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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

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Submission of Comments

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- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 16602-6

Protective clothing for protection against chemicals — Classification, labelling and performance requirements —

Part 6: Guidance for Selection, Use, Care and Maintenance

*Habillement de protection contre les produits chimiques —
Classification, étiquetage et exigences de performances —*

*Partie 6: Lignes directrices relatives à la sélection, l'utilisation,
l'entretien et la maintenance*

ICS: 13.340.10

This document is circulated as received from the committee secretariat.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation 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*, Subcommittee SC 13, *Protective clothing*.

This second edition cancels and replaces the first edition ISO 16602:2007. The standard has completely been rewritten and split in parts, the most significant changes compared to the previous edition relating to: (1) a new modular approach, (2) marking, (3) chemical protection

A list of all parts in the ISO 16602 series can be found on the ISO website.

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

This document addresses the selection, use, care and maintenance (SUCAM) of chemical protective clothing and also links the old classification to the new modular approach. This document is intended to provide comprehensive explanation of the requirements for the performance classification and labelling of chemical protective clothing and how these may apply in the workplace.

This document is part of a series of standards for test methods and requirements for both limited use and reusable chemical protective clothing. ISO 16602 consists of the following parts, under the general title "Protective clothing for protection against chemicals — Classification, labelling and performance requirements":

- Part 1: General requirements;
- Part 2: Physical test methods, classification and requirements;
- Part 3: Chemical test methods, classification and requirements;
- Part 4: Test methods, classification and requirements for specific designs and ensemble components including gloves, footwear, and respirators;
- Part 5: Garment test methods, classification and requirements;
- Part 6: Guidance on Selection, Use, Care and Maintenance.

This series of documents is intended to provide a modular approach to design and specification for chemical protective clothing accommodating the variety and severity of risks found, and activities carried out, in the workplace. This document includes the requirements of ISO 8194 on radiation protection so that it can be withdrawn.

The Type 1 through Type 6 garments were originally created to differentiate garment performances through specific garment test(s): These "Type" garments could not be placed in an intrinsic hierarchy, although the fabric barrier performances (intrinsic properties of the fabric and seams) created an indirect hierarchy in certain cases. For example, Type 1 is in general more protective than Type 2, Type 5 and Type 6; and Type 3 is, in general, more protective than Type 4 and Type 6. Although the Type 1-Type 6 system has been superseded by the modular approach, a correlation table will be available.

In the previous ISO 16602 (and EN equivalents EN 13034, EN 14605, EN 943 series, EN 1073 series, and EN 14325), there is a link between the garment tests, the Type (Type 1 through Type 6), and the physical and chemical requirements of materials and components. This revision of the ISO 16602 series (intended to be an EN ISO standard), applies a modular approach that breaks that link. Nevertheless, the existing test methods from ISO 16602 and in other European standards (e.g EN 14325) have been used as the basis for this revision.

The selection of appropriate chemical protective clothing is strongly advised to be based on a risk assessment. In this assessment the user organization identifies the hazards, and determines:

- the potential for chemical contact with individual workers,
- the consequences of exposure, and
- the type of practices or controls needed to eliminate or minimize exposure.

When it is determined that chemical protective clothing is needed, the risk assessment identify the chemical protective clothing required in terms of its overall performance requirements from physical characteristics, chemical protection and whole garment test perspective. ISO/DIS 16602-6 is intended to assist user organizations with these determinations.

Protective clothing for protection against chemicals — Classification, labelling and performance requirements —

Part 6: Guidance for Selection, Use, Care and Maintenance

1 Scope

This document addresses the selection, use, care and maintenance (SUCAM) of chemical protective clothing (CPC). This guidance document is primarily intended for users, specifiers and others with responsibility for the procurement and provision of chemical protective clothing. It is also intended to be used by manufacturers in their dialogue with the users of PPE.

This guidance document is intended to clarify the inter-relationship between this ISO 16602 series of standards and its modular approach, ISO 17723-1 but also how this links to the old classification of CPC.

These guidelines are intended to assist users and specifiers in selecting the correct type of CPC for the task to be performed, and to help them ensure it is used according to the manufacturer's instructions to provide adequate chemical protection (including solids, airborne particles, aerosols, liquids, and gases (including radioactive contamination)) during its entire lifetime. Lifetime and effectiveness of protective clothing depend largely on care and maintenance. When cleaning, disinfection and end-of-life disposal are considered, the environmental impact should also be taken into account.

To assist the users of products covered under this document, this document provides descriptions of referenced test methods, guidelines for conducting hazard and risk assessments and suggested performance levels for certain applications. It is not the intent of this document to address all potential situations.

NOTE Although this document has been created as a stand-alone document covering ISO/DIS 16602-1 through ISO/DIS 16602-5, it is strongly recommended to read this guidance in conjunction with ISO/DIS 16602-1 (if not the other parts) to understand the detail of the requirements.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11610:2023, *Protective clothing — Vocabulary*

ISO 12947-2:2016, *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 2: Determination of specimen breakdown*

ISO/DIS 16602-1:—¹⁾, *Protective clothing for protection against chemicals — Classification, labelling and performance requirements — Part 1: General requirements*

ISO/DIS 16602-2:—²⁾, *Protective clothing for protection against chemicals — Classification, labelling and performance requirements — Part 2: Physical test methods, classification and requirements*

1) Under preparation. Stage at the time of publication: ISO/DIS 16602-1:2025

2) Under preparation. Stage at the time of publication: ISO/DIS 16602-2:2025

ISO/DIS 16602-3:—³⁾, *Protective clothing for protection against chemicals — Classification, labelling and performance requirements — Part 3: Chemical test methods, classification and requirements*

ISO/DIS 16602-4:—⁴⁾, *Protective clothing for protection against chemicals — Classification, labelling and performance requirements — Part 4: Test methods, classification and requirements for specific designs and ensemble components including gloves, footwear, and respirators*

ISO/DIS 16602-5:—⁵⁾, *Protective clothing for protection against chemicals — Classification, labelling and performance requirements — Part 5: Garment test methods, classification and requirements*

ISO 17491-1:2012, *Protective clothing — Test methods for clothing providing protection against chemicals — Part 1: Determination of resistance to outward leakage of gases (internal pressure test)*

ISO 17491-4:2024, *Protective clothing — Test methods for clothing providing protection against chemicals — Part 4: Determination of resistance to penetration by a spray of liquid (spray test)*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions in ISO 11610 and the following apply (see also [Annex A](#)).

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

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

3.1 Definitions

3.1.1 Definitions from ISO/DIS 16602-1 through -5

3.1.1.1

abrasion cycle

completion of all the translational abrasion movements tracing a Lissajous figure comprising 16 rubs, i.e. 16 revolutions of the two outer drives and 15 revolutions of the inner drive of the Martindale abrasion tester

[SOURCE: ISO 12947-1:1998]

Note 1 to entry: also used in ISO 16602:—2, 3.2

3.1.1.2

abrasion rub

one revolution of the outer drives of the Martindale abrasion tester

[SOURCE: ISO 12947-1:1998]

Note 1 to entry: also used in ISO/DIS 16602-2:—, 3.1

3.1.1.3

accessory

subordinate or supplementary part, object, or the like of a garment used mainly for convenience, safety, etc.

Note 1 to entry: Accessory may be permanently attached or removable.

[SOURCE: ISO 11610:2023, 4.3.25]

Note 2 to entry: also used in ISO/DIS 16602-1:—, 3.1

3) Under preparation. Stage at the time of publication: ISO/DIS 16602-3:2025

4) Under preparation. Stage at the time of publication: ISO/DIS 16602-4:2025

5) Under preparation. Stage at the time of publication: ISO/DIS 16602-5:2025

3.1.1.4

body protection

protection of the full body or parts thereof

[SOURCE: ISO/DIS 16602-1:—, 3.2]

3.1.1.4.1

full body

protection of the body that includes at least the torso, arms and legs, not necessarily head, feet and hands

EXAMPLE encapsulating suits, one or more piece suits (e.g. coveralls, jackets and trousers).

[SOURCE: ISO/DIS 16602-1:—, 3.2.1]

3.1.1.4.2

partial body

protection of the body that includes only one or more of the elements of the body (torso, arm(s), leg(s), head, feet)

EXAMPLE Examples of partial body would include: aprons, smocks, hoods, sleeves, and shoe and boot covers

[SOURCE: ISO/DIS 16602-1:—, 3.2.2]

3.1.1.5

chemical protective ensemble

chemical protective garment and all relevant items required to protect against the chemical risk

Note 1 to entry: Examples for relevant items are visor, gloves, boots or bootees, RPD, ventilation (non-breathing), and other design features.

[SOURCE: ISO/DIS16602-4:—, 3.1]

3.1.1.6

chemical protective footwear/chemical safety footwear

footwear, whether integral to the garment or not, incorporating safety features to protect the wearer from injuries that could arise through accidents

[SOURCE: ISO/DIS 16602-4:—, 3.2]

3.1.1.6.1

chemical protective overshoe/overboot

footwear, not integral to the garment, incorporating safety features to protect the wearer and worn over the sock/bootee

[SOURCE: ISO/DIS 16602-4:—, 3.2.1]

3.1.1.6.2

chemical protective sock/bootee

sock like extension of the chemical protective suit. Sock or bootee are integral part of the chemical protective garment

Note 1 to entry: The bootee may or may not be made of the same material used in the construction of the chemical protective suit.

[SOURCE: ISO/DIS16602-4:—, 3.2.2]

3.1.1.7

chemical protective garment

single article of protective clothing, worn to provide protection to the skin against exposure to or contact with chemicals, which covers or replaces personal garment(s)

[SOURCE: ISO/DIS 16602-1:—, 3.4 & ISO/DIS 16602-4:—, 3.3]

3.1.1.7.1

re-usable chemical protective garment

chemical protective garment that is constructed from materials which allow the garment to be cleaned after repeated chemical exposures such that it remains suitable for continued use

[SOURCE: ISO 11610:2023, 5.2.2]

Note 1 to entry: also used in ISO/DIS 16602-1:—, 3.4.1

3.1.1.7.2

limited use chemical protective garment

chemical protective garment for limited duration of use, i.e. to be worn until hygienic cleaning becomes necessary or chemical contamination has occurred and disposal is required

Note 1 to entry: This includes protective garment for single use and for limited re-use according to the information supplied by the manufacturer.

[SOURCE: ISO 11610:2023, 7.2.8]

Note 2 to entry: also used in ISO/DIS 16602-1:—, 3.4.2

3.1.1.8

chemical protective suit

garment worn to protect against chemicals that covers the whole, or greater part of the body

Note 1 to entry: A chemical protective suit may comprise of garments combined together to provide protection to the body. A suit may also have various types of additional protection such as hood or helmet, boots and gloves joined with it.

[SOURCE: ISO 11610:2023, 7.2.2]

Note 2 to entry: also used in ISO/DIS 16602-1:2020X, 3.5 & ISO/DIS 16602-4:—, 3.4

3.1.1.9

component

part or sub-assembly of a protective item necessary for it to meet its respective requirements

[SOURCE: ISO/DIS 16602-1:—, 3.6 & ISO/DIS 16602-4:—, 3.5]

3.1.1.9.1

attached components

components such as but not limited to gloves and boots that can be connected, by design, to the chemical protective suit to create a chemical protective ensemble

[SOURCE: ISO/DIS 16602-4:—, 3.5.1]

3.1.1.9.2

attachable components

components such as but not limited to gloves and boots that can be temporarily attached (for example by taping), by a procedure described by the manufacturer in the user instructions, to the chemical protective suit to create a chemical protective ensemble

[SOURCE: ISO/DIS 16602-4:—, 3.5.2]

3.1.1.10

compressed air line ventilated protective clothing

protective clothing which is continuously supplied from a source of compressed breathable air ensuring internal ventilation and overpressure

[SOURCE: ISO/DIS 16602-5:—, 3.1]

3.1.1.11

cross direction

direction perpendicular to the direction of the film or fiber parallel to its movement in the fabric making direction

[SOURCE: ISO/DIS 16602-2, 3.3.1]

3.1.1.12

escape device

emergency breathing facility for the purpose of escape

system, either integrally combined with the clothing, or intended for simultaneous use with the clothing, providing the wearer with respiratory protection in the event of the failure of the primary air supply to the suit, while (s)he makes his escape from the contaminated environment

[SOURCE: ISO/DIS 16602-5:—, 3.2]

3.1.1.13

garment test

test procedure with the test subjects of PPE garment moving under specified conditions evaluate the integrity of the garment to penetration of gases, liquids or particulates

[SOURCE: ISO/DIS 16602-5:—, 3.3]

3.1.1.14

inward leakage

L_i

ingress of test particles from the outside of the chemical protective garment to the inside

[SOURCE: ISO 11610:2023, 7.57]

Note 1 to entry: also used in ISO/DIS 16602-5:—

3.1.1.15

total inward leakage

$L_{i,tot}$

ratio of the concentration of the test particles inside the suit to the challenge concentration of test particles inside the test chamber

Note 1 to entry: The total inward leakage, $L_{i,tot}$, is expressed as percentage.

Note 2 to entry: The challenge concentration corresponds to 100 %.

[SOURCE: ISO 11610:2023, 7.5.8]

Note 3 to entry: also used in ISO/DIS 16602-5:—, 3.4

3.1.1.16

low temperature use

temperature of use where working temperatures reach below freezing temperature

[SOURCE: ISO/DIS 16602-2, 3.4]

3.1.1.17

machine direction

direction of the film or fiber parallel to its movement in the fabric making direction

[SOURCE: ISO/DIS 16602-2, 3.3.2]

3.1.1.18
material

substances, excluding hardware and labels, of which a garment is made

[SOURCE: ISO 11610:2023, 4.3.5]

Note 1 to entry: also used in ISO/DIS 16602-2:—, 3.5

3.1.1.19
multilayer material

material consisting of several layers, which may be either permanently bonded together or intimately combined prior to the garment manufacturing stage, or which can be separated without any damage to each individual layer

Note 1 to entry: By “permanently bonded together” is meant for example by coating, laminating, gluing. By “intimately combined” is meant for example by weaving, quilting.

[SOURCE: ISO/DIS 16602-2, 3.5.2]

3.1.1.20
multilayer material consisting of separate layers

multilayer material, where individual layers that are neither permanently bonded together nor intimately combined, can be separated without any damage to the individual layers

[SOURCE: ISO/DIS 16602-2, 6.5.3]

3.1.1.21
minimum air flow rate

minimum air flow rate with the device operating at the manufacturer’s minimum pressure and any user’s control valve set to the minimum

[SOURCE: ISO/DIS 16602-5:—]

3.1.1.22
maximum air flow rate

maximum air flow rate with the device operating at the manufacturer’s maximum pressure and any user’s control valve set to the maximum

[SOURCE: ISO/DIS 16602-5:—]

3.1.1.23
nominal protection factor ($100:L_i$)

ratio of the concentration of the contaminant in the ambient atmosphere to the concentration of contaminant inside the suit

[SOURCE: ISO 11610:2023, 7.5.10]

Note 1 to entry: [Note to entry: also used in ISO/DIS 16602-5:—,]

3.1.1.24
particulate radioactive contamination

contamination by radioactive or radioactively contaminated solid particles

[SOURCE: ISO 11610:2023, 7.4.2]

Note 1 to entry: [Note 1 to entry also used in ISO/DIS 16602-5:—,]

3.1.1.25
protective clothing against solid airborne particles including radioactive contamination

protective clothing intended to provide protection to the skin and if required to the respiratory tract against radioactive contamination and solid airborne particles

Note 1 to entry: Original source is the EN 1073 series of standards

[SOURCE: ISO/DIS 16602-5:—,]

3.1.1.26

specimen breakdown

in abrasion resistance or flex cracking resistance testing, the visually observed deterioration in a specimen after exposure to a specified number of abrasion rubs or cycles of flexing

[SOURCE: ISO 12947-2:2016]

Note 1 to entry: also used in ISO/DIS 16602-2:—, 3.6

3.1.2 Definitions specific to this document

NOTE The source of these definitions are from respective test methods and ISO 11610

3.1.2.1

ageing

change of one or more initial properties of the materials during the passage of time

[SOURCE: ISO 11610:2023, 4.6.13]

3.1.2.2

air-impermeable materials

materials through which gases cannot pass except by a diffusion process on a molecular level

3.1.2.3

air-permeable materials

materials with pores or apertures that allow the transmission of gases

3.1.2.4

breakthrough (detection) time

time elapsed from the start of the test to the sampling time at which the test chemical is first detected

Note 1 to entry: The breakthrough detection time is dependent on the sensitivity of the method and the frequency of sampling of the collection medium

[SOURCE: ISO 11610:2023, 7.5.22]

3.1.2.5

care

process of keeping the protective garments in good working order, including procedures for cleaning, decontamination and storage

[SOURCE: ISO 11610:2023, 15.3]

3.1.2.6

chemical hazard

potential of a chemical to cause harm or damage to a person's health or to the human body

3.1.2.7

challenge chemical

test chemical

liquid or gas that is used to challenge the protective material specimen when testing

Note 1 to entry: The liquid or gas may be either one component, i.e. a neat liquid or gas, or have several components, i.e. a mixture or solution.

[SOURCE: ISO 11610:2023, 7.5.2]

3.1.2.8

cumulative permeation mass

cumulative permeation time

time at which the total quantity of chemical that has permeated through each square centimetre of fabric (4.3.1) has reached a predetermined mass total amount of chemical that permeates during a specified period of time since the start of the test

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

[SOURCE: ISO 11610:2023, 7.5.19]

3.1.2.9

degradation

deleterious change in one or more physical properties of a protective material

EXAMPLE Flaking, swelling, disintegration, embrittlement (6.5.6) , colour change, dimensional change, appearance change, hardening, softening.

[SOURCE: ISO 11610:2023, 4.6.4]

3.1.2.11

maintenance

protective garments process for inspection, care and repair with the aim of retaining the protective properties and preventing excessive deterioration of the garments

[SOURCE: ISO 11610:2023, 15.4]

3.1.2.12

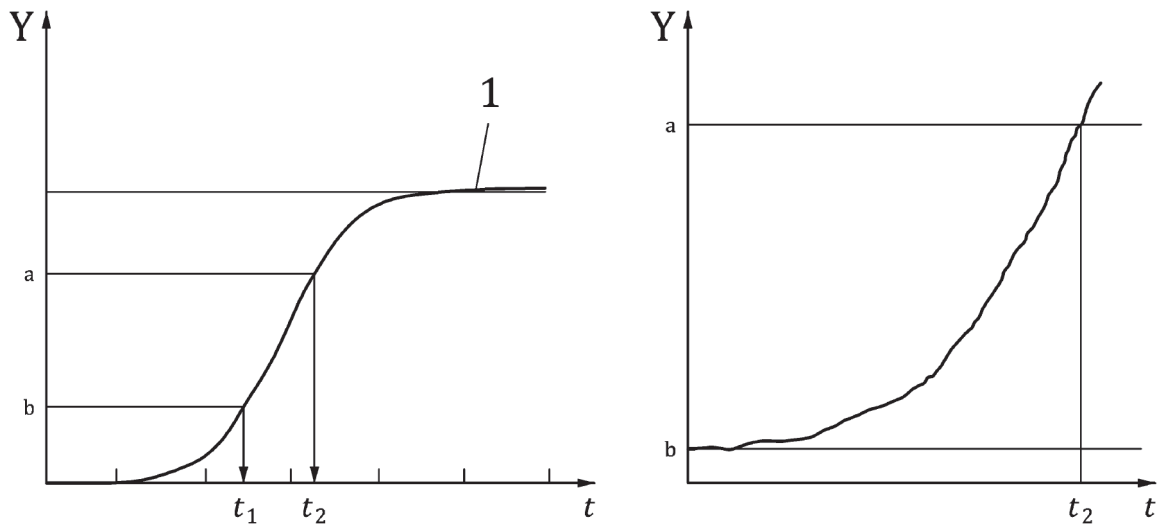
normalized breakthrough (detection) time

NBT

time at which the permeation rate reaches the normalization permeation rate

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

[SOURCE: ISO 11610:2023, 7.5.23]

**Key**

1	steady-state permeation rate (SSPR)
Y	permeation rate ($\mu\text{g}/\text{cm}^2/\text{min}$)
a	normalized permeation rate (NPR)
b	minimum detectable permeation rate (MDPR)
t	time (min)
t_2	normalized breakthrough time (NBT)

Note 2 to entry The breakthrough detection time is dependent on the sensitivity of the method and the frequency of sampling of the collection medium.

Note 3 to entry The cumulative permeated mass over a t_2 period is equal to the area of the shaded region under the graph. (Shading needs to be added)

Figure 1 — Schematic permeation graph showing actual and normalized breakthrough times and cumulative permeation mass

3.1.2.13**penetration**

process by which a chemical moves through pores, apertures or other openings in a material or finished garment

[SOURCE: ISO 11610:2023, 7.5.21]

3.1.2.14**permeation**

process by which a chemical moves through a protective clothing material on a molecular level

Note 1 to entry: Permeation involves a) sorption of molecules of the chemical into the contacted (outside) surface of a material, b) diffusion of the sorbed molecules in the material, and c) desorption of the molecules from the opposite (inside) surface of the material into the collection medium.

[SOURCE: ISO 11610:2023, 7.5.13]

3.1.2.15**rapid deterioration**

unexpected loss of the essential requirements listed in the European PPE Regulation

3.1.2.16**risk**

combination of the probability of occurrence of harm and the severity of that harm

[SOURCE: ISO/IEC Guide 51:2014, 3.9, modified — Note 1 to entry has been deleted. ISO 11610:2023, 5.4.3]

3.1.2.17**risk assessment**

quantification of the risk relating to one or several hazards (including the process of determining these)

3.1.2.18**selection**

protective garment process of determining the type of protective garments that is necessary for the required protection

[SOURCE: ISO 11610:2023, 15.1]

3.1.2.19**use**

protective garments process of putting in service of protective garments including its limitations

[SOURCE: ISO 11610:2023, 15.2]

3.2 Abbreviations

For the purposes of this document the following abbreviations apply.

CPC	chemical protective clothing
ET	emergency team
IL	inward leakage
IFU	Instructions For Use
NBT	normalized breakthrough time
PF	protection factor
PPE	personal protective equipment
SUCAM	selection, use, care and maintenance
TIL	total inward leakage

4 Comparison with previous CPC system and modular approach**4.1 Background**

The revision of ISO 16602 to a modular approach encompasses a broader review to include EN standards and other standards not referenced in the previous ISO 16602. When starting the revision, both the ISO 16602 and the individual (Type 1-6) EU standards, these were used across the world, while at the same time the EN standards started to be revised. Therefore, the project team started to draft a comprehensive chemical protective clothing (CPC) standard, which hopefully will be adopted globally. The intent of the revision is to include all Chemical protective clothing (CPC) currently on the market that have been certified under the EN or ISO standards, and other equivalent national standards across the world.

NOTE To be able to make the comparison between the previous ISO 16602:2007 and the proposed ISO/DIS 16602-1 through ISO/DIS 16602-6 series, these will be referred to respective as “old/previous ISO 16602” and “new ISO 16602 series”.

4.2 Goals of new ISO 16602 series

The main goals of the revision are:

- A single standard or standard series.
- Modular approach
- Define what the garment does versus what it is
- Integrate the latest learnings for the EN but also non EN standards where relevant (modernise the standard).
- Prevent intersections of scope, multiple standards covering similar risks (styles double-defined)
- Clear the misconception of hierarchy of the Type 1 through Type 6 approach, as each is based on a single garment test, but also that not all Type 3 or Type 4 are identical.
- Avoid loopholes in the current standards (both ISO and EN)
- Improve information and marking for end-users (what part of body protected, level of barrier protection, and mechanical strength)
- Creation of a SUCAM to help end-users and purchasers of CPC.

4.3 What remains unchanged

4.3.1 General

The test methods and classification systems that were described for the physical, mechanical and chemical testing have remained unchanged other than the updating of the test methods themselves (e.g. ISO 6530, ISO 6529 during their standard revision processes). Certain tests are optional whereas others are required ([4.5](#) for more details on required tests).

Maintain a link with the current Type 1 through Type 6 garments via the same garment test system, although move away from this nomenclature to a more modular approach.

4.3.2 Unchanged from old Type 1 through 6 system

The current fabric and garment requirements are based on the same test methods found in the previous ISO 16602. Nevertheless, the classification system was updated based on latest version EN 14325, amending requirements based on visual inspection and clarifying the test methods and expression of results (including uncertainty of measurement).

All existing chemical risks are covered using the same test methods as before. Chemical ingress requirements have been sharpened to include:

- including both the cumulative and breakthrough time permeation;
- for partial body where no garment test is performed, seam penetration test is required;
- marking requires additional information for the end user.

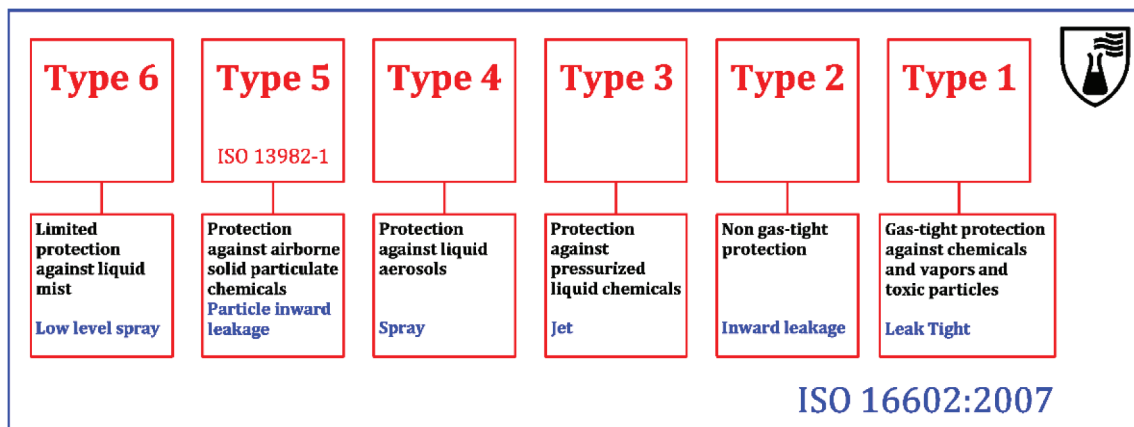
All products known today are covered, while opening with the modular approach new designs to incorporate user needs, including emergency team (ET) or other potential requirements.

4.3.3 Types 1 through 6 and related international standards

Below, a number of figures will try to depict the differences between the various CPC standard at ISO, CEN and internationally.

The Type 1 through Type 6 garments were originally created to differentiate garment performances through a specific garment test(s): These “Type” garments could not be placed in an intrinsic hierarchy, although the fabric barrier performances (intrinsic properties of the fabric and seams) created an indirect hierarchy in certain cases (see [Figure 2](#)). For example, Type 1 is in general more protective than Type 2, Type 5 and Type 6; and Type 3 is, in general, more protective than Type 4 and Type 6. Although the Type 1-Type 6 system has been superseded by the modular approach, a correlation table is available in [Table 2](#). As can be seen in [Figure 1](#), there are currently three additional standards under ISO that are chemical protective garments:

- ISO 27065 which details protection requirements against pesticides for agricultural workers. This standard will remain a standalone standard.
- ISO 17723-1 which is equivalent to the old ISO 16602 to Type 1 for Emergency Team (ET) with optional CBRN protection (covered in ISO sub-committee ISO/TC94/SC14 on firefighter PPE). This standard will remain standalone standard, but with an equivalence under the new ISO 16602 series.
- ISO 8194 which details protection requirements against radioactive contamination (covered in ISO sub-committee ISO/TC85/SC2 on Nuclear energy). This standard in agreement with ISO/TC85 is being integrated into the new ISO 16602 series.



ISO 27065 – Agricultural garments
 ISO 17723-1 – Type 1 ET
 ISO 8194 – Radiation protection

Figure 2 — ISO CPC standards

In the previous ISO 16602 (and EN equivalents EN 13034, EN 14605, EN 943 series, EN 1073 series, and EN 14325)(see [Figure 3](#)), there is a link between the garment tests, the Type (Type 1 through Type 6), and the physical and chemical requirements of materials and components. This revision of the ISO 16602 series (intended to be an EN ISO standard), applies a modular approach that breaks that link. Nevertheless, the existing test methods from ISO 16602 and in other European standards (e.g EN 14325:2018) have been used as the basis for this revision.

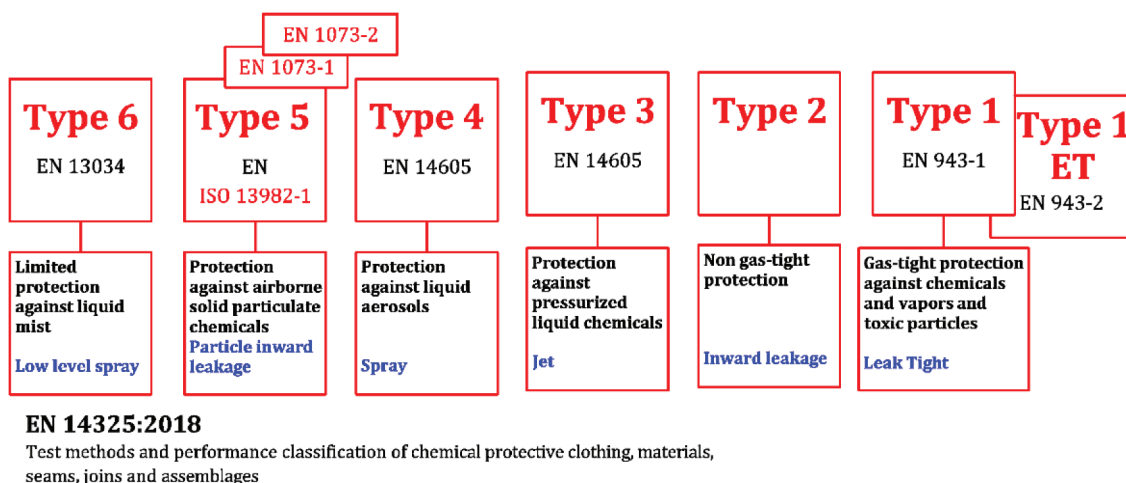


Figure 3 — Current EN standards relating to protective chemical clothing

Finally, the US does not currently have a chemical protective garment standard. When trying to correlate the ISO / CEN CPC system to the US system (including OSHA legislative definitions), one needs to remember that the higher NPFA requirements are geared to a higher level type garment versus what is common in Europe (Figure 4).

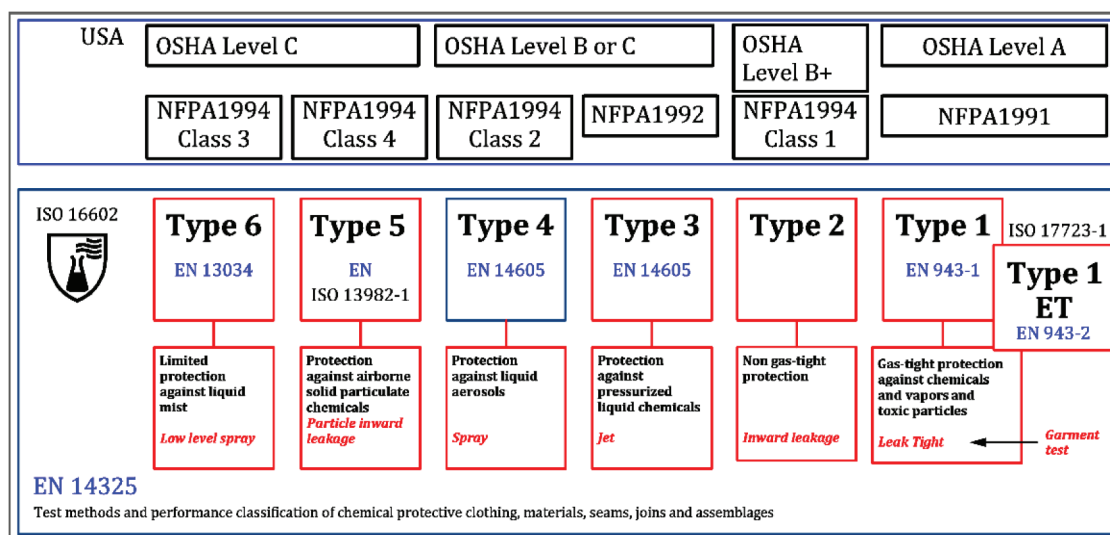


Figure 4 — General comparison of EN/ISO and US standards

4.4 Changes in the new modular approach

- More risk/hazard than product driven for the end-user to choose the right product for the hazard
- Look beyond ISO to see what is available (learnings from EU standards and certification), inclusion of ISO 17491-5 as manikin garment test. Look at ISO 17723-1 the emergency teams CPC. Look at glove and permeation requirements around the world to adapt the chemical requirements.
- Abrasion – abrasive material has been replaced, but requirement remain unchanged to make the test more reproducible.
- Cleaning and decontamination have been addressed
- Revised and improved practical performance testing

- Clearer requirement for partial body (including definitions in ISO/DIS 16602-1)
- Improved marking and Manufacturer's instructions (IFU) to help end-users (including artwork)
 - IFU to clearly indicate how garments are tested
 - Chemical(s) protected against (coherency between permeation and penetration testing)
 - Illustration of what is protected – highlight relevant body parts
- Practical performance testing improvements – similar minimum requirements, but also extended the number of the tests to include more task-specific practical performance tests
- Include in series a CPC SUCAM

4.5 Structure of modular approach standard

The new ISO 16602 series is split into 6 parts to make it easier in the future to revise this series. The overall requirements are found in ISO/DIS 16602-1, with the design requirements in ISO/DIS 16602-4. ISO/DIS 16602-2, -3 and -5 are mostly testing requirements respectively for physical parameter, chemical requirements and finally, practical performance tests and garment testing.

Most of the description of the requirements can be found in the following sections in this document:

- [4.5](#) General overall requirements
- [5.5.5.2](#) Physical requirements
- [5.2.2](#) Chemical ingress requirements
- [5.5.4](#) Particulate testing
- [5.5.6](#) Garment tests and practical performance tests

ISO/DIS 16602-1 covers general requirements and creates a coherent set of requirements with the other parts. It covers (in bracket the clauses of this document that describe these requirements):

- Pre-treatment
- Physical attributes (see [5.5.5](#))
- Chemical attributes (see [5.2.2](#), [5.5.3](#))
- Garment design (full/partial body) ([5.5.1.2](#), [5.5.6.3](#))
- Practical performance and garment testing ([5.5.6.2](#), [5.5.6.4](#)-5.5.6.6, [5.5.4](#))
- Decontamination ([7.4](#))
- Non-chemical additional options (not necessarily covered by the ISO 16602 series, such as high visibility, biological protection, etc. These are separate standards on their own and this document does not supersede these respective standards) ([5.5.1.5](#))
- Incompatibilities
- Marking & labelling ([5.6](#))
- Manufacturer's information (IFU) ([6.3](#))

NOTE This document does not replace or substitute the text and requirements of ISO/DIS 16602-1 through ISO/DIS 16602-5.

ISO/DIS 16602-2 covers the physical properties, while ISO/DIS 16602-3 covers the chemical barrier requirements. ISO/DIS 16602-4 specifies at design requirements from the garment to visor/facemask,

gloves, footwear, air (non and breathing air), etc. ISO/DIS 16602-5 covers the practical performance tests and the garments test(s), including how the garment test(s) shall be performed.

[Table 1](#) links the requirements of garment design to the chemical ingress and the garment testing.

Table 1 — Required garment design and chemical ingress test methods (see ISO/DIS 16602-1)

Garment design (ISO/DIS 16602-4)	Garment test method (ISO/DIS 16602-5)	Partial body	Chemical ingress test Method			
			Permeation resistance including seams, joins and assemblages (ISO 6529)	Resistance to penetration by liquid under pressure including seams (ISO 13994)	Particulate penetration resistance (ISO/DIS 16602-5, Annex C)	Liquid penetration / repellency resistance (ISO 6530)
Vapour/gas resistant design	ISO 17491-1	NA	√	0	0	0
Inward leakage and particulate resistant design	ISO/DIS 16602-5 Annex C	0	0	0	√	0
Liquid jet resistant design	ISO 17491-3	0	√	0	0	0
Liquid spray resistant design	ISO 17491-4 Method B (high level)	0	√	0	0	0
Liquid mist resistant design	ISO 17491-4 Method A (low level)	0	0	0	0	√
Manikin liquid spray resistant design	ISO 17491-5	0	0	√	0	0
NOTE: √ means required; 0 means optional, NA means Not applicable						

As a minimum, a garment shall meet the garment design requirements of ISO/DIS 16602-4, the corresponding garment test of ISO/DIS 16602-5, the minimum chemical ingress requirements in ISO/DIS 16602-3, and the minimum physical properties described in ISO/DIS 16602-1, clause 5 and tested according to ISO/DIS 16602-2.

NOTE For example, a gas tight suit would need to at least meet the design requirement of the pressure tight design, meet the garment test of ISO 17491-1 according to ISO/DIS 16602-5, and the fabrics, seams, etc. need to meet at least the minimum requirement of ISO/DIS 16602-3 for permeation (Barrier class A).

Chemical protective garment and materials need to fulfil the minimum requirements as defined in [Table 1](#). Some of these designs allow for partial body (PB) protection as defined in ISO/DIS 16602-1 (7.3), corresponding design requirements of ISO/DIS 16602-4 and potentially meet the respective garment test of ISO/DIS 16602-5, and the fabrics, seams, etc. need to meet at least the minimum corresponding requirements of ISO/DIS 16602-3.

If a garment claims to meet the requirements of more than one garment design, it needs to meet the full requirements of each garment design respectively.

For example, if a garment is intended to meet both Liquid spray resistant design and Liquid mist resistant design, it then is required to pass both garment design tests. In addition, it is also required to pass both penetration and permeation tests for the same chemical(s).

ISO/DIS 16602-6:2025(en)

The requirements for partial body protection, when permitted, are the same as for full body protection. The marking is different as it will have the letters PB added to the symbols as indicated in ISO/DIS 16602-1, 7.3.2 and in [Annex B](#) (see summary [Table 2](#) below).

Table 2 — Summary of Full Body and Partial Body testing requirements in 7.1-7.3 of ISO/DIS 16602-1

#	Clause	Protection designation	Garment description	Testing requirements	Marking and additional information
1	7.2.2 §1	Full body	Full body garment	Full garment test performed	All marking including garment tests.
2	7.2.2 §2	Full body	Assembly of garments covering the full body	A combination of garments that cover the full body is tested together and sold together	All marking including garment tests. The IFU shall describe that all the parts of the ensemble are required to be worn together. PB marking is not required provided the garments are sold together in a single packaging unit. (See 7.3.2(3) III if sold separately)
3	7.2.2 §3	Full body	Full body garment with areas of different levels of protection	A full garment test needs to be passed for the whole garment.	PB marking is not required provided that the physical and chemical performance levels are only claimed to the lower performing area of the garment (these may be different depending on property). All marking including garment tests. The IFU shall include any risks related to the wearing of PB garments. PB marking may be provided if both the higher and lower performing areas of the garment are marked separately - see 7.3.2(3) III for detail.
4	7.3.2 (1)	Stand-alone PB	The protection is defined by material	No full garment design test, but seam tests only	Marking: PB and the material performance only, no garment test marking. The IFU shall include any risks related to the wearing of PB garments, including that these were not tested using any of the garment test.
5	7.3.2 (2)	PB linked to a design		An ensemble of garment items is created for the sole purpose of doing the full garment design test	Marking: PB, the full garment test and design pictogram and the material performance. All marking including garment tests. The IFU shall include any risks related to the wearing of PB garments.

Table 2 (continued)

#	Clause	Protection designation	Garment description	Testing requirements	Marking and additional information
6	7.3.2 (3) I	PB linked to a design		A full body protection garment is tested, the PB garments made with the same material and having identical construction (including but not limited to seams)	Marking: PB, the full garment test(s) and design pictogram and the material performance. All marking including garment tests. The IFU shall include any risks related to the wearing of PB garments.
7	7.3.2 (3) II, (see 7.2.2 §3)	PB linked to a design	Full body garment with two different levels of protection marked separately as PB (e.g. overall with areas of different protection)	Full garment design tests required for both levels of protection shall be passed for the full garment either 7.3.2(1) or 7.3.2(2).	Marking: PB shall be provided where both the higher and lower performing areas of the garment are marked separately from a chemical protection perspective. Mechanicals properties can only be claimed to the level of the lower performing material. The IFU shall provide performance information for the lower and higher level of protection if this is indicated as the protected area(s) of the body. All marking including garment tests. The IFU shall include any risks related to the wearing of PB garments.
8	7.3.2 (3) III	PB	Assembly of garments covering the full body	A combination of garments that cover the full body is tested together but sold separately	PB marking is required as the garments are not sold together. All marking including garment tests. The IFU shall include any risks related to the wearing of PB garments. See 7.2.2 §2, if sold together as one package.

In addition, chemical protective clothing materials shall be tested and classified according to the physical requirements of ISO/DIS 16602-2, unless specified differently in ISO/DIS 16602-4. ISO/DIS 16602-1 also defines the core physical requirement (see [Table 3](#)); the garment needs to meet at least class 1 in each case to meet the requirement of the standard.

Table 3 — Core physical requirements

Core Physical Requirements
Abrasion resistance
Flex cracking resistance
Tear resistance
Tensile strength
Puncture resistance
Seam strength

The garment physical average properties shall also be marked with the hammer symbol in see [5.6.4](#) (or ISO/DIS 16602-1 Annex B.3). This marking will be used in conjunction with a number in the upper right-hand corner of the symbol that provides the average of the core physical requirements as defined in ISO/DIS 16602-1 and tested and classified according to ISO/DIS 16602-2. This number will be rounded down to the corresponding integer. The individual results of the mechanical tests shall be mentioned in the IFU (see [6.3.3](#)).

4.6 Correlation of Type 1 through Type 6 (and other existing standards covered) and the new modular approach

For the correlation of the ISO 16602 series with the old ISO 16602 Type 1 through Type 6 can be found in [Table 4](#). More details are provided [5.6](#) and [6.3](#) of this document on marking and information from manufacturers.

This table also links other product standards that have not been incorporated in the revision or are very similar to them (see [4.3.3](#)).

The correlation for ISO 27065 is not possible as the chemical ingress test methods are different.

The Type 1 through Type 6 garments were originally created to differentiate garment performances through a specific garment test(s): These Type garments could not be placed in an intrinsic hierarchy, although the fabric barrier performances (intrinsic properties of the fabric and often the seam construction used in each case) created an indirect hierarchy in certain cases. For example, Type 1 is in general more protective than Type 2, Type 5 and Type 6; similarly, Type 3 is, in general, more protective than Type 4 and Type 6.

All the requirement of ISO 8194 can be met using the ISO 16602 series depending on the chosen requirements (see [Table 4](#) for correlation). ISO 8194 did not set clear minimum requirements for mechanical properties, while for leak tightness different levels of performance were included (see [Table 7](#)).

Table 4 — Correlation table of the Type 1-6 of old ISO 16602 and new ISO 16602 series

Old ISO 16602* & Marking	Physical Properties and Class							Garment test		Chemical Properties		ISO 16602 series marking		
	Abrasion resistance	Flex cracking / Cold Flex resistance	Tear resistance	Tensile strength	Puncture resistance	Resistance to ignition	Seam strength	Gas tightness	Particulate resistance	Liquid resistance	Permeation resistance	Marking (minimum requirement)**		
														
EN 13034 / ISO 16602 Type 6	1	0/0	1	1	1	-	1	-	-	Low Spray	-	  	  	Liquid mist resistant
ISO 13982-1 Type 5	1	1/0	1	1	1	-	1	-	Yes	-	-	  	  	Inward leakage and particulate resistant
EN 1073-1	1	1/0	1	-	2	-	1	-	Yes	-	-	  	  	
EN 1073-2	1	-	1	-	2	yes	1	-	-	-	-	  	  	
EN 14605 / ISO 16602 Type 4	1	1/0	1	1	1	-	1	-	-	High Spray	Class 1, min. 1 chemical	  	  	Liquid spray re-sistant
EN 14605 / ISO 16602 Type 3	1	1/0	1	1	1	-	1	-	-	Jet	Class 1, min. 1 chemical	  	  	Liquid jet resistant
ISO 16602 Type 2	1	1/0	1	1	1	yes	1	-	-	-	Class 3, min. 1 chemical	  	  	Inward leakage
* Old ISO 16602:2007 sets minimum requirement for each of the type, these are reflected in this table and in the conversion to the ISO/DIS 16602-1 marking requirements. These include marking for the garment test, physical properties and chemical ingress properties of the garment (see 5.6 for more detail).														
** the pictograms in the ISO 16602 series, provide information on the minimum requirements for the critical physical properties (see Table 2). Therefore a 1 would always be next to the mechanical symbol. For the inward leakage and particulate protection, the chemical symbol can in ISO 16602 series have all “x”’s next to it as there is no liquid chemical ingress requirement. In addition, if a garment has permeation requirements, it may display “x” for other chemical ingress requirements as they are not required.														

* Old ISO 16602:2007 sets minimum requirement for each of the type, these are reflected in this table and in the conversion to the ISO/DIS 16602-1 marking requirements. These include marking for the garment test, physical properties and chemical ingress properties of the garment (see 5.6 for more detail).

** the pictograms in the ISO 16602 series, provide information on the minimum requirements for the critical physical properties (see Table 2). Therefore a 1 would always be next to the mechanical symbol. For the inward leakage and particulate protection, the chemical symbol can in ISO 16602 series have all "x"s next to it as there is no liquid chemical ingress requirement. In addition, if a garment has permeation requirements, it may display "x" for other chemical ingress requirements as they are not required.

Table 4 (continued)

Old ISO 16602* & Marking 	Physical Properties and Class							Garment test		Chemical Properties		ISO 16602 series marking	Design Name
	Abrasion resistance	Flex cracking / Cold Flex cracking	Tear resistance	Tensile strength	Puncture resistance	Resistance to ignition	Seam strength	Gas tightness	Particulate resistance	Liquid resistance	Permeation resistance	Marking (minimum requirement)**	
EN 943-1 / ISO 16602 Type 1	3	1/2	3	3	2	-	5	Yes	If not gas	-	Class 3, min. 1 chemical	 ⁶  ²  ²  ²  ^{AA}  ^x  ^x  ^x	Pressure tight design
EN 943-2 / ISO 17723-1 Type 1 ET	4	1/2	3	4	2	yes	5	Yes	If not gas	-	> Class 2 with 15 chemicals, max. class 1 for 1 chemical	 ⁶  ²  ²  ³  ^{ET}  ^x ^x ^x	Pressure tight design
ISO 8194	-	-	-	-	-	-	-	-	Yes	-	-	 ⁶  ¹  ^{xx}  ^x ^x ^x	Inward leakage and particulate resistant
* Old ISO 16602:2007 sets minimum requirement for each of the type, these are reflected in this table and in the conversion to the ISO/DIS 16602-1 marking requirements. These include marking for the garment test, physical properties and chemical ingress properties of the garment (see 5.6 for more detail).													
** the pictograms in the ISO 16602 series, provide information on the minimum requirements for the critical physical properties (see Table 2). Therefore a 1 would always be next to the mechanical symbol. For the inward leakage and particulate protection, the chemical symbol can in ISO 16602 series have all “x”s next to it as there is no liquid chemical ingress requirement. In addition, If a garment has permeation requirements, it may display “x” for other chemical ingress requirements as they are not required.													

* Old ISO 16602:2007 sets minimum requirement for each of the type, these are reflected in this table and in the conversion to the ISO/DIS 16602-1 marking requirements. These include marking for the garment test, physical properties and chemical ingress properties of the garment (see 5.6 for more detail).

** the pictograms in the ISO 16602 series, provide information on the minimum requirements for the critical physical properties (see Table 2). Therefore a 1 would always be next to the mechanical symbol. For the inward leakage and particulate protection, the chemical symbol can in ISO 16602 series have all "x"s next to it as there is no liquid chemical ingress requirement. In addition, if a garment has permeation requirements, it may display "x" for other chemical ingress requirements as they are not required.

4.7 Correlation with ISO 8194

ISO 8194 is not covered in the [Table 1](#) directly, but would be similar to the EN 1073 series and potentially to ISO 13982-1 (see inward leakage and particulate resistant design). Although the ISO 8194 refers to radiation protection, in reality the protection is against radioactive particulates and not against ionizing radiation using either ventilated-pressurized garments or unventilated-unpressurized garments. These are covered by ISO/DIS 16602-4 (4.3). The ISO 8194 standard has 4 classes of protective clothing that are ventilated-pressurized clothing with different air exhaust systems.

- Class I: Ventilating-pressurized clothing with a channelled outlet outside the shield
 - the exhaust air is channelled and released at a distance from the ambient atmosphere (e.g. an argon atmosphere) so that the composition of the latter is not affected.
- Class II: Ventilating-pressurized clothing with a controlled and channelled outlet
 - the exhaust devices (valves, perforations, particulate and gas filters) are fitted with a channel which directs the exhaust air over a specified distance so as to prevent, by ensuring a fast enough exhaust speed, back-diffusion of pollutants.
- Class III: Ventilating-pressurized clothing with a controlled outlet
 - the air is released through exhaust devices (valves, perforations, particulate and gas filters) into the surrounding atmosphere.
- Class IV: Ventilating-pressurized clothing with an uncontrolled outlet
 - the air escapes freely into the surrounding atmosphere (through belt, sleeves, etc.).

There are no specific classes for the unventilated-unpressurized garments. Other requirements of either a ventilated-pressurized garments or unventilated-unpressurized garments include:

- Minimum storage life of two year based on the manufacturer's recommendations;
- Flammability of materials shall be clearly indicated;
- Field of vision and distortion of vision (angle of vision, minimum optical defects, no misting, impact resistance for rigid headgear, etc.);
- Footwear and gloves do not need to be an integral part of the garment;
- Air supply requirements cover both breathing requirements and those for thermal regulation;
- Emergency devices, in case of breakdown of air supply;
- Maximum noise and pressure in suit levels ;
- Sealing device to minimize the risk of contamination when the wearer is removing the garment

Tritium and radon contamination of garments can be difficult to remove as tritium and radon can change their chemical and physical form following exposure. If decontamination from radioactive materials instructions are provided in the IFU, the ability to decontaminate is to be tested according to the following standards depending on the type of contamination:

- ISO 9271, Decontamination of radioactively contaminated surfaces — Testing of decontamination agents for textiles
- ISO 8690, Measurement of radioactivity — Gamma ray and beta emitting radionuclides — Test method to assess the ease of decontamination of surface materials

All the requirements of ISO 8194 can be met using the ISO 16602 series depending on the chosen requirements (see [Table 4](#) for correlation and [Annex D](#)), but ISO 8194 did not have requirements for the last two bullets above.

5 Selection

5.1 General

The selection of chemical protective clothing (CPC) is a step-by-step approach that starts with a broad risk assessment for a defined work situation. Risk assessment should take into account the use of preventive measures other than the use of CPC and related PPE. The main purpose of the hazard and risk assessment is to identify and then to eliminate or minimise worker exposure to residual hazards and risk. If the chemical risk cannot be adequately reduced by these preventive measures, CPC and related PPE should be specified to protect against the residual risk.

This section will provide several simplified steps to select the appropriate CPC. A detailed analysis of the work environment is essential in making the right choice of the most effective protective clothing that balances protection and comfort while being compliant to the norms and regulations.

To ensure the correct choice and use of CPC by the user, the protective performance of the CPC, its correct use and the limitations to its use should be made clear.

The following should be considered:

- Assessment of the nature of the hazard;
- Assessment of risk;
- Assessment of need of protection;
- Definition of CPC design & material criteria;
- Selection of CPC;
- Conditions of use;
- Workplace legislation;
- Local/national/regional occupational health and safety legislation
- Local/national/regional environmental legislation.

5.2 Understanding the hazards and the remaining risks

5.2.1 Assessment of the nature of the hazard

5.2.1.1 General

To assess the nature of the hazard, it starts with the chemicals and how these are used. This information provides an understanding the route of exposure (dermal, inhalation and/or ingestion). The main focus for the ISO 16602 series is protective garments and therefore the risk of skin and dermal injury.

5.2.1.2 Chemicals

What is the specific chemical risk considering there are many thousands of known chemicals? Is it a gas, vapour, liquid, particulate? Can the chemical change state (e.g. from liquid to vapour)? What are the concentration levels of the chemical(s)? Is the hazardous chemical in pure form or a mixture of several chemicals? Many of the key properties of a specific chemical that are important to CPC selection can be found in the safety data sheet (SDS), such as:

1. Physical properties: vapour density, vapour pressure, flash point, boiling point, melting / freezing point, solubility, state, specific gravity
2. Toxicity: corrosivity, exposure limits, risk phrases.

5.2.1.3 Toxicity

Knowing the toxicity or consequences of short or long-term exposure to the hazard is essential. Data on the garment's fabric, seams, and closure system on penetration and permeation testing can be used alongside known toxicity data to calculate a hypothetical permitted time of exposure (depending on the expected level of exposure) before reaching human toxicity. Toxicity is dependent on the mode of interaction with the human body; some chemicals are more toxic by skin, others by inhalation, and the dose or concentration of the uptake into the body is important. Some chemicals have a short-term effect, others have a long-term effect or more insidious effect on the organism as it is less visible (see [Figure 5](#)).

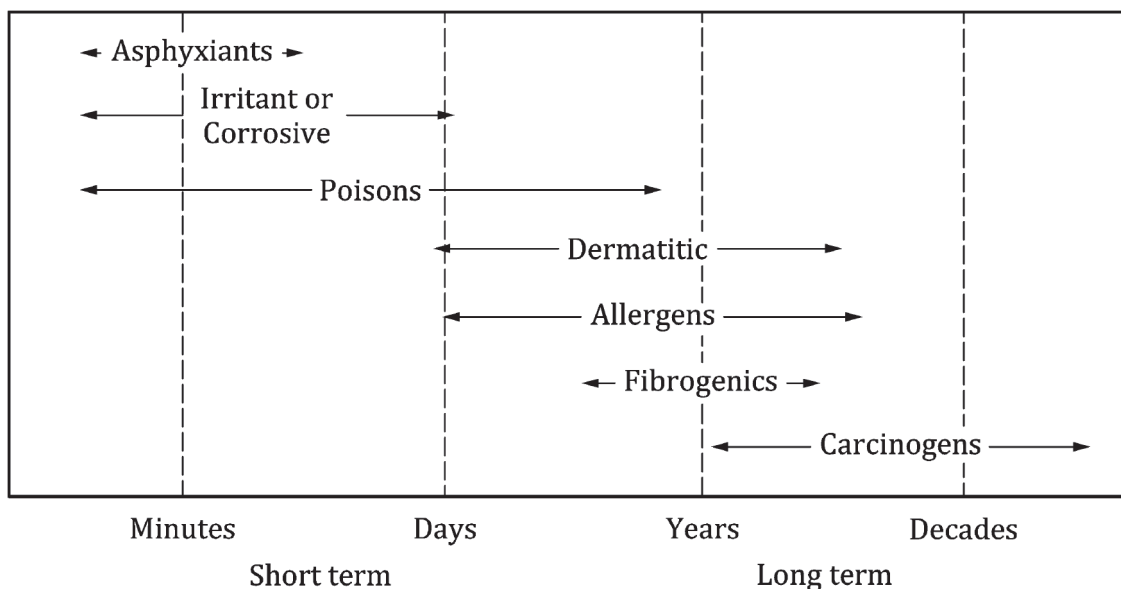


Figure 5 — Short versus long term effect of chemical exposure

The following considerations should be taken into account in assessing the hazardous nature of the chemical. The access route of the chemical to the body: an assessment of the adverse health effects from chemical contact is the most important factor in the determination of the right CPC, with an emphasis on the local effects on the skin (e.g., effects of skin contact such as chemical burns, corrosion, staining, irritation, etc.), and the systemic effects of chemicals that might permeate the skin and enter the blood stream and/or other areas of the body.

1. **Inhalation:** protection is primarily provided through respiratory protection, but CPC is important when hazardous particles and volatile liquids are involved because the CPC can limit cross-contamination. If a respiratory hazardous particles collects on a worker's skin or clothing, those hazardous particles can later transfer to the worker's vehicle or home, thereby bringing a toxic material home unknowingly.
2. **Ingestion:** is not just "eating" the chemical, but also the exposure to dust or particulates that become trapped in mucus on respiratory tract walls, for example.
3. **Skin Contact:** Skin damage when in contact with corrosive substances or allergens may cause irritation/inflammation leading to secondary microbial/fungal attack. CPC can also protect from chemical absorption through the skin into the blood stream, as blood flows close to the skin.
 - by skin damage: corrosive chemicals destroy the unprotected skin and flesh by direct attack. Other chemicals such as petrol, paint, solvents and cleaning fluids will dissolve the skin's natural oils, leaving the skin dry and liable to form painful cracks or to develop dermatitis and/or sensitization. Such damage to the skin, together with any existent cuts or grazes, provides entry points for foreign substances and thus increases the risk of harm to the body.
 - by absorption through the skin: chemicals can pass through the skin and be carried in the bloodstream resulting in injury to other parts of the body that are remote from the initial point of contact. Rapid absorption by the skin is a very important issue to consider. Poisoning due to phenol and related

compounds can be quoted as an example where skin exposure and subsequent absorption is of particular concern. A large contact surface area on the skin provides a significant route of chemical entry.

The body's tolerance and rate of elimination of a foreign substance varies from person to person, and can also vary within the same individual at different times or under different circumstances. The harmful effects will depend roughly on the amount of substance in contact with the skin or absorbed by it. Hence they will be related to the mass of substance to which the body has been exposed, the area of contact, the in-use concentration, and to the frequency and duration of exposure.

Exposure to high doses of a chemical (e.g. by a jet of liquid or a copious splash), should be an immediate major concern, besides the risk of exposure through inadvertent ingestion and inhalation. The pattern of skin exposures to substances will vary across the spectra of frequency, duration and concentration. Long term adverse health effects can be linked with low level exposures (small amounts of substances) on a regular basis. Because acute and chronic exposures can result in very different adverse effects on human health, both need to be considered in the overall risk assessment.

Mixtures (multi-components of chemicals) can increase the risk from exposure as they may have synergistic effects (e.g. the rate of absorption through the skin can be higher if a chemical is used in conjunction with some solvents), or the toxicity may be increased. The effects of mixtures (whether or not they include solvents) can be greater than those of their constituent parts.

5.2.1.4 Work environment

Next to the hazards, understanding the specific work location is important to understand the exposure(s), and the breadth of the exposure. The exposure is defined by duration (e.g. seconds, minutes, hours), frequency (e.g. continual, intermittent or accidental contact), the amount of the exposure, , but also the force /pressure (e.g. mist, shower, jet) and the direction of the exposure (to which part of the body).

To make the right selection of future PPE, understanding the historical information on exposure data and incident records can help to define or refine the PPE needs. Finally, before PPE is chosen, all risk mitigation and engineering and administrative controls should be applied and validated.

Most important are still the human factors such as:

- how many workers may be affected;
- work rate, work load, the temperature and humidity of the work area, age and degree of fitness of workers as these are all parameters which determine the length of time before building up of excessive heat stress;
- the need for adequate vision and mobility;
- potential need for decontamination (potential contamination during decontamination, other persons involved or due to decontamination shower).

These factors are used to decide the chemical barrier needed, in addition to information about the chemicals and their toxicity.

5.2.1.5 Protection to consider for hazards other than chemical hazards

In addition to the toxicity of the chemicals, other factors should be taken into account that can be related to overall risk. Here are a couple of examples:

1. Rough terrain or workplace with a risk of puncture, cuts or abrasion. An excellent barrier is only worthwhile if it withstands working conditions and remains intact for the duration of the task.
2. The use of a volatile flammable substance(s) may define a need for anti-static properties to avoid a spark igniting the substance(s) or creating a chemical explosion.

Explosive atmospheres occur when flammable substances are mixed with air; this includes substances of different physical states from gases, mist, vapours to dust. The amount needed to create an explosive atmosphere is substance-specific. If the air is mixed with a substance to a critical concentration , a