INTERNATIONAL STANDARD

ISO 9462

Fifth edition
2023-01

Alpine ski-bindings — Requirements and test methods

Fixations de skis alpins — Exigences et méthodes d'essai

Reference number
ISO 9462:2023(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: 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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 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 fifth edition cancels and replaces the fourth edition (ISO 9462:2014), which has been technically revised.

The main changes are as follows:

— modification of definitions and addition of notes to entry in 3.1.1, 3.1.2 and 3.1.3;

— addition of 3.1.4;

— addition of new Figure 2 “Application of $F_{y,toe}$ and $F_{z,heel}$”;

— modification of 4.3;

— addition of new 6.8 “Compatibility to boot in accordance with ISO 23223”;

— addition of new Figure 8 “Clearance area around the antifriction device (AFD)”;

— addition of new Table 4 “Compatibility marking”;

— correction of scale of Figure D.2 “Tolerances on M_y”;

— addition of new Annex E “Test body in accordance with ISO 9838 for compatibility test”.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Alpine ski-bindings — Requirements and test methods

1 Scope

This document specifies the main characteristics of ski-bindings and describes, as an example, test methods A and B.

This document applies to ski-bindings for alpine skiing for children, juniors and adults.

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 5355, *Alpine ski-boots — Requirements and test methods*

ISO 8061, *Alpine ski-bindings — Selection of release torques values*

ISO 9465, *Alpine ski-bindings — Lateral release under impact loading — Test method*

ISO 9838, *Alpine and touring ski-bindings — Test soles for ski-binding tests*

ISO 11087, *Alpine ski-bindings — Retention devices — Requirements and test methods*

ISO 23223, *Alpine ski boots with improved walking soles — Interface with alpine ski-bindings – Requirements and test methods*

3 Terms and definitions

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

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
alpine ski-binding
system to ensure firm connection between boot and ski, fixing the heel low for downhill skiing

Note 1 to entry: The system releases the boot from the ski when certain loads reach preset values.

3.1.1
binding of type C
type C binding
binding which can be adjusted to at least the following *release values* (3.3):

a) M_z = 10 Nm;

b) M_y = 37 Nm

Note 1 to entry: Bindings of type C are suitable for boot soles conforming to type C of ISO 5355.

Note 2 to entry: Bindings of type C for boots with improved walking soles are suitable either for boot soles conforming to type C of ISO 5355 or for boot soles conforming to type C of ISO 23223.

Note 3 to entry: "C" stands for "children".

3.1.2
binding of type CA
type CA binding
binding which can be adjusted to at least the following *release values* (3.3):

a) M_z = 20 Nm;

b) M_y = 75 Nm

Note 1 to entry: Bindings of type CA are suitable for boot soles conforming to types C and A of ISO 5355.

Note 2 to entry: Bindings of type CA for boots with improved walking soles are suitable either for boot soles conforming to types A and C of ISO 5355 or for boot soles conforming to types A and C of ISO 23223.

Note 3 to entry: "CA" stands for junior-type bindings.

3.1.3
binding of type A
type A binding
binding suitable for boot soles of type A

Note 1 to entry: Boot soles of type A are defined in ISO 5355.

Note 2 to entry: Bindings of type A for boots with improved walking soles are suitable either for boot soles conforming to type A of ISO 5355 or for boot soles conforming to type A of ISO 23223.

Note 3 to entry: "A" stands for "adult".

3.1.4
binding of type MN
binding suitable for boot soles complying with different standards

Note 1 to entry: The boot soles complying with bindings of type MN are type A soles according to ISO 5355, boot soles of type A of ISO 23223 and boot soles according to ISO 9523.

Note 2 to entry: “MN” stands for “multi-norm”.

3.2
release
detachment of the boot from the ski by freeing of the mechanism that ensures the connection between the boot and the ski

Note 1 to entry: This release is only considered effective when all the loads due to the boot-ski connection have dropped to values which present no danger to the skier.

3.3
release value
maximum value of the torque M_z or M_y caused at the boot-ski connection by the movement of rotation or forward bending

Note 1 to entry: For the torques M_z and M_y, see Figure 1.

Note 2 to entry: The release values are generally adjustable on current bindings which have a scale and an indicator displaying the setting level.

Note 3 to entry: In the present state of the art, bindings are designed at least to release in torsion ($\pm M_z$) and in forward bending ($\pm M_y$).

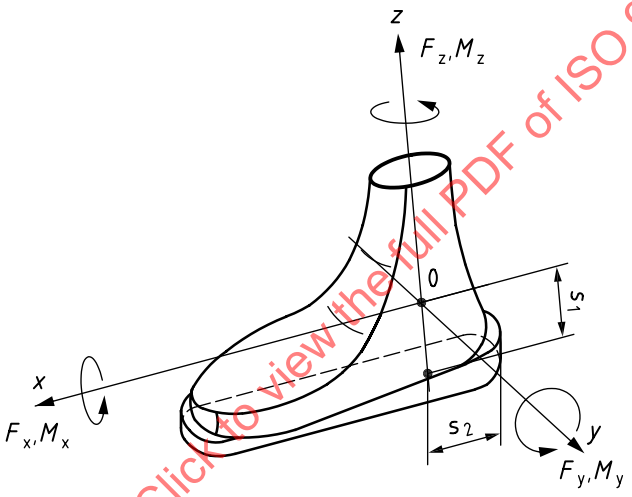
3.4
reference value
value, adjusted after a series of tests, used as a basis of comparison to evaluate the behaviour of the binding during the tests

Note 1 to entry: See 6.3.1.

3.5
combined loading
loading of the sole or ski in several directions at the same time, where one of the loads is the torque M_z progressively applied to the sole until the binding releases

Note 1 to entry: Each of the load combinations simulates a given situation, chosen within an infinite field of possibilities and simplified for the purpose of the tests. The main simplification being that the loads applied additionally to the release torque M_z are held constant in value and direction during all the release process.

Note 2 to entry: For the loading, see Figure 1 and Table 1.



Key
F_x anterior/posterior force
F_y medial/lateral force
F_z vertical force
M_x edging/roll moment/torque
M_y forward/backward lean moment/torque
M_z twisting moment/torque
0 origin of the coordinate system
S_1 vertical distance from boot sole
S_2 horizontal distance from end of the heel projection of the boot

Figure 1 — Combined loadings

Table 1 — Coordinates of reference point 0

	Type of binding		
	C (see 3.1.1)	**CA (see 3.1.2)**	**A (see 3.1.3)**
S_1	85	100	100
S_2	70	80	80

3.6
additional load
load applied additionally to the release torque M_z

Note 1 to entry: For the torque M_z, see Figure 1.

3.7
deflection of the ski
bending of the ski perpendicular to its gliding surface

Note 1 to entry: In practice, the deflection of the ski depends at the same time on the loading situation and the profile of the snow-surface ("geometrical" situation). In test simplification, only the "geometrical" situation is simulated.

3.8
limit L_1
lowest possible position of the setting indicator

3.9
limit L_2
position of the indicator at the lowest mark on the setting scale

3.10
limit L_3
position of the indicator at the highest mark on the setting scale

3.11
limit L_4
highest possible position of the setting indicator

4 Test conditions

4.1 Loading rate

The tests shall be performed quasi-statically, ensuring that the following indicative values of the torque gradient conform to:

a) torsion release:

The angular velocity of the test shall be for:

M_z (moment in z-axis)

3,8°/s ± 0,1°/s

$F_{y,toe}$ (horizontal force applied at the toe, see Figure 2)

5 mm/s ± 2 mm/s

b) forward bending release:

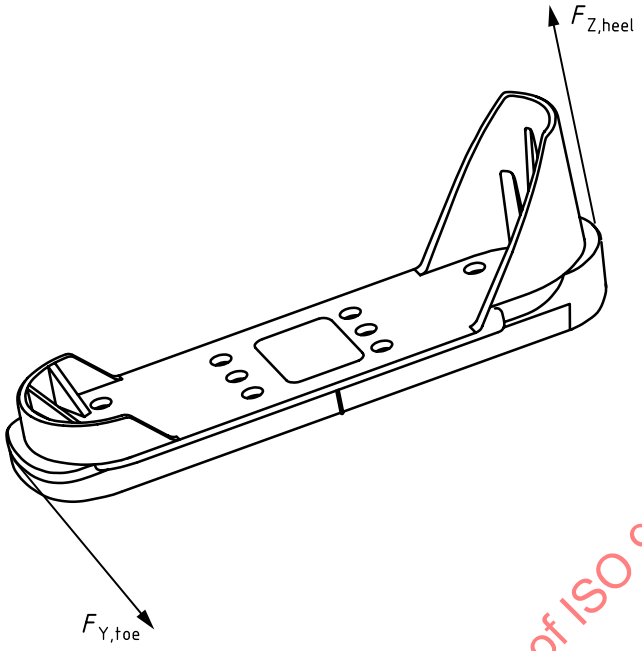
The angular velocity of the test shall be for:

M_y (moment in y-axis)

3,8°/s ± 0,1°/s

$F_{z,heel}$ (vertical force applied at the heel, see Figure 2)

5 mm/s ± 2 mm/s



Key

$F_{y,toe}$ medial/lateral force at the toe

$F_{z,heel}$ vertical force at the heel

Figure 2 — Application of $F_{Y,toe}$ and $F_{Z,heel}$

4.2 Accuracy of measurement

The measurement error of the release value in torsion shall be smaller than ±2 % for values above 50 Nm inclusive and ±1 Nm for values below 50 Nm.

The measurement error of the release value in forward bending shall be smaller than ±2 % for values above 200 Nm inclusive and ±4 Nm for values below 200 Nm.

The test equipment shall be designed to allow the application of pure moments without any extraneous forces during the entire release process.

4.3 Test sole

The test sole shall be in accordance with ISO 9838.

If a boot-binding system requires a specific boot-sole design, a test sole should be cut from a boot provided by the manufacturer and adapted for test needs.

If the binding is a multi-norm binding, all tests shall be carried out with test sole form A type A. In addition, with one binding and test sole form T the following tests shall be carried out:

a) accuracy of the setting scale (6.2.1.3);

b) release with ski deflection (6.3.3);

c) general requirement about scattering (6.3.4.1);

d) influence of forward lean of the body (6.3.4.3);

e) influence of roll loading (6.3.4.4);

f) influence of backward lean of body (6.3.4.5);

g) influence of the axial force (6.3.4.6);

h) snow pack (6.3.7);

i) energy absorption (resetting) (6.4).

If the binding is for boots with improved walking soles, then it shall be tested with the test sole in accordance with ISO 9838 form A type A or form A type C.

The test sole shall be degreased, washed, and dried before testing.

4.4 Test ski

For the release tests in the laboratory, the bindings shall be mounted either on whole skis or on appropriate sections of skis. If the binding is pre-mounted (already mounted on the ski by the producer), use the ski with which the binding is delivered in its medium size. If not, choose a ski which represents the market.

5 Test methods A and B

5.1 Principle

The binding shall be mounted on a ski in accordance with the manufacturer's instructions. A test sole shall then be inserted in the binding.

In method A, the ski is rigidly connected to the test frame and the torque M_z or M_y is progressively applied to the sole until the binding releases. The peak value of M_z or M_y is recorded.

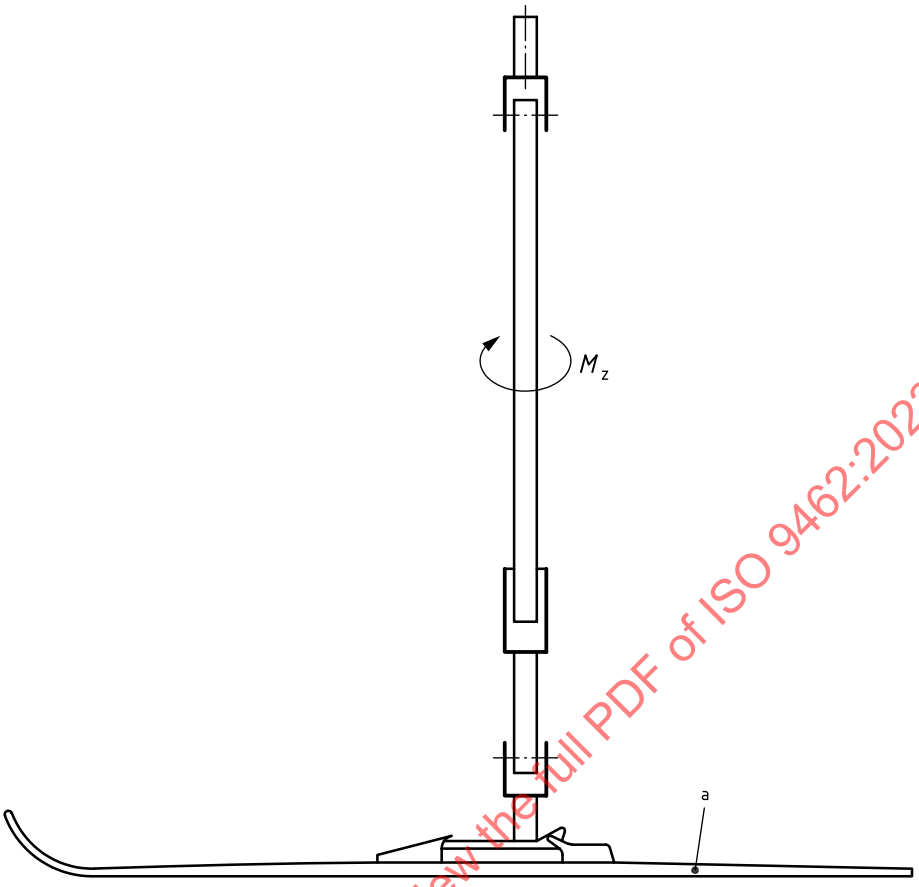
In method B, the sole is rigidly connected to the test frame through a sensor that measures the torques M_z and M_y. Forces are progressively applied to the ski until the binding releases. The peak value of M_z or M_y is recorded.

Annexes A and B give examples of how to realize method A or method B.

Passing by either method shall be deemed satisfactory.

5.2 Simple torsion test

For method A, see Figure 3.



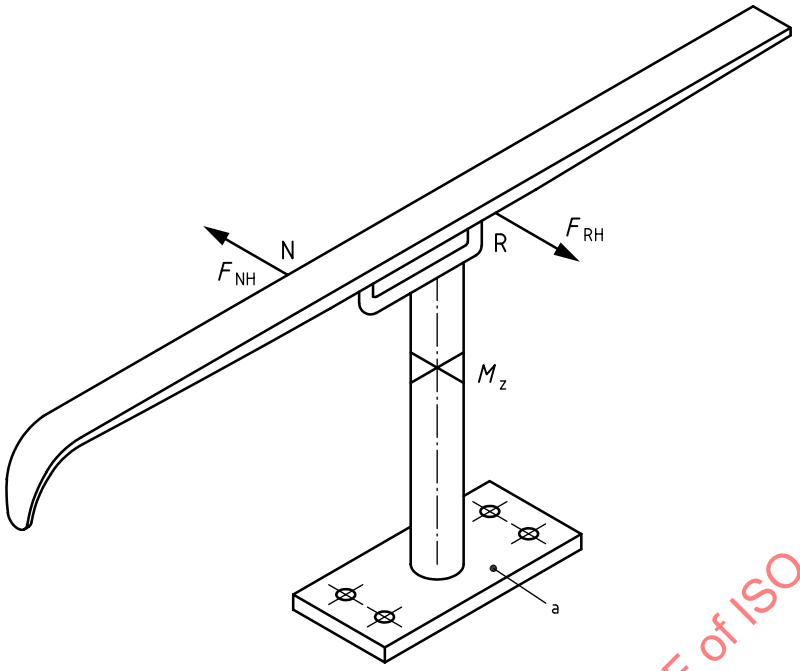
Key

[a] Fixed ski.

M_z twisting moment

Figure 3 — Application of M_z torque and measurement of $M_{z,max}$

For method B, see Figure 4.



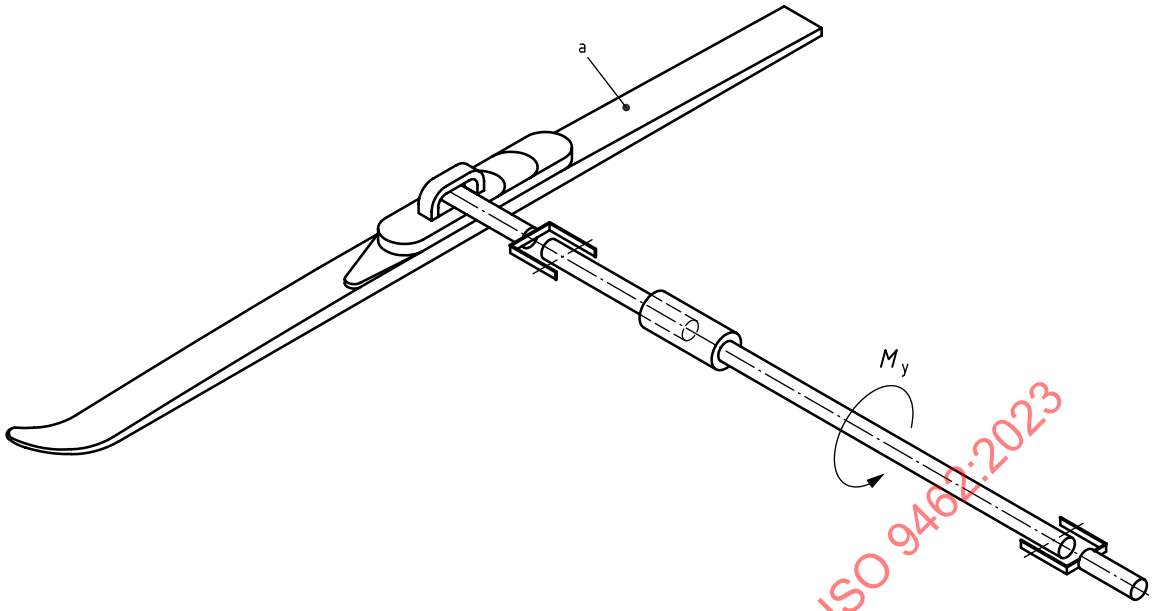
Key

a Fixed base.
N near point (see Annex B)
R rear point (see Annex B)
M_z twisting moment
F_{NH} horizontal force at near point
F_{RH} horizontal force at rear point

Figure 4 — Application of two equal forces F_{NH} and F_{RH} and measurement of $M_{z,max}$ torque

5.3 Forward bending test

For method A, see Figure 5 and Figure 6.



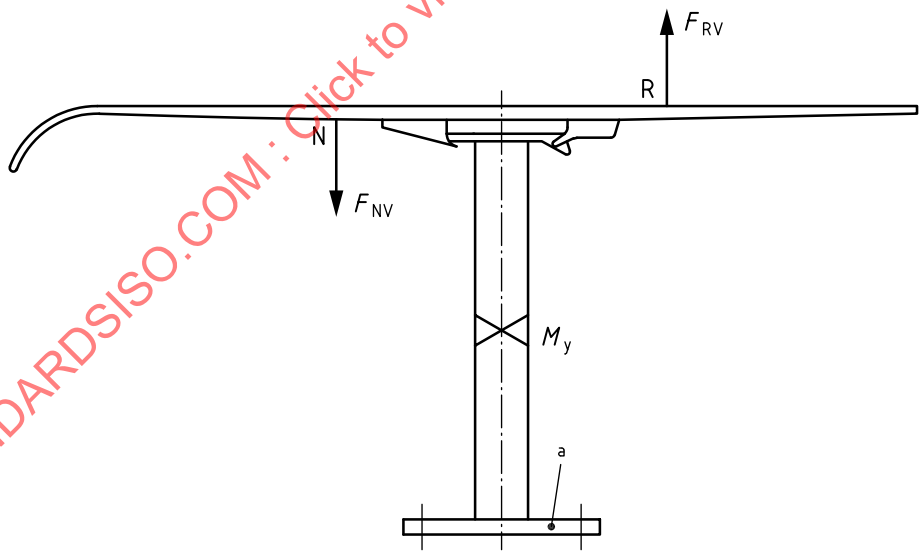
Key

a Fixed ski.

M_y forward lean moment

Figure 5 — Application of M_y torque and measurement of $M_{y,max}$

For method B, see Figure 5.



Key

a Fixed base.

N near point (see Annex B)

R rear point (see Annex B)

M_y forward bending moment

F_{NV} vertical force at near point

F_{RV} vertical force at rear point

Figure 6 — Application of two equal forces F_{NV} and F_{RV} and measurement of $M_{y,max}$

6 Requirements and testing

6.1 General requirements

6.1.1 Function and form

6.1.1.1 The binding shall release at least in two cases:

— when applying a torque M_z about an axis perpendicular to the ski gliding surface;

— when applying a torque M_y about an axis parallel to the ski surface and perpendicular to the longitudinal axis of the ski.

The binding is said to release when the mentioned torque reaches a maximum value (release value) and then drops to a value that is harmless for the skier. After release, all the loads applied by the ski and the boot on the leg shall remain under the dangerous level for all possible movements, and until all the risks associated with the coupling boot-ski have disappeared.

6.1.1.2 The release level shall be clearly indicated by a scale covering all of the setting range anticipated by the manufacturer. The release shall still be possible at the upper limit (maximum setting). Settings above $Z = 10$ shall be clearly differentiated from settings below $Z = 10$ on the indicator scale.

6.1.1.3 Each procedure of adjustment to the boot having an influence on the binding functioning shall be verifiable by the use of a clear indicator, or by any other means considered suitable by the operator for showing the correct adjustment.

6.1.1.4 The binding shall be equipped with a ski-brake or allow for an easy and secure attachment of a leash. The ski-brake and the attachment for the leash shall be in accordance with ISO 11087.

6.1.1.5 The design of the ski-brake or the leash shall be such that, after release, no unnecessary danger will occur to the skier.

6.1.1.6 The binding shall have an external design which does not have a negative influence on skiing or cause unnecessary risk of injuries when used normally.

6.1.2 Handling

6.1.2.1 Mounting instructions

The manufacturer or the importer shall deliver mounting instructions that are easily understood to the sports shop. These instructions shall include at least:

a) the mechanical procedure for adjusting the release values of the binding;

b) the recommendations for determining the appropriate release values for the skier;

c) the sole characteristics required for good functioning of the binding;

d) the boot-sole requirements and preparation for mounting of additional elements if necessary;

e) the preparation and mounting of the binding e.g. use of jig, compatibility with ski;

f) the adjustment instructions necessary for accommodating different boot-sole lengths and heights, the centring of the sole and ways of controlling the length adjustment;

g) the ways of performing the basic functional tests after mounting;

h) the recommendation for setting the binding with a setting device;

i) the troubleshooting procedures for non-symmetric release and readjustment.

6.1.2.2 Instructions for use

An easily understood set of instructions for the skier shall be included with all bindings. These instructions shall contain at least:

a) the warnings against important modifications of the recommended setting;

b) the instructions on how to step in and out of the binding, how to restore the binding to its initial position after release, and how to open the binding after a fall in an awkward position;

c) the recommendations for avoiding problems, for example increase of the release level with time;

d) the instructions for maintenance, storage, and control of the binding;

e) the recommendations for setting the binding by a specialist with a setting device and for controlling this setting each year;

f) a warning that, when skiing in deep snow, the brake alone is not sufficient to avoid losing the ski;

g) the information on the appropriate ski-boots the binding is designed to function with.

6.2 Release tests — Setting, reproducibility, and symmetry of release values

6.2.1 Requirements

6.2.1.1 Scattering of values

The difference between each of the five values and their mean value shall not exceed ±10 % of that mean value.

6.2.1.2 Symmetry in torsion

The difference between the mean of the five values of M_z in one direction and the mean of the 10 values of $|M_z|$ shall not exceed ±10 % of the latter.

6.2.1.3 Accuracy of setting scale

The release value that corresponds to the indicator position of the setting scale is given in Table 2.

For M_z, the tolerance is ±5 Nm for Z = 1 and then increases linearly to ±10 Nm for Z = 10.

For M_y, the tolerance is calculated by taking into account the relationship between M_y and M_z given in Table 2.

To determine the tolerances on M_z and M_y, use Annex D (Figures D.1 and D.2).

This requirement applies to each of the mean values of the 10 values of $|M_z|$ and each of the mean values of the five values of M_y corresponding to the settings limit L_2, 1/3, 2/3, and limit L_3.

NOTE In general, the setting limit L_2 is different from the setting limit L_1.

For the highest setting (limit L_4, i.e. off the scale), these mean values shall not exceed the mean values corresponding to limit L_3 by more than 20 %.

6.2.2 Testing

6.2.2.1 Sampling

Carry out the test on four bindings randomly chosen from a set of six bindings. If the requirements in 6.2.1 are not fulfilled, two of the four bindings can be replaced by the remaining two bindings in this set.

6.2.2.2 Choice of settings

The tests shall be carried out at ambient temperature (23 ± 5) °C, with the sole and bindings dry, for the following settings:

— limit L_2;

— at approximately 1/3 of the scale;

— at approximately 2/3 of the scale;

— limit L_3;

— limit L_4.

The tests shall be carried out using the sole length corresponding to the setting mark, in accordance with Table 2.

Table 2 — Setting scale

Setting mark Z	Release torques		Sole length l mm
	M_z Nm	M_y Nm	
0,5	5	18	200
1	10	37	225
1,5	15	55	243
2	20	75	258
2,5	25	94	270
3	30	114	280
3,5	35	134	290
4	40	154	298
4,5	45	175	306
5	50	196	314
5,5	55	218	320
6	60	239	327
6,5	65	261	333
7	70	284	339
7,5	75	307	344
8	80	330	350
8,5	85	353	355
9	90	377	360
9,5	95	401	364
10	100	425	369

For each setting, release each of the four bindings five times in torsion to the right ($+M_z$), five times in torsion to the left ($-M_z$), and five times in forward bending (M_y).

6.2.2.3 Calculation of mean values

Calculate for each setting and each binding the following values:

— mean value of the five values of $+M_z$;

— mean value of the five values of $-M_z$;

— mean value of the 10 values of $|M_z|$;

— mean value of the five values of M_y.

6.3 Evaluation of reproducibility of release under different influences

6.3.1 Order of tests

Carry out the tests described in 6.3 in the following order on the four bindings already used for the tests in 6.2.2.

6.3.2 Reference values

Set the bindings in order to release for one pair of the values M_z / M_y indicated below:

l = 250 mm for

M_z = 20 Nm ± 2 Nm, and

M_y = 75 Nm ± 5 Nm.

l = 305 mm for

M_z = 40 Nm ± 3 Nm, and

M_y = 154 Nm ± 10 Nm.

l = 320 mm for

M_z = 60 Nm ± 3 Nm, and

M_y = 240 Nm ± 10 Nm.

l = 340 mm for

M_z = 80 Nm ± 4 Nm, and

M_y = 330 Nm ± 15 Nm.

Use the pair that lies nearest to the release value corresponding to the middle of the L_2/L_3 range of the binding.

Indicate also the boot-sole length l. Carry out the tests at ambient temperature (23 ± 5) °C with sole and bindings dry.

Release each binding five times in torsion to the right or to the left (for all subsequent tests maintain the direction) and five times in forward bending.

The mean value of each group of five release values is considered as the reference value.

This setting remains the same for all of the following tests (6.3.3 to 6.7.2).

6.3.3 Release with ski deflection

6.3.3.1 Requirements

The mean value of the deviations between each of the release values and the corresponding reference value shall not exceed 20 % for the torsion release (deflection of the ski M_z) and 15 % for the forward bending release (M_y).

None of the five values for the torsion release shall exceed ±10 % of their mean value.

None of the five release values for the forward bending release shall exceed ±7,5 % of their mean value.

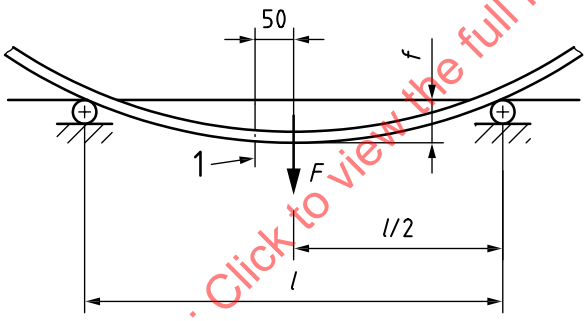
6.3.3.2 Testing

Subject one binding to the test. Release the binding five times in torsion to the right and five times in forward bending. Carry out the tests at ambient temperature (23 ± 5) °C with wet sole and binding.

Position and deflect the test ski with the sole inserted in the binding in accordance with Figure 7 and Table 3 and force the ski to deflect to given values by a strap or clamp, which does not interfere with the binding.

If the distance of the supports is different, use Table 3.

Dimensions in millimetres



Key

1 boot toe
f deflection
l distance of support

Figure 7 — Deflection of the ski

Table 3 — Deflection of the ski

Radius, R mm	l mm	f mm
4 717,5	500	6,6
	600	9,5
	700	13,0
	800	17,0
	900	21,5
	1 000	26,6
	1 100	32,2
	1 200	38,3
	1 300	45,0
	1 400	52,2
	1 500	60,0
	1 600	68,3
	1 700	77,2

6.3.4 Release under combined loading

6.3.4.1 General requirement about scattering

For a given test, each of the five release values shall remain within ±10 % of their mean values.

6.3.4.2 General test conditions

Subject one binding to the following tests. Carry out these tests at ambient temperature (23 ± 5) °C, with wet sole and binding.

For each of the following configurations of combined loading, release the binding five times in torsion to the right.

The values of the additional load are proportional to the reference value M_z measured in accordance with 6.3.2.

Apply the combined load to the ski boot (method A) on the reference point or to the ski (method B) in an equivalent manner during all its movements, which shall remain constant in amplitude and direction relative to the ski boot (method A) or relative to the ski (method B).

6.3.4.3 Influence of forward lean of the body

6.3.4.3.1 Requirement

The mean value of the deviations between each of the release and the reference value shall not exceed 35 %.

6.3.4.3.2 Testing

Apply the following additional loads:

— $+M_y = 2\,M_z$;

— $-F_z = \frac{40}{6} M_z$;

where

M_z is the reference value in Nm;

$-F_z$ is the additional load, expressed in N;

40 is expressed in N;

6 is expressed in Nm.

Calculate the mean value from five measurements.

6.3.4.4 Influence of roll loading

6.3.4.4.1 Requirement

The mean value of the deviations between each of the release values and the reference value shall not exceed 20 %.

6.3.4.4.2 Testing

Apply the following additional loads:

— $M_x = 0{,}2\ M_z$ (first test configuration);

— $M_x = -0{,}2\ M_z$ (second test configuration).

Calculate the mean value from five measurements.

6.3.4.5 Influence of backward lean of the body

6.3.4.5.1 Requirement

The mean value of the deviations between each of the release values and the reference value shall not exceed 25 %.

6.3.4.5.2 Testing

Apply the following additional loads:

— $M_y = 1{,}25\ M_z$;

— $F_z = \frac{40}{6} M_z$.

where

M_z is the reference value in Nm;

F_z is the additional load, expressed in N;

40 is expressed in N;

6 is expressed in Nm.

Calculate the mean value from five measurements.

6.3.4.6 Influence of axial force

6.3.4.6.1 Requirement

The mean value of the deviations between each of the release values and the reference value shall not exceed 15 %.

6.3.4.6.2 Testing

Apply the following additional load:

— $F_x = \frac{20}{6} M_z$.

where

M_z is the reference value in Nm;

F_x is the additional load, expressed in N;

20 is expressed in N;

6 is expressed in Nm.

Calculate the mean value from five measurements.

6.3.5 Low temperature exposure

6.3.5.1 Requirements

The difference between each of the release values and the corresponding reference value shall not exceed 35 % for bindings of types C and CA and 30 % for bindings of type A.

6.3.5.2 Testing

Subject only one binding to the test.

Subject boot sole and binding in a dry state separately to −20 °C. Release the binding twice in torsion to the right and twice in forward bending.

6.3.6 Icing

6.3.6.1 Requirements

All (at least 8, maximum 24) deviations (in %) are used to calculate the arithmetic mean. This value shall not exceed 35 % for bindings of type A and 40 % for bindings of types C and CA. These calculations shall be done for M_y and M_z separately.

6.3.6.2 Testing

Subject four bindings to the following cycles.

a) The ski will be placed in a horizontal position and frozen to −20 °C for at least 30 min after the following preconditions:

1) hold ski upright, with tip up at (23 ± 5) °C;

2) binding open at heel;

3) shower with water at (40 ± 3) °C for 2 min;

4) leave in this position for approximately 1 min.

Then insert a boot sole (dry and at –20 °C) into binding. Flex the ski five times (curve of deflection approximately 30 mm while ski is supported between supports 1 000 mm apart). The specimen is now ready for specified release tests in accordance with the following instructions.

b) Take the horizontal ski, with an inserted test sole [both at (23 ± 5) °C], and shower it for 2 min with water at (40 ± 5) °C, from a distance of 200 mm. Place the ski in an upright position (tip up) for 10 s. Place the ski in a horizontal position and freeze it to –20 °C for at least 30 min.

For cycles a) and b), after five flections of the ski [see a)] carry out the release tests at first for M_y, then after stepping into the binding again, immediately for M_z.

c) Carry out cycles a) and b) alternatively. Immediately after the release test, store the binding at ambient temperature (23 ± 5) °C for 10 min before beginning the subsequent cycle. The total number of cycles is six, each of them being carried out three times. The number of cycles may be reduced to two, if the mean value of the deviations between the measurements for the first two cycles and the corresponding references is smaller than 25 %.

6.3.7 Snow pack

6.3.7.1 Requirements

The mean value of the deviations between each of the release values and the corresponding reference value shall not exceed 40 % for bindings of types C and CA, and 35 % for bindings of type A.

Additionally, this mean value shall not be situated in a range of 25 % to 75 % of the reference value for the forward fall release, in order to avoid the risk of inadvertent release due to the binding having been fixed incorrectly.

6.3.7.2 Testing

Simulate the effect of snow pack by a peeled PTFE plate, with the same dimensions as the sole, being placed under the sole when it is inserted in the binding. The thickness of this plate shall be 2 mm along its frontal half and 3 mm along the rear half.

Submit only one binding to the test. Release it twice in torsion and twice in forward fall. Carry out these tests at ambient temperature (23 ± 5) °C with binding and sole wet.

6.3.8 Exposure to vibration and shock

6.3.8.1 Requirements

The mean value of the deviations between each of the release values and the corresponding reference value shall not exceed 15 % for bindings of types C and CA, and 10 % for bindings of type A.

6.3.8.2 Testing

Place four bindings (mounted on their ski sections) loosely together in a steel cylinder 400 mm in diameter. Then rotate this cylinder (20 revolutions at a speed of 60 min^{-1}).

Then perform a shock test as follows.

Drop one of the skis, vertical with the tip pointing up from a height of 500 mm onto a hard surface. Repeat the test five times.

Then release the binding twice in torsion and twice in forward bending. Carry out the tests at ambient temperature (23 ± 5) °C, with bindings and sole dry.

6.4 Energy absorption (recentring)

6.4.1 Requirements

During the test, the binding shall return the test sole quickly to within ±2 mm of its original position (i.e. no point of the sole shall be distant by more than 2 mm from its original position) after absorbing the required energy.

The energy W absorbed shall be at least M_z/45 Nm for the binding set, in order to release at the values for the following types:

— Type C: 5 Nm above the value corresponding to limit L_2;

— Types CA and A: 10 Nm above the value corresponding to limit L_2.

6.4.2 Testing

The quasi-static test method does not allow a prediction of the dynamic behaviour of the binding in all circumstances, but it does represent an appropriate means of evaluation of this behaviour.

Carry out the tests with a wet test sole on one of the new bindings remaining from the set of six bindings (see 6.2.2), at two values of the longitudinal compression of the sole: normal and increased. The "increased" value is obtained by reducing the length between the clamping elements by 1 mm.

A quasi-static torsion moment diagram is recorded for each repetition of the test.

6.5 Lateral release under impact loading

6.5.1 Requirement

When tested in accordance with ISO 9465, the angle of release of the pendulum shall fall between the two limits U according to Formula (1) and L according to Formula (2), for all quasi-static release values M_z of the binding greater than 20 Nm.

$$U = \frac{8}{7} \cdot M_z \tag{1}$$

$$L = 12 + 0{,}2 \cdot M_z \tag{2}$$

where

U is the upper limit, in degrees;

L is the lower limit, in degrees;

$\frac{8}{7}$ is in degrees per newton per metre;

0,2 is in degrees per newton per metre;

12 is in degrees;

M_z is the reference value, in Nm.

6.5.2 Testing

Carry out the test in accordance with the method defined in ISO 9465 on the binding already used for the tests of 6.4.

6.6 Field tests

6.6.1 Object of the tests

Field tests are an important complement to laboratory tests. Since evaluation of the following procedure is, to a degree, subjective, results should not form the basis for acceptance or rejection of a given binding. However, comments from this test procedure should be attached to laboratory test results and should be considered by the manufacturer.

6.6.2 Performance of the test and grading

Tests are carried out on bindings already used for the laboratory tests.

All adjustment screws that are essential to proper functioning shall be sealed with lacquer.

Carry out the tests with skis specified by the binding manufacturers.

The ski boots shall be fitted with a sole in accordance with ISO 5355.

Snow conditions:

— hard to icy snow, piste on which moderately to highly unfavourable conditions prevail;

— soft course or deep snow with moderate to high clearing resistance.

Each of these two conditions shall be present over at least one-third of the total piste.

Mode of skiing: free style, i.e. no prescriptions concerning the mode of skiing.

The bindings are tested by four skiers, usually only in winter conditions, on several difficult runs with a total vertical drop of at least 5 000 m. Each of the four items described in 6.6.3 are graded on the basis of the following scale.

Very good:	+2
Good:	+1
Satisfactory:	0
Mediocre:	−1
Bad:	−2
Unacceptable:	rejected

The sum of the 20 (16) results thus obtained shall be positive or zero. Otherwise, the release settings are checked after the practical tests. For each measurement, the deviation from the initial setting should be smaller than or equal to 35 % (initial setting M_z lower than or equal to 40 Nm) or 30 % (initial setting M_z greater than 40 Nm).

During the tests, each binding is released at least once in torsion. The deviation of the measured value from the initial setting should be smaller than or equal to:

— 45 % for initial setting values of 20 Nm to 40 Nm;

— 35 % for values >40 Nm to 50 Nm;

— 30 % for values >50 Nm.

After the test, it shall be verified that no alteration of the setting of any of the adjustment screws that are essential to proper functioning (e.g. release setting, sole lug, contact pressure) has occurred.

NOTE There is no measurement for initial setting values lower than 20 Nm.

6.6.3 Items to consider

6.6.3.1 Unwanted release

For all practical tests, the bindings shall be adjusted in accordance with ISO 8061, on values located in the mid-range between the lower and upper limit, individually for each skier. If the binding has a coupled setting (only one setting screw or feature for adjusting torsion and forward lean), one of both release values shall be set in accordance with ISO 8061, mid-range. The other release value should be equal to or lower than the value indicated by ISO 8061.

The setting in the other release directions (if foreseen) shall be carried out in accordance with the manufacturer's instructions, with the condition that the release values in torsion and forward lean remain equal to or lower than the values indicated by ISO 8061, mid-range (case of the coupled setting).

With these settings, the binding shall allow skiing with a very restricted number of inadvertent releases.

6.6.3.2 Boot-ski connection

The fixing of the boot to the ski shall be sufficiently rigid to offer adequate steering control.

6.6.3.3 Stepping into the binding

Stepping into the binding and centring of the boot shall be simple. The closing shall be positive and easily understood by the skier. Stepping in after release shall be possible without difficulty, even on steep slopes or in deep snow.

6.6.3.4 Manual release

Manual release shall be as simple as possible so that the skier can easily take off the skis, for example, after a fall or under difficult conditions (e.g. deep snow).

6.7 Exposure to corrosion and dirt

6.7.1 Requirements

The mean value of the differences between each of the release values and the corresponding reference value shall not exceed 35 % for bindings of types C and CA, and 30 % for bindings of type A.

6.7.2 Testing

Subject the four bindings, closed and adjusted to the reference values in accordance with 6.3.2, first to a salt mist for 48 h:

— salt content of the mist: (5 ± 0,5) % (percentage by mass of sodium chloride in water);

— temperature: (35 ± 2) °C.

Immediately afterwards, immerse the bindings eight times per minute for 15 min in a mixture with the following composition and temperature:

— salt content: 6 g of NaCl per litre of water;

— dirt content: 12 g of street dirt per litre; the grain size distribution of the dirt shall be in accordance with Annex C;

— temperature: (23 ± 5) °C.

Stir the mixture constantly to ensure good homogeneity.

After drying for 24 h, subject each of the bindings to one release test in torsion and one release test in forward bending. Carry out the tests at ambient temperature, (23 ± 5) °C, with bindings and boot sole dry.

6.8 Compatibility to boot in accordance with ISO 23223

6.8.1 Requirements

There shall be no other contact between binding and test body than low-friction zones (boot and binding).

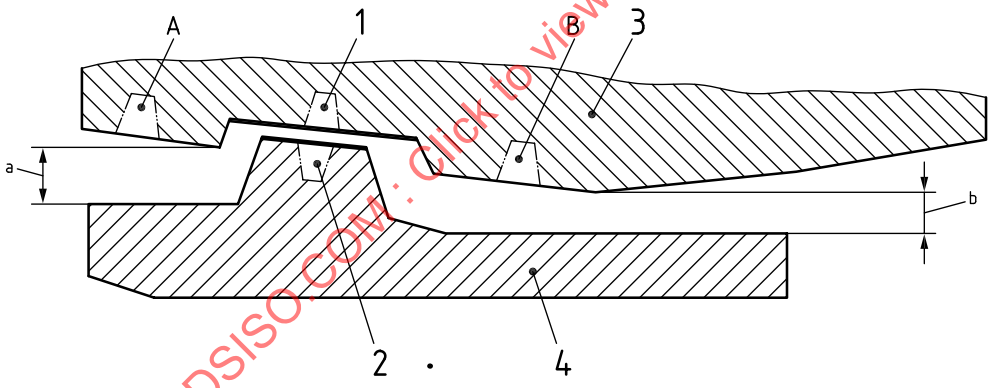
6.8.2 Testing

Mount the binding on the ski and fix the ski in three points on a flat table: in front of the toe, piece in the middle of the ski and behind the heel piece.

Measurements with the test body in accordance with ISO 9838 (see also Annex E for information) shall be done with a preload of 200 N for both type A and type C.

The clearance shall be checked with a 0,1 mm thickness gauge in the areas A and B in accordance with Figure 8.

The low-friction zone of the test body shall contact the interface area of the binding.



Key

1 low friction zone of test body
2 interface area of the binding AFD
3 test body
4 binding
A area in front of interface area
B area behind interface area
a Clearance in area A.
b Clearance in area B.

NOTE See Figure E.1 or Figure E.2 for details of test body.

Figure 8 — Clearance area around the antifriction device (AFD)

7 Marking

7.1 Ski-bindings in accordance with this document shall be marked with the name or trademark of the manufacturer or the importer.

7.2 If the binding is compatible to boots with walkable soles in accordance with ISO 23223, a logo or pictogram or colour code, identical to the one on a boot that conforms with ISO 23223, shall be placed on the ski-binding in a clearly visible position.

If the binding is compatible to touring ski boots in accordance with ISO 9523, this information shall be clearly marked on the binding.

The marking shall be done in accordance with Table 4:

Table 4 — Compatibility marking

Binding compatible with International Standard(s) on boots	To be marked with	Mandatory logo / pictogram
ISO 5355 - TYPE A	**A**	
ISO 5355 - TYPE A **ISO 23223 - TYPE A**	**A**	[specific technology logo for improved walking soles] ①
ISO 5355 - TYPE A **ISO 23223 - TYPE A** **ISO 9523**	**A**	MN (MN)
ISO 5355 - TYPE C **ISO 5355 - TYPE A**	**CA**	
ISO 5355 - TYPE C **ISO 23223 - TYPE C** **ISO 5355 - TYPE A** **ISO 23223 - TYPE A**	**CA**	[specific technology logo for improved walking soles] ①
ISO 5355 - TYPE C	**C**	
ISO 5355 - TYPE C **ISO 23223 - TYPE C**	**C**	[specific technology logo for improved walking soles] ①

Key

MN multi-norm (for bindings of type MN)

① logo or pictogram or colour code or the letter "W", identical to the one on a boot that conforms with ISO 23223

NOTE For marking the boot, see ISO 23223, ISO 5355 and ISO 9523 and for boot-binding compatibility see ISO 11088 and ISO 13993.

Annex A
(informative)

Additional information to conduct tests in accordance with test method A

A.1 Influence of forward lean (see 6.3.4.3)

Apply loads, see Figure A.1:

$$m = (F_z / 9{,}81) - m_x \quad \text{(A.1)}$$

$$m_x = m_{lever} + m_{balance} \quad \text{(A.2)}$$

$$M_y = 2 \times M_z \quad \text{(A.3)}$$

$$F_z = (40/6) \times M_z \quad \text{(A.4)}$$

$$\Delta L\,[\mathrm{m}] = \frac{2 \times M_z - M_{lever}}{(40/6) \times M_z - F_{lever}} \quad \text{(A.5)}$$

where

F_{lever} is the resulting force from the test fixture (without balance mass);

M_{lever} is the moment about y-axis produced by the test fixture;

ΔL is the adjustable length for additional mass, in metres;

m is the additional mass, in kg;

M_y is the forward bending moment, in Nm;

M_z is the twisting moment, in Nm;

m_x is the combined mass, in kg;

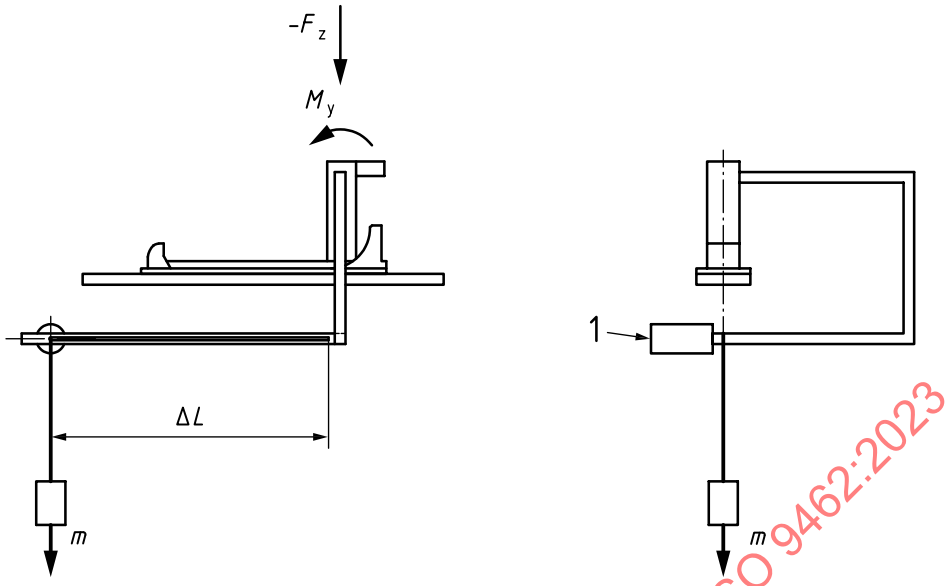
m_{lever} is the mass of lever, in kg;

$m_{balance}$ is the mass of balance, in kg.

40 is expressed in N;

6 is expressed in Nm.

The applied torque moment is the result of the adjustable length of the lever and the additional calculated force.



Key

1 balance mass
F_z vertical force
M_y forward bending moment
m additional mass
ΔL adjustable length for additional mass

Figure A.1 — Influence of forward lean

A.2 Influence of roll loading (see 6.3.4.4)

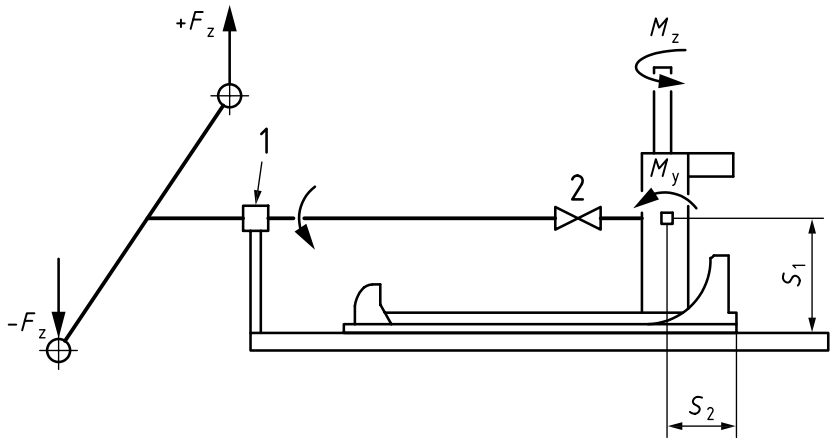
Apply loads, see Figure A.2:

$$M_x = 0{,}2 \times M_z \quad \text{(A.6)}$$

where

M_z is the twisting moment, in Nm;

M_x is the edging/roll moment, in Nm;



Key

1 axial ball bearing
2 cardanic joint
M_z twisting moment, in Nm
M_x edging/roll moment, in Nm
M_y forward bending moment, in Nm
F_z force couple (in N) to produce M_x
S_1 vertical distance from boot sole
S_2 horizontal distance from end of the heel projection of the boot

Figure A.2 — Influence of roll loading

A.3 Influence of backward lean (see 6.3.4.5)

Apply loads, see Figure A.3:

$$m = (F_z / 9{,}81) - m_x \quad \text{(A.7)}$$

$$m_x = m_{lever} + m_{balance} \quad \text{(A.8)}$$

$$M_y = 1{,}25 \times M_z \quad \text{(A.9)}$$

$$F_z = (40/6) \times M_z \quad \text{(A.10)}$$

$$\Delta L = [\text{m}] = \frac{1{,}25 \times M_z - M_{lever}}{(40/6) \times M_z - F_{lever}} \quad \text{(A.11)}$$

where

F_{lever} is the resulting force from the test fixture (without balance mass) in N;

M_{lever} is the torque moment of the mass from lever construction in Nm;

ΔL is the adjustable length for additional mass in m;

m is the additional mass in kg;

M_y is the forward bending moment, in Nm;

M_z is the twisting moment, in Nm;

m_x is the combined mass, in kg;

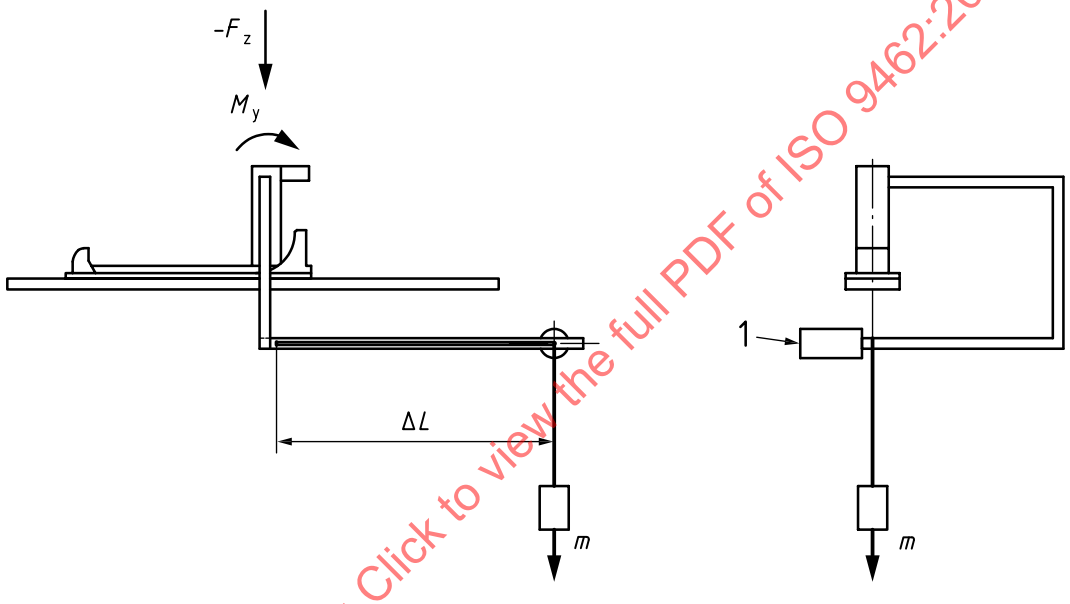
m_{lever} is the mass of lever, in kg;

$m_{balance}$ is the mass of balance, in kg;

40 is expressed in N;

6 is expressed in Nm.

The applied torque moment is the result of the adjustable length of the lever and the additional calculated force.



Key

1 balance mass

F_z vertical force

M_y forward bending moment

m additional mass

ΔL adjustable length for additional mass

Figure A.3 — Influence of backward lean

A.4 Influence of axial force (see 6.3.4.6)

Apply loads, see Figure A.4:

$$F_x = (20/6) \times M_z \quad \text{(A.12)}$$

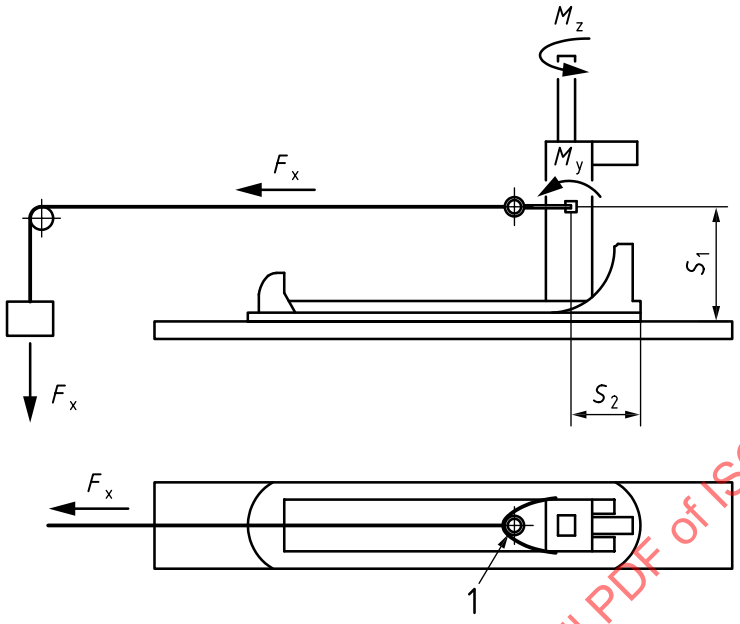
where

M_z is the twisting moment, in Nm;

F_x is the axial force;

20 is expressed in Nm;

6 is expressed in Nm.



Key

1 roll
M_z twisting moment
M_y forward bending moment
F_x axial force
S_1 vertical distance from boot sole
S_2 horizontal distance from end of the heel projection of the boot

Figure A.4 — Influence of axial force

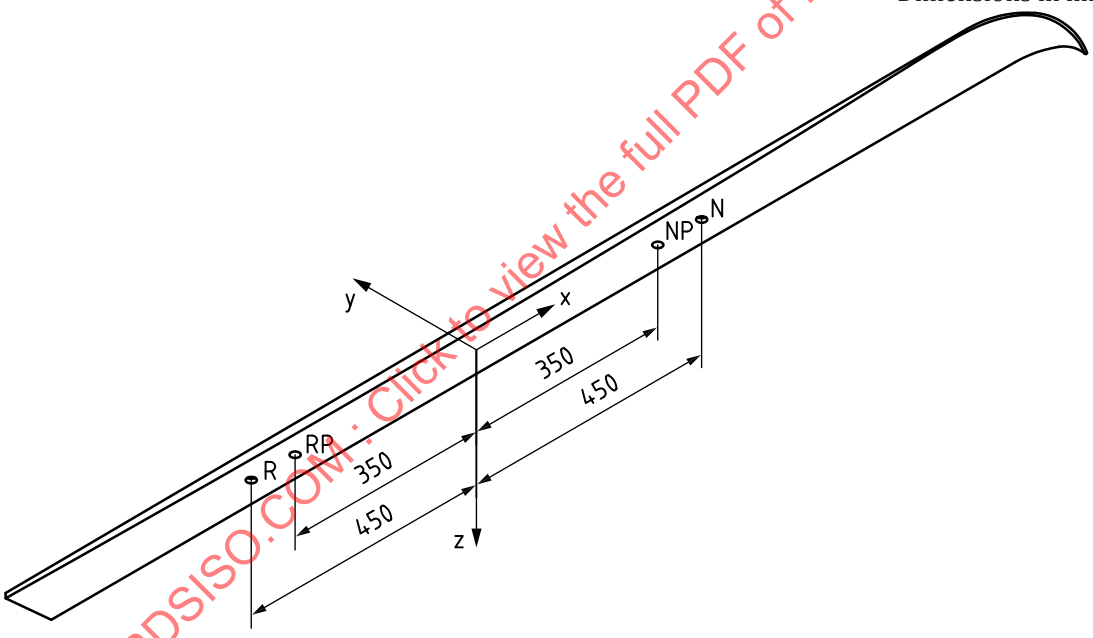
Annex B
(informative)

Fixtures and load configurations necessary for conducting tests using test method B

B.1 Fixtures and test configurations

B.1.1 An individual release measurement should consist of attaching a ski-binding system to the boots-test frame system and applying a load configuration sufficient to cause the binding mechanism to release while simultaneously recording information sufficient to determine the two peak M_z and M_y moments, see Figure B.1.

Dimensions in millimetres



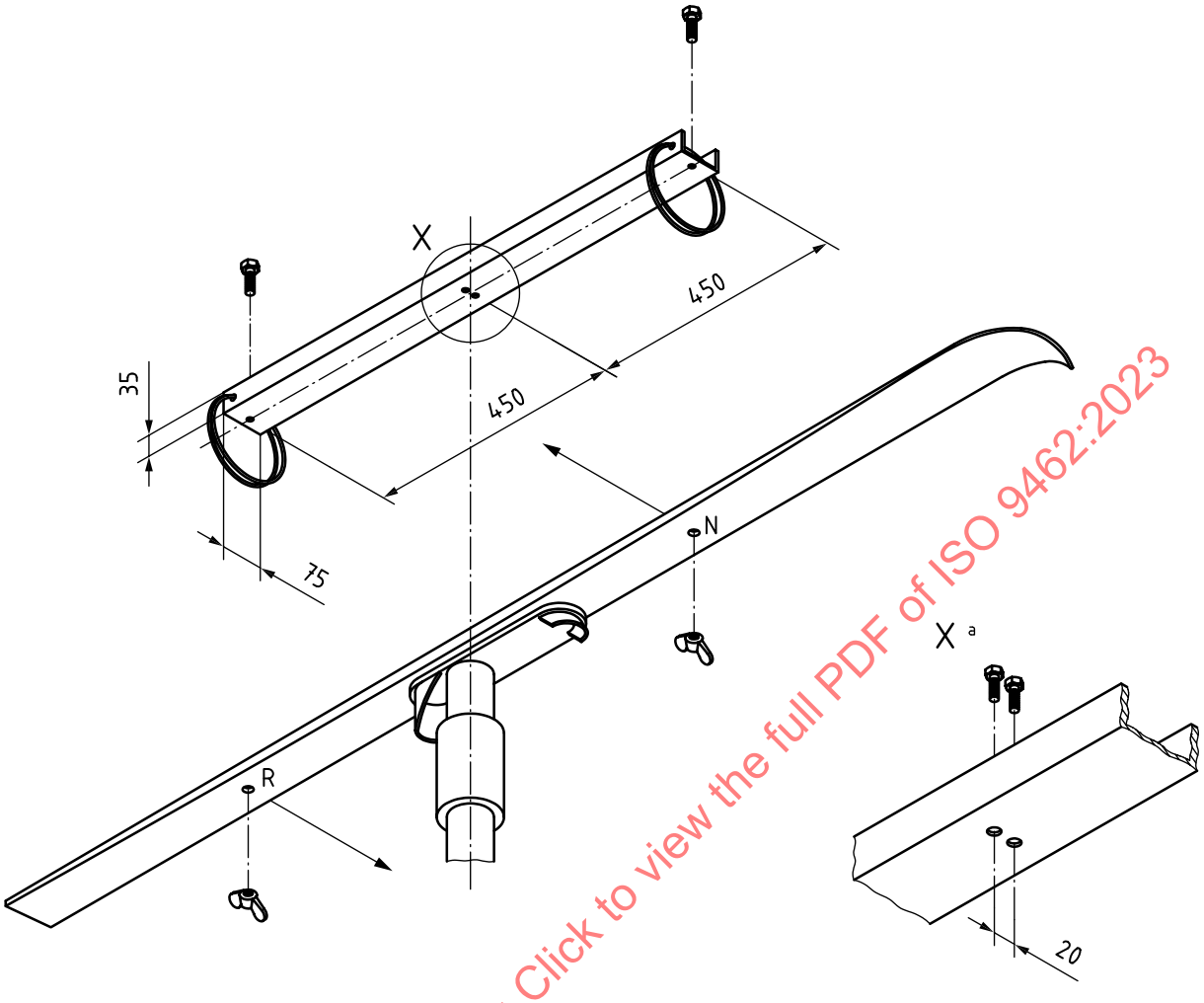
Key

NP near preload point
N near point
RP rear preload point
R rear point

Figure B.1 — Load application

Use the ski stiffening fixture described in Figure B.1 as defined in Figure 3 and Figure 5 unless otherwise specified. The release moments should be prefaced by two equal and contrary tractive forces as shown in Figure B.2.

Dimensions in millimetres



Key

a View on X (enlarged).
N near point
R rear point

Figure B.2 — Ski stiffening fixture

B.1.2 The application of two equal forces for combined loads:

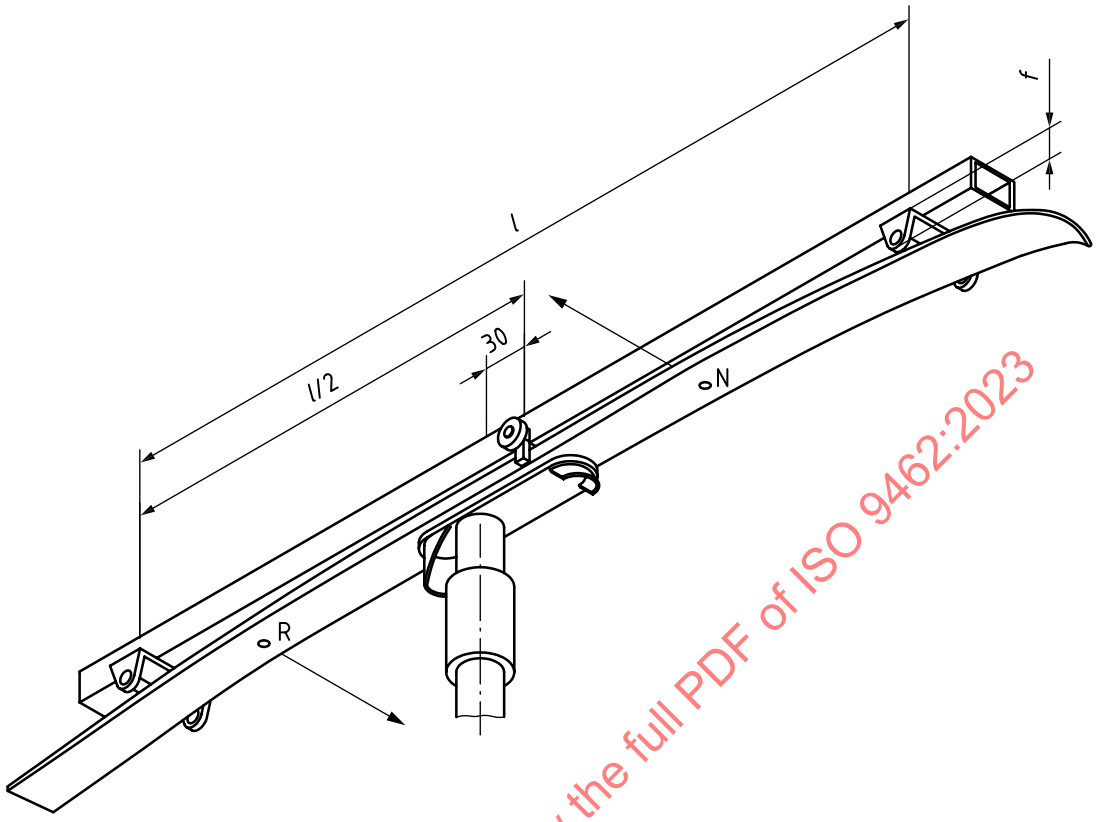
— for F_{NH} and F_{RH} shall be as described in Figure 4;

— for F_{NV} and F_{RV} shall be as described in Figure 6.

B.1.3 The fixture described in Figure B.3 should be used to perform the release with ski deflection test.

l and f are defined in Table 3.

Dimensions in millimetres

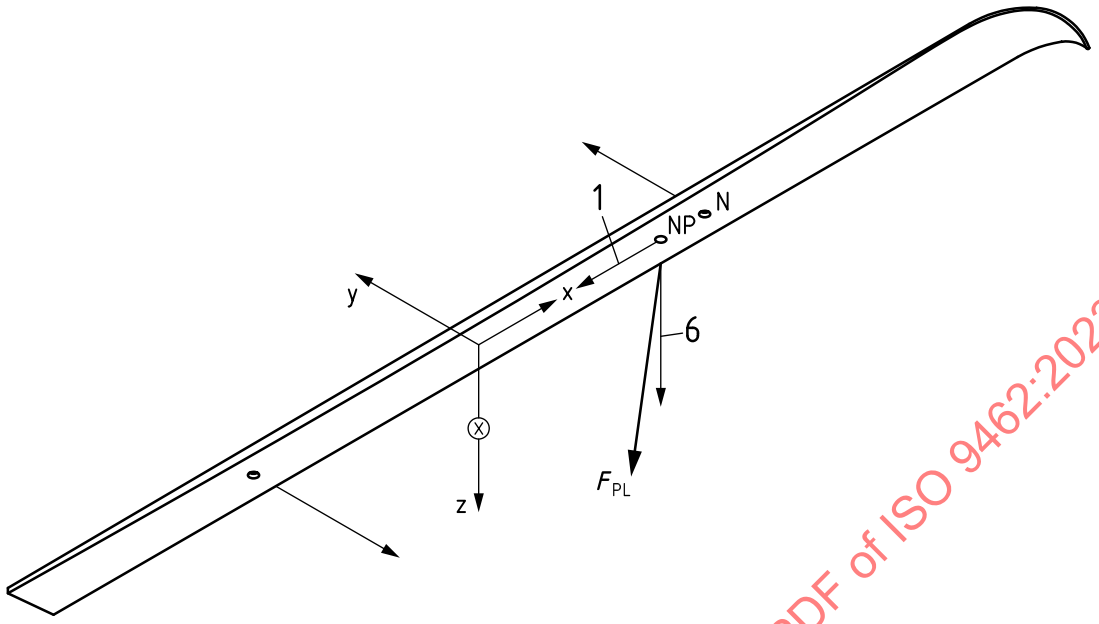


Key

l	distance of support
f	deflection
N	near point
R	rear point

Figure B.3 — Release with ski deflection test

B.1.4 Use the load configuration defined in Figure B.4 to perform the release with combined loading test for influence of forward lean of the body.



Key

N	near point loading
NP	near preload point
$\boldsymbol{F}_{PL}$	force vector necessary to produce the required M_y preload
1 and 6	vector components of $\boldsymbol{F}_{PL}$ in the ratio of 1:6

Figure B.4 — Release with combined loading test for influence of forward lean of the body