
**Protective clothing for use in
snowboarding — Wrist protectors —
Requirements and test methods**

*Habillement de protection destiné à la pratique du surf des neiges —
Protecteurs de poignets — Exigences et méthodes d'essai*

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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).

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).

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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 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 162, *Protective clothing including hand and arm protection and lifejackets*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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.

Introduction

Snowboarding are all the pastimes and competitions in which a snowboard is used. The users range from small children to adults of all ages.

The wrist is the most frequently injured body region among snowboarders. The majority of wrist injuries are consequences of falls. The most common injury mechanism is described as a compressive load applied to a hyperextended wrist. Beginners and children have a high incidence of wrist injuries due to snowboarding. One third of injuries among beginner snowboarders are to the wrist.

Studies have shown that the risk of sustaining a wrist injury can be reduced by wearing wrist protection. Wrist protectors in snowboarding are intended to protect the wearer against fractures as well as contusions and sprains.

Wrist protectors will not prevent all wrist, forearm, hand, elbow and shoulder injuries in snowboard accidents.

A wide variety of wrist protectors is commercially available. Consumers can choose between different principal design concepts. One is the “integrated protection concept” in which the protective elements are integrated within a glove. Another one is the “separated protection concept” where the protective elements are individual components (similar to a brace or orthosis) that can be worn with or without a glove. If worn with a glove it can be foreseen to place them underneath or on top of the glove^{[3][4][5][6]}.

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Protective clothing for use in snowboarding — Wrist protectors — Requirements and test methods

1 Scope

This document specifies the requirements and test methods for ergonomics, innocuousness, comfort/sizing, restraint, ability to limit wrist extension and attenuate impact force on the palm as well as provisions for marking and instructions supplied by the manufacturer for wrist protectors for all users of snowboard equipment.

It does not apply to protectors used in roller sports, alpine skiing, or other sports. This document does not address protection for the forearm due to axial forces caused by an impact on the fingers or fist. Moreover, this document does not address protection against palmar flexion (terminal flexion) caused by an impact on the dorsal side of the hand.

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 21420:2020, *Protective gloves — General requirements and test methods*

ISO 13999-1:1999, *Protective clothing — Gloves and arm guards protecting against cuts and stabs by hand knives — Part 1: Chain mail gloves and arm guards*

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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:

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

3.1

wrist

radio-carpal joint

3.2

dorsal

pertaining to upper side or back of the hand and wrist

3.3

palmar

pertaining to the palm side of the hand and wrist

3.4

wrist protector

wrist guard

device worn on the wrist and extending onto the forearm and the hand, that is intended to reduce the risk of wrist injuries by mechanical impact

3.5 concepts of wrist protectors

3.5.1 integrated protection concept

glove and protection elements forming one unit and used as one product

3.5.2 standalone protection concept

protection elements forming a wrist protector which can be worn with a glove, where the suitable type of glove will be specified by the manufacturer

Note 1 to entry: The manufacturer specifies how the protector is to be worn, including, whether the protector is to be worn underneath or on top of the glove.

3.7 stiffness element

design element that limits wrist extension

3.8 splint

type of stiffness element that uses semi-rigid support on either the dorsal and/or palmar area of the protector

3.9 fastener

strap or connector attaching wrist protector to the wrist

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3.10 extension

movement of the hand in the dorsal direction

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Note 1 to entry: Dorsal pertains to the back of the hand, palmar to the palm.

3.11 flexion

movement of the hand in the palmar direction

4 Requirements

4.1 General

Performance requirements shall be based on 3 ranges (A, B, C) as defined in [Table 1](#).

The size of the wrist protector shall be defined according to the hand size in ISO 21420.

Table 1 — Correlation range to size

	Range		
	A	B	C
Size	≤6	7 to 8	≥9

Requirements are fulfilled, if ergonomic-, innocuousness - and restraint- tests are fulfilled at room temperature (20 °C) and impact- and limitation of wrist extension-tests are fulfilled at room temperature and in cold condition (-10 °C)

However, additional impact- and limitation of wrist extension-tests at lower temperature might be performed and specified in the information supplied by the manufacturer (see [Clause 7](#)).

4.2 Splints

Wrist protectors may have splints on either the dorsal and/or palmar area of the protector. If splints are used, their dimensions must be appropriate to ensure sufficient pressure distribution on the surface of the hand and forearm. The dimension shall conform to the measures as given in [Table 2](#). The reference point for measurements shall be the plane of the wrist of an appropriate size of assessor (see [Table 1](#)), who has put on the protector in straight position. The position of the plane of the wrist of the assessor shall be determined according to ISO 13999-1:1999, Figure 1.

Table 2 — Minimum dimensions of splints in wrist protectors

Dimensions in millimetres

Location of splints	Range		
	A	B	C
Length from the wrist up the arm towards the elbow	45 ± 2	50 ± 2	55 ± 2
Length from the wrist up the hand towards the finger tip	40 ± 2	45 ± 2	50 ± 2
Width at each end of the splints	25 ± 2	25 ± 2	30 ± 2

NOTE Differences between A, B and C are based on Reference [9].

4.3 Ergonomics

When tested in accordance with [5.4](#), the assessor shall be able to put on and take off the two wrist protectors by themselves without any discomfort, significant problem or hazard being encountered.

When tested in accordance with [5.4](#), the assessor shall be able to close and open the binding system by themselves while wearing wrist protectors.

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4.4 Innocuousness

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The product shall comply with the requirements in ISO 21420:2020, 4.2.

The tested sample shall not show permanently deformed nor broken parts, when tested according to [5.7](#) and [5.8](#).

Straps and closures of the tested samples shall not open during the tests according to [5.6](#) and [5.8](#).

The handling of the wrist protector during tests according to [5.4](#) and [5.5](#) shall not show roughness, sharp edges, projections and the like which could cause excessive irritation or injuries.

If splints are used for limitation of the wrist extension, their dimensions must fulfil the requirements of [4.2](#).

4.5 Restraint

When tested in accordance with [5.5](#), the displacement Δl (see [Figure 2](#): $l_2 - l_1$) of each test shall not exceed 20 mm.

4.6 Impact strength

When tested in accordance with [5.6](#) all components of the wrist protector shall not break or split.

4.7 Impact performance

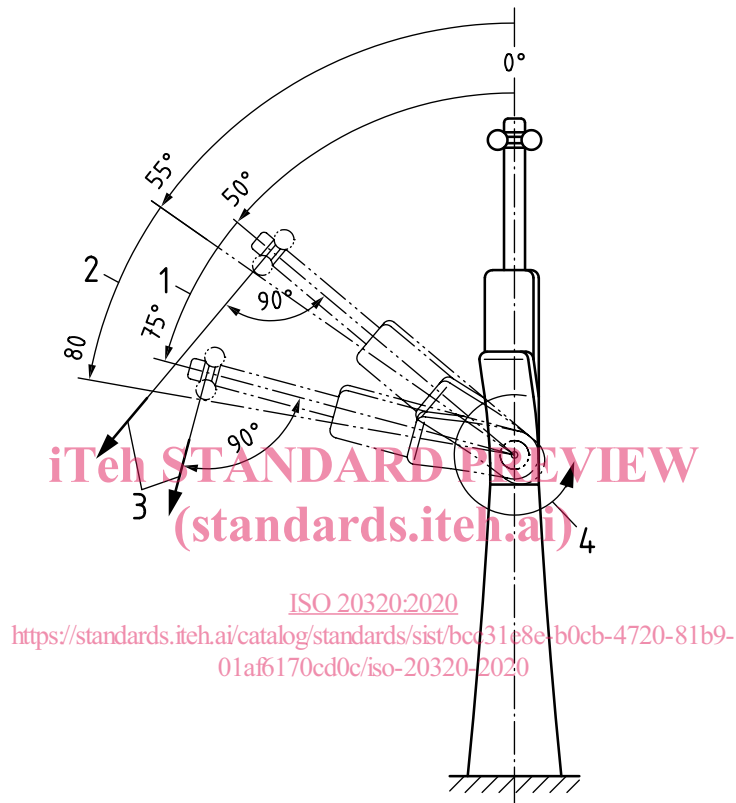
Wrist protectors can have protection elements that protect the palm against impact.

When tested in accordance with [5.7](#) all measured impact forces shall not exceed 3 kN.

4.8 Limitation of wrist extension

Wrist protectors shall be sufficiently stiff that when tested according to 5.8 and loaded with torque 1 according to Table 8 all resulting angles of the artificial wrist joint (extension 1) shall be within 50° to 75° (extension 1 = 50° ... 75° ± 1°). When tested according to 5.8 and loaded with torque 2 according to Table 8, all resulting angles of the artificial wrist joint (extension 2) shall be within 55° to 80° (extension 2 = 55° ... 80° ± 1°).

When torque 2 according to Table 8 is applied, extension 2 shall be at least 5° greater than extension 1 at torque 1 (extension 2 - extension 1 ≥ 5° ± 1°).



Key

- | | | | |
|---|-------------|---|------------|
| 1 | extension 1 | 3 | force |
| 2 | extension 2 | 4 | torque 1/2 |

Figure 1 — Extension angle

5 Testing

5.1 General

If no specific methods are specified, compliance with the requirements of this document shall be examined by measurement, visual inspection and tactile examination.

Only wrist protectors, as offered for sale shall be tested.

One size is tested per range (see Table 1) and the results are valid for all sizes within the range. Manufacturers do not need to supply a size for each range but test results are not transferable between ranges.

According to the two main types of design concept, the testing samples for all performance tests are as follows:

- If the wrist protector is built as an integrated protection concept, the complete product (protector and glove) has to be tested.
- If the wrist protector is built as a standalone protection concept, the product is to be tested in the configuration as specified in the information supplied by the manufacturer. If one or more types of gloves are foreseen, the protector shall be tested in combination with all type of gloves specified in the information supplied by the manufacturer. The protector shall be mounted as specified in the information supplied by the manufacturer (e.g. underneath or on top of the glove).

The sequence of tests shall be as shown in [Table 3](#).

Table 3 — Sequence of tests and number of test sample (to be done for each range)

Performance Test	Sequence of tests	Sample number/Conditioning	
Ergonomics	1st	No. 1 (L+R)	-
Restraint	2nd	—	No. 2 (L)/Room Condition
Limitation of extension	3rd	No. 1 (R)/Room Condition	No. 2 (R)/Cold Condition
Impact strength	4th	No. 2 (L)/Room Condition	No. 2 (R)/Cold Condition
Impact performance	5th	No. 3 (R)/Room Condition	No. 3 (L)/Cold Condition

5.2 Sampling

For each range to be tested, two pairs of wrist protectors shall be provided (Sample No. 1 and No. 2). For standalone wrist protectors, manufacturers shall provide all type of gloves specified in the information supplied by the manufacturer and for all ranges to be tested

If the wrist protector according to the information supplied by the manufacturer (see [Clause 7](#)) protects the palm against impact ([4.7](#)), a third pair of wrist protectors (No. 3) shall be provided.

The test samples shall be supplied with the information supplied by the manufacturer according to [Clause 7](#).

5.3 Conditioning

5.3.1 General

All samples shall be conditioned before testing impact strength ([5.6](#)), impact performance ([5.7](#)) and limitation of extension ([5.8](#)), where samples shall be mounted to the prosthesis before conditioning. For standalone wrist protectors, gloves shall be conditioned too.

5.3.2 Room temperature conditioning

The mounted samples shall be exposed to a temperature of (20 ± 2) °C for not less than 4 h. Testing shall be completed in the conditioning environment or within 2 min of removal from the environment.

5.3.3 Cold temperature conditioning

The samples shall be exposed to a temperature of (-10 ± 2) °C for not less than 4 h. Testing shall be completed in the conditioning environment or within 2 min of removal from the environment.