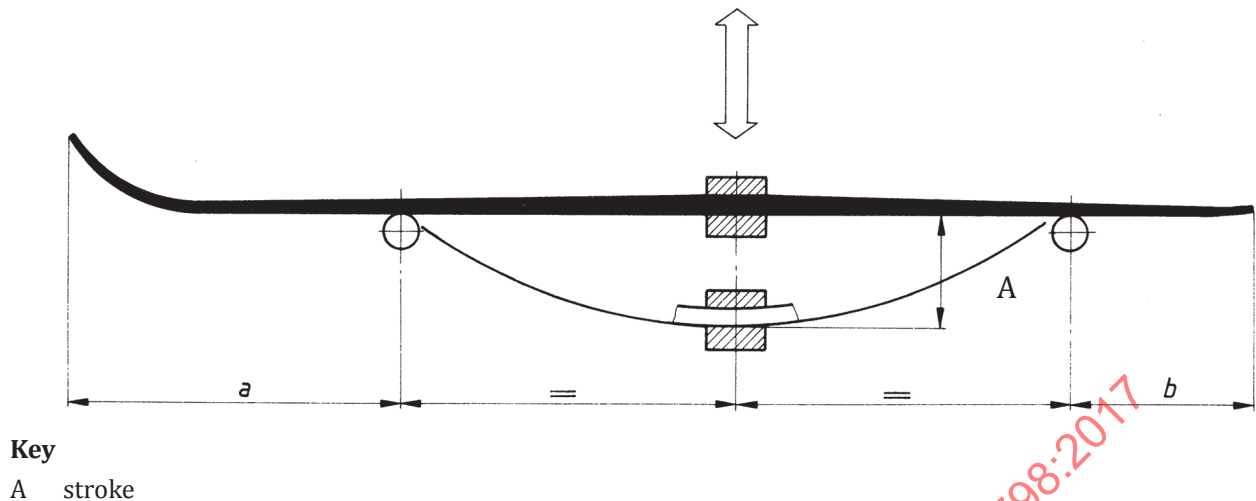


Figure 4 — Support arrangement for determination of spring constant,  $C_F$ , and for fatigue test

Table 1 — Dimensions for  $a$  and  $b$

Dimensions in millimetres

Ski length	1 600	1 700	1 750	1 800	1 850	1 900	1 950	2 000	2 050	2 100	2 150
$a$	370	400	415	430	445	460	475	490	505	520	535
$b$	250	270	280	290	300	310	320	330	340	350	360

## 6 Test specimens

The test shall be carried out on five skis of the same model-size.

## 7 Temperatures for conditioning and testing

The fatigue properties of the ski described in this document can be affected by the test temperature to a greater or lesser extent depending on the particular material configuration of the ski. Therefore, two versions of test procedure with different test temperatures are specified:

- version A, standard laboratory test:  $(+20 \pm 2) ^\circ\text{C}$ ;
- version B, cold chamber test:  $(-20 \pm 2) ^\circ\text{C}$ .

All measurements shall be carried out on a ski conditioned at the test temperature for at least 2 h.

## 8 Test procedure

### 8.1 Measurement of original weighted bottom camber, $h_B$

Measure the height of the original bottom camber,  $h_B$ , after conditioning and prior to the bending by cyclic loading. Mark the measurement point on the top surface of the ski. Press the ski against the flat surface plate. Place the dial indicator at the measurement point on the top surface of the ski and set to zero. Remove the flattening load, and read the bottom camber height from the dial indicator to an accuracy of  $\pm 0,03$  mm.