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Protective clothing — General requirements

Vêtements de protection — Exigences générales

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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.

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 13688 was prepared by Technical Committee ISO/TC 94, *Personal safety - Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing* and by Technical Committee CEN/TC 162, *Protective clothing including hand and arm protection and lifejackets* in collaboration.

This second edition cancels and replaces the first edition (ISO 13688:1998), which has been technically revised to include the following changes:

— A statement that this International Standard (and pictogram) is intended to be used in combination with another product standard was added to the Scope.

— Additional definitions on waist to waist over the shoulder length, and torso.

— Notes on level of performance moved to informative Annex A.

— Clause 4 on ergonomics changed to basic health and ergonomic requirements and revised into separate sub-sections: general (4.1), innocuousness (4.2), design (4.3) and comfort (4.4).

— Informative Annex C added on ergonomic features.

— Subclause 5.2 on colour fastness removed.

— Subclause 5.3 on cleaning renamed as washing and dry-cleaning (5.2) now includes reference to standardised processes, including industrial washing.

— Strengthened provisions in 5.3 on dimensional change due to cleaning.

— The size designation system in Clause 6 was simplified with regard to intervals and ranges to allow more freedom to obtain a better individual fit.

— Subclause 7.2 on specific marking amended to include qualification labelling for industrial laundry care.

— Informative Annex B (Flow chart) added on acceptability of materials.

— Informative Annex F added on environmental aspects.

Introduction

This International Standard is a reference standard to be called up as appropriate by specific standards. This International Standard is not intended to be used alone but only in combination with another standard containing requirements for the specific performance of the product which provides protection.

Protective clothing — General requirements

1 Scope

This International Standard specifies general performance requirements for ergonomics, innocuousness, size designation, ageing, compatibility and marking of protective clothing and the information to be supplied by the manufacturer with the protective clothing.

This International Standard is only intended to be used in combination with other standards containing requirements for specific protective performance and not on a stand-alone basis.

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 3071, *Textiles — Determination of pH of aqueous extract*

ISO 3175-1, *Textiles — Professional care, drycleaning and wetcleaning of fabrics and garments — Part 1: Assessment of performance after cleaning and finishing*

ISO 3635, *Size designation of clothes — Definitions and body measurement procedure*

ISO 3758, *Textiles — Care labelling code using symbols*

ISO 4045, *Leather — Chemical tests — Determination of pH*

ISO 5077, *Textiles — Determination of dimensional change in washing and drying*

ISO 7000, *Graphical symbols for use on equipment — Registered symbols*

ISO 17075, *Leather — Chemical tests — Determination of chromium(VI) content*

ISO 30023, *Textiles — Qualification symbols for labelling workwear to be industrially laundered*

EN 1811, *Reference test method for release of nickel from products intended to come into direct and prolonged contact with the skin*

EN 14362-1, *Textiles — Methods for determination of certain aromatic amines derived from azo colorants — Part 1: Detection of the use of certain azo colorants accessible with and without extracting the fibres*

3 Terms and definitions

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

3.1
ageing
change of one or more initial properties of protective clothing materials during the passage of time

3.2
hazard
situation which can be the cause of harm or damage to the health of the human body

Note 1 to entry: There are different general types of hazards, e. g. mechanical hazards, chemical hazards, cold hazards, heat and/or fire hazards, biological agents hazards, radiation hazards. Certain types of these hazards can, according to circumstances, derive from more specific hazards. Thus, a heat hazard can derive from contact heat, radiant heat etc. for each of which there can be separate test methods.

Particular garments have been designed to give protection against the hazards encountered in specific types of activities. Examples of such garments are aprons that provide protection against hand knives, trousers for use with chainsaws, clothing for protection against chemicals, high visibility clothing and motorcycle rider's protective clothing.

3.3
risk
combination of the frequency, or probability, of occurrence and the consequence of a specified hazardous event

Note 1 to entry: The concept of risk always has two elements: the frequency or probability with which a hazardous event occurs and the consequences of the hazardous event.

3.4
performance level
number that designates a particular category or range of performance by which the results of testing can be graded

Note 1 to entry: For further information see Annex A.

3.5
protective clothing
clothing including protectors which cover or replace personal clothing, and which is designed to provide protection against one or more hazards

3.6
waist to waist over the shoulder length
maximum length measured from the plane of the waist over the shoulder to the plane of the waist

Note 1 to entry: See also Clause 6.

3.7
torso
thorax and abdomen or section of the body to which the limbs, head and neck are attached

4 Basic health and ergonomic requirements

4.1 General

In the following paragraphs some basic health and ergonomic requirements are stated that are relevant for many types of protective clothing.

NOTE For general ergonomic principles to be used in designing and specifying personal protective equipment see EN 13921.[7]

Protective clothing shall be designed and manufactured as follows.

4.2 Innocuousness

Protective clothing shall not adversely affect the health or hygiene of the user. The materials shall not, in the foreseeable conditions of normal use, release substances generally known to be toxic, carcinogenic, mutagenic, allergenic, toxic to reproduction or otherwise harmful.

NOTE 1 Information on the classification and identification of harmful substances can be found, e.g. in[9] of the Bibliography.

NOTE 2 Guidance on how to consider acceptability of materials in protective clothing is given in the flow chart in informative Annex B (Figure B.1).

The following list of documents is given for information and as examples of documents to be examined:

— Information supplied by the manufacturer could include evidence-based information confirming that the product does not contain any substances at levels that are known or suspected to adversely affect user hygiene or health,

— Materials specifications,

— Safety data sheets relating to the materials,

— Information relating to the suitability of the materials for use with food, in medical devices, or other relevant applications,

— Information relating to toxicological, allergenic, carcinogenic, toxic to reproduction or mutagenic investigations on the materials,

— Information relating to ecotoxicological and other environmental investigations on the materials.

Materials should be selected to minimize the environmental impact of the production and disposal of protective clothing (see also Annex F).

The examination shall determine whether the claim that the materials are suitable for use in the protective clothing or protective equipment is justified. Particular attention shall be paid to the presence of plasticisers, unreacted components, heavy metals, impurities and the chemical identity of pigments and dyes.

Each layer of material of the protective clothing shall comply with the following requirements:

a) Chromium VI content in leather clothing shall not exceed 3 mg/kg according to ISO 17075.

b) All metallic materials which could come into prolonged contact with the skin (e.g. studs, fittings) shall have a release of nickel of less than 0,5 µg/cm^2 per week. The method of test shall be according to EN 1811.

c) Protective clothing material shall have a value greater than pH3,5 and less than pH9,5. The test method for leather shall be according to ISO 4045 and for textile materials according to ISO 3071.

d) Azo colorants which release carcinogenic amines listed in EN 14362-1 shall not be detectable by the method in these standards.

4.3 Design

4.3.1 The design of protective clothing shall facilitate its correct positioning on the user and shall ensure that it remains in place for the foreseeable period of use, taking into account ambient factors, together with the movements and postures that the wearer could adopt during the course of work or other activity. For this purpose, appropriate means, such as adequate adjustment systems or adequate size ranges shall be provided so as to enable protective clothing to be adapted to the morphology of the user. (See Annex C).

4.3.2 The design of protective clothing shall ensure that no parts of the body get uncovered by expected movements by the wearer (e.g. a jacket should not rise above the waist when the arms are raised) if

this is defined in the specific standard. The specific standard for protective clothing shall contain test criteria (for example: checking that the garment can be put on and taken off easily; that arm and knee and bending movements are possible; that unprotected body areas do not appear during movements; that there is an adequate overlap of jacket and trousers; that the manufacturers information is adequate to explain the correct usage of the protective clothing). (See Annex C).

4.3.3 Where applicable, protective clothing design shall take into account other items of protective clothing or equipment from the same manufacturer which must be worn to form an overall protective ensemble. When two or more items are worn together, they should be compatible and each one shall comply with its own standard. None of them has to reduce the performance of the other item(s) and the appropriate level of protection should be provided at interface areas between those products, for example in sleeve to glove, trousers to footwear, hood and respirator combinations. There may be other combinations.

4.3.4 In each specific standard, a minimum mechanical property to assess the strength of a garment shall be defined.

4.4 Comfort

4.4.1 Protective clothing shall provide users with a level of comfort consistent with the level of protection required against the hazard which is present, the ambient conditions, the level of the user's activity, and the anticipated duration of use of the protective clothing.

Protective clothing shall not

— have rough, sharp or hard surfaces that irritate or injure the user;

— be so tight, loose and/or heavy so that it restricts normal movement (see Annex C).

4.4.2 Protective clothing that imposes significant ergonomic burdens such as heat stress, or is inherently uncomfortable because of the need to provide adequate protection, shall be accompanied in the information supplied by the manufacturer by specific advice or warnings. Specific advice on the appropriate duration for continuous use of the clothing in the intended application(s) shall be given.

5 Ageing

5.1 General

This International Standard is concerned only with the dimensional change caused by cleaning on the performance of the clothing and legibility of marking (see 5.3).

5.2 Washing and dry cleaning

The cleaning shall be in accordance with the manufacturer's instructions, on the basis of standardized processes. If the number of cleaning cycles is not specified, five cleaning cycles shall be performed. This shall be reflected in the information supplied by the manufacturer.

Where rapid deterioration in performance is caused by the use of cleaning procedures, the manufacturer, in the marking and/or in the information, shall indicate the maximum number of cleaning operations that may be carried out before the protective clothing has to be discarded.

Manufacturers should typically indicate one or several of the various methods and processes of ISO 6330,[5] ISO 15797,[8] ISO 3175 (Parts 2 to 4) [2-3-4] or equivalent standardized processes for cleaning.

NOTE The use of domestic care labels infers their selection according to Annex A of ISO 3758 and that testing to the appropriate parts of ISO 6330 and ISO 3175 has been carried out.

5.3 Dimensional change due to cleaning

If the manufacturer's instructions indicate that garments can be washed or dry cleaned, the test procedure for dimensional change for washing of protective clothing material shall be carried out in accordance with 5.2. Measurement of dimensional change shall be carried out according to ISO 5077 and for dry cleaning in accordance with ISO 3175-1.

Changes in dimension due to cleaning of material for protective clothing shall not exceed ± 3 % for woven materials and ± 5 % for knitted material and nonwovens in either length or width, unless stated otherwise in a specific standard.

One sample shall be subjected to five cleaning cycles according to 5.2. If both industrial washing and domestic washing are permitted, only industrial washing shall be carried out. If the manufacturer includes instructions for washing or washing and dry-cleaning, the garment shall only be wash tested. If only dry-cleaning is allowed, the garment shall be dry-cleaned.

6 General size designation

Protective clothing shall be marked with its size based on body dimensions measured in centimetres. The size designation of each garment shall comprise the control dimensions as given in Table 1. Exceptions shall be specified in detail in the relevant product standards, e.g. Genital protectors for use in sports. Measurement procedures and the designation of dimensions shall correspond to ISO 3635, if not otherwise specified in other product standards (see also Annex D).

The size designation system is required especially for labelling.

The interval figures given in Annex D should not be standardized (flexible approach).

Table 1 — Body dimensions for sizing protective clothing

No	Protective clothing	Control dimensions (ranges expressed as centimetres or kilograms)
1	jacket, coat, vest	chest or bust girth and height
2	trousers	waist girth and height
3	coverall	chest or bust girth and height
4	aprons	chest or bust girth, waist girth and height
5	protective equipment (e.g. knee pads, back protectors, torso protector)	Select the relevant measurement: — chest or bust girth, waist girth and height — body weight — waist to waist over the shoulder length

The manufacturer can also designate additional measurements, e.g. the arm length, the inside leg length or the hip girth for women's garments. The value shall correspond to the actual value in centimetres of the user's body dimensions.

According to ISO 3635 and Annex D, the figures of size designations on the garment series should be used to indicate the size. Examples of size designations are shown in Annex D.

Also taking Annex C into account, product standards or the design criteria used by manufacturers for protective clothing shall take the following into account:

— That if there is a requirement for a zone or zones of protection there shall be a specified numerical relationship between the dimensions of the specific protective materials or constructions in the products, and the size of user.

— That it shall be possible to optimize PPE adaptation to user morphology by all appropriate means, such as adequate adjustment and attachment systems or the provision of an adequate size range.