International Standard

ISO 23616

Second edition
2024-08

Cleaning, inspection and repair of firefighters' personal protective equipment (PPE)

Nettoyage, inspection et réparation des équipements de protection individuelle (PPE) des pompiers

Reference number
ISO 23616:2024(en)

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

Contents

Page

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 — Personal protective equipment*, Subcommittee SC 14, *Firefighters' personal equipment*.

This second edition cancels and replaces the first edition (ISO 23616:2022), which has been technically revised.

The main changes are as follows:

— editorial changes throughout the document.

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

The purpose of this document is to provide the requirements, guidance, and recommendations, and establish criteria regarding the cleaning, inspection, and repair of firefighters' personal protective equipment (PPE). This document has been developed in response to growing concerns about contaminated PPE and potential health hazards for firefighters. Fire and rescue services, and the manufacturers of PPE, want to provide instructions and guidance to effectively minimize and manage this risk.

Following the designation by the World Health Organization of firefighting as an at risk occupation from cancer, the intent of this document is to consider all technologies for decontaminating and cleaning firefighters PPE, including all new technologies, i.e $LC0_2$ processes.

It is the responsibility of the firefighter (initially and ongoing) to undertake regular inspections of their PPE, and there should also be a reliable system/mechanism, (including training), to ensure that this can be achieved effectively.

This document also provides instruction and guidance to fire and rescue services regarding more advanced cleaning, inspection and repair.

Cleaning, inspection and repair of firefighters' personal protective equipment (PPE)

1 Scope

This document provides requirements, guidance and recommendations for the cleaning, inspection, and repair of PPE for use by firefighters.

This document is intended to be used by those responsible for the cleaning, inspections, and repair of firefighters PPE, however, it will also provide vital guidance to those who are responsible for establishing such a program including fire and rescue services.

This document does not cover the following at this time:

a) chemical protective clothing;

b) PPE required for protection against chemical, biological, radiological and nuclear (CBRN) materials.

The selection and use of personal protective equipment (PPE) for firefighters are covered by ISO/TR 21808.

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/TS 16975-1, *Respiratory protective devices — Selection, use and maintenance — Part 1: Establishing and implementing a respiratory protective device programme*

ISO/TS 16975-2, *Respiratory protective devices — Selection, use and maintenance — Part 2: Condensed guidance to establishing and implementing a respiratory protective device programme*

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

ISO/TR 21808, *Best practices on the selection and use of personal protective equipment (PPE) designed to provide protection for firefighters*

3 Terms and definitions

For the purposes of this document, the following terms and definitions given in ISO/TR 19591, ISO/TR 21808 and the following apply.

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

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

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

3.1
advanced cleaning
cleaning by the product manufacturer, the manufacturers approved organization, a specialized competent organization, or mutually agreed competent organization when a PPE item has been, or is potentially exposed to a hazardous or dangerous contaminant

Note 1 to entry: CBRN *contaminated PPE* are to be disposed of not cleaned. PPE should be disposed of following local laws and regulations.

Note 2 to entry: Some known chemicals are commercially available for industrial use. PPE that have been exposed to known chemicals may not have to be disposed of. Specialist advice shall be sought on the contamination, however, the PPE shall be treated in the first instance as if the contamination is unknown.

Note 3 to entry: The decision to decontaminate or dispose of PPE shall be made following a detailed risk assessment.

3.2
advanced inspection
inspection to ensure PPE is fit for purpose before return to use looking at all aspects of the PPE (e.g. inside, outside, defects, wear and tear, need for repairs or disposal)

3.3
competent organization
organization that is experienced in the inspection, cleaning, maintainance or repair of firefighters PPE

3.4
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)

3.5
contaminated PPE
any PPE that has been exposed to a *contaminant* (3.4)

3.6
repair
rectification of defects identified in PPE so that the required level of protection is re-established

3.7
routine cleaning
periodic cleaning conducted by the user as per manufacturers or suppliers' instructions

3.8
routine inspection
superficial inspections by user of their PPE upon issue, or after return from cleaning or repair, and after each use

4 General information

4.1 General

Any PPE provided to a firefighter shall be maintained in efficient working order and good repair. During cleaning, inspection and repair, alternative PPE shall be provided to ensure continually operational availability of the firefighter.

Every firefighter shall ensure that any PPE provided to them is clean, in optimum working order and in good repair before being used.

When an item of PPE needs to be cleaned or repaired, the fire and rescue service shall ensure that suitable replacement PPE is made available.

The fire and rescue service shall ensure that its firefighters, service providers or members of the public are not unnecessarily exposed to soiled or potentially contaminated PPE.

An effective cleaning, inspection and repair system includes the following:

a) inspection — checking for faults, damage, wear and tear, dirt, etc.;

b) cleaning — including disinfection and decontamination if appropriate;

c) repair;

d) replacement;

e) recording.

f) testing — to ensure PPE is operating as intended;

4.2 Innocuousness

Any cleaning, repair or maintenance carried out on firefighting PPE shall not impact the innocuousness of that PPE.

See ISO 13688:2013, 4.2 and ISO 13688:2013/Amd.1:2021, 4.2, and ISO 21420 and ISO 21420:2020/Amd.1:2022, 4.2.

4.3 Management system

All routine PPE cleaning and inspection shall be carried out according to the manufacturers or supplier's instructions and shall be conducted by a competent firefighter or competent person or competent organization, such as a PPE manufacturer, a competent laundry or other competent organization.

All advanced PPE cleaning, inspection and repair shall be carried out by a competent organization. Training shall be provided by the PPE manufacturers or suppliers of the same PPE item to the competent person or organization undertaking the advanced cleaning, inspection, and repair.

The competent organization responsible for cleaning, inspection and repair, shall develop and implement a program for the care and maintenance of PPE used by the members of the fire and rescue service in the performance of their assigned functions.

The program shall provide sufficient PPE to maintain service continuity during cleaning inspection and repair.

This program shall have the goals of providing instruction and guidance to the suitable cleaning, inspection and repair of PPE for its intended use, through:

a) Maintaining such PPE in a safe, usable condition to provide the intended protection to the firefighter.

b) Removing from use any PPE that could cause or contribute to firefighter injury or health issues.

c) Reconditioning, repairing, or retiring such PPE as necessary.

The competent organization shall develop and provide specific criteria for removal of PPE considered to be not fit for purpose or beyond economic repair.

When handling PPE prior to cleaning, those handling the PPE shall observe appropriate health and safety precautions to protect them from any contaminants. Cross contamination shall be avoided at every stage of the process, especially during routine cleaning and inspection.

All firefighter PPE that is found or suspected to be soiled or contaminated shall be cleaned or decontaminated before any additional inspection and/or repair is initiated.

All repairs shall be carried out in accordance with manufacturer's instructions by competent organizations. All PPE that is found or suspected to be soiled or contaminated shall be cleaned or decontaminated before any additional inspection is initiated.

As a minimum, advanced cleaning (see 6.4.3) and advance inspection (see 5.2) shall be carried out as required and at least once per year.

5 Inspection

5.1 Routine inspection

Individual firefighters shall conduct routine inspections of their PPE upon issue and after each use, cleaning and/or repair. These checks shall be carried out by the firefighters before and after each use to identify any defects before being exposed to hazardous situations.

There shall be clear criteria and instructions provided to the firefighters for when and how to send PPE for cleaning and inspection. The instructions shall include details of how to prevent cross contamination and how those transporting or receiving these items can be protected.

The inspection criteria shall be selected based on the potential consequence and may include:

If the abnormality is

a) minor: take no action,

b) moderate: send for repair, and

c) major: prohibit use, major repair or discard and replace.

5.2 Advanced inspection

Advanced cleaning shall be carried out prior to advanced inspection.

Any advanced inspection shall be carried out according to the manufacturer's instructions by competent firefighters, competent persons or competent organizations.

The PPE manufacturer, or supplier, or competent organization shall determine the level of training required to perform advanced inspections. They shall maintain records of such training.

If the competent organization is endorsed to provide training, it shall be permitted to determine the level of training necessary to perform the inspection.

Advanced inspections of all PPE which has been issued shall be conducted at a minimum of every 12 months, or whenever routine inspections indicate that a problem could exist. PPE which has been properly stored according to the manufacturer's instruction and are not being used are not required to be subjected to advanced inspection.

New PPE, that have been stored in accordance with manufacturer's instructions, are not required to be subjected to advanced inspection.

The findings of the inspection shall be recorded, see Clause 8.

6 Cleaning and decontamination

6.1 General

Firefighters shall evaluate and determine the required cleaning level (routine cleaning or advanced cleaning) in accordance with the procedures of a competent organization.

Firefighters shall distinguish between appropriate cleaning levels by reference to the following factors:

a) soiling:

- soiling in regular use require hygienic cleaning.

b) contamination:

- biological contamination (e.g. blood);
- fire contamination due to combustion products during fire (e.g. smoke, soot);
- chemical contamination (e.g. oil, grease, battery acid);
- unidentified CBRN agents;
- soiling due to other activities not listed above.

The cleaning methods are determined in 6.4.2 and 6.4.3.

PPE contaminated unintentionally by unidentified CBRN agents shall be destroyed in accordance with local laws and legislation after confirmed exposure and shall not be subjected to cleaning or decontamination.

Some known chemicals are commercially available for industrial use. PPE that has been exposed to known chemicals may not have to be disposed of. Specialist advice shall be sought on the contamination. The PPE shall be isolated until the contamination is identified and an appropriate decontamination process is identified. The decision regarding decontamination shall be made following a detailed risk assessment.

Only competent organization persons shall be responsible for performing or managing advanced cleaning of PPE contaminated with hazardous materials.

Contaminated PPE shall not be brought into the home or transported in fire apparatus cabs or passenger compartments within personal vehicles. It is recommended that a procedure be established within the fire service whereby contaminated PPE is removed from the body as soon as possible after the intervention and packed in a vapour-proof and puncture resistant bag/container. Where cleaning of PPE is required, guidance shall be provided to the firefighter by the fire and rescue service on how to identify contamination, as opposed to soiling, and on how best to clean the PPE in a safe and effective manner.

Commercial dry cleaning shall not be used as the means of cleaning or decontaminating PPE unless approved by the PPE manufacturer.

When an organization is used for cleaning or decontamination, they shall demonstrate to the fire and rescue service's satisfaction that the procedures are effective and do not degrade the intrinsic qualities of the item, the materials used in the construction of the item, or the level of performance of the PPE.

Consideration shall be taken of all new technologies for improving the efficacy of cleaning PPE. These considerations shall also take into account any impact in the performance of the PPE.

When conducting a cleaning with cleaning chemicals, the operator shall be aware of the safety data sheet and act accordingly by wearing the appropriate PPE.

Waste waters discharged from the laundry process and its environmental effects shall be considered and shall conform to local laws and/or national regulations when discharging waste waters or effluent to public drainage or waterways.

6.2 Management systems

The competent organizations shall provide the means for having PPE cleaned and decontaminated.

Fire and rescue services shall have written procedures that detail decontamination and cleaning processes for contaminated PPE. These procedures shall:

a) Minimize the risk of contamination to all people from exposure to contaminated garments/firefighting PPE.

b) Require that PPE not be worn or stored in the non-operational living areas of the fire and rescue service facilities.

c) Ensure PPE be stored in a correctly lit, ventilated and dedicated storage room, which is isolated from any other section of the fire station.

d) Provide training in identifying contamination and determining the cleaning methods (routine and advanced cleaning) to be applied. PPE known or suspected to be contaminated by hazardous materials shall be assessed at the incident to determine the appropriate level of treatment.

Items shall be prepared for safe transportation. For further guidance, see Annex B on post incident management of contaminated PPE.

Contaminated or potentially contaminated PPE should not be worn or taken into the cabin of the fire appliance/truck. Where this is unavoidable, the cabin of the fire appliance/truck shall be cleaned and decontaminated at the first possible opportunity once firefighting operations have ceased.

When firefighters are combating a moving wildland fire, they are often required to move on an ongoing basis during firefighting operations with no opportunity to change PPE, therefore the PPE shall be cleaned at the first possible opportunity, this may be at the end of an allocated shift.

Where possible and where the contaminant and its source have been identified, the competent organization shall consult the supplier of the contaminant and the manufacturer of the PPE for an appropriate decontamination agent and process.

6.3 Contamination

Cleaning requirements will be dictated by contaminant and exposure. Soiling due to normal wear shall require routine cleaning to be undertaken. Biological, product of combustion and chemical contamination shall require advanced cleaning. The cleaning levels are described in 6.4.2 and 6.4.3.

PPE contaminated by unidentified CBRN agents shall be destroyed in accordance with local laws and legislation after confirmed exposure and shall not be subjected to cleaning or decontamination.

6.4 Cleaning procedures

6.4.1 General

The member(s) of the competent organization who has received training in the cleaning of PPE shall be responsible for performing or managing advanced cleaning of PPE contaminated with hazardous materials.

When cleaning or decontamination is completed, there shall be a method to periodically demonstrate to the fire and rescue service's satisfaction that the procedures are effective, do not degrade the intrinsic qualities of the materials and the level of performance of the PPE. As it is impossible to identify or to quantify all the existing pollutants, a generalized cleaning method that can clean as many pollutants as possible shall be used to clean all the PPE.

Waste waters discharged from laundry process and its environmental effects shall be considered. Refer to local laws and/or national regulations when discharging waste waters or effluent to public drainage or waterways.

6.4.2 Routine cleaning

Routine cleaning includes

a) hygienic cleaning, and

b) partial cleaning completed by fire fighter (e.g. brushing of clothing).

Firefighters shall ensure that their PPE is cleaned routinely and as required. The routine cleaning shall be done by a trained and competent person. The routine cleaning shall be carried out according to the manufacturer's or supplier's instructions.

6.4.3 Advanced cleaning

Any advanced cleaning shall be carried out by competent firefighters or competent organization according to the manufacturer's instructions.

Before advanced cleaning is undertaken advice shall be taken on whether the contaminant can be removed.

Advance cleaning includes

a) decontamination from chemical contamination,

b) decontamination from biological contamination, and

c) decontamination from contamination due to products of combustion.

Items contaminated by unidentified CBRN must be disposed of according to local laws and regulations.

Some known chemicals are commercially available for industrial use. PPE that have been exposed to identifiable chemicals may not have to be disposed of. Specialist advice shall be sought on appropriate decontamination methods, however, the PPE shall be treated in the first instance as if the contamination is unknown. The decision shall be made following a detailed risk assessment.

PPE that is issued and used shall receive advanced cleaning at the time of advanced inspection if not subjected to advanced cleaning in the preceding 12 months.

Organizations shall follow the manufacturer's label and instructions on cleaning and drying that were provided with the PPE. In the absence of manufacturer's instructions or manufacturer's approval of alternative procedures for the PPE, the advanced cleaning and drying procedures provided in 9.2.3 and 9.3 (for garments) shall be used. Cleaning instructions for other items of PPE can be found in 10.2.1 and 10.2.3, 11.2.1 and 11.2.3, 13.2.1 and 13.2.3, and 14.3.1 and 14.3.3.

7 Repair

Any repairs shall be carried out by agreed competent organization according to the manufacturer's instructions.

PPE shall be subjected to advanced cleaning before any repair work is undertaken.

All repairs and alterations to PPE shall be done in a consistent manner and use like materials and components that are compliant with the relevant standard(s) and have been approved for use in that item.

Due to the different methods of construction, the PPE manufacturer shall be contacted if the agreed competent organization is unsure of whether a repair can be accomplished without adversely affecting the integrity and/or performance of the PPE.

Poor repair can impact the protection provided by the PPE. This may lead to firefighter injury and/or inability to perform tasks.

8 Records

8.1 General

The competent organization shall compile and maintain records on its PPE.

Records shall be kept for PPE that are used by the fire and rescue service (see Annex A).

At least the following records shall be kept for each item of PPE:

a) person to whom PPE is issued;

b) date and condition when issued;

c) manufacturer and model name or design;

d) manufacturer's identification number, lot number, or serial number;

e) month and year of manufacture;

f) date(s) of cleaning and inspection and type of cleaning;

g) date of repair with details of repairs carried out.

The following are the responsibilities covered in later subclauses of this document:

— reason for cleaning or decontamination and who performed cleaning or decontamination;

— date(s) of repair(s), who performed repair(s), and brief description of repair(s);

— date of retirement;

— date and method of disposal.

8.2 Reporting PPE health and safety concerns

The agreed competent organization shall report all PPE health and safety concerns, if caused by a known or suspected PPE failure, to the manufacturer or supplier.

The agreed competent organization shall notify the manufacturer or supplier in writing.

9 Garment

9.1 Inspection

9.1.1 General

Routine inspections shall be conducted by firefighters. The fire and rescue service shall manage the advanced inspections.

If known to be contaminated, inspection shall occur post return from advanced cleaning.

Inspection shall ensure the items still fit correctly, have no visible physical damage and are compatible with other items of PPE at the interface.

9.1.2 Routine inspection

The routine inspection shall identify, as a minimum, the following:

a) contamination;

b) soiling;

c) physical damage, such as:

   1) rips, tears, and cuts;

   2) damaged or missing hardware and closure systems;

d) thermal damage, such as:

   1) charring, burn holes, melting, discoloration of any layer, especially outer shell;

   2) charring and discoloration of the retro-reflective trims;

e) damaged or missing reflective trim;

f) loss of seam integrity and broken or missing stitches of any layer;

g) correct assembly and size compatibility of shell, liner, and the drag rescue device (DRD), where appropriate.

h) moisture/particulate barrier (if accessible by flap):

   1) membrane burns with hole formation or tear, loose sealing strip;

   2) rips, tears, cuts, or abrasions;

   3) discolouration;

   4) thermal damage;

9.1.3 Advanced inspection

Advanced inspection shall occur at least once per year, unless the garment has not been used.

The advanced inspection shall be performed in accordance with manufacturer's instructions. If a garment is contaminated advanced inspection shall be performed after advanced cleaning and decontamination.

The garment, and if possible, all separate layers, or as a minimum, the outer and the inner layer of the garment shall be individually inspected.

Attention should be given to all the items listed for routine inspection (see 9.1.2) with additional focus on the following defects:

a) outer fabric and reinforcement:

   1) the presence of holes;

   2) stitching seams removed, broken (seams, pockets, flaps, slides, hook-and-loop fasteners, etc.);

   3) change in outer fabric's colour and flexibility over 10 mm in length;

   4) damaged knee, trouser hem and cuff reinforcements;

   5) damaged fasteners that no longer close a flap and/or pocket;

   6) physical integrity [e.g. ultraviolet (UV) or chemical degradation] as evidenced by discolouration, significant changes in material texture, loss of material strength;

b) high visibility trim:

   1) gap in seam stitching ≥5 mm;

   2) area of trim missing or damaged;

3) damaged by heavy abrasion;

4) loss of retro reflectivity/fluorescence;

c) lining:

1) loss of physical integrity due to UV or chemical degradation, identified by discoloration, significant changes in texture, loss of material strength, loss of liner material and shifting of liner material;

2) gaps in assembly seam;

d) moisture barrier (if accessible):

1) membrane burns with hole formation or tear, loose sealing strip;

2) rips, tears, cuts, or abrasions;

3) discolouration;

4) thermal damage;

e) anti-wicking material on jacket sleeves or trousers' hem:

1) delamination;

2) holes with length greater than 5 mm;

f) closure systems:

1) loss of functionality or corrosion on zipper or snap button;

2) loss of functionality on hook and loop fastener;

3) loss of functionality on other fastenings e.g. magnetic strips, buttons, etc.;

g) elastic bands at the waist and shoulder straps:

1) loss of elasticity/functionality;

2) broken buckle;

h) loss of functionality of the wristlet, e.g. elasticity, stretching, runs, cuts, or burn holes;

i) liner attachment systems;

j) correct assembly and size compatibility of shell, liner, and DRD, where appropriate;

k) pocket (deterioration of pockets, pocket closures);

l) stitching and readability of labels.

m) fully functional unique RFID or legible unique barcode/serial number;

9.1.4 Periodic fit for purpose testing

Periodic fit for purpose testing is testing based on the requirements of the garment as defined in the required standards or by the fire and rescue service. Periodic testing shall be conducted to ensure that the thermal, moisture management and particulate protection (where present) is fit for purpose and still conforms to the entirety of the required standard.

NOTE Periodic testing can include destructive testing.

When selecting garments for periodic testing, consideration shall also be given to garments that have been purchased as a complete roll out or those issued on an "as required" basis.

The identified garments shall be selected strategically from a broad selection that have been exposed to numerous hazards, have been in the field for at least 2 years, and are from different locations.

The quantity and location of the selected garments shall be identified by the fire and rescue service.

9.2 Cleaning

9.2.1 General

All cleaning shall be performed in accordance with manufacturer's instructions, and will be conducted by an agreed competent organization.

Contaminated garments shall be separated from clean garments to avoid cross contamination.

Cleaning personnel shall be trained and have appropriate PPE to handle the contaminated PPE. Clean water shall be used for each wash cycle to reduce risk of cross contamination.

9.2.2 Routine cleaning

In case of observing mild soiling without hazardous contamination, clean the surface with water and gentle brushing.

Where possible, the contamination type shall be evaluated and field decontamination shall be initiated at the emergency scene. See Annex B.

Contaminated garments shall be contained wherever possible and shall be isolated to avoid cross contamination.

Personnel shall be trained on cleaning garments and provided with PPE appropriate to the contaminant(s).

Any dry debris shall be brushed off, ensuring adequate respiratory protection is used during this process.

Other debris shall be gently rinsed off with water. Heavy scrubbing or spraying with high-velocity water jets such as a power washer shall not be used.

Where necessary, a soft bristle brush should be used to gently scrub the garment, and the garment shall be rinsed off again.

For spot cleaning only, garment can be cleaned in a utility sink designated for PPE cleaning and decontamination using the following procedures:

a) to avoid cross contamination, garment layers shall be isolated whenever possible;

b) cleaning of the entire garment shall be accomplished using advanced cleaning procedures;

c) to avoid contamination of personnel, handling shall be minimized when processing garments.

9.2.3 Advanced cleaning

Whenever PPE is heavily soiled and/or contaminated with hazardous materials which cannot be removed by routine cleaning, advanced cleaning shall be applied.

Advanced cleaning of garments shall be conducted by a cleaning process that has been proven to adequately clean.

NOTE Depending on the accessibility, type and quality of the gear, the advance cleaning process can be carried out through a traditional water-based process as well as through the use of new technologies such as the cleaning process based on liquid carbon dioxide, ozone technology, and or combination of different, or new innovative cleaning processes.

Washing machine manufacturer's instructions shall be followed for proper settings or program selection for the specific garment being cleaned based on garment manufacturer's instructions. The garment manufacturer shall provide appropriate cleaning instructions.

If no instructions are provided from the garment manufacturer the following process shall be used:

a) Select an appropriate load factor. The recommended loading is 50 % to 60 %. In case of over loading, contaminants may not be sufficiently removed, in case of under loading the mechanical action may cause damage.

b) Heavily contaminated or spotted areas shall be pre-treated according to the garment manufacturer's instructions.

c) Chlorine bleach, chlorinated solvents, active-ingredient cleaning agents or solvents shall not be used without the garment manufacturer's approval.

d) Fasten all closures, including pocket closures, snaps, zippers, and hook and loop fasteners. Pockets can contain sharp objects so care shall be taken when checking/emptying pockets.

e) Water temperature shall not exceed the temperature stated on the care label and the manufacturer's instructions. If no temperature is given, seek advice from the garment manufacturer. Failing that in the absence of any recommendation, the water temperature shall not exceed 60 °C.

f) A detergent with a pH range of not less than 6,0 pH and not greater than 10,5 pH as indicated on the product safety data sheet (SDS) or original product container shall be used.

g) Washing machines with drum revolutions per minutes (r/min) adjustment shall be adjusted to the garment manufacturer's instructions.

h) Removal of detergent and chemical residues through appropriate rinsing is very important.

i) A minimum three rinse cycles are advised, with a water to weight ratio of 9:1.

j) The item shall be inspected and rewashed if necessary.

k) The garment shall be dried in accordance with 9.3

Independent verification of the cleaning process shall be obtained at least annually. This will prove that the cleaning process remains effective.

The washing machine shall be cleaned by running the machine without a laundry load, through a complete cycle with detergent and filled to the maximum water level with the water set to the maximum temperature (in excess of 70 °C). This shall be done at least weekly.

Where the outer shell and liner of protective garment are separable, those items shall be cleaned and decontaminated only with like items. Separable liner systems shall be turned inside out so the moisture barrier is on the inside for both machine washing and machine drying.

Where fabric treatments are required for a garment to meet the requirements of the relevant standard, based on the manufacturer's instruction:

Ensure the fabric treatment still meets requirements.

If not, refurbish the fabric treatment.

9.3 Drying

All drying shall be performed in accordance with manufacturer's instructions and shall be conducted by competent organizations.

In the absence of manufacturer's instructions or manufacturer's approval of alternative procedures, the drying procedures provided in this subclause shall be used. Based on the manufacturer's instructions, the drying temperature may need to be increased to re-activate repellency.

The following procedures shall be used for air drying:

a) items shall be placed in an area with good ventilation;

b) items shall not be dried in direct sunlight.

The following procedures shall be used for machine drying:

a) the recommended capacity of the machine shall not be exceeded;

b) all closures, including pocket closures, snaps, zippers, and hook and loop fasteners shall be fastened;

c) a “no heat” or “air dry” option shall be used, if available;

d) in the absence of a “no heat” or “air dry” option, the basket temperature shall not exceed 60 °C unless otherwise indicated on the garment label or in the manufacturer’s instructions;

e) the use of a heat cycle shall be discontinued prior to the removal of all moisture from the item;

f) the remainder of the drying process shall be accomplished by a “no heat” machine setting or removal of the item from the machine dryer to air dry;

9.4 Repair

9.4.1 General

Repairs specified in 9.4 shall be performed by the manufacturer, or their approved agent to ensure continual compliance with the required standard.

All repairs shall be performed in the same manner and using original materials as used by the original item manufacturer, including, but not limited to, fabric, thread, seam construction, hardware, and hardware backing, unless approved by the manufacturer. Repairs shall be made to all components and to all layers of the composite that have been damaged or that are affected by the repair.

9.4.2 Basic repair

Basic repairs shall be conducted per manufacturer’s or supplier’s instructions to be limited to the following:

a) patching of minor tears, char marks and ember burns to a separable outer shell;

b) repairing of skipped, broken and missing stitches to a separable outer shell;

c) replacement of missing hardware, excluding positive closure systems to a separable outer shell;

d) reclosing of the liner of a garment after inspection.

9.4.3 Outer/lining

Repairs of minor tears, char marks, ember burns and abraded areas shall be limited to those where the damaged area can be covered by a maximum 160 cm^2 patch of the same material as the original garment. For any tears, char marks, ember burns, and abraded areas that require a patch larger than 160 cm^2, the manufacturer or the approved agent, in conjunction with the organization, shall be consulted.

The finished edges of the patch shall extend at least 25 mm in all directions beyond the damaged area.

To prevent fraying, the patch shall have no raw edges.

9.4.4 Moisture barrier

Where moisture barrier tears, holes or abrasions are being repaired guidance shall be sought from the moisture barrier supplier. If no information is available, the following method shall be used. A single width of seam tape shall be used and shall be required to extend at least 12,5 mm in any directions beyond the edge

of the repaired damage. Where the moisture barrier has a hole or abrasion measuring more than 12,5 mm in diameter in any direction or a tear greater than 75 mm in length, a patch consisting of the same moisture barrier fabric shall be used for repair.

9.4.5 Hardware

Replacement hardware shall be installed in a manner consistent with the garment manufacturer's method of construction. When hardware is replaced, the reinforcement backing material shall be reinstalled or, if it is no longer serviceable, the backing material shall be replaced.

9.4.6 Reflective trim

Replacement reflective trim shall be installed in a manner consistent with the garment manufacturer's method of construction, unless an alternative method is approved by the garment manufacturer.

Reflective trim being replaced shall be completely removed so that no new visibility marking is placed over an older visibility marking.

No repair or alteration shall result in the reduction of the minimum required visibility marking pattern specified in the garment standard.

Where the complexity of the visibility marking repair is uncertain, the garment manufacturer shall be consulted.

9.4.7 Advanced repair

Repairs to the garment outer shell or moisture barrier shall be performed consistent with the garment manufacturer's methods. The original garment manufacturer shall be contacted if the fire and rescue service is unsure as to whether an area to be repaired contains a moisture barrier.

Repairs to garment thermal liners shall be permitted provided there is no stitching through the moisture barrier.

Due to labelling requirements, as well as the complexity and specialized equipment needed to replace entire garment component layers (e.g. the outer shell, moisture barrier, or thermal liner), only the garment manufacturer or the garment manufacturer's designated organization shall replace entire garment component layers.

Re-stitching of more than 25 mm continuous of a Major A seam shall require consulting the garment manufacturer or supplier and shall be conducted in a manner consistent with the garment manufacturer's methods. Re-stitching shall be carried out in accordance with the manufacturer's instruction.

If replacing trim necessitates sewing into a Major A seam, trim replacement shall be conducted in a manner consistent with the garment manufacturer's methods.

Replacement hook-and-loop fastener tape shall be installed in a manner consistent with the garment manufacturer's method of construction. If the complexity of the repair is uncertain, the garment manufacturer shall be consulted.

10 Glove

10.1 Inspection

10.1.1 General

Firefighters shall conduct a routine inspection of their gloves in accordance with manufacturer's instructions upon issue and before and after each use to identify any defects before being exposed to hazardous situations. If the gloves are known to be contaminated, inspection shall be carried out after their return from advanced cleaning.

10.1.2 Routine inspection

Routine inspection of gloves shall be in accordance with manufacturer's instructions, provided the gloves are not contaminated. The routine inspection shall include, as a minimum, the checks specified below:

a) soiling;

b) contamination;

c) physical damage such as the following:

   1) rips, tears, and cuts;

   2) thermal damage (charring, burn holes, melting, discolouration of any layer);

   3) inverted liner;

   4) serious shrinkage;

d) loss of dexterity or flexibility;

e) loss of seam integrity and broken or missing stitches;

f) loss of elasticity of the wrist knit (if appropriate);

g) the glove still fits the individual correctly;

h) any wrist adjustment fully functional.

The membrane cannot be visually inspected.

10.1.3 Advanced inspection

Attention shall be given to the items listed for routine inspection (see 10.1.2), with the following additional focus:

Label integrity and legibility.

10.2 Cleaning

10.2.1 General

All cleaning shall be performed in accordance with manufacturer's instructions and will be conducted by agreed competent organization.

Appropriate PPE shall be worn, such as protective gloves and eye and face protection against splashes.

10.2.2 Routine cleaning

This shall be achieved by washing the gloves using a similar action as normal hand washing using mild soap and warm water.

In addition, routine cleaning includes external or spot cleaning in accordance with manufacturer's or supplier's instructions.

10.2.3 Advanced cleaning

Additional requirements for advanced cleaning of gloves:

a) Use a washing machine wherever possible to avoid cleaning by hand (by soaking). Water temperature shall not exceed the temperature stated on the label and by the manufacturer. If no temperature is given on the label, the temperature shall not exceed 40 °C.

b) Select a moderate program with a reduced spin speed.

c) A mild detergent with a pH in the range of 6 to 10,5 shall be used.

d) The washing machine shall be suitably loaded dependant on its size. If necessary, fillers (polyester) can be added to achieve the desired load.

Depending on the accessibility, type and quality of the gloves, the advance cleaning process can be carried out through a traditional water-based process as well as through the use of new technologies such as the decontamination process based on liquid carbon dioxide. Or a combination of both

An independent verification of the cleaning process shall be obtained at least once a year. This will prove that the cleaning process remains effective.

10.3 Drying

After cleaning, machine dry if possible.

Do not completely dry the glove in the machine, finish drying in the open air, in a heated room or in a drying cabinet with or without ozone. Gloves shall be dried flat or with the fingers pointing upwards.

Alternative drying method: drying at 40 °C and drying flat, on a forced air form.

10.4 Repair

It is not expected for gloves to be repaired. If they are unfit for service, they shall be replaced.

11 Helmet

11.1 Inspection

11.1.1 General

Firefighters shall conduct a routine inspection of their helmet in accordance with manufacturer's instructions upon issue and before and after use to identify any defects before being exposed to hazardous situations. If the helmet is known to be contaminated, inspection shall be carried out after their return from advanced cleaning.

11.1.2 Routine inspection

Without having to disassemble the helmet the routine inspection shall include, as a minimum, the visual inspections specified below:

a) outer shell:

   1) heavily soiled or contaminated with products of combustion, oil or chemicals;

   2) physical damage, cracks, crazing, dents, puncture holes, signs of heavy abrasion;

   3) thermal damage, bubbling, soft spots, warping, distortion, discoloration, contact with molten metals or hot solids;

   4) serious discoloration due to contact with strong chemicals;

   5) those with edge beading that have missing, broken, distorted or melted edge beading;

b) suspension and retention systems:

   1) brittle, deformed, broken or missing quick release buckle and other plastic components;

   2) quick release buckle cannot release or cannot lock;

3) frayed, torn, serious abraded, or discoloured webbing straps;

4) loss of sewing integrity with broken, cut, missing or frayed stitches;

5) dirty or contaminated leather/fabric comfort padding;

6) hook and loop fastener no longer catches, worn out or missing;

c) face shield/eye protector/goggle:

1) heavily soiled or contaminated with carbon, oil or chemicals;

2) physical damage such as cracks, penetrating holes, or deep scratches that impair vision;

3) thermal damage such as charred lens, blistered/bubbled lens, distortion, discoloured lens, optical distortion, or elongated goggle straps/loss of elasticity;

4) chemical damage such as pitting, blooming, or crazing;

5) mechanical failures such as broken attachment, visor unable to stay up when stowed, or visor unable to deploy;

d) neck protector/shikoro (if present):

1) heavily soiled or contaminated with carbon, oil or chemicals;

2) physical damage such as rips, tears or cuts in the fabric, broken or missing stiches, and opened seams;

3) thermal damage such as charring, burn holes, and serious discoloration;

e) accessories like badges, decal and retro-reflective trims:

1) physical damage such as tears, lifting, or missing;

2) thermal damage such as charring, discoloration, loss of reflectivity.

11.1.3 Advanced inspection

Advanced inspection requires the disassembly of the helmet in order for each component to be thoroughly inspected and evaluated.

Attention shall be given to the items listed for routine inspection (see 11.1.2), with the following additional focus:

a) Damage to the underside of the shell, for example signs of delamination, stress marks, micro-crack lines, and discolouration due to exposure to extreme heat.

b) Damage to the shock absorbing liner, for example “halo effect” (ring of discoloured foam due to heat), blisters or brittle foam due to extreme heat, depression marks as evidence of impact, cracks and distortion.

c) Label integrity and legibility.

11.2 Cleaning

11.2.1 General

All cleaning shall be performed in accordance with manufacturer’s instructions and will be conducted by agreed competent organization.

Remove all accessories (e.g. hearing protectors, flashlight, communication headset, etc.) from the helmet. Helmet accessories shall be cleaned following manufacturer’s recommendation.

Where possible machine cleaning shall be used, but only in specialist machines designed for this purpose.

If hand cleaning, appropriate PPE shall be worn such as protective gloves and protection against splashing of eyes and face.

11.2.2 Routine cleaning

Unless otherwise instructed by the manufacturer, the following routine cleaning steps shall be followed:

a) Shell

1) Remove all soft material (e.g. neck protector, leather/fabric sweat pads, and comfort sponge) from the helmet.

2) Use warm water at a temperature no warmer than 40 °C using a mild detergent, having a pH of not less than 6,0 or more than 10,5 at the detergent manufacturer's recommended ratio of detergent to water.

3) Scrub the helmet shell gently with a soft bristle brush to remove products of combustion stains, dirt, oil and hard debris.

4) Rinse each part of the helmet individually; ensuring that all "hook and loop" components are free of any contamination e.g. dirt, grime, soil, asbestos and fire ground particulates etc.

5) Rinse the helmet and all parts thoroughly with fresh water. Inspect again and rinse if necessary until it is totally clean.

6) Dry with a microfiber or similar cloth.

7) Reassemble the helmet.

8) Air dry the helmet in accordance with 11.3.

b) Face shield/eye protector

For the cleaning of face shield/eye protector (either permanently affixed or detachable), the following procedure shall be applied:

1) Use a soft sponge or cloth dampened with a solution of warm water and mild detergent to wipe the surface gently to remove dirt and stains.

2) To remove light scratches, smoke stains or stubborn dirt, use plastic cleaner/polish that is not abrasive and use as recommended by the manufacturer or supplier.

3) Cleaning solvents, oils, varnishes, or polishes shall not be used to clean or decontaminate helmets or the visors. The manufacturer shall be consulted if stronger cleaning agents are required.

c) Soft components

Unless otherwise instructed by the manufacturer, handwash the soft materials with the following steps:

1) Use warm water at a temperature no warmer than 40 °C using a mild detergent, having a pH of not less than 6,0 or more than 10,5 at the detergent manufacturer's recommended ratio of detergent to water.

2) Scrub the soft materials gently with a soft bristle brush to remove carbon stains, dirt, oil and hardened debris.

3) Rinse each soft material thoroughly, ensuring that all "hook and loop" components are free of any contamination e.g. dirt, grime, soil asbestos and fire ground particulates etc.

4) Allow complete air-drying before re-installing inside the helmet

11.2.3 Advanced cleaning

Remove all removable parts inside (padding, chinstrap, visors, etc.) and external accessories (attachment devices, neck protector).

Where possible machine cleaning shall be used, but only in specialist machines designed for this purpose.

Helmets shall not be machine-washed or dried using equipment that produces mechanical action by tumbling or agitation.

Appropriate PPE shall be worn such as protective gloves and protection against splashing of eyes and face.

a) Rinse each part of the helmet individually.

b) Clean each part of the helmet individually, ensuring that all “hook and loop” components are free of any contamination, e.g. asbestos and fire ground particulates, etc.

c) Rinse.

d) Reassemble the helmet.

11.3 Drying

Manufacturer’s instructions shall be followed for drying the helmet.

In the absence of manufacturer's instructions or approval by the manufacturer of other procedures, the drying procedures described in this subclause shall be used.

Drying methods could be one of the following:

a) drying in well ventilated room with free moving air for the duration required to totally dry the helmet and its components, or

b) drying in a heated room with maximum temperature set at 40 °C for the duration required to totally dry the helmet and its components, or

c) drying in a convection air drying cabinet with or without ozone with maximum temperature set at 40 °C ± 5 °C for 2 h, or

d) dry with a microfiber cloth.

11.4 Repair

All repairs to helmet components shall be performed in accordance with the helmet manufacturer’s instructions.

Where there is an indication of a crack, dent, abrasion, bubbling, soft spot, discolouration, or warping in the helmet shell, the helmet manufacturer shall be contacted to determine serviceability.

Small surface nicks shall be repaired in accordance with the helmet manufacturer’s instructions.

Small scratches on the helmet shell shall be permitted to be removed by using mildly abrasive compounds recommended by the helmet manufacturer.

Helmet face shield and goggle components that become cracked or badly scratched shall be replaced.

12 Footwear

12.1 Inspection

12.1.1 General

Firefighters shall conduct a routine inspection of their footwear upon issue, then before and after eachuse. This is to identify any defects before being exposed to hazardous situations. If the footwear is known to be contaminated, inspection shall be carried out after their return from advanced cleaning.

12.1.2 Routine inspection

The routine inspection shall include, as a minimum, the inspections specified below:

a) soiling;

b) contamination;

c) physical damage such as the following:

   1) cuts, tears, and punctures, including protective toe caps;

   2) thermal damage (charring, burn holes, melting, discoloration of any layer);

   3) exposed or deformed metal/composite toe, metal/composite midsole, or shank;

d) when the toecap or puncture resistant insert has been exposed to a critical load (e.g. impact, compression, puncture), the footwear shall be replaced, as the safety function may not withstand a further critical load and fail;

e) loss of water resistance;

f) closure system component damage and/or loss of functionality.

g) loss of seam integrity, delamination, or broken or missing stitches.

h) check the inside of the footwear by hand for signs of deterioration of the lining or toe protection area;

NOTE Disposable nitrile (or similar) gloves shall be worn during this inspection.

i) check the thickness of the sole pad; the height of the tread shall not be less than 1,5 mm;

j) check the integrity of the insole (if existing).

12.1.3 Advanced inspection

The following checks shall be undertaken, in addition to all checks in 12.1.2:

a) condition of lining such as the following:

   1) tears;

   2) excessive wear;

   3) separation from outer layer;

b) heel counter failure;

c) label integrity and legibility.

12.2 Cleaning

12.2.1 General

All cleaning shall be performed in accordance with manufacturer's instructions and will be conducted by agreed competent organization.

Appropriate PPE shall be worn, such as protective gloves and eye and face protection against splashes.

12.2.2 Routine cleaning

During routine cleaning procedure appropriate PPE shall be worn such as protective gloves and eye and face protection against splashes shall be worn. Where routine cleaning fails to render footwear sufficiently clean for service, the footwear shall receive advanced cleaning.

Where possible, contamination levels shall be assessed and decontamination in the field initiated at the emergency site.

a) Rinse the footwear with water to remove the dirt and debris.

b) Clean off the surfaces using a brush and scrub all parts of the exterior of the footwear (top and bottom). Clean in a sink provided for this purpose.

c) Clean using a microfiber cloth or sponge and warm water at a temperature no warmer than 40 °C and a mild detergent having a pH of not less than 6,0 or more than 10,5 at the detergent manufacturer's recommended ratio of detergent to water (without wetting the inside of the footwear).

d) Wipe using a dry microfiber or similar cloth.

e) Leave to air dry.

f) Apply footwear care products recommended by the manufacturer of the boots.

12.2.3 Advanced cleaning

During advanced cleaning procedure appropriate PPE shall be worn such as protective gloves and eye and face protection against splashes shall be worn. Where it is possible for the footwear to be machine cleaned, then this shall be in line with the manufacturers' instructions and the cleaning machines instructions.

Footwear shall not be machine cleaned using equipment that produces mechanical action from tumbling or agitation.

Additional requirements for advanced cleaning of footwear:

a) Remove the laces, protect the hook-and-loop fasteners (if present).

Disinfection of the footwear should be undertaken every six months, and when advanced cleaning is required.

12.3 Drying

Footwear shall not be machine dried using equipment that produces mechanical action from tumbling or agitation.

Allow to dry in the open air. Drying shall be away from direct heat sources and away from UV.

12.4 Repair

All repairs to footwear components shall be performed in accordance with the footwear manufacturer's instructions.

Footwear shall be repaired or replaced when showing at least one sign of wear:

a) exterior materials:

   1) deep crack affecting half of the thickness of the material constituting the upper;

   2) high abrasion of the material constituting the upper and any reinforcement such as a toe cap becomes visible;

3) the upper has significant deformation (sagging), the upper or the quarters have burns, bubbles, seams cut, loose stitching;

b) outsole:

1) the outsole has cracks with a width >10 mm and a depth >3 mm;

2) the sole is separated over a length of >10 mm and a depth >5 mm;

3) the depth of the sole tread shall not be <1,5 mm.

c) inside lining:

1) the insock is deformed or crushed;

2) the heel counter lining is damaged;

3) sharp edges appear at the area of protection of the toes (detectable by passing the hand inside the footwear);

d) closure systems:

1) closing systems (when present) are not in working order (zipper cut or damaged lace, broken eyelet, crooked hook, burnt or missing hook-and-loop fastener).

Other than for the replacement of footwear laces and zipper assemblies, the footwear manufacturer shall be contacted to determine feasibility of the repair.

All replacement footwear laces and zippers shall be provided by the footwear manufacturer.

13 Fire hood

13.1 Inspection

13.1.1 General

Firefighters shall conduct a routine inspection of their fire hood in accordance with manufacturer's instructions upon issue and before and after use to identify any defects before being exposed to hazardous situations. If the fire hood is known to be contaminated, inspection shall be carried out after their return from advanced cleaning.

13.1.2 Routine inspection

Routine inspection shall include, as a minimum, the inspection specified below**:**

a) soiling;

b) contamination;

c) physical damage such as the following:

1) rips, tears, and cuts;

2) thermal damage (charring, burn holes, melting, discolouration of any layer);

d) loss of face opening elasticity;

e) loss of seam integrity and broken or missing stitches;

f) loss of shape or elasticity;

g) loss of integrity of particulate barrier, if present.

13.1.3 Advanced inspection

In addition to the checks undertaken as part of the routine inspection (see 13.1.2), the label shall also be checked for integrity and legibility.

Periodic fit for purpose testing shall be conducted to ensure that the thermal, moisture management and particulate protection (where present) is fit for purpose and still conforms to the entirety of the required standard.

13.2 Cleaning

13.2.1 General

Organizations shall review the manufacturer's label and instructions on cleaning procedures that have been provided with the hood. In the absence of manufacturer's instructions or approval by the manufacturer of other procedures, the cleaning procedures described in this subclause shall be used.

All cleaning shall be performed in accordance with manufacturer’s instructions, and will be conducted by agreed competent organization.

Machine cleaning is recommended.

13.2.2 Routine cleaning

Where possible, contamination levels shall be assessed and decontamination in the field initiated at the emergency site.

The fire hood shall be separated as much as possible from other items of PPE to avoid cross contamination.

Cleaning is recommended after each use.

Never use a stiff brush or other abrasive cleaning product to clean the fire hood as it may damage the knit.

Fire hoods shall be cleaned separately from other different PPE.

For cleaning non-polar dirt and specific decontamination of PPE, the cleaning of the fire hood shall be done using advanced cleaning procedures.

The temperature of the water shall not exceed the temperature indicated on the label and the manufacturer’s instructions.

If no temperature is indicated on the label, the temperature shall not exceed 60 °C. A detergent with a pH range of not less than 6,0 pH and not greater than 10,5 pH shall be used.

If spots visible, repeat cleaning process. The fire hood may be dried in accordance with 13.3.

13.2.3 Advanced cleaning

Advanced cleaning of fire hoods shall be done by machine.

The following procedures shall be used:

a) The recommended load is 60 % to 70 % of the machine capacity. The washing machine shall be suitably loaded dependant on its size. If necessary, fillers (polyester) can be added to achieve the desired load. (In the case of a larger load cleaning efficiency may not be achieved. In the case of a smaller load the mechanical action may damage the fire hoods.)

b) Heavily soiled, contaminated or spotted areas shall be pre-treated. Chlorine bleach, chlorinated solvents, cleaning agents containing active ingredients or solvents shall not be used without the approval of the manufacturer.

c) The temperature of the water shall not exceed the temperature indicated on the maintenance label and the manufacturer's instructions. If the maintenance label gives no temperature, the water temperature should not exceed 60 °C.

d) A detergent with a pH range of not less than 6,0 pH and not greater than 10,5 pH shall be used.

e) To remove all detergent and chemical residues after cleaning, rinsing is very important. The rinsing shall be carried out with sufficient water, the weight/water ratio 1/9, with a minimum recommended 3 rinsing cycles.

f) The machine manufacturer's instructions shall be followed for appropriate settings or program selection for the fire hoods to be cleaned.

The fire hood shall be dried in accordance with 13.3.

Depending on the accessibility, type and quality of the hoods, the advance cleaning process can be carried out through a traditional water-based process as well as through the use of new technologies such as the decontamination process based on liquid carbon dioxide. Or a combination of both.

The washing machine shall be cleaned by running the machine without a laundry load, through a complete cycle with detergent and filled to the maximum water level with the water set to the maximum temperature (in excess of 70 °C). This shall be done at least weekly. An independent verification of the cleaning process shall be obtained at least once a year. This will prove that the cleaning process remains effective.

13.3 Drying

Manufacturer’s instructions shall be followed for drying the fire hood.

In the absence of manufacturer's instructions or approval by the manufacturer of other procedures, the drying procedures described in this subclause shall be used.

They shall not be dried in direct sunlight.

The following procedures shall be used for machine drying:

a) The recommended capacity of the machine may not be exceeded.

b) Basket temperature shall not exceed 60 °C unless otherwise specified on the fire hood label.

13.4 Repair

All repairs to fire hoods shall be performed in accordance with the manufacturer’s instructions.

14 Respiratory protective devices (RPD)

14.1 General

This is a guidance on self-contained breathing apparatus (SCBA) RPD, how they shall be cleaned, inspected and repaired in accordance with manufacturer or supplier instructions and in accordance with fire and rescue service policies and procedures.

For additional guidance on how other types of RPD shall be cleaned, inspected, and repaired in accordance with manufacturer or supplier instructions and in accordance with fire and rescue service policies and procedures as specified in ISO/TS 16975-1 and ISO/TS 16975-2.

14.2 Inspection

14.2.1 General

The routine inspection ensures the SCBA is properly set-up and ready for use. The advanced inspection should be done by agreed competent organization. If contaminations are observed the RPD shall be cleaned using the routine cleaning procedure (14.3.2), then inspected. If the contaminations cannot be removed, the inspection shall not be conducted and advanced cleaning (14.3.3) commenced.

The inspection ensures proper set-ups and functions for an SCBA.

14.2.2 Routine inspection

The routine inspection and daily inspection shall be completed using the following visual and function checks. The routine inspection procedure shall be completed using instructions issued by the manufacturer. The procedures may be developed by the fire and rescue service in consultation with the manufacturer.

a) Dirt

b) Contamination

c) Ensure all items are correctly mounted or connected, check manufacturer's instructions.

d) Physical or heat damages, such as the following:

   1) Tear, split, cut, carbonization, burning hole, dissolution and/or discoloration of fabric parts, such as strap, belt, etc.

   2) Break, corrosion, and/or hole of metallic parts, such as buckle, etc.

   3) Break, wearing, scratch, carbonization, burning hole, and/or dissolution of resin parts.

   4) Deformation, sticking, and/or cracks of elastic parts.

      NOTE Defective or damaged parts shall be replaced immediately, using original spare parts.

e) Loose connectors such as the following:

   NOTE Loosen connectors shall be tightened.

   1) Ensure proper connection between the cylinder valve and the pressure regulator;

   2) Ensure proper connection between face shield and pressure demand valve;

   3) Ensure the cylinder is secure by pulling on the coupling and the strap;

   4) Ensure proper connection of the demand valve to the main and emergency medium pressure hoses;

   5) Ensure proper connection of the hose of the demand valve to the main and emergency exits.

f) Check the pressure needle following the manufacturer's instructions;

g) Check there is no air-leak following the manufacturer's instructions;

h) The test procedure shall follow the manufacturer's instructions;

i) Ensure the passage of the hoses;

j) Check the mask exhalation valve disks for unrestricted movement.

k) Check that the main and emergency hoses are free of movement;

l) Make sure that the demand valve is properly held in its standby position.

m) Ensure the correct position and maintenance of the belt;

n) Ensure that the voice diaphragm functions properly;

o) Ensure no loose screws on the entire SCBA.

14.2.3 Advanced inspection

14.2.3.1 General

In addition to all checks undertaken as part of the routine inspection in 14.2.2 the following checks (14.2.3.1 to 14.2.3.3) are to be completed as part of the advanced inspection.

14.2.3.2 Inspection of the compressed air cylinder

The cylinders are to be presented at regular intervals for periodic inspection by a certified or appointed authority with regard to national or local regulations or guidance from the manufacturer if no national or local regulations exist.

The periodic inspection intervals are determined by the certified authority. An interval for the first periodic inspection is 3 years or 5 years, respectively, depending on cylinder type (see indication in manufacturers type approval or on the cylinder label, respectively). Depending on cylinder type the life is limited to 15 years, 20 years, 30 years or is unlimited. Observe the national regulations in the country of use.

14.2.3.2.1 Visual check

Inclined hand wheel, leaking cylinder valve, cracks in hand wheel, damaged cylinder connection, etc.

a) Cylinders shall be checked carefully for outside damage (abrasion, impact, dents, cuts and delamination). Depending on the damage, three categories are defined:

   1) Category 1: Non-critical superficial damage, e.g. small abrasion, small cuts, scores or scratches. Such cylinders may be used again.

   2) Category 2: If damage is considered repairable, make contact with the manufacturer.

   3) Category 3: Damage down to the carbon fibre layer. These cylinders may be taken out of service.

b) Check validity of periodic inspection.

A defective compressed air cylinder shall be taken out of service immediately, it is to be emptied (depressurized) in a safe area and shall be presented to an inspection station and or a certified authority for a cylinder.

14.2.3.2.2 Tightness test

a) The compressed air cylinder filled to service pressure and with closed valve less sealing plug is immersed into water. Air leaking from the cylinder valve outlet connection indicates a leakage in the valve between the lower shaft and the valve body. Air leaking at the cylinder neck thread indicates an insufficient packing of the cylinder valve to the cylinder.

b) To blow out the water from the valve, put cylinder into holding fixture (use only holding fixtures which do not exert impermissible forces to the cylinder, and which do not damage the cylinder surface). Open cylinder valve carefully and briefly, and close again.

c) Seal cylinder valve outlet connection with sealing plug, open and close again cylinder valve.

d) Immerse cylinder with cylinder valve into water. Air leaking under the hand wheel indicates a damaged packing of the upper valve shaft.

e) After tightness test dry cylinder valve.

f) If the tightness between cylinder valve and cylinder only is to be checked, the joint may alternatively be brushed with soap water.

14.2.3.3 Inspection of the valves

Visual inspection of the valves: Inspect the valves for possible damage.

14.2.3.4 Inspection of the facepiece

Advanced inspection for the facepiece shall be conducted in the following parts. Procedures of the inspection shall be carried out by agreed competent organization:

a) facepiece body;

b) eye piece part;

c) strap;

d) inhalation valve;

e) breathing valve;

f) nose cup;

g) inhalation tube;

h) speaking diaphragm.

14.3 Cleaning

14.3.1 General

All cleaning shall be performed in accordance with the manufacturer's instructions and shall be conducted by agreed competent organization.

Training shall be carried out by the manufacturer. This ensures that the competent organization has received the necessary training. Where possible machine cleaning shall be used, but only in specialist machines designed for this activity.

If doing manual cleaning, then appropriate PPE shall be worn, such as protective gloves and protection against splashing of eyes and face.

During cleaning water must be prevented from entering any hose or hose connection. The best way to achieve this is to clean while the set is pressurised.

14.3.2 Routine cleaning

If the firefighter identifies light soiling or non hazardous contaminations, the RPD shall be cleaned in accordance with the following.

For cleaning see the manufacturer's instructions, including the information on the use of any other chemicals or any abrasive materials:

a) Frame cleaning – straps-buckles-belt.

The cleaning shall be carried out exclusively with water and mild non-abrasive soap, a brush can be used for particularly dirty components and textiles.

Screws or connections as well as medium pressure connectors shall be protected against splashing.

b) Cleaning the demand valve.

Cleaning shall only be done with water and mild non-abrasive soap, a "nailbrush" brush can be used for particularly dirty parts.

During cleaning, make sure that no fluid enters the demand valve through the medium pressure hose.

For this, the demand valve shall be in the standby position and the medium pressure hose connected to a frame. If it is not connected it is necessary to put the cap on the fitting.

c) Cleaning the cylinder.

Cleaning shall be done with a sponge with mild non-abrasive soap and water.

d) Cleaning the mask:

   1) Cleaning shall be done with mild non-abrasive water and soap.

   2) Clean the dirt from inhalation valve.

   3) Mask shall be disinfected after every use.

e) Apply the maintenance parts, e.g., greases if applicable.

14.3.3 Advanced cleaning

Advanced cleaning is required whenever the firefighter finds heavy dirt and/or hazardous contamination that cannot be removed by routine cleaning. The advanced cleaning shall be conducted by competent organization. The inspector shall inquire of the manufacturer and/or cleaning service whether the dirt and/or contamination can be removed. If it is impossible, the inspector shall consider disposal of the RPD. The disposal shall follow the governmental and/or local authorities' rules.

14.4 Drying

Before being put into service it is very important that all components shall be dried. Water left in medium or high-pressure parts may cause icing during use, and thus blocking air flow. Parts may need to be pressurized before submerged in water.

The drying shall be carried out according to the manufacturer's instructions and shall be conducted by competent organization, such as the manufacturer, a trained laundry or other competent organization.

Training shall be carried out by the manufacturer of the RPD and the dryer. This ensures that the competent person or organization has received the necessary training. Drying may be carried out manually or by machines.

14.5 Repair

The repair shall only be performed by the manufacturer, unless the manufacturer has provided training and authorised certain repairs.

Annex A
(informative)

Records of all items of firefighters' PPE

A.1

This annex is just a sample of a record form.

Fire service name:

User's name:

Issue date:

Inspected by: end user / authorized personnel

	Garment			Gloves	Hood	Helmet	RPD	Footwear	Other please specify	Interfaces
	Coat	Trousers	Cover-all							
Condition:										
New										
Good										
Reasonable										
Retire										
Manufacturer										
Model name										
Identification										
Lot number										
Date of manufacture										
Size										
Training provider										
Cleaning/ decontamination date										
Repair date										