

BS ISO 10256-5:2017



BSI Standards Publication

Protective equipment for use in ice hockey

Part 5: Neck laceration protectors for ice
hockey players

National foreword

This British Standard is the UK implementation of ISO 10256-5:2017. Together with BS EN ISO 10256-1:2016, BS EN ISO 10256-2, BS EN ISO 10256-3, BS EN ISO 10256-4 and BS EN ISO 10256-6, it supersedes BS EN ISO 10256:2003 which will be withdrawn upon publication of all parts of this standard.

The UK participation in its preparation was entrusted to Technical Committee SW/136, Sports, playground and other recreational equipment.

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This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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**Protective equipment for use in ice
hockey —**

Part 5:
**Neck laceration protectors for ice
hockey players**

Équipement protectif destinées à être utilisées en hockey sur glace —

Partie 5: Protège-cous contre les lacérations pour joueurs de hockey sur glace





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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).

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

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.

The committee responsible for this document is ISO/TC 83, *Sports and other recreational facilities and equipment*, Subcommittee SC 5, *Ice hockey equipment and facilities*.

This first edition of ISO 10256-5, together with ISO 10256-1, ISO 10256-2, ISO 10256-3, ISO 10256-4 and ISO 10256-6, cancels and replaces ISO 10256:2003, which has been technically revised.

This document was developed primarily from neck laceration protector standards previously published by Bureau de Normalisation du Québec (BNQ) (CAN/BNQ 9415-370) and the European Committee for Standardization (CEN/TS 15256:2005).

A list of all the parts in ISO 10256 can be found on the ISO website.

Introduction

The intention of neck laceration protection is to reduce the frequency and severity of lacerations to the neck while playing ice hockey. The protective function is such that the penetration of a skate blade is counteracted.

Neck laceration protection for use in ice hockey consists of a neck laceration protector. To achieve the performance of which it is capable and to ensure stability on the neck, a neck laceration protector should be as closely fitting as possible consistent with comfort. In use, it is essential that the neck laceration protector is securely fastened according to the manufacturer's instructions.

ISO/TC 83/SC 5 is aware that specifications for the performance of the neck laceration protector are required to reduce the risk of injury in ice hockey. The goal of the subcommittee is to promote the use of improved materials and/or constructions as they become available to meet the future requirements of the sport of ice hockey. ISO/TC 83/SC 5 recognizes that in order to provide for comfort, fit and use, neck laceration protectors should be constructed from materials providing the appropriate performance characteristics.

The intent of this document is to reduce the risk of lacerations to the neck without compromising the form or appeal of the game.

Ice hockey is a sport in which there is a risk of injury. This document is intended only for neck laceration protectors used for ice hockey. Ice hockey neck laceration protectors do not afford protection from impacts to the neck or spine, nor do they protect against axial compressive loading of the cervical spine. Severe head, brain or spinal injuries, including paralysis or death, may occur even though an ice hockey neck laceration protector meeting the requirements of this document is used.

In order for a neck laceration protector to perform adequately, it needs to be in good condition, fit properly, be worn properly and not be altered in any way.

Protective equipment for use in ice hockey —

Part 5:

Neck laceration protectors for ice hockey players

1 Scope

This document specifies performance requirements and test methods for neck laceration protectors used in ice hockey. Neck laceration protectors are needed to reduce the risk of direct laceration to the neck caused by contact of a hockey skate blade.

The tests required to ensure that a neck laceration protector conforms to the requirements of this document do not attempt to predict the performance of the neck protector in all possible situations. This document does not address protection from the impact of pucks, sticks or other objects.

This document does not address accessories that are associated with a neck laceration protector.

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 6330, *Textiles — Domestic washing and drying procedures for textile testing*

ISO 10256-1:2016, *Protective equipment for use in ice hockey — Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10256-1 and the following 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

anatomical form

solid or hollow object defined by its shape and size, used to support a *neck laceration protector* (3.6) for the verification of the test requirements of this document

3.2

anvil

round or square sectioned rigid metal block with a specified shape at its upper end used to transmit the force of impact from the inside of the test specimen to the force transducer

3.3

bib

part of a *neck laceration protector* (3.6) that lies over the anterior thoracic region

3.4 median plane

vertical plane that passes through the *neck laceration protector* (3.6) from front to back and divides the neck laceration protector into right and left halves

3.5 model

category of a *neck laceration protector* (3.6) that does not differ in essential elements

Note 1 to entry: The essential elements are the materials, design, construction, marking requirements and retention system.

Note 2 to entry: The same model can be available in several sizes and colours.

3.6 neck laceration protector

cut resistant device worn to reduce the risk of external laceration injury from skate blades in the *protected area* (3.8)

3.7 neck part

part of a *neck laceration protector* (3.6) that surrounds the cylindrical portion of the anatomical neck form

3.8 protected area

area of the *neck laceration protector* (3.6) that is subject to testing as defined in this document

3.9 easy access

ability to open the protector and position it away from the wearers neck without any tools when the wearer is laying supine (i.e. on the back, facing upward) and without lifting the head from the ground

4 General requirements

4.1 Innocuousness/materials

4.1.1 In addition to the requirements of ISO 10256-1:2016, 4.1, the requirements in 4.1.2 to 4.1.4 shall apply. Examination shall be made according to 5.3.1.

4.1.2 The neck laceration protector shall be made with no removable parts in the protected area.

4.1.3 If any of the materials used tend to shrink when laundered, this aspect shall be taken into consideration in order to assure that the protective material covers the protected area after laundering.

4.1.4 The protective materials shall be attached securely to each other and to the other materials in such a way that they provide continuous protection in the protected area, ensure the comfort of the user and do not shift during normal use.

4.2 Ergonomics, ease of use and adjustment

4.2.1 The neck protector shall comply with the requirements of ISO 10256-1:2016, 3.2.

4.2.2 The neck laceration protector shall be compatible with other equipment such as shoulder pads, helmet and facial protector.

4.2.3 The neck laceration protector shall be quickly and easily adjustable and in the event of an emergency, it shall allow easy access to the protected area.

4.2.4 The neck laceration protector shall be designed and manufactured so that it remains in place during normal ice hockey play when worn according to the manufacturer's instructions.

4.3 Protected area and area of coverage

When examined according to [5.3.3.1](#), the protective material of the neck laceration protector shall cover the protected area as shown in [Figure 1](#).

4.4 Cut resistance

When tested according to [5.3.5](#), the protective area of the neck laceration protector shall meet the specified minimum cut resistance requirements for the test method performed.

When tested according to the method in [Annex A](#), there shall be no cuts detected on the artificial neck foam, nor cut through the bottom layer (the one found in contact with the skin of the user) of the neck laceration protector.

When tested according to the method in [Annex B](#), there shall be no cut through the entire thickness of the neck protector within the cut test area.

4.5 Permanence of markings

When tested in accordance with [5.3.4](#), permanent markings shall remain legible for the useful life of the neck laceration protector under normal use and maintenance following the manufacturer's care and maintenance recommendations.

5 Test methods

5.1 Test apparatus tolerances

Unless otherwise specified, the dimensions of the cut test apparatus shall have a tolerance of $\pm 2\%$.

5.2 Test samples and conditioning

5.2.1 Test samples

Only new and complete neck laceration protectors, as offered for sale, shall be tested. The neck laceration protectors shall be inspected visually, and by hand, prior to conditioning. The number of samples required for each test is specified in [Table 1](#).

5.2.2 Sample preparation and conditioning

5.2.2.1 Washed and dried

All neck laceration protector samples shall be washed three times according to ISO 6330 using the manufacturer's instructions.

After each wash, the protector shall be hung in ambient conditions according to ISO 6330 and according to the manufacturer's instructions.

5.2.2.2 Conditioning

Unless otherwise specified, neck laceration protector samples for the cut test shall be

- a) dry condition — dry conditioned under ambient temperatures according to ISO 10256-1, and
- b) wet condition — submerged in water at a temperature of (20 ± 2) °C for at least 4 h. After removal from the water, the protector shall be hung for (30 ± 5) min in ambient conditions according to ISO 10256-1:2016, 6.1.

5.3 Test procedures

5.3.1 Innocuousness

The neck laceration protector shall be examined visually and or by hand to determine that there are no items that might injure the user or another player during normal use.

Documents supplied by the manufacturer shall be examined to determine whether the claim that the materials are suitable for use in ice hockey protective clothing and equipment is justified. If the documentation is deemed inadequate, the model shall not be tested.

The results of the examination for innocuousness shall be recorded in the test report.

5.3.2 Ergonomics

The protector shall fulfil the ergonomics requirements in ISO 10256-1 and [4.2](#).

5.3.3 Verification of the protected area and area of coverage and examination of sizing

5.3.3.1 Verification of coverage of the protected area

The protected area of a neck laceration protector shall include a neck part (collar) and a bib.

Verification of the protected area shall be carried out on an anatomical form manufactured according to the specifications in [Annex C](#). The size of the anatomical form shall correspond to the size indicated on the neck laceration protector.

When the neck laceration protector is installed on the anatomical form and held in place according to the manufacturer's recommendations, the protective material shall cover the protected area requirements of the neck part and the bib (see [Figure 1](#)).

The protected area of the neck part shall be defined on each anatomical form corresponding to the size(s) indicated on the neck protector. This verification of the protected area of the neck part shall be carried out according to the following conditions:

- a) Neck laceration protector shall be placed on corresponding size of anatomical form. The median plane of the protector shall be lined up with points F and J of the anatomical form (see [Figure 1](#)).
- b) In order to simulate a standard fit, a 10 mm diameter × 15 cm long piece of foam shall be placed over the front part of the anatomical form between the form and the neck laceration protector. This bar shall be lined up at midpoint of the anatomical form. The lower centre part of the bar shall be lined up with point J and the piece of foam shall extend up for width to be centred over point F of the anatomical form.
- c) If the neck laceration protector employs a hook and loop or similar fastening system, the neck laceration protector shall be installed on the anatomical form so that the two parts of the fastening system are parallel.
- d) After positioning the neck laceration protector on the form, the bar shall be removed during the verification of the protected area.

- e) A manual adjustment of the neck laceration protector is allowed in the vertical axis as long as its centreline remains lined up with point F on the anatomical forms. No further adjustment shall be permitted.
- f) The neck laceration protector can be held in place with manual pressure on the anatomical form during the verification of the protection zone if the rigidity of the neck laceration protector prevents it from staying in contact with the torso part of the anatomical form.
- g) If more than one size is indicated on the neck laceration protector, the verification of protection zone testing shall be carried out on each of the anatomical forms corresponding to each of the indicated sizes.
- h) If a neck laceration protector is integrally attached within a garment, the neck laceration protector shall be cut away from the garment before it is placed on the anatomical form to verify the protected area.
- i) Verification of the protected area of the bib shall be determined by measuring the bib height according to the following conditions:
 - 1) measurements shall be taken at three points on the anatomical form: at 0°, 90° and -90° (see [Figure 1](#));
 - 2) measurements shall be taken from bib seam to bottom edge of bib, at 90° angles from seam.

5.3.3.2 Sizing of each model

All available sizes shall be verified to [5.3.3.1](#). The sizes marked on the samples (see [Table 2](#)) and details in the information supplied by the manufacturer (see [Clause 8](#)) shall be examined to determine whether the test specimens correspond to the marking and to the information given for that neck laceration protector. The results of the examination shall be recorded in the test report.

5.3.4 Permanence of markings

The permanence of the marking shall be verified by testing a specimen (representative part) of the neck laceration protector according to ISO 6330 using the following conditions and requirements:

- a) wash procedure no. 6B: i.e. for textile materials that are expected to withstand repeated hand washing, or equivalent normal machine washing at lukewarm temperatures (40 ± 3 °C);
- b) AATCC 1993 reference detergent WOB (without optical brightener);
- c) number of cycles: 20 continuous wash cycles;
- d) dry procedure no. A (line dry after 20 wash cycles);
- e) undyed adjacent fabric: multifibre test fabric no. 10 (with fibres of acetate, cotton, nylon, polyester, acrylic and wool).

5.3.5 Cut testing

Cut testing of neck laceration protectors shall be performed as described in [Annex A](#) or [Annex B](#).

6 Test report

In addition to the requirements in ISO 10256-1:2016, Clause 7, the test report shall include at least the following information:

- a) results of tests according to [Clause 5](#);
- b) correspondence with requirements in [Clauses 4, 7](#) and [8](#).

7 Markings and labelling

7.1 Markings

Markings shall be according to ISO 10256-1:2016, Clause 8.

7.2 Labelling

Label(s) securely attached to the neck laceration protector shall contain the following information:

- a) recommendations for maintenance, washing and use;
- b) the date of manufacturer in all numerical format (i.e. year, month, day);
- c) a warning statement stipulating that the neck laceration protector is only designed to reduce the risk of direct laceration caused by contact with a skate blade in the protected zone, and that it therefore does not eliminate risks in all possible situations to which the user may be exposed, including direct blows to the neck;
- d) a warning statement stipulating that if the neck laceration protector is not properly maintained, does not fit, is not worn properly or is altered in anyway, the protection that it provides will be compromised.

8 Information for users

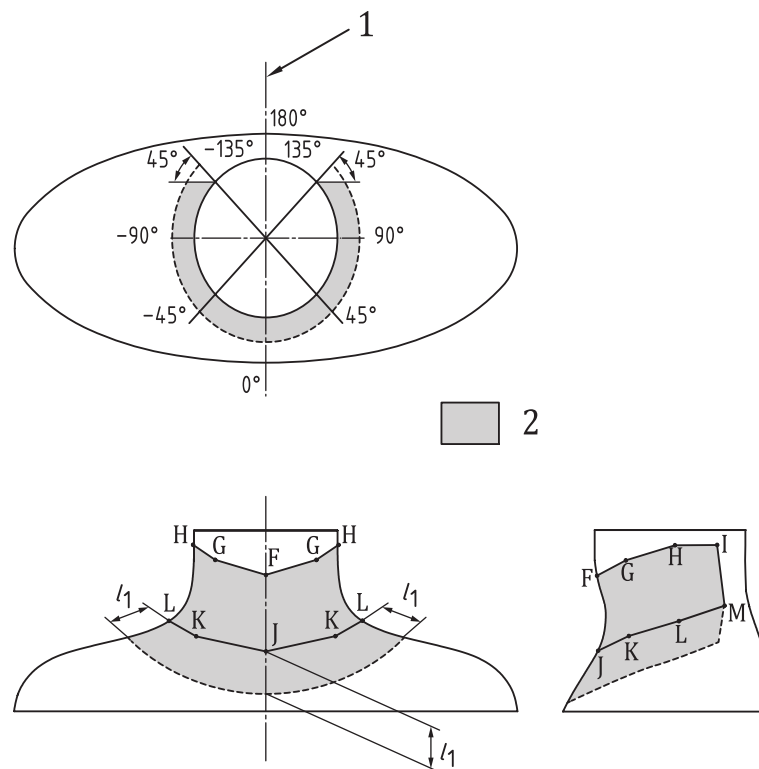
In addition to the requirements of ISO 10256-1, each neck laceration protector shall be permanently marked with the size designation of the neck laceration protector and the minimum and maximum neck circumference for which the neck laceration protector is intended.

Table 1 — Neck laceration protector test specimens

Test samples required if using Annex A cut testing method			
Test	Conditioned	Samples needed	Model size
Protected area of coverage	Washed	1	All model sizes
Cut test	Dry	3	1 model size
Cut test	Wet	1	1 model size
Test Samples required if using Annex B cut testing method			
Test	Conditioned	Samples needed	Model size
Protective zone of coverage	Washed	1	All model sizes
Cut test	Dry	1	1 model size
Cut test	Wet	1	1 model size

Table 2 — Neck laceration protector size classification

Size	Abbreviation	Neck circumference	
		cm	
		Minimum	Maximum
Extra small	XS	22	27
Small	S	26	31
Medium	M	30	35
Large	L	34	39
Extra large	XL	38	43
Double extra large	XXL	42	48



Key

- 1 centreline
- 2 protected area

Neck laceration protector size	Minimum protected area dimensions — Neck part	Minimum protected area — bibpart (l_1) dimensions (mm)
Extra small (XS)	All area between upper limit points F, G, H, I and lower limit points J, K, L, M as marked on the extra small (XS) size anatomical form shall be covered.	30
Small (S)	All area between upper limit points F, G, H, I and lower limit points J, K, L, M as marked on the small (S) size anatomical form shall be covered.	30
Medium (M)	All area between upper limit points F, G, H, I and lower limit points J, K, L, M as marked on the medium (M) size anatomical form shall be covered.	30
Large (L)	All area between upper limit points F, G, H, I and lower limit points J, K, L, M as marked on the large (L) size anatomical form shall be covered.	40

Neck laceration protector size	Minimum protected area dimensions — Neck part	Minimum protected area — bibpart (l_1) dimensions (mm)
Extra large (XL)	All area between upper limit points F, G, H, I and lower limit points J, K, L, M as marked on the extra large (XL) size anatomical form shall be covered.	40
Double extra large (XXL)	All area between upper limit points F, G, H, I and lower limit points J, K, L, M as marked on the double extra large (XXL) size anatomical form shall be covered.	40
The cut test area shall be the same as the protected area, except that it shall exclude a perimeter area of 10 mm wide.		

Figure 1 — Protected area for neck laceration protectors

Annex A (normative)

Cut test using guided horizontal monorail apparatus

A.1 Principle

The test bench was designed to simulate the movement (at approximately 25 km/h) of a hockey skate blade worn by a person weighing from 68 kg to 90 kg, coming into contact with the neck of another person.

A.2 Cut test apparatus

A.2.1 Test bench

The test bench, as in [Figure A.1](#), shall include an artificial neck, hockey skate blade, pneumatic cylinder and other necessary components. The skate blade shall be held by a pendulum mechanism in a position parallel to the axis of motion of the artificial neck. During the entire test, a mechanism shall be employed that restricts vertical movement of the artificial neck while offering little resistance to horizontal movement. A catch allowing for easy release shall be used to restrain the neck while the cylinder is under pressure.

A.2.2 Artificial neck

The artificial neck shall be made of an aluminium cylinder with an outside diameter of 115 mm \pm 5 mm covered with a firmly secured 12,5 mm nominally thick piece of foam. The total diameter shall be approximately 140 mm. This foam shall have the following characteristics:

- a) density: from 20 kg/m³ to 36 kg/m³ (1.25 lb/ft³ to 2.25 lb/ft³) (ASTM Test Method D 3575, Suffix W, Method A);
- b) resistance to vertical compression at 50 % deflection: 96 kPa \pm 24 kPa (14 lb/in² \pm 3.5 lb/in²) (ASTM Test Method D 3575, Suffix D).

A.2.3 Hockey skate blade

The skate blade shall have the following characteristics:

- a) thickness of 3,00 (+0/−0,20) mm;
- b) Rockwell hardness C of 50 to 60;
- c) profile according to the inspection template for skate blades specified in [Figure B.3](#);
- d) the skate blade shall be sharpened to a nominal concavity radius of 12,7 mm using an apparatus capable of maintaining the original profile of the blade. The sharpening is considered valid for the nine tests unless the skate blade comes into contact with the aluminium cylinder of the artificial neck, in which case the skate blade shall be replaced. Another possible exception is described in [A.4](#).

A.2.4 Pneumatic cylinder

The pneumatic cylinder shall have the following characteristics:

- a) double acting cylinder with one end left open;
- b) nominal inside diameter of 5,08 cm;

- c) minimum stroke length of 91 cm;
- d) nominal stem diameter of 15,9 mm.

A.2.5 Adjustment of the test bench

Adjustment of the test bench includes the following steps:

- a) Adjust the mass of the artificial neck and of the moving pieces attached to it (ties, cylinder, stem, etc.) so that the combination reaches a mass of $4 \text{ kg} \pm 250 \text{ g}$.
- b) Adjust the catch so that the portion of the cylinder under pressure has a length of $250 \text{ mm} \pm 10 \text{ mm}$. In this position, the portion of the cylinder under pressure has a theoretical volume of 458 cm^3 .
- c) Determine the pressure to apply in the cylinder chamber so that once the catch is released, the artificial neck attains a speed of $25 \text{ km/h} \pm 1 \text{ km/h}$ over a stroke of $250 \text{ mm} \pm 10 \text{ mm}$. The method for adjusting the speed shall result in an instantaneous speed of $25 \text{ km/h} \pm 1 \text{ km/h}$ at the point of contact. A test report shall describe the procedure used to adjust the test bench and shall include a graph illustrating the development of the artificial neck's speed in relation to its distance from the starting point. The speed adjustment shall be performed "empty", i.e. without a neck protector or a piece of foam on the artificial neck.
- d) Adjust the distance between the artificial neck and the hockey skate blade to $250 \text{ mm} \pm 10 \text{ mm}$.
- e) Adjust the height of the skate blade so that at the moment when the artificial neck (without a neck protector or a piece of foam) passes underneath the skate blade, there is a distance of 0,1 mm ($100 \mu\text{m}$) between the skate blade and the metallic surface of the artificial neck.
- f) Adjust the mass of the apparatus holding the skate blade and of the moving pieces attached to it to $100 \text{ kg} \pm 2 \text{ kg}$.

A.3 Cut resistance test procedure

Use test specimens that have been conditioned according to [Table 1](#). The test procedure includes the following steps:

- a) attach the neck protector to the artificial neck so that the hockey skate blade can enter into contact with the part of the neck protector to be tested;
- b) apply pressure in the cylinder as determined by requirements for adjustment of test bench and close the air intake valve;
- c) release the catch so that the neck protector is propelled toward the skate blade at the required speed;
- d) remove the neck protector and check whether there are any cuts on the foam of the artificial neck.

Carry out the number of cuts to each protector as specified in [Table A.1](#). Do not carry out more than one test at a given spot on the artificial neck foam and replace the foam for each neck protector.

Table A.1 — Neck laceration protector cut site requirements

Test specimen	Conditioning	Site	Number of cuts in cut resistance testing
1	Dry ^a	This test shall be performed on each neck protector at three different locations in the protective zone. If an assembly of two parts covers the protective zone of the neck protector, the skate blade test shall be performed on each of the two parts and the seam between the two parts.	3
2	Dry ^a	This test shall be performed on each neck protector at three different locations in the protective zone. If an assembly of two parts covers the protective zone of the neck protector, the skate blade test shall be performed on each of the two parts and the seam between the two parts.	3
3	Dry ^a	This test shall be performed on each neck protector at three different locations in the protective zone. If an assembly of two parts covers the protective zone of the neck protector, the skate blade test shall be performed on each of the two parts and the seam between the two parts.	3
4	Wet	Neck part	2
4	Wet	Bib	2

^a The neck laceration protectors shall be conditioned at an ambient temperature of 22 °C ± 3 °C in the test laboratory for at least 24 h.

A.4 Interpretation of the test results

After carrying out the required cut tests on each model of neck protector, if one or more cuts are detected on the artificial neck foam, the model being tested shall be deemed not to conform to this document.

If the bottom layer (the one in contact with the skin of the user) of a neck protector is pierced, the model being tested shall be deemed not to conform to this document.

If a cut area reaches the bottom layer of a neck protector without altering it, three additional tests shall be carried out over the same area of a new neck protector, but without having to change the hockey skate blade used for the first nine tests.

If there are no cuts detected on the artificial neck foam, nor cut through on the bottom layer (the one found in contact with the skin of the user) of the neck laceration protector, the neck laceration protector shall be deemed to conform to this document.

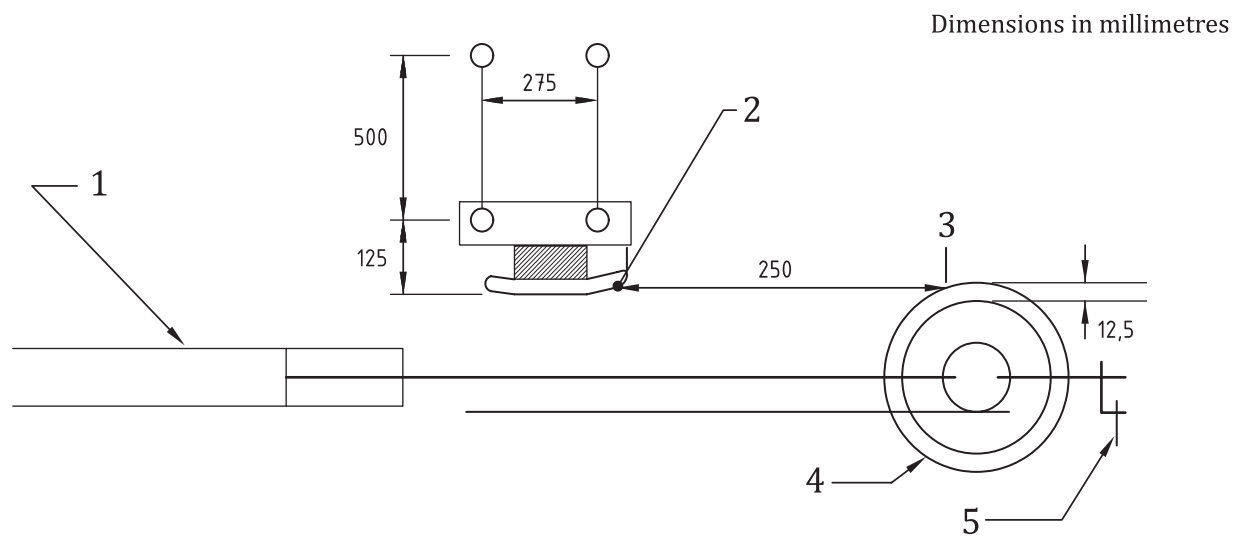


Figure A.1 — Diagram of the test bench

Annex B (normative)

Cut test using guided drop apparatus

B.1 Cut test apparatus

B.1.1 Cut assembly

B.1.1.1 General

The cut assembly shall consist of the following elements, as shown in [Figures B.1](#), [B.2](#) and [B.3](#).

B.1.1.2 Drop apparatus

The drop apparatus shall consist of two guided blocks made of metal. The upper block shall have a mass of $(25 \pm 0,1)$ kg and the lower block a mass of $(2 \pm 0,1)$ kg. A rubber block having the following properties shall be placed between the two metal blocks:

- a) thickness of (25 ± 1) mm;
- b) shore A hardness of 60 ± 5 ;
- c) compression deflection at 25 % at 25 mm/min of $90 \text{ kPa} \pm 5$;
- d) contact area between the rubber and the blocks $6\,000 \pm 1\,000 \text{ mm}^2$.

B.1.1.3 Skate blade

B.1.1.3.1 The skate blade shall be mounted on the lower block (see [B.1.1.2](#)) so that the centre of the edge of the blade is vertical. The plane of the blade shall be at an angle of $(25 \pm 5)^\circ$ to the vertical plane normal to the surface of the test specimen support form (see [B.1.1.4](#)). The skate blade shall have the following characteristics:

- a) thickness of $3,00^{-0,20}$ mm;
- b) rockwell hardness C of 50 to 60;
- c) a profile according to the inspection template for skate blades specified in [Figure B.3](#).

B.1.1.3.2 The sharpening pattern shall be determined using a new, unused skate blade that shall conform to the indications in [Figure B.3](#). The blade shall be sharpened

- a) using an apparatus capable of reproducing the original shape of the blade, and
- b) to a radius of concavity of $(12,7 \pm 3)$ mm.

NOTE Normally, the sharpening is considered valid for nine test cycles and not to exceed 12 test cycles.

B.1.1.3.3 When a blade comes into contact with the surface of the test specimen support form (see [B.1.1.4](#)), it shall be replaced.

B.1.1.4 Test specimen support form

The test specimen support form (see [Figure B.2](#)) shall be made of steel. The support form shall be provided with a clamping system or straps to attach the test specimen securely along the upper edge of the test specimen support form so that it does not become detached during testing.

Between the test specimen and the support form, there shall be a single layer of closed cell polyethylene foam with a thickness of $(9,0 \pm 1)$ mm and a density of (43 ± 3) kg·m⁻³.

Two layers of aramid fabric, each having a thickness of $(0,4 \pm 0,1)$ mm and a density of $(1\ 400 \pm 50)$ kg·m⁻³ shall be placed beneath the foam to protect the test specimen support form.

The test specimen support form shall be pressed against the skate blade by means of a system of hinged bars and a mass. The mass shall be adjusted so that the force between the test specimen support form and the skate blade is (300 ± 10) N.

B.2 Cut resistance testing

B.2.1 Verification of skate blade sharpness and velocity

Verification of the skate blade sharpness shall be carried out using a test specimen of neoprene rubber with a thickness of $(1,55 \pm 0,08)$ mm.

The instant of cutting through the neoprene rubber shall be detected by the skate blade contacting an aluminium foil backing beneath the neoprene rubber layer and thus, completing an electrical circuit. The neoprene rubber shall be placed on the test specimen support form shown in [Figure B.2](#).

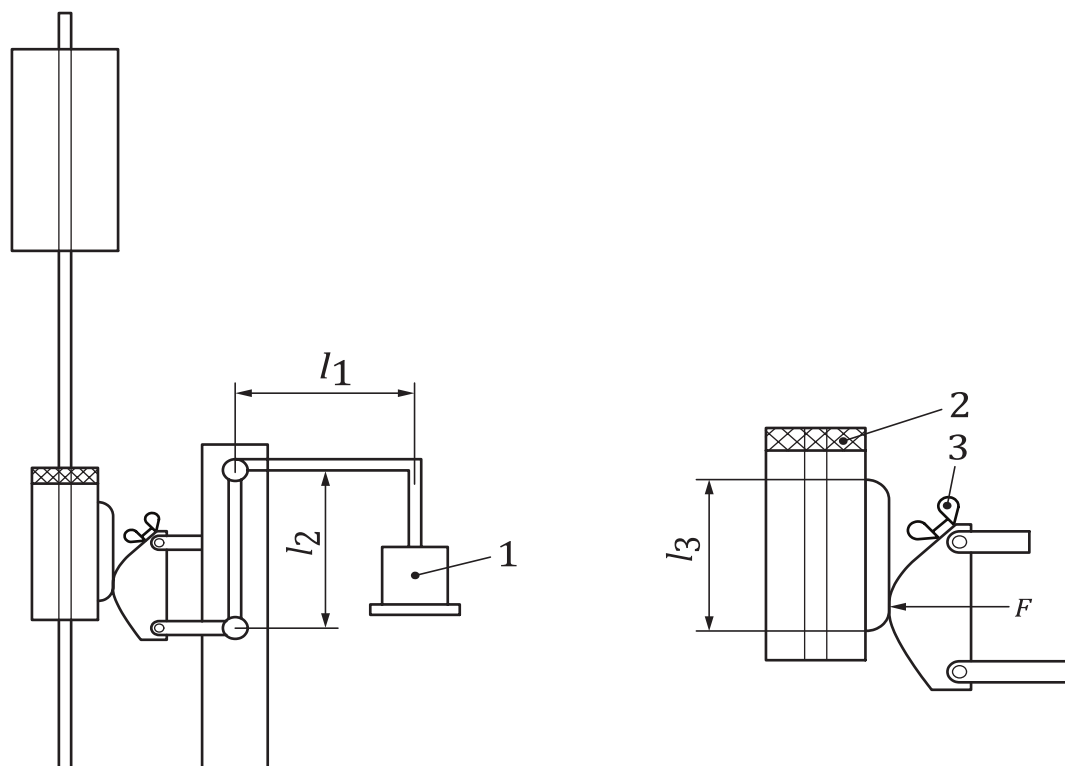
The blade shall be placed in contact with the neoprene rubber inclined at an angle of $(25 \pm 5)^\circ$ as in testing protectors. The force between the blade and the neoprene rubber shall be (100 ± 10) N. The block and the skate shall be pushed steadily past the neoprene rubber. The speed of the blade shall be (15 ± 10) mm·s⁻¹.

When the electrical circuit is closed, movement of the blade shall be immediately stopped and the distance that was needed to cut through the neoprene rubber shall be measured. This distance is required to be between 120 mm and 180 mm. The blade shall be sharpened or dulled to achieve an appropriate distance.

The velocity of the skate blade during normal testing of neck laceration protectors shall be measured by performing a cut test as described in [B.2.2](#) using neoprene rubber $(1,55 \pm 0,08)$ mm thick and foam and aramid layers on a neck laceration protector test specimen support form. The average velocity over the central 100 mm of the cut shall be measured. The drop height of the upper block shall be changed so that the velocity of the blade is $(6,0 \pm 0,2)$ m·s⁻¹.

B.2.2 Neck protector testing

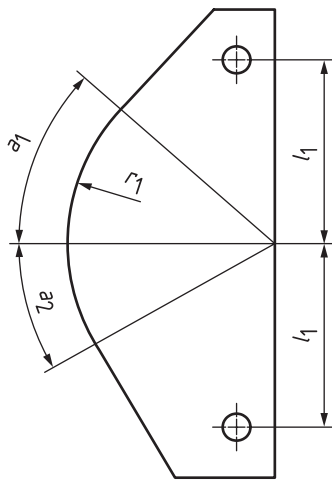
Use test specimens that have been conditioned according to [Table 1](#). Place a neck laceration protector on the test specimen support in the test apparatus shown in [Figure B.2](#). Adjust the neck laceration protector so that the site within the cut test area is directly under the skate blade. Secure the neck laceration protector on the test specimen support form with the clamp or straps. Adjust the height of the skate blade, so that the blade will have a length of edge of (200 ± 10) mm above the contact point on the test specimen. Apply a force to the test specimen support form, so that the force against the skate blade is (300 ± 10) N. Raise the top block to an appropriate height and drop it onto the block to which the skate blade is fixed. Carry out the number of cuts to each protector as specified in [Table A.1](#). After each test, the neck laceration protector shall be inspected to determine whether the test blade has cut through the entire thickness of the neck laceration protector. Cut tests shall be made at points more than 15 mm apart. Before and after the cuts specified in [Table A.1](#), the sharpness of the blade shall be verified according to [B.2.1](#). If the blade is out of compliance with [B.2.1](#), the test shall be repeated.



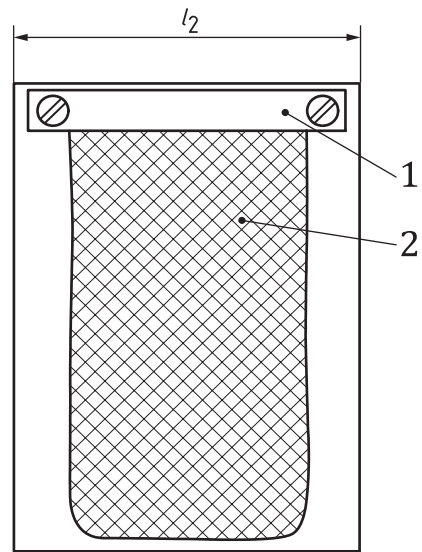
Key

- 1 mass
- 2 rubber block
- 3 clamping system
- l_1 and l_2 equal ± 10 mm
- l_3 200 ± 10 mm

Figure B.1 — Test apparatus



a) Side view

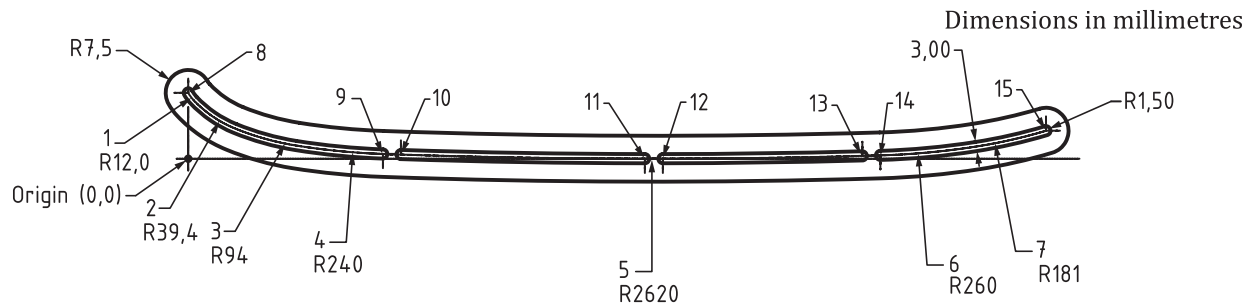


b) Face view showing a clamping system and a test specimen

Key

- 1 clamping system
- 2 test specimen
- l_1 (55 ± 5) mm
- l_2 100 mm
- r_1 (60 ± 5) mm
- a_1 $(45 \pm 3)^\circ$
- a_2 $>25^\circ$

Figure B.2 — Test specimen support form



Radius: coordinates and dimension				Arc: coordinates for extremities		
Radius	X	Y	Dimension	Point	X	Y
1	10,4	27,5	12,0	8	0,00	21,5
2	30,1	46,5	39,4	9	65	1,56
3	50	97	94	10	71	1,36
4	73	241	240	11	152	0,00
5	155	2620	2620	12	158	0,00
6	223	261	260	13	225	0,92
7	235	182	181	14	231	1,09
				15	286	9,15

Figure B.3 — Inspection template for skate blades

Table B.1 — Neck laceration protector cut site requirements

Test specimen	Conditioning	Site	Number of cuts in cut resistance testing ^a
1	Dry	Neck part	4
1	Dry	Bib	2
1	Dry	Seam	2
2	Wet	Neck part	2
2	Wet	Bib	2
2	Wet	Seam	2

^a See B.2.2.

Annex C (normative)

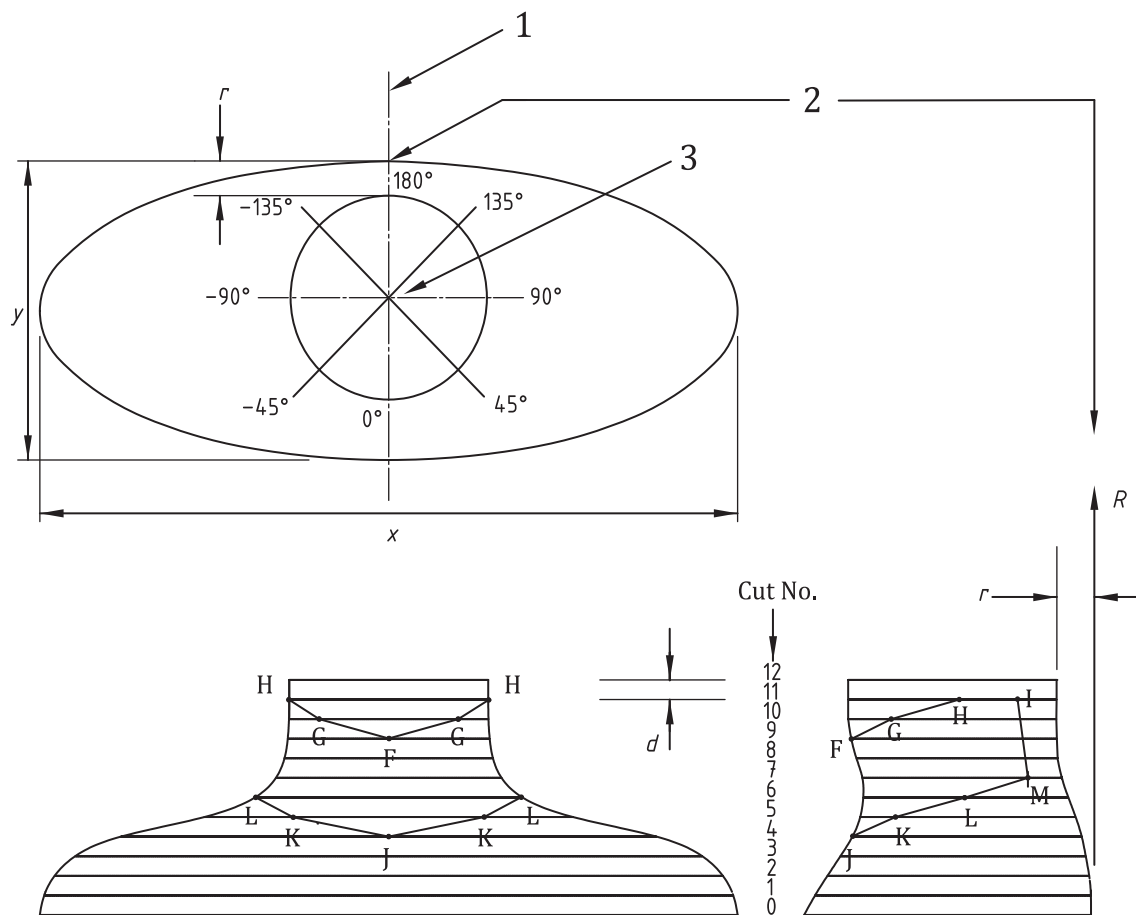
Anatomical forms

NOTE This annex is intended for the manufacturing of the anatomical forms, which are used for the verification of the neck part protected area of neck laceration protectors.

C.1 Manufacturing anatomical forms

Anatomical forms used in tests shall be manufactured according to [Figure C.1](#) and the values in [Table C.1](#), within a tolerance of ± 2 mm. Anatomical forms are defined by 12 regular ellipses stacked one on top of the other and separated by a distance d . Each ellipse is defined by the overall front to back dimension y and the overall left to right dimension of x . The back of each ellipse is offset towards the front on the centreline by a distance r from a reference axis R rising from the centre of the back of the ellipse defined for cut 0.

A tolerance of ± 2 mm is permitted on the x dimension of the ellipses for cut 6 to 12, on the y dimension of ellipses for cut 4 to 12, and on the r dimensions. The tolerance permitted for the other x and y dimensions is ± 5 mm (these dimensions do not have a direct effect on the contour points).



Key

- 1 centreline
- 2 reference axis, R
- 3 geometric centre of each horizontal cut

Figure C.1 — Anatomical form and contour points

Table C.1 — Dimensions of the anatomical forms

Dimensions in millimetres

Size	Extra small			Small			Medium		
DISTANCE, <i>d</i>	7,3			9,6			11,9		
ELLIPSE	<i>y</i>	<i>x</i>	<i>R</i>	<i>y</i>	<i>x</i>	<i>r</i>	<i>y</i>	<i>x</i>	<i>r</i>
CUT 0	111,4	270,0	0,0	127,9	334,0	0,0	144,4	405,0	0,0
CUT 1	106,9	267,7	0,1	122,8	331,1	0,2	138,6	401,3	0,3
CUT 2	102,1	260,4	0,3	117,2	321,7	0,5	132,3	389,7	0,6
CUT 3	95,6	244,9	1,4	109,7	302,1	2,3	123,9	365,3	3,2
CUT 4	89,1	216,0	3,4	102,3	265,2	5,5	115,5	319,5	7,7
CUT 5	83,4	134,9	6,2	95,8	162,1	10,1	108,2	191,3	14,1
CUT 6	78,6	100,2	9,4	90,2	117,9	15,5	101,9	136,4	21,5
CUT 7	77,8	85,7	11,5	89,3	99,4	18,9	100,8	113,5	26,2
CUT 8	78,3	79,9	12,6	89,9	92,1	20,7	101,5	104,3	28,8
CUT 9	79,8	77,7	13,2	91,6	89,3	21,6	103,4	100,9	30,1
CUT 10	81,0	77,0	13,4	93,0	88,4	22,1	105,0	99,8	30,7
CUT 11	81,0	77,0	13,4	93,0	88,4	22,1	105,0	99,8	30,7
CUT 12	81,0	77,0	13,4	93,0	88,4	22,1	105,0	99,8	30,7

Size	Large			Extra large			Double extra large		
DISTANCE, <i>d</i>	11,9			11,9			11,9		
ELLIPSE	<i>y</i>	<i>x</i>	<i>r</i>	<i>y</i>	<i>X</i>	<i>r</i>	<i>Y</i>	<i>x</i>	<i>R</i>
CUT 0	160,9	473,0	0,0	177,4	540,0	0,0	198,0	623,8	0,0
CUT 1	154,4	468,7	0,4	170,3	535,0	0,5	190,1	617,9	0,6
CUT 2	147,4	454,9	0,8	162,5	519,1	1,0	181,4	599,4	1,2
CUT 3	138,1	426,0	4,1	152,2	485,7	5,0	169,9	560,4	6,1
CUT 4	128,7	371,7	9,8	141,9	423,1	12,0	158,4	487,4	14,7
CUT 5	120,5	219,7	18,0	132,9	247,8	22,0	148,3	282,8	26,9
CUT 6	113,5	154,6	27,6	125,1	172,6	33,6	139,7	195,2	41,2
CUT 7	112,3	127,4	33,6	123,8	141,3	41,0	138,2	158,6	50,2
CUT 8	113,1	116,6	36,9	124,7	128,8	45,0	139,2	144,0	55,1
CUT 9	115,3	112,4	38,5	127,1	124,0	47,0	141,8	138,5	57,6
CUT 10	117,0	111,1	39,4	129,0	122,5	48,0	144,0	136,7	58,8
CUT 11	117,0	111,1	39,4	129,0	122,5	48,0	144,0	136,7	58,8
CUT 12	117,0	111,1	39,4	129,0	122,5	48,0	144,0	136,7	58,8

C.2 Determination of the protected area for neck parts

The protected area shall be symmetrical on each side of the centreline and defined by the contour points specified in [Table C.2](#) and [Figure C.1](#). The tolerance permitted on the position of the points is $\pm 2^\circ$ on the angles and ± 2 mm on the height of the cut where the contour point is located.

NOTE The measurements of the *x*, *y* and *r* dimensions are taken at the nominal height of each of the cuts.

Table C.2 — Protected area: Contour points

Contour points	Location on top view of Figure 1	Cut
Upper Limit		
Point F	0°	9
Point G	45° and -45°	10
Point H	90° and -90°	11
Point I	135° and -135°	11
Lower Limit		
Point J	0°	4
Point K	45° and -45°	5
Point L	90° and -90°	6
Point M	135° and -135°	7

Bibliography

- [1] CAN/BNQ 9415-370/2007 (R2013), *Neck protectors for ice hockey and ringette players*
- [2] CEN/TS 15256:2005, *Protective clothing. Hand, arm, leg, genital and neck protectors for use in ice hockey — Protectors for players other than goalkeepers — Requirements and test methods*

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