INTERNATIONAL STANDARD

ISO 10256

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Head and face protection for use in ice hockey

Protections de tête et de visage destinées à être utilisées en hockey sur glace

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Contents

Page

Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 10256 was prepared by Technical Committee ISO/TC 83, *Sports and recreational equipment*, Subcommittee SC 5, *Ice hockey equipment and facilities*.

This second edition cancels and replaces ISO 10256:1996, ISO 10257:1996 and EN 967:1996.

Introduction

The intention of head and face protection is to reduce the frequency and severity of localized injuries to the head and that part of the face surrounded by the protector. The protective function is such that the force from impacts against the protector is distributed and dampened and the penetration of objects is counteracted.

Head and face protection for use in ice hockey comprise helmets and an associated face protector. Face protectors can consist of eye protectors (visors) or full-face protectors. Helmets are tested and assessed as a separate unit, but face protectors are always tested and assessed together with the helmet or helmets for which the face protector is intended.

To achieve the performance of which it is capable, and to ensure stability on the head, a helmet and associated face protector should be as closely fitting as possible consistent with comfort. In use, it is essential that the helmet and associated face protector be securely fastened, with any chin strap or neck strap adjusted according to the manufacturer's instructions.

ISO/TC 83/SC 5 is aware that specifications for the performance of the helmet and the face protector are required to reduce the risk of injury in ice hockey. There was consensus that most of today's head and face protectors meet the performance requirements of this International Standard. However, the goal of ISO/TC 83/SC 5 is to promote the use of better materials and/or constructions as they become available to meet the future requirements of the sport of ice hockey. ISO/TC 83/SC 5 is also aware that in order to provide for comfort and correct fitting and use, helmets and face protectors should have low mass consistent with providing the appropriate performance characteristics.

Head and face protection for use in ice hockey

1 Scope

This International Standard specifies performance requirements and test methods for head and face protection for use in ice hockey.

NOTE 1 The intent is to reduce the risk of injury to the head and face without compromising the form or appeal of the game.

NOTE 2 Ice hockey is a sport in which there is a risk of injury. This International Standard is intended only for helmets and face protectors used for ice hockey. Ice hockey helmets afford no protection from neck or spinal injury. Severe head, brain or spinal injuries, including paralysis or death, may occur in spite of using an ice hockey helmet in accordance with this International Standard.

Performance requirements and test methods, where appropriate, are given for the following:

a) construction;

b) shock absorption;

c) puck-impact resistance;

d) penetration;

e) retention-system properties;

f) field of vision;

g) marking and information.

The head and face protection is intended for use by

a) players,

b) goalkeepers and

c) certain functionaries (e.g. referees).

2 Normative references

The following referenced documents are indispensable for the application 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 6487:2002, *Road vehicles — Measurement techniques in impact tests — Instrumentation*

EN 960:1994, *Headforms for use in the testing of protective helmets*

CAN/CSA Z262.4-00, *Ice hockey pucks*

ASTM F1446, *Standard test methods for equipment and procedures used in evaluating the performance characteristics of protective headgear*

3 Terms and definitions

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

3.1 General

3.1.1
acceleration of a body
a
(self-explanatory)

NOTE Acceleration is measured in metres per second squared, in units of g.

3.1.2
acceleration of a body due to gravity
g
(self-explanatory, $g = 9{,}806\ \text{m/s}^2$)

3.1.3
central vertical axis
line relative to the headform that lies in the median plane of symmetry, and that is normal to the basic plane at a point equidistant from the front and back of the headform

3.1.4
Gadd Severity Index
GSI
weighted impulse criterion measure that estimates the injury hazard to the human head based on an impact and determined from the acceleration-time wave form, and mathematically defined by the equation

$$\text{GSI} = \int_{t_0}^{t_0 + t_1} a^{2,5} \mathrm{d}t$$

where

a is the acceleration of a body, in metres per second squared;

t is the time in seconds, at the 5 g level;

t_1 is the time of impact, i.e. pulse duration, in seconds, measured from the 5 g level.

3.1.5 Planes

3.1.5.1
basic plane of the human head
Frankfurt Horizontal
plane that is located at the level of the external upper borders of the ear canal (external auditory meatus) and the inferior margins of the orbits of the eyes

3.1.5.2
basic plane of a headform
plane relative to the headform that corresponds to the basic plane of the human head

3.1.5.3
reference plane
construction plane parallel to the basic plane of the headform at a distance from it which is a function of the size of the headform

3.1.5.4
frontal plane
vertical plane that is perpendicular to the median and reference planes and passes through the crown of the headform

See Figure 1.

3.1.5.5
horizontal plane
plane that passes across the body at right angles to both the frontal and median planes

See Figure 1.

3.1.5.6
median plane
vertical plane that passes through the headform from front to back and divides the headform into right and left halves

See Figure 1.

3.1.6
permanent marking and warning
information that remains legible and cannot be removed in its entirety under normal use conditions

See Clause 8.

3.2 Helmet

3.2.1
retention system
system which secures the helmet firmly to the head by passing under the mandible, in whole or in part, when adjusted according to the manufacturer's instructions

3.2.2
drop height
vertical distance between the lowest point (impact point) of the elevated helmet and the impact surface

3.2.3
fastening system
those devices used to connect all components of the helmet

3.2.4
helmet
device intended to reduce the risk of head injury to ice hockey participants and including

a) the outer covering and shock-attenuating system,

b) the retention system,

c) all associated hardware, and

d) the manufacturer's attachments

NOTE a) to d) can be discussed individually in relation to their function as part of the helmet as a whole.

3.2.5
helmet model
category of helmets that do not differ in such essential respects as the materials, dimensions, construction of the helmet, retention system or the protective padding

3.2.6 Impact sites (defined in relation to the headform) (see Figure 2)

3.2.6.1
crown
point where the central vertical axis meets the top of the headform

3.2.6.2
front
point on the median plane which is 50 mm above the anterior intersection with the reference plane

3.2.6.3
front boss
point 25 mm above the reference plane and 45° from the anterior intersection of the median plane and the reference plane (intersection of the reference and frontal planes)

3.2.6.4
side
point 25 mm above the reference plane and 90° from the anterior intersection of the median plane and the reference plane (intersection of the reference and frontal planes)

3.2.6.5
rear boss
point on the reference plane and 135° from the anterior intersection of the median plane and the reference plane

3.2.6.6
rear
point at the posterior intersection of the median and reference planes

3.2.7
liner
material inside the outer covering of the helmet, with a principal objective to absorb kinetic energy generated by an impact to the head, this material, or part of it, ensuring a snug comfortable fit of the helmet on the head

3.2.8
maximum value of acceleration
a_{max}
maximum acceleration encountered during impact, in units of g

3.2.9
natural frequency
frequency at which a system will tend to oscillate when displaced from its static equilibrium position

3.2.10
outer covering
shell
outer material that gives the helmet its form

3.2.11
support assembly
drop assembly in the monorail system minus the weight of the headform, ball clamp, ball-clamp bolts, and accelerometer

3.2.12
securely attached label and tag
label or tag affixed at the time of manufacture, and which is normally removed at the time of helmet use

See 5.4.6 and Clause 8.

3.3 Face protection

3.3.1
chip
readily visible macroscopic particle missing from the protector

3.3.2
collimated light source (source of illumination)
quartz halogen lamp (17 lx or 1,68 foot candles) producing a 100 mm beam at 6 m distance which is centred on the pupils of the eyes of the headform or on the midpoint between the pupils of the eyes of the headform, this centring being maintained at all times during the test

3.3.3
combination
combined unit of a face protector or visor placed on a hockey helmet with which it is designed to be used

3.3.4
computer interface
linkage between the computer, the goniometer and the sensors, enabling a fully automated measurement process via a menu-driven operation

3.3.5
dioptre
measure of the power of a lens or a prism equal to the reciprocal of its focal length expressed in metres

3.3.6
face protector
device intended to reduce the risk of injury to the eyes and face of ice hockey participants

3.3.7
field of vision
projection outward of all retinal points (the nervous layer of the eye) at which visual sensations can be initiated

See Figure 3.

3.3.7.1
temporally
refers to an angle in the horizontal plane measured from the primary position of gaze to the right for the right eye and from the primary position of gaze to the left for the left eye

3.3.7.2
nasally
refers to an angle in the horizontal plane measured from the primary position of gaze to the left for the right eye and from the primary position of gaze to the right for the left eye

3.3.7.3
inferior
downward
refers to an angle in the vertical plane measured downwards from the horizontal

3.3.7.4
superior
upward
refers to an angle in the vertical plane measured upwards from the horizontal

3.3.8
glabella
most prominent midline point between the eyebrows, identical to the bony glabella of the frontal bone

3.3.9
goniometer
positioning device that moves the headform such that the angular rotation and movement in both the horizontal and vertical directions enables a spherical scan to be made of the fields of vision as seen through a face protector or visor

3.3.10
haze
percentage of transmitted light that, in passing through the specimen, deviates from the incident beam by forward scattering

3.3.11 Impact sites

3.3.11.1
side impact
point half-way between the mouth level and the eye level in the horizontal plane, 25° to the median plane and in the direction of the axis formed by the intersection of the median plane and the frontal plane

See Figure 11.

3.3.11.2
eye impact
point in the horizontal plane 25° to the median plane and in the direction of the eye

See Figure 11.

3.3.11.3
mouth impact
point in the intersection between the horizontal plane and the median plane in the direction of the centre of the mouth

See Figure 11.

3.3.12
interpupillary distance
PD
distance, in millimetres, between the centres of the pupils of both eyes on the facially-featured headform

3.3.13
laser
luminous device used for alignment of the sensors

EXAMPLE Helium-neon (He-Ne) laser, power 0,5 mW, monochromatic light source.

WARNING — Observe safety rules when using a laser.

3.3.14
luminous transmittance
ratio of the light transmitted by a medium to the incident light

3.3.15
menton
lowest point on the mandibular symphysis

3.3.16
no-contact zone
designated zone of the headform where contact is not permitted during the puck-impact resistance test

See 5.3.3 and 5.4.3, and Figures 13 and 14.

3.3.17
optical clarity
sharpness of an image

3.3.18
optical quality field of vision area
that area on a transparent face protector or visor determined by the outline of a cone whose axis projects along the primary position of gaze and extends 35° (radius of fixation), the apex of the cone being centred on each pupil, the area generated by each cone being joined above and below and extended to a point 90° laterally to each side in the horizontal plane

See Figure C.1.

3.3.19
orbit
either a quadrilateral, pyramidal cavity situated at the upper and anterior part of the face, or the bony cavity containing the eyeball and other associated tissues within the orbit

3.3.20
orbitale
lowermost point on the inferior margin of the orbit (infraorbital margin)

3.3.21
peripheral field of vision
oval-shaped field extending 90° temporally, 60° inferiorly, 45° nasally and 35° superiorly

See Figure 4.

3.3.22
photosensor
sensor 5 mm in diameter centred in the pupils of the headform, covered by a 5 mm translucent lens of 8 mm radius of curvature, convex forward

NOTE 1 The photo sensor is cosine corrected, e.g. provided with a diffusing cover which is a means of correcting the light-sensitive surface for wide angles of incidence.

NOTE 2 Light contact with the sensor produces an electrical signal that is fed into a computer interface.

3.3.23
porion
highest point on the upper margin of the cutaneous, external auditory meatus

3.3.24
primary position of gaze
line running forward from the centre of the pupil parallel to the median and horizontal planes

See Figure 1.

3.3.25
prism dioptre
unit used in measuring the deviating power of a prism

NOTE This power in prism dioptres is 100 times the tangent of the angle of deviation of a ray of light.

3.3.26
prism imbalance
light passing through a lens and entering one eye is deviated by an amount differing in direction from the same light passing through the lens and entering the other eye

3.3.27
protector
face protector or a visor as they are defined in 3.3.6 or 3.3.34

3.3.28
resolution
ability of an optical system to distinguish two points at their minimum separation

3.3.29
scan area
oval, peripheral fields area, specified by superior, temporal, inferior and nasal directions

3.3.30
scotoma
blind spot in the field of vision

3.3.31
securely attached label and/or tag
label or tag affixed at the time of manufacture, and which is normally removed at the time of face-protector or visor use

See 5.4.6 and Clause 8.

3.3.32
subnasal
Sn
deepest point on the concavity of the anterior surface of the maxilla in the midline, within 3,0 mm of the floor of the nose

See Figure 6.

3.3.33
threshold value
output reading obtained when the collimated light beam has been centred on the midpoint between the pupils in the primary position of gaze

NOTE The headform is rotated 90° in the horizontal plane, and the collimated light source contacts the pupillary sensor closest to the light source.

3.3.34
visor
device intended to reduce the risk of injury to the eyes of ice hockey participants

3.3.35
vertex
point of intersection on the headform of the median plane with the frontal plane

See Figure 1.

4 Types of head and face protectors

The head and face protector for use in ice hockey comprises a helmet and a face protector either specially adapted to the helmet or forming a continuous unit, designed to protect the whole or parts of the wearer's head and face against injury.

Head and face protectors (adapted or continuous unit) are a helmet in combination with

a) eye protector (visor),

b) full-face protector for players, or

c) full-face protector for goalkeepers.

5 Requirements

5.1 General

5.1.1 Materials

5.1.1.1 Documentation

The manufacturer shall provide written documentation indicating that the materials used in the construction of the helmet and face protector fulfil the requirements of 5.1.1.2 to 5.1.1.7.

5.1.1.2 Conditioning

When conditioned in accordance with any of the methods described in 6.3, the head and face protector shall still fulfil the requirements of this International Standard.

5.1.1.3 Cleaners

All materials used shall not be adversely affected by ordinary household soap and cleaners as recommended by the manufacturer.

5.1.1.4 Finishes

Paints, glues and finishes used in manufacturing shall be compatible with the materials used in the construction of the head and face protector.

5.1.1.5 Non-irritants

Material coming in contact with the wearer's head shall not be of any type known to cause skin irritation or disease or undergo significant loss of strength, flexibility, or other physical changes as a result of contact with perspiration, oil or grease from the wearer's head.

5.1.1.6 Adhesives

Adhesive material used to attach padding or straps to the face protector or visor shall be of a formulation that will not alter the chemical or physical properties of the materials to such an extent as to reduce their protective qualities.

5.1.1.7 Polymeric changes

All materials used in the construction of the head and face protector shall be resistant to irreversible polymeric changes when exposed to temperatures up to 70 °C or when exposed to ultraviolet radiation.

5.1.2 Finish

All parts shall be well finished and free of sharp edges and other irregularities which would present a potential hazard to the user or other players.

5.1.3 Attachment system

The attachment system of a face protector to a helmet shall be so designed that the face protector can be easily attached to the helmet without requiring any machining operation by the user.

5.1.4 Penetration

When tested in accordance with 6.7, no contact with the bare headform by the test blade shall be made within the protected areas, except for the ear apertures.

5.1.5 Mass

Helmet and face-protector combinations for players other than goalkeepers, that, according to the manufacturer's recommendations, fit headforms of size E or smaller, shall have a mass no greater than 900 g.

5.2 Special requirements for helmets

5.2.1 Design

No sharp surfaces or protruding parts shall present a potential hazard to the user or other players. The back edge of the helmet shall be designed to minimize the possibility of lacerations and/or contusions to the back of the neck. The assembly to be used by the user shall not require any machining operation.

5.2.2 Attachments

5.2.2.1 Optional devices

Any optional devices fitted to the helmet shall be so designed that they are unlikely to cause any injury to the wearer or other players during contact or otherwise.

5.2.2.2 Fastener components

The components of the fasteners for securing attachments to the helmet shall be so designed that the degree of protection afforded to the wearer by the helmet is not thereby reduced.

5.2.3 Protected area

5.2.3.1 Minimum

The protected area shall be at least the area above the line BCDEF in Figure 5 when the helmet is positioned in accordance with 6.4.4.

5.2.3.2 Ear aperture

No ear aperture shall have a linear dimension exceeding 38 mm and the distance to any other edge of the helmet shall be not less than 20 mm (see Figure 5). The ear apertures shall be completely surrounded by the outer covering of the helmet (shell) (see Figure 5).

5.2.3.3 Ventilation openings

Ventilation openings shall fulfil the penetration requirements given in 5.1.4 and the distance from any ventilation opening to the edge of the helmet outer covering shall be not less than 20 mm.

5.2.4 Shock absorbing capacity

When tested in accordance with 6.4, no single impact shall exceed a GSI of 1 500 and the peak acceleration shall not exceed 275 g. The helmet shall remain intact with no visible cracks through the thickness of the outer covering (shell) nor shall the shock absorbing components of the liner show any permanent damage.

5.2.5 Retention system

5.2.5.1 Straps

Any retention system strap which passes under the mandible shall be not less than 13 mm wide. It shall be attached to the helmet in such a manner that the helmet will remain in its normal position on the user's head during play and impact conditions provided the strap is firmly fitted.

5.2.5.2 Extensibility and strength

When tested in accordance with 6.5, the displacement of the roller holder shall not exceed 25 mm during the load range between 5 N and 110 N and the release force shall be not less than 110 N and not more than 300 N.

5.2.6 Field of vision

There shall be no occultation in the field of vision bounded by angles as follows, (see Figure 3):

a) upwards, 35°; and

b) horizontally, 90°

5.3 Special requirements for full-face protectors

5.3.1 Design

5.3.1.1 Maximum distance

The distance measured perpendicularly from the headform between the inside of the face protector and points K and Sn (subnasal) on the headform shall not exceed 60 mm (see Figure 6).

5.3.1.2 Overlap

Face protectors shall overlap the lower edge of the helmet (forehead area) by at least 6 mm in the horizontal plane.

5.3.1.3 Padding area

The face protector shall have a padded load-bearing area with a minimum as shown in Figure 7.

5.3.1.4 Minimum distance

Except where it is covered by padding, no part of the face protector shall be closer than 10 mm to the surface of the headform. No part of the face protector shall rest against the headform in the no-contact zone (see Figures 13 and 14).

5.3.2 Protected area

5.3.2.1 Area of coverage for skaters

The area protected by the face protector and helmet combination shall extend laterally and vertically around the headform at least to the line GHJ in Figure 6, as seen from the side, when the face protector is assembled and mounted on the appropriate helmet, in accordance with the manufacturer's instructions and when placed on a headform as described in 6.7.2.1.

5.3.2.2 Additional coverage

Where the helmet provides protection in front of the line GHJ, the face protector need not extend back to the GHJ line provided the face protector overlaps the helmet by at least 6 mm as seen from the side (see Figure 6).

5.3.2.3 Area of coverage for goalkeepers

For goalkeepers, the face protector shall overlap the lower edge of the helmet (forehead area) by at least 6 mm in the horizontal plane and follow the helmet backwards at least to the frontal plane down to the basic plane (see Figure 6, G'H'HJ).

5.3.3 Puck-impact resistance

When tested in accordance with 6.8, neither the face protector nor the puck shall touch the headform in the no-contact zone except during the toughness test. The shock-absorbing material at the load-bearing area shall remain securely attached to the face protector. There shall be no breakage of the structural components of the face protector. Cracking of surface coatings is permissible but chips (see 3.3.1) are not permitted. In the case of welded wire protectors, there shall be no weld separations on the perimeter of the protector or at the wire terminals.

5.3.4 Scotomas

There shall be no overlapping bilateral scotomas in the peripheral field of vision.

5.3.5 Optical quality

5.3.5.1 Visual inspection

The following is a list of matters for which the face protector will be subjectively inspected in a visual and tactile fashion within the field of vision (list is not exhaustive):

a) localized power errors;

b) aberrations caused by waves, warpage, etc;

c) lens defects such as scratches, greyness, bubbles, cracks, water marks, etc.

5.3.5.2 Face-protector requirements

When testing in accordance with 6.6 for the optical quality field-of-vision area at (20 ± 2) °C, face protectors shall

a) possess adequate definition to permit resolution of the 240 s ring,

b) have a luminous transmittance of not less than 80 %; face protectors specifically identified as being tinted or intended for filtering by the manufacturer shall have a minimum luminous transmittance of 20 %,

c) have a prism imbalance not exceeding 0,5 prism dioptre; for two eyes, the prism imbalance test allows a total of up to 1,0 dioptre of prismatic deviation, and

d) have a haze reading that does not exceed 3 %.

NOTE Annex C describes test methods for the optical quality of face protectors.

5.4 Special requirements for eye protectors (visors)

5.4.1 Design

5.4.1.1 Maximum distance (headform to eye protector)

The distance measured perpendicularly from the headform between the inside of the eye protector and point K on the headform shall not exceed 60 mm (see Figure 8).

5.4.1.2 Overlap

The eye protector shall overlap the lower edge of the helmet (forehead area) by at least 6 mm in the horizontal plane.

5.4.1.3 Maximum distance (helmet to eye protector)

The distance between the helmet and the eye protector shall be 20 mm maximum.

5.4.2 Protected area

5.4.2.1 Area of coverage for skaters

The area protected by the eye protector and the helmet combination shall extend laterally and vertically around the headform at least to the line GHN in Figure 8, as seen from the side when the eye protector is assembled, mounted on the appropriate helmet in accordance with the manufacturer's instructions and placed on a headform as described in 6.7.2.1. In front of the nose, a notch of maximum dimensions (10 mm to 50 mm) as shown in Figure 8 is allowed.

5.4.2.2 Additional coverage

Where the helmet provides protection in front of the line GHN, the face protector need not extend back to the GHN line, provided the face protector overlaps the helmet by at least 6 mm when viewed from the side.

5.4.3 Puck-impact resistance

When tested in accordance with 6.8, the eye protector or the puck shall not have touched the headform, except during the toughness test. There shall be no chips, cracking or breakage of the eye protector or separation of the eye protector from the helmet.

5.4.4 Scotomas

There shall be no overlapping bilateral scotomas in the peripheral field of vision.

5.4.5 Optical quality

5.4.5.1 Visual inspection

The following is a list of matters for which the eye protector will be subjectively inspected in a visual and tactile fashion within the field of vision (list is not exhaustive):

a) localized power errors;

b) aberrations caused by waves, warpage, etc;

c) lens defects, such as scratches, greyness, bubbles, cracks, water marks.

5.4.5.2 Eye-protector requirements

When testing in accordance with 6.6 for the optical quality field-of-vision area at (20 ± 2) °C, eye protectors shall

a) possess adequate definition to permit resolution of the 240 s ring,

b) have a luminous transmittance of not less than 80 %; eye protectors specifically identified as being tinted or intended for filtering by the manufacturer shall have a minimum luminous transmittance of 20 %,

c) have a prism imbalance not exceeding 0,5 dioptre; for two eyes, the prism imbalance test allows a total of up to 1,0 dioptre of prismatic deviation, and

d) have a haze reading that does not exceed 3 %.

5.4.6 Warning

A warning, that includes an appropriate signal word (such as Danger or Warning), shall be printed on a peel-off label, printed on a label or tag affixed to the visor or permanently printed on the visor when offered for sale. This warning shall indicate that the helmet must be worn properly and, if the helmet and visor combination is not worn in accordance with the manufacturer's instructions (e.g. is tilted backwards), the eyes may be exposed to possible serious and permanent injury.

6 Test methods

6.1 Sampling

6.1.1 Types

Only new and complete helmets, face protectors and eye protectors as offered for sale shall be tested. The head protectors shall be inspected visually, and by hand, prior to conditioning.

6.1.2 Inspection

The helmets shall be inspected to see that they comply with 5.1.1.2 to 5.1.1.7.

6.1.3 Documentation

The manufacturer shall provide written documentation indicating that the materials used in the construction of the helmet and face protector fulfil the general requirements in 5.1.1.2 to 5.1.1.7

6.1.4 Sample quantity

A total of eight helmets shall be provided for testing: four each of the smallest (S) and largest (L) sizes for the model. They shall be identified as 1S, 1L, 2S, 2L, 3S, 3L, 4S and 4L.

6.1.5 Time period

The duration between the date of manufacture (the final assembly of the helmet and/or the face protector) and the date of testing shall be not less than 6 days.

6.1.6 Helmets

Helmets shall be tested and assessed separately.

6.1.7 Face protectors

Face protectors shall be assembled and mounted on the appropriate helmets in accordance with the instructions of the manufacturer.

6.2 Inspection and determination of mass (for helmet/face protector combinations fitting headforms of size E or smaller)

Determine the mass of the head-protector/face-protector combinations of the same model and size submitted for testing that are conditioned in accordance with 6.3.1. Calculate and record the mean value in grams rounded to the nearest 10 g.

6.3 Conditioning

6.3.1 Ambient conditioning

The sample shall be exposed to a temperature of (20 ± 2) °C and a relative humidity not exceeding 55 % for not less than 4 h.

6.3.2 Low-temperature conditioning

The sample shall be exposed to a temperature of (−25 ± 2)°C for not less than 4 h. Testing shall begin within 40 s of removal from the refrigeration chamber.

6.3.3 Elevated temperature conditioning

The sample shall be exposed to a temperature of (30 ± 2)°C for not less than 24 h. Testing shall begin within 40 s of removal from the heating chamber.

6.4 Helmets — Determination of shock-absorbing capacity

6.4.1 Impact sites

Each helmet shall be impacted at the six target areas: front, front boss, side, rear, rear boss and crown. The target areas on the headform are centred around the points defined in Figure 2.

6.4.2 Apparatus

The impact tests shall be performed on the test apparatus described in Annex A or B.

6.4.3 Procedure

6.4.3.1 Protocol

Carry out the testing in accordance with Table 2 and 6.4.3.2 to 6.4.5.2.

6.4.3.2 Conditions

Under ambient conditions, subject each site to three successive impacts with a time interval of not less than 30 s and not more than 60 s.

6.4.3.3 Reserves

Helmets numbered 4L and 4S shall be reserved for failures.

6.4.3.4 Velocity measurement

Measure the drop velocity of the headform with an accuracy of ± 1 %, at a distance not exceeding 30 mm prior to impact.

6.4.4 Helmet positioning

Adjust the helmet on the headform in accordance with the manufacturer's recommendations so that it covers the area to be protected. Secure the helmet to the headform such that it does not shift position prior to or during impact and ensure that the retention system does not interfere with the fall or impact of the helmeted headform.

6.4.5 Recording

6.4.5.1 Data

Record the measured and calculated results (a_{max}, GSI) in tabular form, complete with time/acceleration diagrams.

6.4.5.2 Damage

Also record the extent of any damage of significance from the safety aspect.

6.5 Determination of retention-system strength and effectiveness for helmets

6.5.1 Coverage

Position the helmet on the largest headform for the helmet's size range in accordance with the manufacturer's instructions. Apply a load of 50 N to the crown of the helmet in order to seat the helmet on the headform. Verify that the helmet covers the area of protection as required in Figure 5 and 5.3.2.1.

6.5.2 Procedure

6.5.2.1 Positioning

Take one room-conditioned helmet that has just undergone the shock-absorbing test and place it on a headform. Position the helmet as given in 6.5.1 and adjust the chin and/or neck strap so that there is about 25 mm of free strap outside the adjusting devices.

6.5.2.2 Force application

Place the retention strap around a set of two rollers as shown in Figure 9.

Apply and retain a force of 5 N for 60 s. Record the vertical position of the roller holder, to the nearest 1 mm. Increase the force uniformly (evenly, without jerking to avoid inertial loads) during 15 s to 110 N, at which point record the vertical position of the roller holder immediately. Subtract the first measurement from the second measurement. The difference is the amount of extensibility (see 5.2.5.2).

6.5.2.3 Releasing force

To check the releasing force of the fastening device, increase the force uniformly until the device releases, but to a maximum of 300 N. Record the releasing force.

6.6 Determination of vision quality

6.6.1 Peripheral fields of vision and scotoma

See Annex D or E.

6.6.2 Scotoma

See Annex D.

6.6.3 Optical quality field of vision

Annex C gives the test method for the optical quality of eye protectors. Other test methods may be used provided that they give equivalent results.

6.7 Determination of penetration characteristics

6.7.1 Test apparatus

The apparatus consists of

a) a headform, in accordance with 6.8.2.4, for full-face protectors and visors and in accordance with EN 960 for helmets, and

b) a test blade in accordance with Figure 10, made of steel.

6.7.2 Procedures

6.7.2.1 Positioning

Position the head protector (helmet with or without full-face protector or visor) on the largest headform for the helmet's size range in accordance with the manufacturer's instructions. Apply a load of 50 N to the crown of the helmet in order to seat the helmet on the headform. Attempt to make contact with the headform in the protected area (see Figure 5 or 6) by trying to enter any part of the test-blade end, in principle without force, through all of the openings, (except the ear apertures), and all openings of the head protector within its designated protected area and within its perimeter.

6.7.2.2 Contact test for visors

Test visors from the front and not from above or below. Record whether contact with the bare headform surface is made or not.

6.8 Face protectors — Determination of puck-impact resistance

6.8.1 Impact sites

The impact sites are shown in Figure 11 and described in 3.3.11.

6.8.2 Equipment

6.8.2.1 Puck accelerator

A device (or puck accelerator), which can give a hockey puck a specific velocity, direction, and with minimal rotation, shall be used. The velocity shall be variable between 10 m/s and 36 m/s with an accuracy of ± 0,5 m/s.

6.8.2.2 Maximum distance

The puck shall be directed toward the impact site with as little rotation as possible. The distance between the impact site on the sample and the end of the guiding device should not exceed 600 mm.

6.8.2.3 Headform base

The test apparatus shall include a plane horizontal base for a headform. The headform shall be aligned vertically on, and firmly attached to, the plane horizontal base.

6.8.2.4 Headform size

The largest facially-featured headform for the protector being tested shall be used.

6.8.2.5 Puck

The hockey puck shall be in accordance with Canadian Standard CAN/CSA-Z262.4-00.

6.8.2.6 Velocity measurement

The velocity shall be measured no more than 600 mm from the site of impact. The equipment for measuring and recording the velocity of the puck shall be capable of measuring the velocity with a tolerance of ± 1 %.

6.8.2.7 Contact

To indicate contact between the face protector and the headform during testing, a suitable agent shall be used, e.g. modelling clay or pressure-sensitive paste.

6.8.3 Samples

6.8.3.1 Quantity

For complete testing and assessment of face protectors of a given make and model, the number of samples is given in Table 1. The sample numbers corresponding to those given in Table 1 shall be of the same helmet size and model. It is required to use the same number of helmets of the model for which the face protector is intended. The samples shall be numbered with 1, 2, 3, etc.

6.8.3.2 Face-protector/helmet combination

If the face protector is intended to fit several models of helmets, one such combination shall be tested completely. The other combinations need only undergo the test(s) specified for room conditioning.

6.8.4 Procedures

6.8.4.1 General

The testing shall be carried out in accordance with Table 1. Figure 12 shows the schematic of the apparatus.

6.8.4.2 Assembly

Assemble the face protector and mount on the appropriate helmet in accordance with the instructions of the manufacturer.

6.8.4.3 Contact indicator

Apply contact indicator agent (6.8.2.7) over the no-contact zone of the headform (6.8.2.7) to a maximum thickness of 1 mm.

6.8.4.4 Headform positioning

Place the headform in front of the puck accelerator so that the centre-line of the path of the puck coincides with the centre of the point to be impacted.

6.8.4.5 Helmet/face-protector positioning

After conditioning, position the helmet with the face protector on the headform in accordance with the manufacturer's recommendations.

6.8.4.6 Contact data

The puck is shot with a velocity as given in Table 1. After each impact, inspect the headform and the head protector for contact impacts, record whether the face protector has touched the headform or not. Record any damage (deformation, cracking, breakage, separation from the helmet). For toughness tests, only recording of damage is necessary.

7 Test report

The test report shall include at least the following information:

a) the number of this International Standard, i.e. ISO 10256;

b) the name or trademark of the manufacturer or the body taking responsibility for manufacture;

c) identification details of the head protector tested including range of size;

d) description of the head protector;

e) results of tests in accordance with Clause 6;

f) test method used for helmet certification;

g) correspondence with requirements in Clauses 5 and 6;

h) date of testing;

i) name of testing laboratory.

8 Permanent marking

Each head and face protector shall be marked in such a way that the following information is easily legible by the user and is likely to remain legible throughout the life of the product:

a) the number of this International Standard, i.e. ISO 10256;

b) the name or trademark of the manufacturer or the body taking responsibility for the manufacture;

c) the designation of the model;

d) the size or size range of the helmet, quoted as the circumference (in centimetres) of the head which the helmet is intended to fit;

e) the size or size range of the face protector;

f) year and quarter of manufacture;

g) in the case of a helmet, the designation “ice-hockey helmet”;

h) tinted or filtering eye protectors and full-face protectors shall be identified as such.

9 Information for users

The following information in the language(s) of the country of sale shall accompany each helmet and/or face protector:

a) instructions for the purchaser, including information for proper fit, comfort and use;

b) in the case of the face protector, instructions concerning the assembly of the face protector on the helmet;

c) in the case of a face protector, the helmets with which it is intended to be used;

d) cleaning and caring instructions, including a warning that cleaning agents, paints, decals or anti-fog material must not be applied unless authorized by the manufacturer;

e) that a helmet/face protector shall be replaced if it has been exposed to violent impact or another strain that may have reduced its protective function;

f) that a helmet does not afford any protection from neck or spinal injuries;

g) in the case of eye protectors, a warning that includes the following elements:

   1) eye protectors (visors) provide only partial protection for the eyes and no protection for the mouth, teeth, lower face and jaw;

   2) in order to minimize the risks of injury, full-face protection is recommended;

   3) failure to follow this recommendation may result in a serious or permanent injury.

h) that consumers should use care to select a helmet and face-protector combination that fits properly, is comfortable and is lightweight;

i) for helmets fitting headforms of size E or smaller, the average mass, in grams.

Table 1 — Protocol for testing face protection

Type	Test	Sample No.	Impact site	Conditioning temperature	Puck velocity [a] m/s (km/h)
Full-face protector for players	Contact	1	Eye	Ambient	28 (101)
		2	Mouth		
		3	Side		
	Toughness	4	Eye	Low	33 (119)
		5	Mouth		
		6	Side		
Full-face protector for goalkeepers	Contact	1	Eye	Ambient	33 (119)
		2	Mouth		
		3	Side		
	Toughness	4	Eye	Low	36 (130)
		5	Mouth		
		6	Side		
Visors	Contact test	1	Eye	Ambient	10 (36)
	Toughness test	2		Low	28 (101)

[a] Tolerance: ± 0,5 m/s (or ± 1,8 km/h)

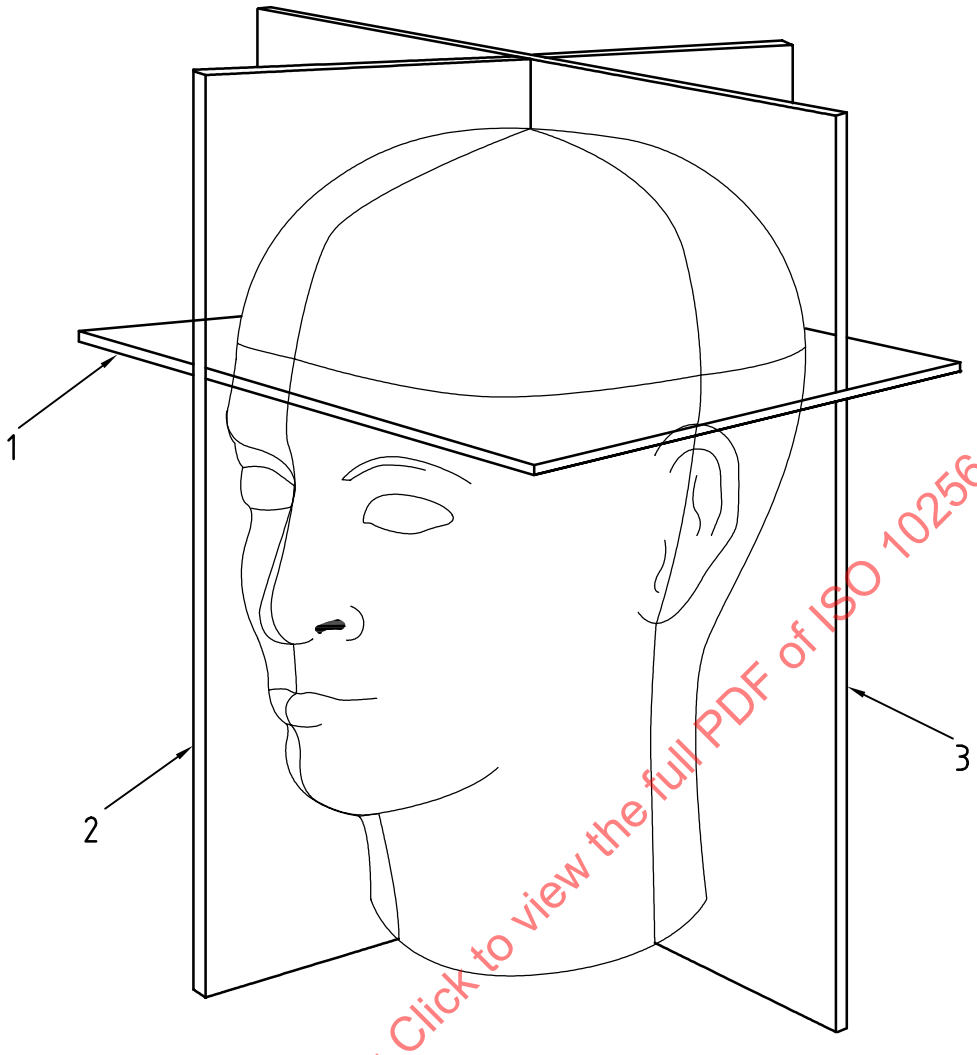
Table 2 — Protocol for testing head protection

Sample number	Conditioning	Impact site	Drop velocity m/s
1S, 1L	Ambient temperature (6.3.1)	Crown	3,96 ± 0,08 (for all samples)
		One side	
		Front	
		Front boss	
		Rear	
		Rear boss	
2S, 2L	Low temperature (6.3.2)	Refer to Note 1 below	
3S, 3L	Elevated temperature (6.3.3)	Refer to Note 2 below	

NOTE 1 The helmets shall be impacted three times at the site which yielded the highest mean GSI under ambient temperature conditions (see 6.3.1).

NOTE 2 The helmets shall be impacted twice at the site which yielded the highest mean GSI under ambient temperature conditions (see 6.3.1).

NOTE 3 Helmets number, 4S and 4L are reserved for failures (see 6.4.3.3).

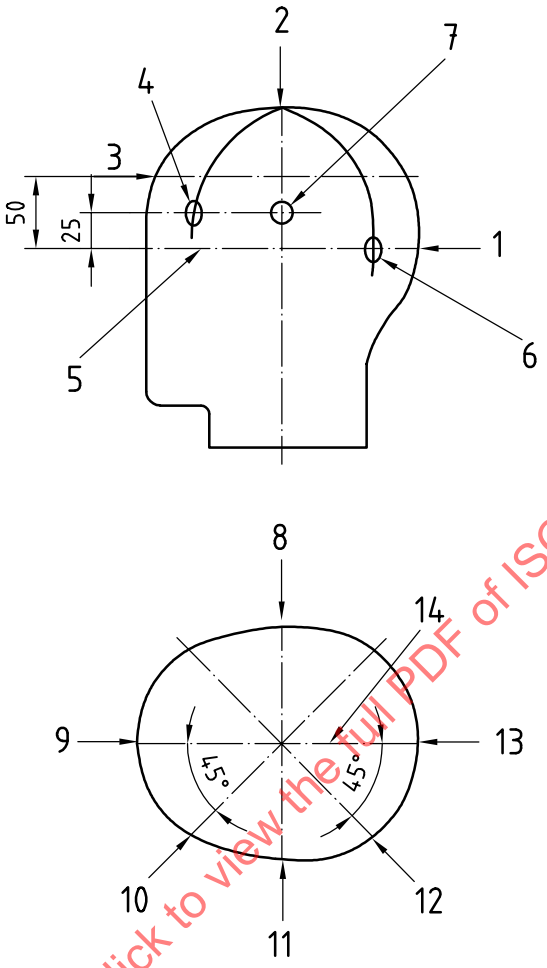


Key

1 horizontal plane
2 median plane
3 frontal plane

Figure 1 — Orientation planes
(3.1.5.4, 3.1.5.5, 3.1.5.6, 3.3.24, 3.3.35)

Dimensions in millimetres

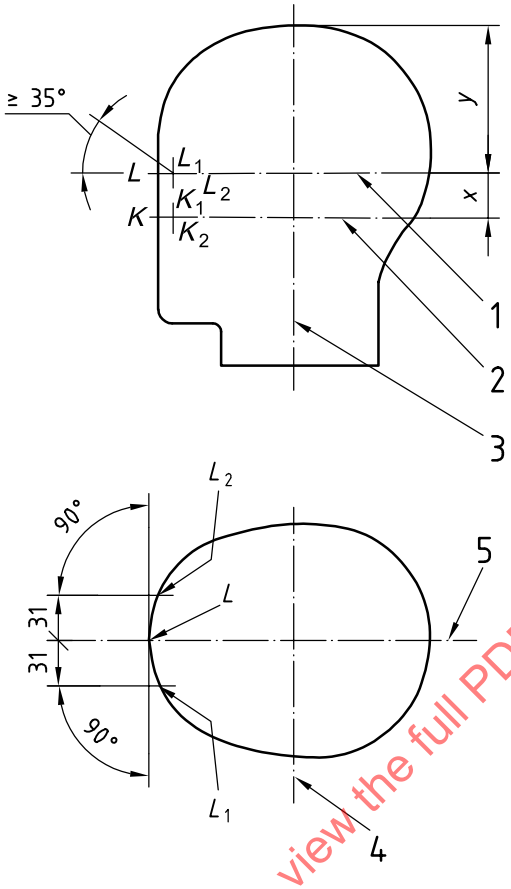


Key

1	rear	6	rear boss	11	side
2	crown	7	side	12	rear boss
3	front	8	frontal plane	13	rear
4	front boss	9	front	14	median plane
5	reference plane	10	front boss		

Figure 2 — Impact sites
(3.2.6, 6.4.1)

Dimensions in millimetres



Key

1 reference plane
2 basic plane
3 central vertical axis
4 frontal plane
5 median plane

Headform code letter (see EN 960)	**Size: inside circumference of helmet** mm	*x* mm	*y* mm
A	500	24	89,5
E	540	26	96
J	570	27,5	102,5
M	600	29	107

Figure 3 — Field of vision
(3.3.7, 5.2.6)

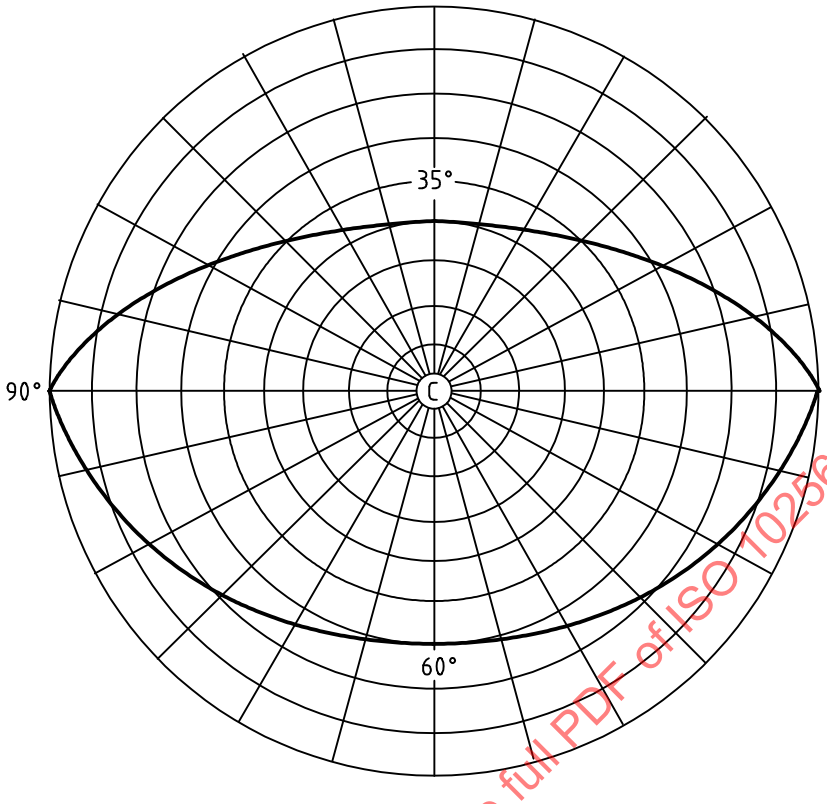
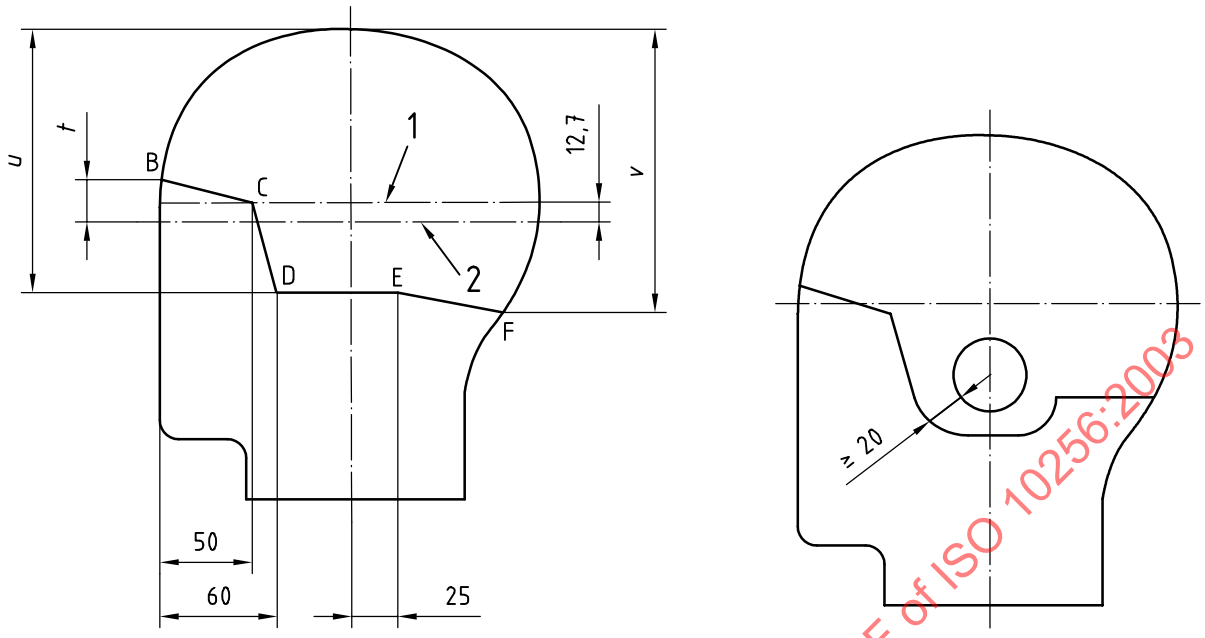


Figure 4 — Peripheral field of vision
(3.3.21)

Dimensions in millimetres



a) Minimum area **b) Extended area**

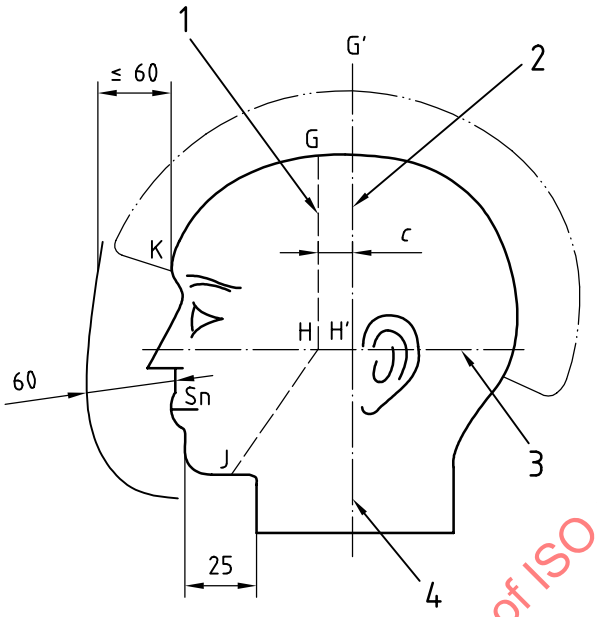
Key

1 reference plane
2 basic plane

Headform code letter (see EN 960)	**Size: inside circumference of helmet** mm	**Distance** mm		
		t	*u*	*v*
A	500	24	123	132
E	540	25	132	140
J	570	27	139	145
M	600	28	146	151

Figure 5 — Definition of protected area for helmets
(5.2.3.1, 5.2.3.2, 6.5.1, 6.7.2.1)

Dimensions in millimetres



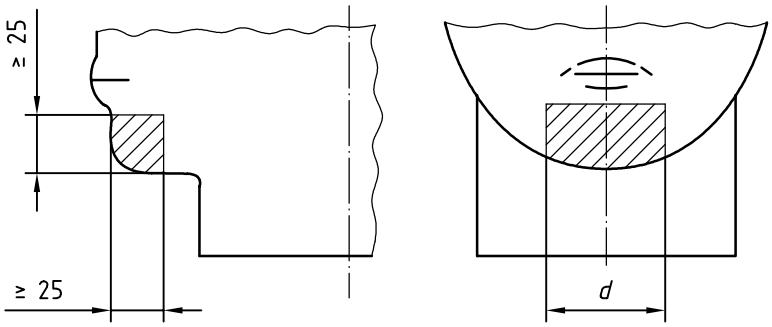
Key

1 players (G H J)
2 goalkeepers (G' H' H J)
3 basic plane (see Figure 1)
4 frontal plane

NOTE For the dimensions for c, see the Table below Figure 8.

Figure 6 — Definition of protected area for full-face protectors
(5.3.1.1, 5.3.2.1, 5.3.2.2, 5.3.2.3, 6.7.2.1)

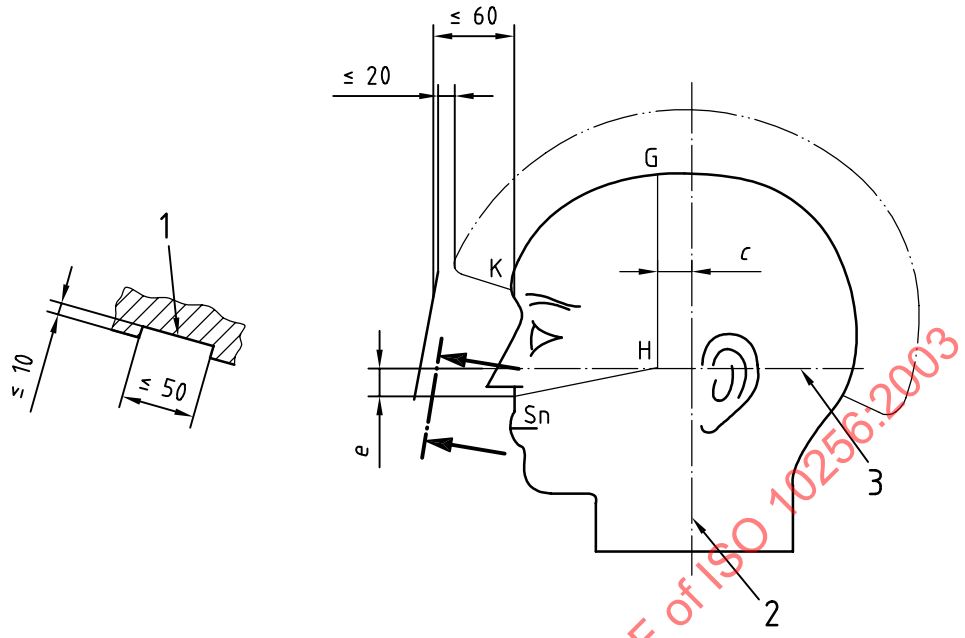
Dimensions in millimetres



Headform code letter (see EN 960)	*d* mm
E	42
J	48
M	53

Figure 7 — Minimum load bearing area
(5.3.1.3)

Dimensions in millimetres



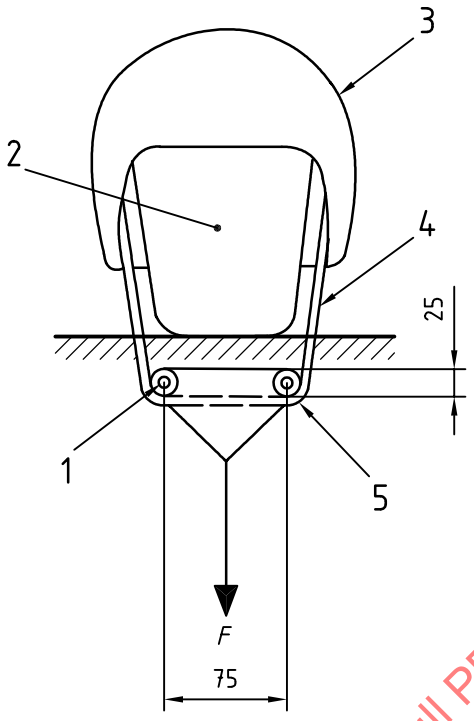
Key

1 notch may have any shape within these boundaries
2 frontal plane
3 basic plane (see Figure 1)

Headform code letter (see EN 960)	**Inside circumference of helmet** mm	*c* mm	*e* mm
A	500	24	24
E	540	25	26
J	570	26	28
M	600	27	29

Figure 8 — Definition of the protected area for eye protectors
(5.4.1.1, 5.4.2.1)

Dimensions in millimetres

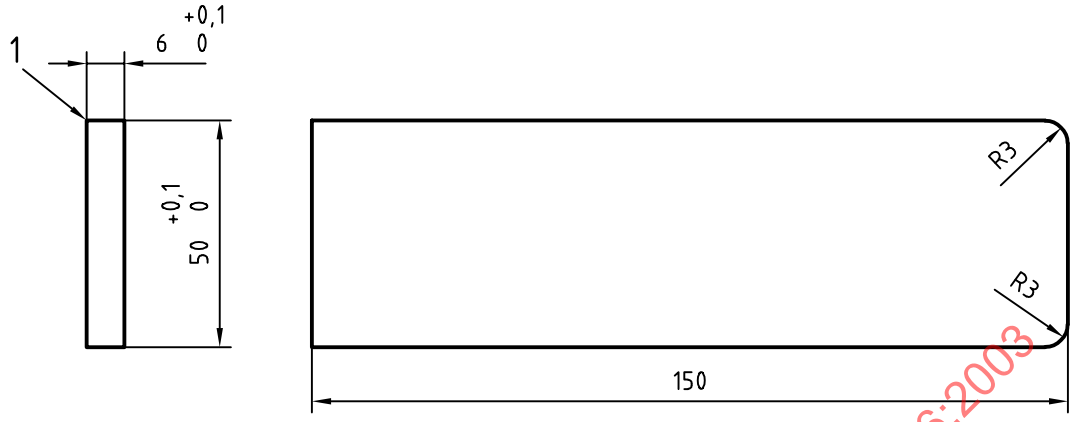


Key

1 free-moving rollers
2 stationary headform
3 test helmet
4 chin strap
5 length of roller 30 min.
F force

Figure 9 — Retention-system testing apparatus
(6.5.2.2)

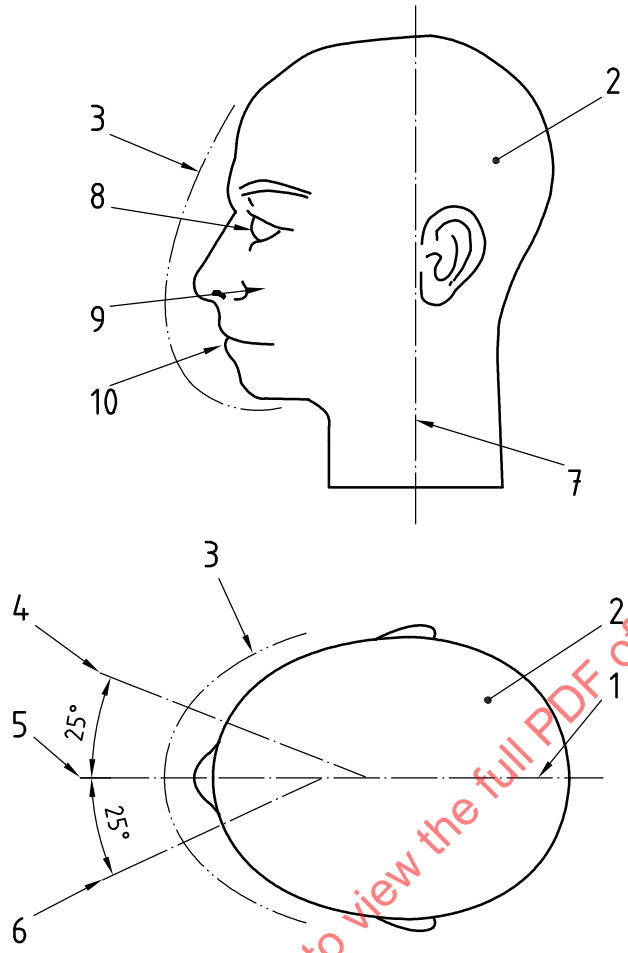
Dimensions in millimetres



Key

1 corner break to remove sharp edges (4 places)

Figure 10 — Test blade (penetrator)
(6.7.1)

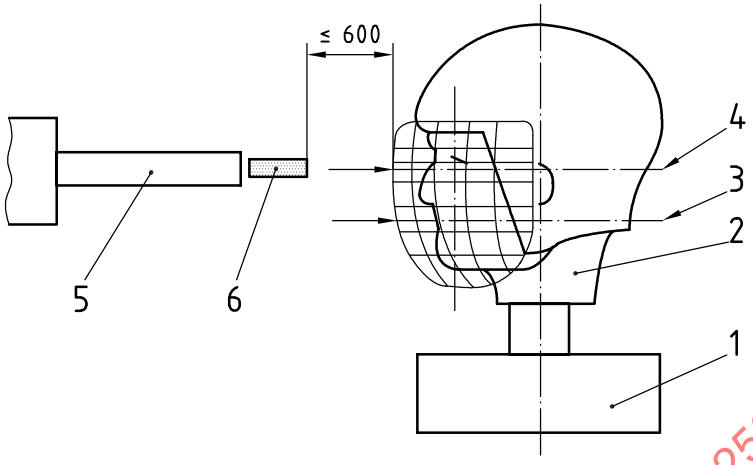


Key

1 median plane
2 headform
3 face protector
4 side impact
5 frontal impact in the horizontal plane over the mouth
6 eye impact in the horizontal plane
7 frontal plane
8 eye impact
9 side impact
10 mouth impact

Figure 11 — Puck-impact sites for testing face protectors
(3.3.11, 6.8.1)

Dimensions in millimetres

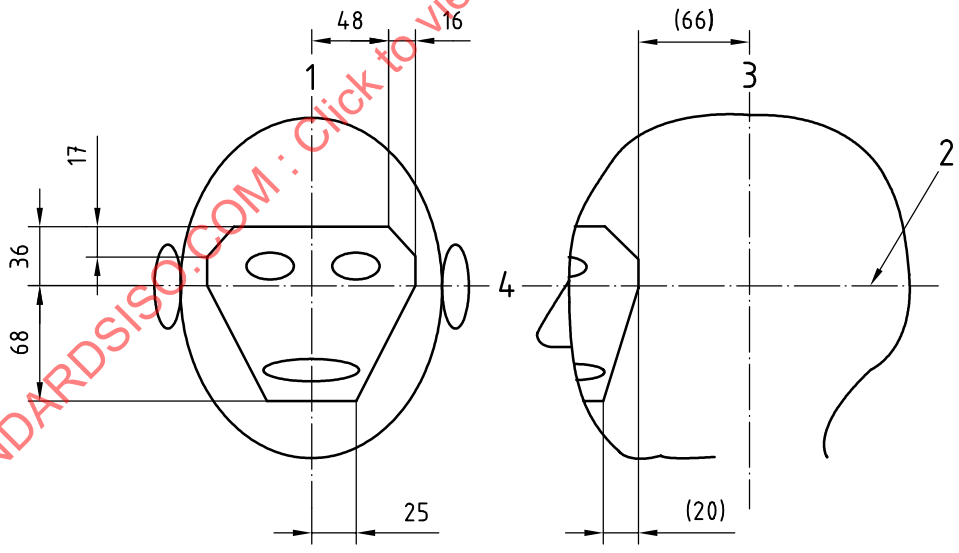


Key

1	base	4	eye level
2	headform	5	puck accelerator
3	mouth level	6	puck

Figure 12 — Schematic of the apparatus for testing puck-impact resistance of face protectors (6.8.4.1)

Dimensions in millimetres



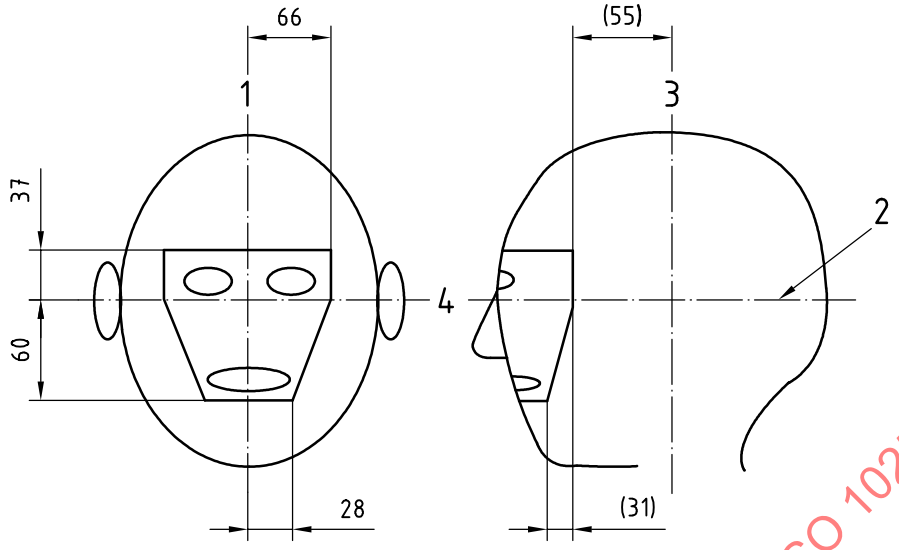
(Numbers in parentheses are for reference)

Key

1 median plane
2 basic plane
3 frontal plane
4 horizontal plane

Figure 13 — No-contact zone for an adult male (projected dimensions) (3.3.16)

Dimensions in millimetres



(Numbers in parentheses are for reference)

Key

1 median plane
2 basic plane
3 frontal plane
4 horizontal plane

Figure 14 — No-contact zone for juveniles (projected dimensions) (3.3.16)

Annex A
(normative)

Impact drop test using a free-fall test apparatus with a guided carrier

A.1 Test apparatus

A.1.1 Description

The test apparatus (see Figure A.1) comprises the following:

a) **a base;**

b) **an anvil,** rigidly fixed to a base;

c) **a headform,** fitted with a triaxial accelerometer and an assembly for measuring and recording the velocity of the headform;

d) **a guided mobile system,** supporting the free-falling helmeted headform;

e) **a guidance system,** for the mobile system;

f) **an impact recording system,** connected to a system by which the point of impact can be brought into correspondence with the centre of the anvil.

A.1.2 Base

The base shall be solid and made of steel or a combination of steel and concrete and have a mass of not less than 500 kg. At least the uppermost 25 mm shall consist of steel and be firmly attached to the concrete.

No part of the base shall have a resonance frequency liable to affect the measurement.

A.1.3 Anvil

A flat steel anvil having a circular impact face of (130 ± 3) mm diameter.

No part of the anvil shall have a resonance frequency liable to affect the measurement.

A.1.4 Headforms

A metal headform, capable of accepting an accelerometer mounted at its centre of gravity and conforming to the requirements of EN 960 (see Table A.1), shall be used.

A.1.5 Accelerometer and signal conditioning

The tridirectional accelerometer is mounted at the centre of gravity of the headform, and shall be capable of measuring and recording accelerations up to 1 000 g and have a maximum mass of 50 g. An ISO 6487 CFC 1000 low-pass filter shall be used in conditioning the accelerometer signal. If a computer is employed as a read-out device, a sampling rate of 10 000 samples per second shall be used for each channel of the accelerometer signal.

Table A.1

Headform code letter (see EN 960)	Inside circumference of helmet mm	Mass kg
A	500	3,1 ± 0,10
E	540	4,1 ± 0,12
J	570	4,7 ± 0,14
M	600	5,6 ± 0,16

A.1.6 Mobile system and guidance system

The mobile system supporting the headform shall be such that its characteristics do not affect the measurement of acceleration at the centre of gravity of the headform. It shall also be such that, with its guidance systems, any impact site (see 6.4.1) can be positioned vertically (within 5°) above the centre of the anvil.

A.1.7 Impact-recording system

The impact-recording system shall be capable of measuring shocks of up to 1 000 g peak acceleration with a limit of error of ± 5 % and over a frequency range of 5 Hz to 900 Hz. Natural frequencies of a particular headform type, up to and including the third harmonic, should be recorded. Means or methods for determining and recording the magnitude of the (resultant) acceleration vector (g), the Gadd Severity Index (GSI) and the impact velocity shall be available. A permanent hard copy record of any particular trial (acceleration/time curve) shall be available.

A.2 Impact-measurement parameters

Shock-absorption capabilities, as measured by a tridirectional accelerometer, shall be determined by the peak acceleration and GSI.

A.3 System verification

A.3.1 Method

A.3.1.1 The system instrumentation shall be checked before and after each series of tests by dropping the «spherical» impactor onto a MEP at an impact velocity of 3,96 m/s (± 2 %). The peak acceleration obtained during this imapct should be (298 ± 8) g.

A.3.1.2 Three such impacts shall be performed in each of three directions at intervals of 75 ± 15 s, before and after each series of tests.

A.3.1.3 If the mean peak acceleration obtained in the pre-test impacts differs by more than 5 % from the mean peak acceleration obtained in the post-test impacts, recalibration of the instruments and transducers is required, and all data obtained during that series of impact tests should be discarded.

A.3.2 Spherical impactor

The spherical impactor shall have striking surfaces of (73 ± 1) mm radius and have a mass of (4,00 ± 0,02) kg including the accelerometer. The centre of gravity shall coincide with the geometrical centre of the sphere within ± 1 mm and the accelerometer shall coincide with the geometrical centre within ± 10 mm.

A.3.3 Modular elastomer programmer (MEP)

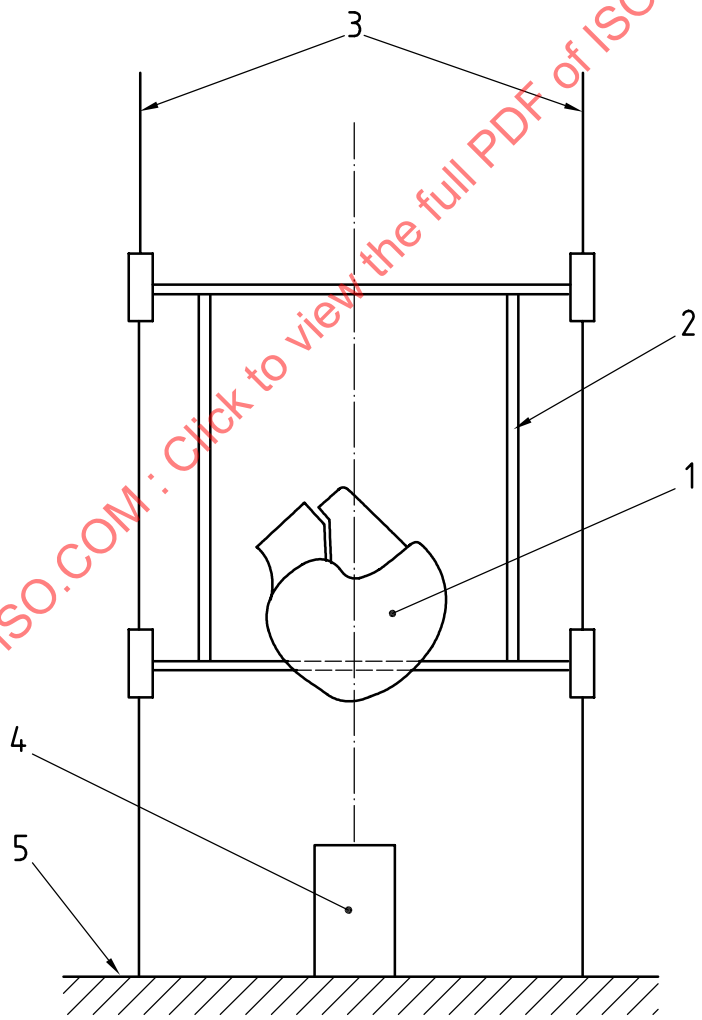
A cylindrical-shaped pad is used as an impact surface for the spherical impactor. The MEP is 130 mm in diameter and 25 mm thick. It is affixed to the top surface of a flat, 6 mm thick aluminium plate. The durometer reading of the MEP is (60 ± 2) Shore A.

A.4 Sampling

For complete testing and assessment of a helmet of a given make and model, eight helmets are required, four of the largest and four of the smallest size. Adjustable helmets shall be fitted to the largest and smallest headforms in the size range. These shall be marked 1L to 4L and 1S to 4S, respectively.

A.5 Procedure

See 6.4.3.



Key

1 headform with helmet
2 support dolly
3 guides
4 anvil
5 steel base

Figure A.1 — Free-fall helmet drop-test rig

Annex B
(normative)

Impact drop test using a guided monorail device

B.1 Apparatus

B.1.1 Description

The test apparatus comprises

a) **a sectioned magnesium headform,** in accordance with EN 960, fitted with a uniaxial accelerometer,

b) **an anvil,** rigidly fixed to a base,

c) **a monorail guidance system,** with an adjustable mounting for the helmeted headform to permit impacts to be delivered to any prescribed location on the helmet, and

d) **a system for acquiring and recording the test data.**

B.1.2 Impact base and impact surface

B.1.2.1 The impact base shall be firmly attached to a concrete floor, and shall consist of a rigid steel slab weighing at least 136 kg with a minimum thickness of 50 mm. The top surface of this base may be used as a flat metal anvil if it is faced with a smooth, flat, circular surface with a minimum area of 0,09 m^2. Otherwise, an impact pedestal may be used. The impact base and impact surface are not interchangeable terms. When an impact pedestal is used, it shall be able to be moved.

B.1.2.2 A smooth, flat, circular steel surface with a minimum diameter of 152 mm shall be used as the impact pedestal. This pedestal may be an anvil with a minimum thickness of 25 mm that is firmly attached to the impact base. This impact pedestal shall be directly beneath the contact point when impact testing.

B.1.3 Headform carriage assembly

The mobile system supporting the headform shall be such that its characteristics do not affect the measurement of acceleration at the centre of gravity of the headform. It shall also be such that any impact site can be positioned vertically above the centre of the anvil. The guides shall be such that the impact velocity is not less than 95 % of the theoretical velocity.

B.1.4 Headform

A headform, capable of accepting an accelerometer mounted at its centre of gravity and conforming to the requirements of EN 960 (see Table B.1), shall be used. The headform shall have no natural resonant frequencies below 3 000 Hz. The headform and supporting assembly shall have a combined mass as described in the following table, with the supporting assembly contributing to no more than 50 % of the total.