ISO/TC 94/SC 13

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Secretariat: SNV

Hand protection — ~~guidance~~Guidance for selection and use

Protection de la main — Conseils pour la sélection et l'utilisation

~~Handschutz - Leitfäden für Auswahl und Gebrauch~~

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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~~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~~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 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~~www.iso.org/iso/foreword.html.

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

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

Introduction

For the past year a push has taken place to align EN and ISO standards. Currently some are covered by a single standard, others are identical, but not yet as an EN ISO standard, others have not been developed as ISO or CEN standard. The table below describes the state of the various standards.

EN Standard	ISO Standard	Future state
EN ISO 21420:2010	ISO 21420:~~2010~~2020	same
EN ISO 374-1:2016+A1:2018	ISO 374-1: 2016 + Amd 1:2018	same
EN 374-2:2014	ISO 374-2:2019	Already equivalent, but single standard as EN ISO
EN 374-4:2013	ISO 374-4:2019	Already equivalent, but single standard as EN ISO
EN ISO 374-5:2016+A1:2018	ISO 374-5:2016 ~~+ Amd 1:2018~~	same
EN ISO 374-6	ISO 374-6	joint project in preparation
EN 388:2016+A1:2018	ISO 23388:2018	Already equivalent, but single standard as EN ISO
EN 407:2020+A1:2021	ISO 23407:2021	Already equivalent, but single standard as EN ISO
No CEN equivalent	ISO 18889	EN ISO 18889 once adopted
EN ISO 19918	ISO 19918	same
EN 16523-1:2015 (liquid permeation) EN 16523-2:2015 (gas permeation) *Replaced EN 374-3*	not equivalent to ISO 6529 but many similarities	Revision of ISO 6529 will more closely align ISO with EN
EN 16530:2016 (electrostatic)	No ISO equivalent	TBD
EN 16778: 2016 (DMFA concentration)	No ISO equivalent	TBD
EN 12477:2001 + A1:2005 (welder)	No ISO equivalent	TBD
EN 511:2006	No ISO equivalent	TBD
EN 659:2003 +A1:2008	ISO 15383:2001 ISO 11999-4:2015	Revision of EN 659 will more closely align EN with ISO
No CEN equivalent	ISO 16073-4:2019	Revision of EN 659 will more closely align EN with ISO
No CEN equivalent	ISO 18639-4:2018	Revision of EN 659 will more closely align EN with ISO
		TBD to be decided

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Hand protection — ~~guidance~~Guidance for ~~Selections~~selection and use

1 Scope

This document gives information on the selection and use of personal protective equipment for the hand protection.

The application of this ~~Technical Report~~document requires that the risk assessment has been carried out and the hazards have been minimized accordingly through substitution and technical and organizational measures.

On this basis, this ~~Technical Report~~document contains information that supports employers in counteracting certain risks to hands that could not be sufficiently reduced by substitution and technical and organizational measures by selecting and using suitable protective gloves.

This ~~Technical Report~~document provides explanations on selection, usage and training applicable to protective gloves. The explanations concerning specific hazards are provided in ~~Annexes~~annexes.

This guidance considers the following risks:

— mechanical, (see Annex A~~)~~);

— chemical, (see Annex B~~)~~);

— biological, (see Annex C~~)~~);

— thermal, (see Annex D and E~~)~~);

— electrostatic discharge (see Annex F~~)~~);

— ionizing radiation and radioactive contamination (see Annex G~~)~~).

This guidance does not cover other risks, because pertinent international or national publications are available or because the relevant information was not available in ISO/TC 94/SC 13/WG 8. Risks not covered include e.g.:

— cuts and stabs by hand knives;

— use of chain saws (covered by ISO 11393-4:2018, Annex A~~)~~);

— animal bites;

— needlesticks;

— electrocution;

— optical radiation;

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— firefighting (covered by ISO/TR 21808~~)~~);

— sport.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

~~For the purposes of this document, the following~~No terms and definitions ~~apply~~are listed in this document.

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

— ISO Online browsing platform: available at ~~https://www.iso.org/obp~~https://www.iso.org/obp

— IEC Electropedia: available at ~~https://www.electropedia.org/~~https://www.electropedia.org/

4 Selection

4.1 General principles

In most countries, manufacturing of gloves is subject to specific legislation, e.g. concerning personal protective equipment, medical devices, etc. Adequate design and construction ensures that a protective glove:

— is appropriate for the risks involved, without itself leading to any increased risk, e.g. entanglement on rotating parts, entrapment, formation of ignition sparks;

— corresponds to existing conditions at the workplace, e.g. grip, tactile sensitivity, waterproofness, breathability, visibility;

— takes account of ergonomic requirements and the worker's state of health, e.g. size, fit, potential allergens.

As a principle, a protective glove is intended for personal use. If the circumstances require that personal protective equipment is used by several persons (e.g. metal ring mesh glove, glovebox), this results in additional hygiene requirements.

Important instructions for the safe use of protective gloves can be found in the supplied manufacturer's instructions and information. The advertised performance levels were achieved under laboratory conditions performed on unused gloves and cannot necessarily be transferred to the actual conditions of use. More detailed information can be obtained from the manufacturers.

Practical tests are a prerequisite for the selection of suitable protective gloves. Criteria for the selection of protective gloves are not only the best possible protection but also ergonomic factors such as wearing comfort, tactile sensitivity and grip. Physiological factors such as wearing comfort, sensitivity or sweat development can be tested in wear tests.

The dexterity of the fingers and the ability to pick up, hold and/or operate objects safely are limited by the wearing of protective gloves. The better the flexibility of the glove and the coefficient of friction of the gripping surfaces are adapted to the geometry and surface characteristics of the objects to be handled, the greater the grip safety for the user.

Only on the basis of the risk assessment is it possible to select the protective glove actually suitable for a particular activity.

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A protective glove is suitable if~~:~~

~~1.~~a) it meets the legal requirements (for example in Europe CE marking),

~~2.~~b) it is accompanied by the manufacturer declaration of conformity,

~~3.~~c) it is capable of reducing the risk to the user to an acceptable level throughout the period of use, and

~~4.~~d) it can be used under the given working conditions.

~~Note:~~NOTE Any modification to the glove requires formal approval by the manufacturer.

4.2 Selection in function of specific hazards

With regard to the hazards covered by the scope of this ~~Technical Report, Annexes~~document, annexes dealing with those specific hazards provide the information required to make the selection correctly.

4.3 Combination with other PPE

The combination of PPE only protects the user if a seamless transition between the equipment parts is ensured. This can be achieved by these methods, for example~~:~~

— adequate cuff length~~;~~,

— adequate arm protectors~~;~~,

— connection with a protective suit, e.g. glove adapter, taping~~;~~, and

— sleeve design of the protective suit, e.g.: thumb loop, throw-on sleeves.

4.4 Wearing trials

Wearing trials can be used to assess the ergonomic and workplace-specific suitability of the protective gloves, including for example~~:~~

— Ease and speed of putting on and taking off the gloves~~;~~,

— comfort, e.g. sweating, flexibility, disturbing seams~~;~~,

— compatibility with all other PPE items~~;~~,

— ability to perform all expected tasks without hindrance and without difficulty, e.g. secure grip, tactile sensitivity~~;~~, and

— maintaining protection in all working positions, e.g. covering with the sleeve.

A systematic approach to carrying out the wearer trials includes, for example~~:~~

— selection of the participants according to a cross-section of the respective occupational group (height, weight, age, gender, etc~~.~~),

— structured collection of feedback for evaluation, so that both qualitative and quantitative data collection and analysis are possible; this can be achieved by using a structured questionnaire, structured or semi-structured interviews and/or group discussions~~;~~, and

— sufficient number of participants to ensure an appropriate selection of suitable protective gloves for all affected employees in a work area.

4.5 Sweating

Sweating when wearing liquid-tight gloves for long periods of time, through heavy physical activity and/or high ambient temperatures can lead to skin reddening, softening and irritations. Gloves designed with a knitliner or flocklining, wearing a textile underglove or changing gloves frequently help providing added comfort and preserve the highest integrity of the gloves. Regular skin care can help to reduce the negative effects of skin softening (e.g. after work cream).

4.6 Allergens

According to ISO 21420, the manufacturer provides the user on request with a list of substances contained in a glove that are known to cause allergies. In the case of gloves containing natural rubber, the information for use include a warning which read something like this: "The glove contains natural rubber which may cause allergic reactions".

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5 Usage

5.1 Testing before use or re-use

By checking the protective gloves before use or re-use (e.g. visual assessment of the surface condition of the barrier), hazards due to possible damage, quality defects, and flaws such as tear, abraded areas, holes or cracks, especially in finger crotches, broken seams or other defects can be identified. The protective effect can be reduced e.g. by pointed objects, soot or heat-induced material embrittlement. Wet gloves, be it inside or outside, may have reduced performance levels and cause skin discomfort. Skin discomfort can also be caused when gloves are worn on wet or dirty hands.

Checking the protective gloves before use also helps to determine whether their expiry date has already passed.

Only fitting gloves (correct size) offer the intended protective performance and suitability.

5.2 Use

Important instructions for the safe use of protective gloves can be found in the supplied manufacturer's instructions and information.

According to ISO 21420, the manufacturer provides the user with instructions together with the gloves containing all relevant information for safe use. Whether the glove is designed for single use or might be reused is an important instruction to be followed.

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Employers are responsible of giving appropriate and understandable instructions to the workers. At the same time, workers are responsible of making correct use of the personal protective equipment supplied to them in accordance with the training and the instructions given by their employer.

6 Training

Training of employees/users in the correct handling of their protective gloves is a prerequisite for their correct use. Providing only written instructions or information without practical demonstrations, training and exercises may not be sufficient.

Important instructions for the safe use of protective gloves can be found in the supplied manufacturer's instructions and information. This can include:

— information on why the protective gloves can be worn;

— information on personal responsibility for correct use and care; and

— information about the limitations and possibilities of the protective gloves:
  — what they can protect against;
  — what they do not protect against;
— how to don, use/wear and doff the protective gloves;
— how to store the protective gloves when not in use;
— information on precautions for cleaning;
— how to determine when the protective gloves are no longer appropriate and can be disposed of;
— procedures for the environmentally sound disposal of gloves which are no longer fit for use;
— how to obtain replacement;
— emergency response.

Annex A
(informative)

Mechanical hazards

~~ISO_7000_2490_small_with_corner_marking.EPS~~

~~ISO 7000 - 2490~~

~~A.4~~A.1 General

Gloves according to ISO 23388 (ISO 23388:2018 is equivalent to the EN 388:2016~~+~~ + A1:2018) offer protection against damage caused by abrasion, cut, puncture, or tear resistance being a product feature. The abrasion, puncture and tear resistance are assigned to four performance levels, the cut resistance to five or 6 performance levels (see ~~tables 1 and 2 from~~ ISO 23388:2018, Tables 1 and 2). According to ISO 23388, protective gloves against mechanical risks achieve at least performance level 1 or at least performance level A for the TDM cut resistance test according to ISO 13997~~:1999~~ for at least one of the properties (abrasion, cut, tear propagation and puncture resistance).

~~Note: the~~NOTE The two cut test methods coexist because they are well established in different regions and standards. The Coupe-test is more cut by pressure, the TDM-test according to ISO 13997 is a slash type of cut.

NOTE 2 See the following pictogram used to indicate conformity with ISO 23388:

ISO 7000 - 2490

Table 1 — Levels of performance

Test	Level 1	Level 2	Level 3	Level 4	Level 5
6.1 Abrasion resistance (number of rubs)	100	500	2 000	8 000	—
6.2 Coupe test: Blade cut resistance (index)	1,2	2,5	5,0	10,0	20,0
6.4 Tear resistance (N)	10	25	50	75	—
6.5 Puncture resistance (N)	20	60	100	150	—

Table 2 — Levels of performance for materials tested with ISO 13997

	Level A	Level B	Level C	Level D	Level E	Level F
6.3 Cut resistance (N) (ISO 13997)	2	5	10	15	22	30

Gloves according to ISO 23388 can also provide specific protection against impact. If parts of the glove meet the requirements for specific impact absorption and this has been tested positively, the glove is marked with "P" in addition to the 5 performance levels.

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The performance levels determined in accordance with ISO- 23388 provide valuable assistance and orientation in the pre-selection of products. They always refer to the test method or conditions. This means that the performance levels are always to be seen relatively and the higher the number or the wider the letter in the alphabet, the higher the theoretical level of protection. Protection in real life may depend on many factors, therefore a wearer trial or suitability test according to 4.~~2.3~~4 can confirm the practical suitability.

These performance levels specified by the manufacturer serve as a selection guide for the use of the protective gloves. However, they do not give any direct indication of the specific protection or suitability in defined applications and their risks.

Wetness and penetrating moisture can reduce the protective properties of protective gloves. Not all protective gloves are liquid-tight, but only those that have been explicitly recommended by the manufacturer.

~~A.5~~A.2 Information sources

Important application instructions for the use of protective gloves against mechanical risks can be found in the manufacturer's instructions and information supplied with the product. According to EN- 388:2016 + A1:2018, Clause 8, these include

— information on special tests carried out under different climatic conditions,

— where appropriate, a warning that the overall classification for gloves with two or more layers does not necessarily reflect the performance of the outermost layer,

— where appropriate, a warning that if dulling occurs during the cut resistance test, the results of the coupe test are only indicative, whereas the TDM cut resistance test in accordance with ISO- 13997 provides reference results in terms of performance,

— if protection against impact is claimed, that the areas for which protection is specified are mentioned, as well as a warning that the protection does not apply to fingers, and

— for gloves with mechanical resistance, which have a tear resistance rating of 1 or higher, a warning that gloves will not be worn in cases where there is a risk of getting caught in moving parts of the machine.

More detailed information can be obtained from the manufacturers.

~~A.6~~A.3 Mechanical properties

— The abrasion resistance test is intended to simulate the wear and tear of the glove material during use. Samples of the material of the palm are fixed with double-sided adhesive tape on sample holders and are moved with a specified sequence of movements and loaded against an abrasive paper until a hole occurs.

— For the determination of the cut resistance there is on the one hand the cutting method with a rotating circular blade according to ISO- 23388, where the cutting index is determined under a constant force by repeated contact and is calculated depending on the sharpness of the circular blade. However, due to the further development of the glove materials used, which can also consist of mineral or steel fibres, this method dulls the knife too quickly.

— If the blade is dulled too early, another cutting method is used. In this method, the resistance to cutting is determined from a linear one-time movement under increasing force until penetration. This test method provides an additional statement on the cut resistance for work with different and also impact-like force effects.

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