PD ISO/TR 21808:2024

BSI Standards Publication

Best practices on the selection and use of personal protective equipment (PPE) designed to provide protection for firefighters

Documents
Document Sharing Hub

Full document details: PD ISO/TR 21808:2024

National foreword

This Published Document is the UK implementation of ISO/TR 21808:2024. It supersedes PD ISO/TR 21808:2021, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PH/14, Firefighters' personal protective equipment.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

This publication is not to be regarded as a British Standard.

© The British Standards Institution 2024
Published by BSI Standards Limited 2024

ISBN 978 0 539 28290 0

ICS 13.340.10

Compliance with a Published Document cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 January 2024.

Amendments/corrigenda issued since publication

Date	Text affected

Documents
Document Sharing Hub

Full document details: PD ISO/TR 21808:2024

Technical Report

ISO/TR 21808

Third edition
2024-01

Best practices on the selection and use of personal protective equipment (PPE) designed to provide protection for firefighters

Meilleures pratiques sur la sélection, l'utilisation, le soin et l'entretien des équipements de protection individuelle (PPE) conçus pour pourvoir à la protection des pompiers

Reference number
ISO/TR 21808:2024(en)

© ISO 2024

Documents
Document Sharing Hub

Full document details: PD ISO/TR 21808:2024

COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Documents
Document Sharing Hub

Full document details: PD ISO/TR 21808:2024

Contents

Page

Foreword ... **v**
Introduction ... **vi**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 General ... **3**
4.1 Responsibility of procedure development ... 3
4.2 Ergonomics ... 3
4.3 Compatibility ... 4
4.3.1 General ... 4
4.3.2 Physical compatibility ... 5
4.3.3 Thermal protection compatibility ... 5
4.3.4 Chemical protection compatibility ... 6
5 Selection ... **6**
5.1 General ... 6
5.2 Selection for PPE procurement ... 6
5.2.1 Identification of activity scope ... 6
5.2.2 Risk assessment for procurement ... 7
5.2.3 Identification of minimum protection levels that fit to the scope of activities ... 7
5.2.4 Collect information on PPE that can be procured ... 8
5.2.5 Collection of information on compatibility ... 8
5.3 Evaluation by trial fitting for selection ... 9
5.4 Provision of information for purchase by PPE manufacturers ... 10
6 Batch testing ... **10**
6.1 General ... 10
6.2 Product certification ... 10
7 Use ... **10**
7.1 Start using PPE ... 10
7.1.1 Training before use ... 10
7.1.2 Record keeping ... 11
7.2 Use in duty ... 11
7.2.1 Routine inspection ... 11
7.2.2 Risk assessment for the scope of activities at the time of mobilization ... 12
7.2.3 Identification of protection required during the activity ... 12
7.2.4 Selection of PPE ... 12
7.2.5 Other consideration ... 12
7.3 Care and maintenance of PPE after use ... 12
7.4 Record of use ... 12
7.5 Storage ... 13
8 Manufacturer information ... **13**
8.1 General ... 13
8.2 Manufacturer information for selection and use ... 14
Annex A (informative) **Risk assessment** ... **15**
Annex B (informative) **Practical performance tests** ... **24**
Annex C (informative) **Examples of relationship between type of activity, the heat/flame hazard linked to the activity and clothing to be chosen for protection based on the existing product standards** ... **31**
Annex D (informative) **Performance levels relating to clothing designed to provide protection from heat and flame** ... **34**

© ISO 2024 – All rights reserved

AVA Documents
Document Sharing Hub

Full document details: PD ISO/TR 21808:2024

Annex E (informative) **Description of burn injury risks** **54**

Annex F (informative) **Best practices on some of the items that may be addressed in labelling, subject to the required use of the PPE** **56**

Bibliography **57**

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub

Full document details: PD ISO/TR 21808:2024

Foreword

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

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

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

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

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

This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective equipment*, Subcommittee SC 14, *Firefighters personal equipment*.

This third edition cancels and replaces the second edition (ISO/TR 21808:2021), which has been technically revised and completely rewritten.

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.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub

Full document details: PD ISO/TR 21808:2024

Introduction

The information in this document has been produced to assist firefighters, fire services and purchasers (or the person who advises the employer) in making the necessary decisions regarding the selection, use, care and maintenance of PPE for firefighters.

The purpose of this document is to establish a best practices document for PPE with the goal to evaluate and reduce the hazards and potential health risks associated with firefighting. This selection and use, guideline provides basic answers, criteria, and options for the fire service personnel that are selecting or using PPE through its life cycle with respect to protection it provides related to heat and flame or damaged PPE.

The main topics that the fire service needs to consider are highlighted in this document. This best practices document goes through the various steps and considerations such as risk assessment, compatibility, testing, information to be provided with the PPE so that the right management choices can be made for each fire service. Many paragraphs of the document contain bullet-lists as thought provokers or options that may need to be considered. The annexes provide additional information that if included, would make the main body of this document too complicated to read, but are necessary to describe hazards and risks, the value of the test methods for the end user, for example Annex E and Annex F provide importance guidance information.

The selection of appropriate PPE for heat and flame are based on your own risk assessment and procurement documents.

In the past 10 years, the world has experienced a rise in temperature due to climate change. As a result of this temperature rising, firefighters are facing the danger of heat stress, heat stroke and other fatal heat sicknesses. Many fire departments have begun considering heat stress management, taking into account the rising temperature and hot and humid climates, and have established new firefighting strategies, including tactics, training, equipment, and organization. Although some countries are placing more emphasis on heat and flame protection, the increased frequency and danger of heat stress and heat stroke incidents are estimated to result from the heavier and thicker PPE required. The risk of these newly generated risks, including dangerous heat stress/stroke, can not be underestimated. Risk assessments of firefighters' PPE(s) are to include the risks associated with heavier and thicker PPE(s) under various environmental conditions.

The compatibility in this document focused mainly on the physical compatibility between each element of PPE and the documentation.

This document is not intended for cleaning, inspection or repair of firefighter PPE. ISO 23616 is used for cleaning, inspection and repair of firefighters personal protective equipment (PPE).

Currently, TC 94/WG1 works to establish a parent standard for the development of this document. In case of the parent standard publication, consider the consistency of this document.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub

Full document details: PD ISO/TR 21808:2024

Best practices on the selection and use of personal protective equipment (PPE) designed to provide protection for firefighters

1 Scope

This document sets out the best practices for the selection and use of PPE designed to provide protection for firefighters while carrying out their duties.

The PPE covered in this document is intended for firefighting personnel exposed to risks associated with but not necessarily limited to the following activities:

— structural firefighting;

— wildland firefighting;

— incidents involving hazardous materials;

— incidents involving motor vehicle;

— urban search and rescue.

The purpose of this document is to highlight the main areas that a fire service needs to consider when providing PPE to its members. This document is a supplement to the information provided in the PPE standards or used in conjunction with them. Most paragraphs of the document contain bullet lists, these lists are provided for guidance only and they are not exhaustive.

Cleaning, inspection and repair of firefighters' personal protective equipment (including care and maintenance) are covered by ISO 23616.

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/TR 19591, *Personal protective equipment for firefighters — Standard terms and definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TR 19591 and the following apply.

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

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

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

3.1
base-layer garment
the first layer of a textile structure that is in direct contact with the skin (i.e. briefs, t-shirts, bras, socks)

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: PD ISO/TR 21808:2024

3.2
care
processes and procedures for cleaning, decontamination, and storage of protective clothing and equipment

[SOURCE: ISO/TR 19591:2018, 3.30]

3.3
cleaning
act of removing soils and contaminants from protective clothing and equipment by a mechanical, chemical, thermal, or combined processes

[SOURCE: ISO/TR 19591:2018, 3.45]

Note 1 to entry: See ISO 23616 for further information

3.4
compatibility
capability of two or more items or components of personal protective equipment to exist or function in the same system without modification, adaption or mutual interference with respect to interfaces and performance

3.5
contaminant
undesirable solid, liquid, gaseous or particulate hazardous substance such as

a) products of combustion (e.g. soot),

b) body fluids,

c) infectious micro-organisms, and

d) chemicals (e.g. asbestos or respirable fibres, flammable, corrosive, carcinogenic, mutagenic, toxic or sensitizing substances)

Note 1 to entry: Same definition with ISO 23616

3.6
coverall
one-piece garment that completely covers the wearer's torso, together with arms, and legs, excluding the head, hands, and feet

3.7
deterioration
downgrading of the effectiveness or physical characteristics of PPE component due to use, *care* (3.2), maintenance or storage conditions

3.8
ensemble
combination or assembly of multiple items that are individually compliant with a standard that provide protection to the head, upper torso including arms and hands and the lower torso including feet

[SOURCE: ISO 11999-1:2015, 3.24]

3.9
ergonomics
scientific discipline concerned with the understanding of interactions among human and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance

[SOURCE: ISO 26800:2011, 2.2, modified — The note has been omitted.]

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: PD ISO/TR 21808:2024

3.10
flame resistance
property of a material whereby combustion is prevented, terminated, or inhibited following the application of a source of ignition, with or without subsequent removal of the ignition source

[SOURCE: ISO/TR 19591:2018, 3.114]

Note 1 to entry: Usually flame resistance materials for fire fighter are Index III of ISO 14116, but flame resistance is denoted by meeting one of the Index of ISO 14416 using the flame spread test method ISO 15025.

3.11
maintenance
the act of preserving PPE from loss or *deterioration* (3.7) and includes procedures for inspection, repair and ultimate removal from service, see ISO 23616 for further information

Note 1 to entry: See ISO 23616 for further information

3.12
risk
probability of a specific undesired event (e.g. injury) occurring so that a hazard is realized

[SOURCE: ISO/TR 11610:2004, 3.205]

3.13
risk assessment
overall process that identifies hazards, estimates the potential severity of injury or damage to health, estimates the likelihood of occurrence of injury or danger to health

3.14
selection
process determining/assessing what PPE is necessary for protection of fire and emergency services response personnel from an anticipated specific hazard or other activity, the procurement of the appropriate PPE, and the choice of the proper PPE for a specific hazard or activity at an emergency incident

3.15
use
application of PPE including its limitations

4 General

4.1 Responsibility of procedure development

Fire services develop procedures for selection and use (of SUCAM) for firefighters' PPE.

NOTE 1 ISO 23616 is a companion to this document which describes detail requirement of cleaning, inspection, and repair.

NOTE 2 ISO/TS 16975-1 is also a companion to this document which describes SUCAM of RPD.

NOTE 3 ISO/TR 18690 is an additional companion to this document which describes SUCAM of occupational footwear and other personal protective equipment offering foot and leg protection.

4.2 Ergonomics

Ergonomics for firefighting organizations is a matter of ergonomic approach that firefighters are to consider when conducting activities, and the main purpose is to reduce the burden on humans.

The following items are to be taken into consideration.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: PD ISO/TR 21808:2024

The firefighting organization are to evaluate the compatibility and ergonomics of PPE by practical performance tests. In addition, the wearers are to try on and evaluate as necessary. Testing is to be performed by firefighting organizations, manufacturers or other competent organization.

Practical performance tests are conducted in accordance with ISO/TS 20141, Annex B and other applicable standards.

When conducting trial fitting by the wearer, the following items are considered:

— ease and time required for donning and doffing;

— ease of adjustment and adjustable range;

— comfort and weight tolerance;

— compatibility with other PPE to be used at the same time;

— whether or not all the expected tasks can be carried out without problems;

— protection against all postures during the work;

— identification of risks associated with attaching accessories to PPE.

NOTE Consider the location (e.g. in high risk areas) and material (e.g. flame retardant) of the accessories.

4.3 Compatibility

4.3.1 General

Compatibility is the capability of two or more items or components of personal protective equipment to exist or function in the same system without modification, adaption or mutual interference with respect to interfaces and performance. ISO/TS 20141 provides general information of Compatibility. This document refers to ISO/TS 20141 for basic references and understandings of compatibility. In some specific cases specified for ER purpose, following information is provided.

This table shows necessity of consideration about compatibility between PPE combinations. For new equipment, there are cases where it does not apply to the classification of this table, so careful attention is paid to the compatibility with related equipment.

Table 1 below shows the interactivity with the various parts of PPE, with in addition underwear.

Table 1 — Compatibility of PPE

Compatibility with	Helmet	Fire hood	Eye protection	Hearing protection	RPD	Neck protection	Clothing	Base layer garment	Over garment	Gloves	Foot protection	Fall protection	Others
Helmet		X	X	X	X	X	X	X	X			X	X
Fire hood	X		X	X	X	X	X	X	X				X
Eye protection	X	X		X		X	X		X				X
Hearing protection	X	X	X		X	X	X		X				X
RPD	X	X		X		X	X	X	X	X		X	X
Neck protection	X	X	X	X	X		X	X	X			X	X
Clothing	X	X	X	X	X	X		X	X	X	X	X	X
Base layer garment	X	X			X	X	X		X	X	X	X	X

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: PD ISO/TR 21808:2024

Table 1 *(continued)*

Compatibility with	Helmet	Fire hood	Eye protec-tion	Hearing protection	RPD	Neck pro-tection	Clothing	Base layer garment	Over gar-ment	Gloves	Foot protec-tion	Fall protec-tion	Others
Over garment	X	X	X	X	X	X	X	X		X	X	X	X
Gloves	X				X		X	X	X				X
Foot protection							X	X	X				X
Fall protection	X				X	X	X	X	X				X
Others	X	X	X	X	X	X	X	X	X	X	X	X	

NOTE PPE samples which are widely used in the current work field include, but are not limited to the following:

— helmet: fire helmet, safety (mechanical protective and electric shock) helmet;

— fire hood: fire hood for firefighting;

— eye protection: safety glasses, goggle, face shield, RPD type;

— hearing protection: earmuff, ear plug;

— RPD: breathing apparatus, non-powered respirator;

— neck protection: SHIKORO, fire hood, stand collar type apart of clothing;

— clothing: firefighting clothing (structural, wildland), rescue activity clothing (RTC, USER);

— base layer garment: briefs, t-shirts, bras, socks, station uniform, radiation protection (head protector), FR underwear, protective undergarment for cold atmosphere (including foot protection), body cooling device for heat stroke prevention;

— over garment: chemical (biological) protection, radioactive particle protection, mechanical risk protection (elbow guard, knee guard, chaps), including partial protective devices for each hazard;

— gloves: firefighting glove, mechanical risk protection (cut resistance), thermal risk protection (low temperature resistance), chemical (biological) protective glove, including over glove style;

— footwear: chemical (biological) protection, radioactive particle protection, mechanical risk protection, including partial protective devices for each hazard;

— others: protective equipment excluding above group, multi-functional protective equipment.

4.3.2 Physical compatibility

Physical interactions between the various PPE such that the various pieces of PPE don't hinder each others protection properties and reduce/jeopardise the level of protection: In addition, ensuring the overlaps between the various pieces of PPE are sufficient. Ensure the overlaps, freedom of movement and potential hindrance are evaluated using practical performance test movements (see Annex B) in addition to specific ones such as firehoods and gloves that may have specific movements between respectively with respiratory protective device (RPD) or glove dexterity for handling various tools and PPE. For optimum protection garments are selected for having a level of ease, or not too tight fitting (air provides additional layer of protection).

NOTE Guidance for structural firefighters gear can be found in ISO/TS 11999-2.

4.3.3 Thermal protection compatibility

The thermal protective properties of different layers will not have a negative impact on each other, e.g. by reduction of air layers between different items of PPE. Different items of PPE will not increase the thermal

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: PD ISO/TR 21808:2024

physiological impact of the PPE on the wearer. Wearers are aware of the materials of the underclothing when using protective clothing against heat and flame to consider the melting possibility of underwear.

4.3.4 Chemical protection compatibility

The chemical thermal protective properties of the outer layer is critical to providing chemical protection of the fire fighter whether this is for structural clothing or hazardous materials incidents.

Repellency, in garment such as for structural fire fighting, station wear, rescue clothing, needs to be ensured after washing through re-impregnation. If not the garment could absorb or let through chemicals during an incident or cleaning operations. These chemicals (e.g. solvent, oil) may negatively impact the heat and flame protection of the garment, glove, boot, etc.

Wear and tear, and specifically abrasion, can negatively impact the chemical protection of boots, gloves and garments. Helmets may lose their robustness if exposed to chemicals (e.g. solvents, acids).

Chemical protection of the ensemble need to ensure, if one part e.g. gloves protect against a specific chemical, set of chemicals or mixtures, that the other parts (e.g. boots, garments, RPD, visor) provide similar protection.

5 Selection

5.1 General

On the procurement process of PPE, emergency response organizations are to select appropriate PPE based on risk assessment. For this purpose, emergency response organizations are to identify the scope of activity, area of activity and required level of protection, after that, determine appropriate PPE range based on purpose and performance information of PPE. In addition, incidental information on PPE (compatibility information, maintenance service information on CIR, information on SDGs, etc.) is to be examined to determine the optimal PPE within the selected range.

Therefore, emergency response organizations are to develop procedures and plans, etc. for making selections, and implement the PPE procurement process including feedback information to purchasing process summarized in Clause 6.

5.2 Selection for PPE procurement

5.2.1 Identification of activity scope

Identifying the scope of activity is an important factor in determining PPE. Emergency response organization are to identify the purpose of the activities so that firefighters are adequately protected from the risks they face during their activities and that their activities are not limited by the excessive performance of the PPE. It also leads correct understanding of the unprotected areas, which can ensure safe activities. Therefore, in procurement, it is necessary to assume an appropriate scope of activities and perform the following steps.

The scope of activities is to be specified in consideration of the following conditions. However, these are not limited to

— what kind of activity and act in which working area is to be considered,

— what kind of environment is to be considered (geographical climate, environment at the actual place of activity (high working place, closed space, gassed place, densely built area, etc.)), and

— duration of work (how often) at each place.

The scope of activities are to be established appropriately, meeting the objective.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: PD ISO/TR 21808:2024

5.2.2 Risk assessment for procurement

The risk assessment of PPE selection is to include the following points:

— check the working activity scope, area and environment using PPE;

— alternative actions to mitigate risks (e.g. mitigation measures in place prior to applying PPE, consideration of organizational knowledge and other organizations experience, training, and understanding of other management measures);

— geographical location and climate (environmental temperature and conditions);

— list of hazards covered with

  — thermal hazards: high temperature and heat flux (e.g. convection, radiation, mixing of heat types), contact heat, work environment, etc.,

  — thermal hazard: low temperature, working environment and/or temperature of the work object (low temperature, cryogenic temperature, etc.),

  — chemicals: phases of chemicals (e.g. gases, liquids, particulates or solids) and which chemicals or mixtures (e.g. acids/bases, organic solvents, gasoline, chlorine, etc.) , pollutants (e.g. asbestos) and combustion residues (e.g. smoke, particulates, etc.),

  — biological: viral, bacterial, and other biological risks,

  — mechanical: wear, cutting, vibration, flying objects, etc.,

  — other hazards (e.g. noise, electrical hazards, falls, flashes, etc.);

— assessment of the risks arising from the use of PPE (frequency and duration of PPE use);

— risk quantification;

— identification of protection level of PPE and the scope of protection;

— identification of whether the attachment of accessories to protective clothing increases the risk.

EXAMPLE When a badge is attached, a convex part is formed on the surface of the protective suit, and molten splashes (droplets) are easily adhered to.

— Feedback from knowledge of accidents, injuries and causes

NOTE Several risk assessment models are available to determine the level of risk associated with a task. Annex A lists literature on risk assessment.

5.2.3 Identification of minimum protection levels that fit to the scope of activities

The level of protection of PPE for the work to be covered is to be determined, including the following:

— identification of body parts that require protection;

— identification of the protective performance required of PPE (for the target body part);

— confirmation of the existence of standards or test methods that stipulate the necessary protective performance.

Other evaluations, depending on the risks involved in the operation, may be necessary to determine the choice, such as the following evaluation items:

— for each item of PPE, determine the level of protection required (to the relevant part of the body) in relative or absolute terms;

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: PD ISO/TR 21808:2024

— evaluation of whether previously used PPE meets standards (any problems or concerns that may have been caused by these, such as comfort, incidents, or inappropriate use));

— identify compatibility issues and requirements for PPE items.

5.2.4 Collect information on PPE that can be procured

Firefighting organizations are to collect information on the acquisition of PPE, including the following:

— conducting market research to determine available products;

— collecting information from suppliers on PPE performance and handling, including compliance information;

— gathering information on PPE use cases used in similar operations;

— check compatibility between all PPEs used simultaneously.

NOTE The following are examples of other matters that may be necessary to gather information on obtaining PPE:

— education for users at the time of procurement (including education provided by third parties);

— post-procurement services;

— quality assurance system up to delivery;

— requirements for washing, sanitizing and decontamination;

— requirements for inspection and repair;

— requirements and costs for replacement of parts;

— delivery times for standard and special sizes;

— size availability;

— supplier inventory;

— availability of supplier's stock;

— inventory needs of users;

— means of delivery to wearer after procurement;

— safe disposal methods for PPE;

— assessment of the impact of additional labelling, such as company name, on performance.

If multiple PPEs are provided by the firefighting organization for different tasks, the firefighting organization may have the PPE wearer select the PPE after providing appropriate training to the PPE wearer. This selection of PPE by the PPE wearer is based on a risk assessment conducted by the fire service organization or a risk assessment by the PPE wearer based on the conditions of use.

5.2.5 Collection of information on compatibility

When PPE is worn in a task, physical or performance compatibility between multiple PPE and the environment in which they are worn may be an issue.

This means that each item of PPE used may not be compatible with each other or may interfere with each other. When collecting information on the compatibility of items of PPE, the following is considered:

— interfaces: physical interference between the items of PPE is not to limit operation or compromise protection in the intended operation;

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: PD ISO/TR 21808:2024

— performance: all PPE used simultaneously is to have a minimum protective performance for the purpose of protection, and the weakest item of PPE is to provide sufficient level of performance and protection;

— protective performance is reviewed based on the reequipments from a chemical, heat and flame and mechanical perspective;

— conditions of use: not only is the PPE to be operational for the intended operation, but it is to also be usable for the local climatic conditions (humidity, temperature, rain, etc.) as well as the length of time the PPE will be worn and the environment in which the wearer will be using it.

When using PPE containing child devices, the compatibility of the interface between the PPE and external devices is also to be considered.

Fire service organizations are to obtain information on compatibility (e.g. results of practical performance tests as defined in ISO/TS 20141) from their suppliers. Since the information provided by suppliers may not be sufficient for the actual activities and conditions of the activities, fire-fighting organizations are to ensure the compatibility of the above three requirements, including evaluation by trial fitting with the PPE to be used.

5.3 Evaluation by trial fitting for selection

The firefighting organization is to evaluate the compatibility and ergonomics of PPE by practical performance tests. In addition, the wearers are to try on the PPE and evaluate as necessary. Testing is to be performed by firefighting organizations, manufacturers or other competent organization.

Practical performance tests are to be conducted in accordance with ISO/TS 20141, this document and other applicable standards.

When conducting trial fitting by the wearer, the following items are considered:

— ease and time required for donning and doffing;

— ease of adjustment and adjustable range;

— comfort and weight tolerance;

— compatibility with other PPE to be used at the same time;

— whether or not all the expected tasks can be carried out without problems;

— protection against all postures during the work;

— identification of risks associated with attaching accessories to PPE.

NOTE Consider the location (e.g. in high risk areas) and material (e.g. flame retardant) of the accessories.

When defining the level of protection required, consideration is given to the following as a minimum, but not be limited to

— determine which parts of the body require protection,

— identify what kind of protection is required,

— identify the appropriate Standards or methods that provide the required protection,

— determine the level(s) of protection required (for the relevant parts of the body) in relative or absolute terms for each item of PPE,

— assessment of previously used PPE for meeting standards (any issues and concerns these may have caused such as comfort, incidents, improper use), and

— identify compatibility issues and requirements of PPE items.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: PD ISO/TR 21808:2024

5.4 Provision of information for purchase by PPE manufacturers

Manufacturers are to provide basic performance information on PPE to fire service organizations as selection considerations for procurement. In addition to this, the compatibility of the equipment, sustainability of the product (e.g. energy reduction, recycling, use of materials with low environmental impact, etc.), simulation results of manikin tests, etc. are to be provided to the fire service organization as additional considerations.

NOTE 1 The standard for PPE compatibility is ISO/TS 20141. There are other standards that are considered parallel to product standards, such as ISO 11999-2, ISO 15384.

NOTE 2 ISO/Guide 64 and ISO/Guide 82 are standards on sustainability of PPE. This document defines the developer of the product standard as the primary user, but provides guidelines that is to be widely applied in the process of manufacturing the product. Therefore, information is provided as reference information for this document.

6 Batch testing

6.1 General

In some regions or countries, batch testing is conducted at predetermined times to confirm that the PPE being supplied and the materials they are made of continue to meet the performance requirements specified in the original contract.

Batch testing is conducted using a set of predetermined requirements that an item of PPE can be tested against. These are the same as the performance requirements contained in the relevant Standard, thus ensuring continual compliance with the specifications.

These tests are conducted according to regional requirement, regulations and specifications.

It is recommendable to make available and submit material certificates and testing results which satisfy the fire service. Batch testing is a decision for the fire service to make and is not a mandatory requirement.

6.2 Product certification

In some region or countries, as part of the procurement process fire services specify and require that the selected PPE is independently certified to the relevant Standard (International, Regional or National). The product certification body is accredited to a national or internationally recognised accreditation system (e.g. ISO/IEC 17065). At least all testing is carried-out by labs accredited to ISO/IEC 17025 for that test and to guarantee correct testing and reproducibility.

Product certification is conducted according to regional requirements, regulations and specifications (for example, NFPA 1971, EU PPE Regulation 2016/425, Brazil CA certification scheme).

7 Use

7.1 Start using PPE

7.1.1 Training before use

The firefighting organization is to conduct training to ensure proper use of the equipment, taking into account the equipment to be used, the area of operation, the environment, tactics, etc. The training is to be conducted in a manner that is appropriate to the organization's needs.

Information on individual pieces of equipment is available from the information provided by the manufacturer, but for the use of multiple pieces of equipment at the same time, the fire service organization is to take the initiative to determine the necessary training and provide training to fire fighters with the appropriate information and appropriate implementers.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: PD ISO/TR 21808:2024

For CIR of PPE, necessary training is to be conducted to operationalize the implementation method developed based on ISO 23616. For example, this includes cleaning, inspection, and repair of PPE as well as retirement of PPE that is no longer suitable for use.

Furthermore, it is desirable that these trainings are properly and continuously conducted, and that they are repeated and appropriately for long-term users in order to maintain and stimulate their understanding.

All personnel are trained on how to use their PPE correctly prior to the PPE being introduced into service. The basis for this training is the instructions for use provided by the manufacturer/supplier.

The training includes but not be limited to

— information concerning limitations and capabilities of the PPE,

— what the PPE will protect from,

— what the PPE will not protect from,

— what the effects are (if any) of long-term use,

— how to care for and maintain the PPE in accordance with the manufacturer's requirements,

— how to undertake routine inspections of PPE before and after use,

— how to don and doff, and if appropriate, how to adjust correctly for the correct use and wear of the PPE,

— the compliance with the manufacturers/supplier's instructions,

— how to store the PPE when not in use,

— how to ensure appropriate cleaning and decontamination (including avoidance of cross contamination to maintenance operator and environment),

— how to determine when the PPE is no longer fit for purpose,

— how to obtain replacements, and

— the importance of using PPE that is fit for purpose and has been cleaned and maintained in accordance with the manufacturer's instructions.

The instructions and training provided to the firefighter will depend on the level of risk and complexity of the PPE provided. The provision of written instructions or information may not be sufficient, and the firefighters may need to be involved in practical demonstrations, training and exercise.

7.1.2 Record keeping

The purpose of recording training prior to use is to

— record that the firefighting organization has conducted training not only on the use of individual PPE but also on the risks associated with the combination of PPE to ensure that the selected PPE can be used appropriately, and

— in the event of an accident, this record is intended to provide feedback on the adequacy of the training prior to the start of PPE use.

Record the content of the training (classroom and practical), when it was conducted (initial and periodic), who conducted it and who received it.

7.2 Use in duty

7.2.1 Routine inspection

The contents of the routine inspection in ISO 23616:—, 5.1 are carried out as maintenance in use.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub

Full document details: PD ISO/TR 21808:2024

7.2.2 Risk assessment for the scope of activities at the time of mobilization

A risk assessment is conducted based on the activities anticipated at the time of each mobilization.

Itemize the items to be considered when conducting the risk assessment (may be taken from Annex A).

One method of risk assessment is given Annex A.

7.2.3 Identification of protection required during the activity

Based on the results of the risk assessment, the appropriate protection for the activity is to be identified. Confirm in 5.2.4 that the scope of protection and protective performance of the PPE owned is applicable to the expected scope of activities at the time of individual mobilization.

7.2.4 Selection of PPE

Select PPE that meets the identified protective performance. If more than one PPE is possessed, select the appropriate equipment for the activity based on the results of the risk assessment. If there is no choice of PPE, alternative means is to be considered if the PPE to be used is not suitable for the activity based on the results of risk assessment.

7.2.5 Other consideration

If there is no PPE to be selected in 5.2.4, it is desirable not only to consider alternative means but also to provide feedback to the PPE procurement process (5.2.1 Identification of scope (including content) of activities).

7.3 Care and maintenance of PPE after use

The PPE used must be cared for and maintained. Detailed procedures and considerations for care and maintenance are specified in ISO 23616. Detailed procedures for cleaning, inspection, and documentation are based on ISO 23616.

7.4 Record of use

Record of use is maintained by fire organizations.

In the overall management of PPE, consideration is given to build a full life history for each item, from manufacture to disposal. Detailed controls are identified in product specifications.

Record keeping incorporates the following, but not limited to

— the specification of the PPE (manufacturer, delivery date, batch number),

— to whom the PPE was issued, including date,

— the service history of the PPE (date of issue, name of wearer),

— training records of operatives using the PPE, including the duration of exposure to risks and the identity of the risks,

— details of hazards to which the PPE has been exposed, record keeping,

— storage, and

— problems arising from the use of the PPE.

These records are made readily available to the current user.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: PD ISO/TR 21808:2024

7.5 Storage

Manufacturers indicate any specific storage requirements of the PPE and the firefighter follow these instructions. Manufacturer provide appropriate storage condition.

If the life cycle of the protective PPE is influenced by the storage condition, this is indicated by the manufacturer.

The following is an example of the storage condition for PPE:

— Not be stored in direct sunlight or exposed to direct sunlight while not being worn (e.g. UV degrades polymers, fabrics and plastics).

— Not be stored in airtight containers unless they are new and unissued or unless on manufacturers guidelines.

— Be stored in a clean, dry, well-ventilated area at a temperature that will not adversely affect the items of the protective clothing.

— Not be stored at temperatures below −32 °C (−25 °F) or above 82 °C (180 °F).

NOTE These are extreme temperatures for storage, not necessarily for use.

— Not be stored or transported in compartments or trunks with sharp objects, tools, or other equipment that could damage the PPE. Where PPE is required to be transported or stored in such environments, PPE is not placed in a protective case or bag to prevent damage.

— Not be stored in living quarters or with personal belongings or taken or transported in the passenger compartment of personal vehicles.

— Not be stored in contact with contaminants such as, but not limited to, oils, solvents, acids, or alkalis. The PPE is not adversely affected by the method of storage.

— Is cleaned and dried before storage when soiled.

— To be used and are awaiting disposal.

8 Manufacturer information

8.1 General

The manufacturer's information can be split into four types of information:

— required by laws and regulations of each country/region (may be required in paper version with each PPE in the local language);

— required by PPE performance standard (may be required in paper version with each PPE in the local language);

— information on the labels and marking (may be required in paper version with each PPE in the local language);

— additional information that the manufacturer may share about the PPE.

All items of PPE are provided with manufacturer information, including use instructions accordance with each PPE regulation, guidance and requirement depends on the country. Each type of PPE has designated appropriate information style to clarify manufacturing information (i.e. both of label and documents are preferred for clothing).

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: PD ISO/TR 21808:2024