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Industrial protective helmets

Casques de protection pour l'industrie

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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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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

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

This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Personal protective equipment*

This second edition cancels and replaces the first edition (ISO 3873:1977), which has been technically revised.

The main changes are as follows:

- Introduction of a Type II helmet that is intended to protect the front, side and rear of the wearer's head. Reflecting this change is the introduction of impact energy attenuation requirements, dynamic strength of the retention system and dynamic stability tests.
- Elimination of mandatory harness dimensions and clearances for Type I helmets. A Type I helmet could be constructed using a conventional harness system, but it could also be constructed using an impact energy attenuation liner.
- Introduction of resistance to ignition tests to replace the flame resistance requirements.

Future considerations:

- Impacts to the head that result in head angular motion (referred to as angled, tangential or oblique impacts) are one of the causes of brain injury. The revisions to the standard have not addressed directly the performance of systems intended to manage head angular motion. The introduction of a Type II helmet will offer some improvements in managing head angular motion with regards to the first edition of ISO 3873 because of the additional impact energy attenuation tests. At the time that second edition of ISO 3873 was developed, no test method was available that could be readily incorporated into this standard. In the future, when a suitable oblique impact test method and risk analysis are available, the ambition of this committee is to revise this document and include requirements for such a test.

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

Introduction

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Industrial protective helmets

1 Scope

This document specifies physical and performance requirements, test methods and marking requirements for industrial protective helmets. This document describes the requirements for two helmet types.

Type I — intended to protect the upper part of wearer's head against impacts that may occur in an industrial setting, such as a falling object.

Type II — intended to protect the head against impacts that may occur in an industrial setting, such as a falling object or a fall.

NOTE The Type II helmet is intended to offer protection from falls from standing or a low height, e.g. standing height elevated by up to one metre. The Type II helmet is not intended to offer protection to the head in all falls and is unlikely to prevent serious head injury or death in uncontrolled falls from one level to another or from a position elevated on a ladder or scaffolding. The selection of a Type II helmet should be considered as one part of an overall safe system of work in the context of working at heights and managing the risks of falls from greater than two metres.

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.

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

J211/1, *SAE Instrumentation for Impact Test Part 1 - Electronic Instrumentation*

EN 13087-1, *Protective helmets - Test methods - Part 1: Conditions and conditioning*

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3 Terms and definitions

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

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

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

3.1 protective helmet

helmet intended to protect at a minimum the upper part of the wearer's head against an impact

3.2 shell

hard, smoothly finished material that provides the general external form of the helmet

3.2.1 crown

the area on the upper, outer surface of a headform, centred on the mid coronal plane (see EN 960)

3.3

peak

horizontal extension of the *shell* (3.2) above the eyes

3.4

brim

rim surrounding the *shell* (3.2)

3.5

chin strap

strap that is intended to pass under the wearer's chin with two points of attachment to the helmet used with Type I helmets

Note 1 to entry: A chin strap is an accessory.

3.6

helmet accessories

any optional parts for special purposes such as chin strap, neck protector, drawlace and attachment devices for lamp and cable

3.7

helmet attachment

accessory which is not an integral part of the helmet and secured to helmet

3.8

helmet positioning index

HPI

vertical distance, measured in the vertical longitudinal plane, between the reference plane of the reference headform and the lowest point of the helmet in the forehead region

Note 1 to entry: HPI is provided by the helmet supplier and indicates the intended position of the helmet when worn.

3.9

liner

protective component of the helmet, positioned between *shell* (3.2) and head, that primarily provides impact energy attenuation

3.10

planes

3.10.1

basic plane

Frankfurt plane

plane intersecting the inferior borders of the orbits and external auditory meatuses

3.10.2

mid-sagittal plane

median plane

plane equivalent to the vertical longitudinal plane

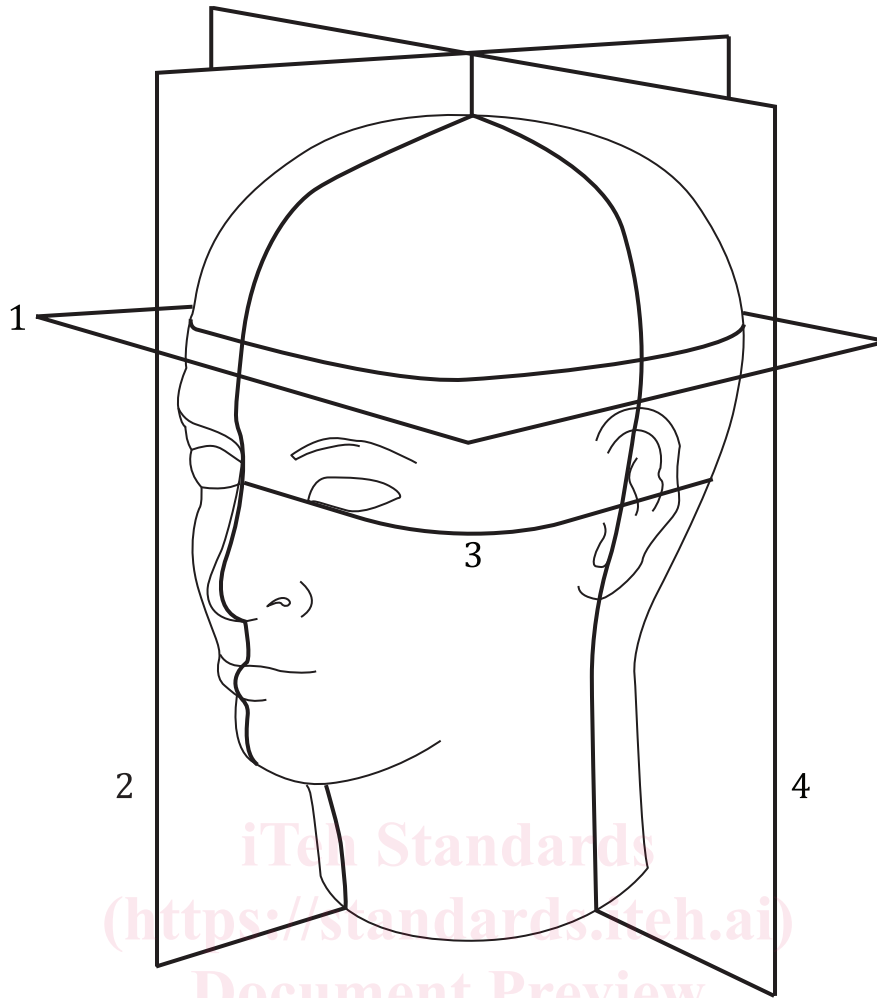
3.10.3

mid-coronal plane

frontal plane

plane equivalent to the vertical transverse plane

Note 1 to entry: See [Figure 1](#).



Key

- 1 horizontal plane (also known as transverse plane)
- 2 mid-sagittal plane
- 3 basic plane
- 4 mid-coronal plane

Figure 1 — Orientation planes

3.11

impact energy attenuation

ability of the helmet to manage the kinetic energy during an impact.

3.12

harness

assembly comprising a cradle, headband, comfort padding and nape strap which maintains the helmet in position on the head and provides *impact energy attenuation* (3.11)

Note 1 to entry: A harness assembly has been the method used on occupational protective helmets meeting ISO 3873:1977 to maintain the helmet in position on the head and provide impact energy attenuation.

3.13

retention system

assembly that maintains the position of the helmet on the head during use; consisting of components for adjustment and improved comfort; a chin strap is not a retention system.

Note 1 to entry: A retention system may consist of webbing, webbing adjustment components used to lengthen and shorten webbing pieces and a buckle

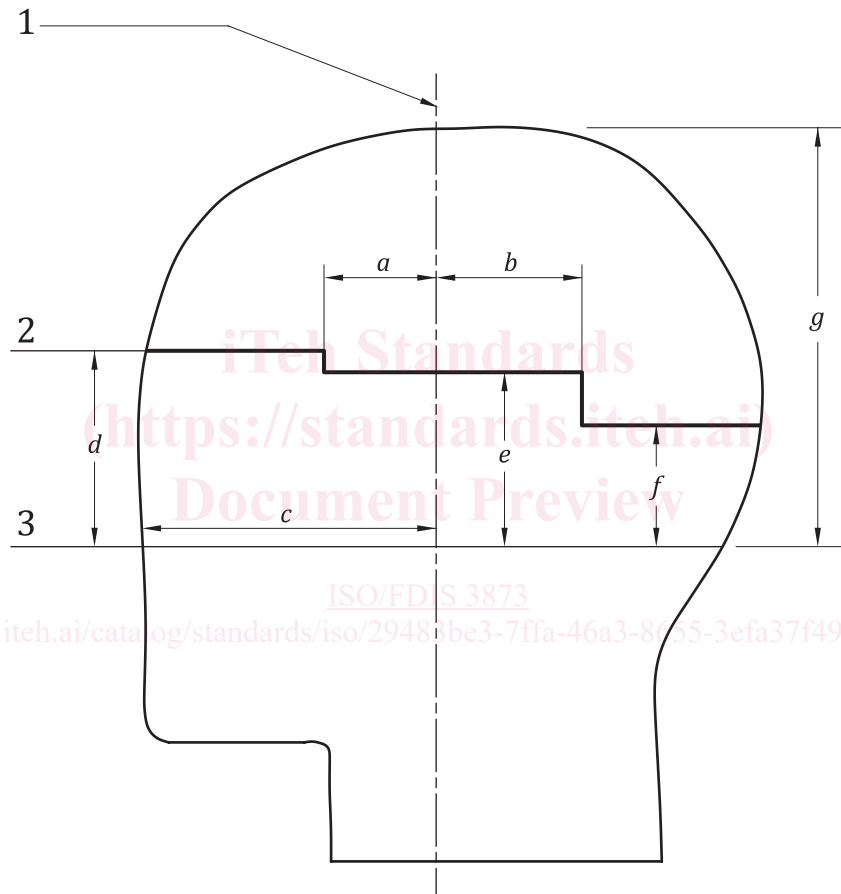
3.14

test line

line denoting the extent of protection of a helmet

Note 1 to entry: Defined by the dimensions presented in [Table 1](#) corresponding to [Figure 2](#).

Note 2 to entry: The extent of coverage may exceed the test line. Helmets may have components below the test line which may be contacted during testing. Such contact does not invalidate the test.



Key

- 1 central and vertical axis
- 2 test line
- 3 basic plane

Figure 2 — Extent of protection and test line for helmets

Table 1 — Test line dimensions for headforms

Headform size Code letter (EN 960 size)	Dimensions(see Figure 2) mm						
	a	b	c	d	e	f	g
A (495)	23	65	88	59	34,5	26,5	113,5
E (535)	29,5	65	94,5	64	39	33	121,5
J (575)	36	65	101	66	41	36	130
M (605)	41	65	106	67	41,5	37	136
O (625)	43,5	65	108,5	68	42	38	140

4 Physical requirements

4.1 Materials

Recommendations for general consideration of materials are given in [Annex A](#).

4.2 General construction

Recommendations for general consideration of construction of helmets are given in [Annex A](#).

A Type I helmet shall typically be constructed from a shell and liner; shell, liner and harness; or, shell and harness.

NOTE If a helmet is constructed from a shell and liner, it requires a system for retaining the helmet on the wearer's head. The headband and nape strap in a harness typically offer an adjustable system for retaining the helmet on the wearer's head.

A Type II helmet shall be constructed from a shell, liner, harness and retention system; or, shell, liner and retention system. The retention system shall have at least three points of permanent attachment to the shell.

NOTE One point of attachment can be shared, e.g. at the rear of the helmet.

4.3 Accessories and attachments

An helmet accessory, an helmet attachment or a combination of accessories and attachments shall not decrease the protective performance of the helmet.

NOTE The test lab should consider testing the helmet with the accessory or attachment on the helmet as per manufacturer's instructions against relevant performance requirements in [Clause 5](#).

5 Performance requirements

5.1 Type I Mandatory requirements

5.1.1 Striker drop test

When tested by the method given in [6.5.1](#) at low and high temperatures and in wet conditions, the force transmitted to the headform shall not exceed 5,0 kN. The striker shall be allowed to fall on the centre of the crown of the helmet shell with an impact energy of 49 J attained by the striker impacting at $4,43 \text{ m/s} \frac{0,05}{0} \text{ m/s}$ measured over the last 40 mm of fall. 4,43 m/s equates to a nominal striker drop height of 1 000 mm.