FES.004.001.0011_001

Selection, Use, Care and Maintenance of Personal Protective Equipment (PPE)

PROCEDURAL

GUIDELINE

Version 2.0
30 April 2019
Doctrine ID: 3059

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Citation

Australasian Fire and Emergency Service Authorities Council. (2019) *Selection, Use, Care and Maintenance of Personal Protective Equipment (PPE)* (AFAC Publication No. 3059). East Melbourne, Vic: Australia. AFAC Ltd.

Review period

This guideline should be reviewed by the doctrine owner by April 2024. However, this guideline refers to a number of Australian/New Zealand and international standards, and these standards may change. Therefore, this guideline will also be reviewed accordingly.

Contents

About AFAC and doctrine

AFAC

AFAC is the Australian and New Zealand National Council for fire, emergency services and land management. It is a collaborative network of fire, emergency services and land management agencies that supports the sector to make communities safer and more resilient.

AFAC doctrine

AFAC develops doctrine to support the practice of emergency management. The information in doctrine publications is evidence-based and drawn from academic research and the collective expert knowledge of member agencies. Doctrine is regularly reviewed and represents the official AFAC view on a range of topics.

Doctrine does not mandate action; rather, it sets aspirational measures. Publishing nationally agreed views, shared approaches and common terminology enhances cooperation and collaboration within and between agencies and jurisdictions.

Types of AFAC doctrine

AFAC doctrine is classified as follows:

Capstone doctrine – includes publications, such as strategic intents, that are high-level accounts of the concepts of emergency management operations and service delivery. They describe the principles of what is practical, realistic and possible in terms of protecting life, property and the environment.

Fundamental doctrine – includes positions, which AFAC members are expected to support, as well as approaches and some frameworks. Fundamental doctrine may become agency or jurisdictional policy on a matter if adopted by individual services or jurisdictions.

Procedural doctrine – includes guidelines, some frameworks, and specifications. AFAC members are expected to be aware of procedural doctrine. A guideline is an advisable course of action, a framework provides a linking of elements to create a supporting structure to a system and specifications are a detailed description of a precise requirement to do something or build something.

Technical doctrine – includes technical notes, training material and the Australasian Inter-Service Incident Management System (AIIMS). Technical doctrine provides guidance of a technical nature: the 'how to do something', or the technical meaning relative to a situation.

Purpose

This guideline has been prepared by the AFAC Personal Protective Equipment (PPE) Technical Group to assist AFAC members with PPE-related matters, both contractual and operational.

The terminology 'should' identifies non-mandatory requirements, and is consistent with terminology used in the development of Australian and international standards. Therefore this information is considered guidance and not mandatory.

This guideline may also be used as a quick reference document for the compliance of PPE with the most appropriate Australian or international standards and guidance on its selection, use, care and maintenance (SUCAM).

This guideline also provides practical steps that may be followed with respect to carrying out a risk assessment process, including the identification of possible hazards and how the risk of exposure may be managed by the use of appropriate items of PPE.

Audience

This guideline has been developed as a reference tool for AFAC members and associated stakeholders, including manufacturers and suppliers of PPE, certifying bodies and testing laboratories.

Scope

This guideline provides direction for AFAC members procuring and managing PPE. It only applies to clothing, headwear (including eye protection), footwear and gloves.

This guideline does not cover other specialist items of PPE such as respiratory protective devices (RPD).

Statement of engagement

Consultation was undertaken with the AFAC Collaborative Procurement Group, Work Health and Safety Technical Group, Urban Operations Group, SES Operations Group, Rural and Land Management Group and the Fire Investigation Network.

Source of authority

The AFAC Council endorsed the guideline *Selection, Use, Care and Maintenance of Personal Protective Equipment (PPE)* on 30 April 2019.

Acknowledgements

We would like to acknowledge the work of ISO TC/94 SC14 (Firefighters' Personal Protective Equipment Committee), some of which is referenced in this document, and AFAC Personal Protective Equipment (PPE) Technical Group.

Definitions, acronyms and key terms

AFAC member: A current member organisation of AFAC.

Emergency services: AFAC members not involved in fighting fire.

NFPA: National Fire Protection Association, a United States based fire protection association.

ISO: International Standards Organisation, the organisation responsible for harmonising Standards internationally.

CEN: the European Committee for Standardisation.

Note: A comprehensive list of terms used within standards is provided in Appendix B: Industry Terminology.

List of standards references

The following standards relate to PPE that is referenced in this guideline:

AS 2001: *Methods of test for textiles*

AS 4011.1: *Single-use medical examination gloves Specification for gloves made from rubber latex or rubber solution (ISO 11193-1:2008, MOD)*

AS/NZS 1270: *Acoustics – Hearing protectors*

AS/NZS 1337: *Personal eye protection – Eye and Face protection – Vocabulary (ISO 4007: 2012, MOD)*

AS/NZS 1338: *Filters for eye protectors – Filters for protection against radiation generated in welding and allied operations*

AS/NZS 1801: *Occupational protective helmets*

AS/NZS 1906.4: *Retroreflective Materials and Devices for Road Traffic Control Purposes – High –Visibility Materials for Safety Garments*

AS/NZS 2161.6: 2003: *Occupational protective gloves Part 6: Protective gloves for firefighters –Laboratory test methods and performance requirements*

> Note: AS/NZS 2161.6: 2003 NB: This Standard outlines the performance requirements for Type 1 wildland gloves. For structural firefighting gloves, AS/NZS 2161.1: 2014 should be used.

AS/NZS 2161.6: 2014: *Occupational protective gloves: Protective gloves for structural firefighting – Laboratory test methods and performance requirements*

> Note: AS/NZS 2161.6: 2014 NB: This Standard outlines the performance requirements for structural firefighting only.

AS/NZS 2210.3: *Occupational protective footwear – Specification for safety footwear (ISO 20345: 2004, MOD)*

AS/NZS 31000: *Risk management – Principles and guidelines*

AS/NZS 4067: *Protective helmets for structural firefighting*

AS/NZS 4602.1: *High visibility safety garments – Garments for high risk applications*

AS/NZS 4602.2: *High Visibility Safety Garments – Garments for fire service personnel*

AS/NZS 4821: *Protective footwear for firefighters – Requirements and test methods (EN 15090: 2012, MOD)*

AS/NZS 4824: *Protective clothing for firefighters – Requirements and test methods for protective clothing used for wildland firefighting (ISO 15384: 2003, MOD)*

AS/NZS 4967: *Protective clothing for firefighters – Requirements and test methods for protective clothing used for structural firefighting*

EN 352: *Hearing protectors – Safety requirements and testing*

EN 374: *Protective gloves against dangerous chemicals and micro-organisms*

EN 388: *Protective gloves against mechanical risks*

EN 455: *Medical gloves for single use*

EN 533: *Protective clothing – Protective against heat and flame – Limited flame spread materials and material assemblies*

ISO 11612: *Protective clothing – Clothing to protect against heat and flame – Minimum performance requirements*

ISO 11999: *PPE for firefighters – Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures*

ISO 12127: *Clothing for protection against heat and flame – Determination of contact heat transmission through protective clothing or constituent materials Part 1: Contact heat produced by heating cylinder*

ISO 13934-1: *Textiles – Tensile properties of fabrics Part 1: Determination of maximum force and elongation at maximum force using the strip method*

ISO 13996: *Protective clothing – Mechanical properties – Determination of resistance to puncture*

ISO 13997: *Protective clothing – Mechanical properties – Determination of resistance to cutting by sharp objects*

ISO 14184–1: *Textiles – Determination of formaldehyde Part 1: Free and hydrolysed formaldehyde (water extraction method)*

ISO 15025: *Protective clothing – Protection against flame – Method of test for limited flame spread*

ISO 16073: *Wildland firefighting personal protective equipment – Requirements and test methods*

ISO 17493: *Clothing and equipment for protection against heat – Test method for convective heat resistance using a hot air circulating oven*

ISO 3146: *Plastics – Determination of melting behaviour (melting temperature or melting range) of semi-crystalline polymers by capillary tube and polarizing-microscope methods*

ISO 5470-1: *Rubber – or plastics-coated fabrics – Determination of abrasion resistance Part 1: Taber abrader*

ISO 6330: *Textiles – Domestic washing and drying procedures for textile testing*

ISO 6942: *Protective clothing – Protection against heat and fire – Method of test: Evaluation of materials and material assemblies when exposed to a source of radiant heat*

ISO 9151: *Protective clothing against heat and flame – Determination of heat transmission on exposure to flame*

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

NFPA 1971: *Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*

Introduction

The PPE Technical Group has developed a range of individual doctrine publications related to PPE. This suite of doctrine has been comprehensively reviewed, and has now been consolidated into this guideline. It provides unified advice for the selection, use, care and maintenance of specific items of PPE.

New doctrine, not previously addressed in the review, and included in this guideline, addresses cleaning and decontamination of Personal Protective Clothing (PPC) as well as a documented risk assessment process. This guideline should be read in conjunction with AFAC member policies and procedures in relation to the operational use of PPE.

AFAC's guideline

Product certification

As part of the procurement process, AFAC members should ensure that the final selected PPE be certified to the relevant Australian/New Zealand standard. If no Australian/New Zealand standard exists, then the product should be certified to international standards. The product certification body should be accredited under the Joint Accreditation System of Australia and New Zealand or another recognised accreditation system. The product should display a certified product mark as per the following examples.

Certified Product ™ Australian Standard

ConformanceMark

Figure 1: Examples of certified product marks

The test certificates provided should be from a single, approved certified testing laboratory for the tests referred to in the relevant standard and as specified in this guideline. Type testing of identified PPE should be undertaken to ensure that the products remain compliant with the standard they were certified to.

As part of their contractual arrangements, AFAC members should require a continuing process of batch testing and auditing in accordance with this document (Section 2: Batch Testing). This should be carried out by a certification authority as part of continual certification to the required standard.

Marking

In addition to mandatory labelling requirements specified in the relevant standard, each PPE item should have a permanently affixed label upon which any specific care and maintenance instructions are printed. The label should include provision for the wearer to insert their name and issue date. Where it is not possible to affix a label to the PPE, printed instructions should be provided.

In the case of personal protective blankets, not covered by any standard, the following should apply:

- each blanket should have a label or labels permanently attached to identify the manufacturer, composition of the blanket, laundering instructions (if applicable) and the date of manufacture and/or serial number
- labels should not detract from the performance levels of the blanket.

Selection, use, care and maintenance

Manufacturers often provide an instruction manual and/or a wearer guideline detailing all information relating to the safe use, wearing, adjustment, assembly and cleaning of the PPE item. When not provided, the AFAC member should request such documentation.

Additional information can be found in ISO TR21808, a standard that provides protection for firefighters. However, the principals that apply in ISO TR21808 can also be applied for all emergency service workers. PPE covered in this AFAC guideline identifies the risks and hazards, but is not necessarily limited to the following activities:

- structural firefighting
- wildland firefighting
- incidents involving hazardous materials
- incidents involving mobile property, e.g. motor vehicle, train, boat
- specialist rescue, e.g. USAR, swift water, vertical
- emergency medical response
- storm and tempest, and flood recovery.

Compatibility

Compatibility becomes an issue when different types or combinations of PPE – or different performance levels within a PPE item – are worn at the same time. This is because different levels of performance could result in varying levels of protection. This could also mean that each PPE item may not functionally interface with each other or may interfere with other items of PPE. This may lead to a reduction in protection and/or restrictions provided by the PPE that may impact on the ability to carry out the tasks.

For guidance on the complex issues surrounding compatibility of PPE, two international standards have been developed by ISO TC/94 SC14.

ISO 11999–2

This standard includes test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures (Part 2: Compatibility).

ISO 18639–2 PPE

This standard is an ensemble for firefighters undertaking specialist rescue activities (Part 2: Compatibility).

Both of these publications provide excellent guidance and should be considered to ensure all PPE items are compatible and, therefore, harmonious in function and performance.

Risk management and assessment

Selection of PPE should be predicated by the use of the documented risk assessment process. When implemented in accordance with AS/NZS 31000, the management of the risk enables an AFAC member to:

- improve the identification of opportunities and threats
- comply with relevant legal and regulatory requirements and international norms
- improve mandatory and voluntary reporting
- improve stakeholder confidence and trust
- establish a reliable basis for decision making and planning
- improve operational effectiveness and efficiency
- enhance health and safety performance, as well as environmental protection.

Additional information specific to carrying out a risk assessment for PPE items can be found in Appendix A: Risk Assessment Guide for Selecting Emergency Service Personnel PPE.

1 – Specifying and selecting PPE

The intent of this section is to identify key items that need to be considered when specifying, procuring and issuing PPE.

1.1 – PPE requirements for structural firefighting

1.1.1 – Protective clothing

Compliance

Protective clothing for structural firefighting should be certified to AS/NZS 4967. This standard includes requirements and test methods for protective clothing used for structural firefighting

Sizing

The protective coat and protective trouser should be loose fitting in their cut and design. Sizing, style and functionality should be required to cover both male and female firefighters. Special sizes may also be required.

General

Protective clothing should be designed and constructed to maximise the rate of dissipation of metabolic heat from the wearer.

Moisture barrier

Where a moisture barrier is fitted, it should comply with the performance requirements of AS/NZS 4967.

High visibility

High visibility trim should be applied in accordance with the requirements of AS/NZS 4967 and AS/NZS 4602.2.

Protective coat

Zip: A heavy duty, non-metallic zip should run from the collar to approximately 180mm from the bottom of coat. A No. 10 single slider zip or greater should be used.

Drainage: External drain vents and/or holes may be fitted where appropriate, e.g. to the pockets or hem.

External pockets: External flap pockets may be fitted to the coat. Where pockets are fitted, they should have bellows action and sized to meet the functional requirements of the agency as well as able to incorporate flaps with a secure closure system.

Storm flap pockets: Openings should be located between the zip and the storm flap. The pockets should be constructed from the outer shell material, and may be fitted to meet the functional requirements of the AFAC member.

AFAC member identification: Forms of identification, where required, may be affixed. If fitted, these should meet the performance requirements of the standard.

Hanging loops and straps: Internal loops and straps that offer sufficient hanging and drying capability may be fitted to the protective coat.

Microphone and radio holder: Microphone and radio clip holders may be fitted and placed in accordance with AFAC member instructions.

Protective trouser

Braces: Braces should be constructed of a flame resistant material and incorporate an elasticised section. They may be removable.

Knee protection: Additional knee protection should be provided to enhance comfort when kneeling.

Pockets: Pockets may be fitted to suit AFAC member requirements. Where pockets are fitted, they should have bellows action and be sized to meet the functional requirements of the AFAC member and able to incorporate flaps with a secure closure system.

Hanging loops and straps: Internal loops and straps that offer sufficient hanging and drying capability may be fitted to the protective trouser.

1.1.2 – Protective helmets

Compliance

Protective helmets for structural firefighting should be certified to AS/NZS 4067.

Design

The helmet should be designed to afford emergency service personnel with head protection while engaged in structural firefighting. Design of the helmet is not restricted to any particular style or shape. The helmet should permit the wearer easy attachment, removal and adjustment (where applicable) of all components and accessories.

The compliant helmet should be as light as possible and well balanced, and it should be made available in a range of colours. However, the successful supplier should be able to supply additional colours over the life of the contract, as determined by the AFAC member.

The design of the helmet may incorporate a hanging loop (or similar) to the rear capable of hanging the helmet during storage. The helmet should be designed to incorporate or facilitate the attachment of ancillary items, e.g. torches.

Dimensions

Helmets should be constructed to accommodate a wide range of sizes, preferably achievable through adjusting the helmet liner band with single-handed action.

Identification

In addition to the required retroreflective material, AFAC members may require a number of organisational specific markings, e.g. brigade badge, rank and qualification insignia and wearer identification nameplate, be displayed on helmets, both as standard and replacement issue items.

All materials used in the construction of the markings should be manufactured from an adhesive retroreflective material and be compatible with the relevant provisions for reflective material as detailed in AS/NZS 4067.

1.1.3 – Protective footwear

Compliance

Protective footwear for structural firefighting should be certified to AS/NZS 4821.

Sizing

The footwear should be supplied in the following Australian (UK) sizes or equivalent sizes: 4, 4½, 5, 5½, 6, 6½, 7, 7½, 8, 8½, 9, 9½, 10, 10½, 11, 11½, 12, 12½, 13, 13½, 14, 14½, 15, 15½, 16. The manufacturer should be required to provide additional sizes, width fittings and custom fitted footwear or special modifications upon request.

1.1.4 – Protective gloves

Compliance

Protective gloves for structural firefighting should be certified to AS/NZS 2161.6: 2014.

Sizing

The gloves should be provided in a range of sizes, including extra small, small, medium, large, extra large and double extra large. The manufacturer should be required to provide additional sizes, custom fitted gloves or special modifications upon request. If numeric sizes are used – as opposed to the categories – then AFAC member should require the manufacturer to provide a sample handprint for each numeric size that is manufactured.

1.1.5 – Protective hoods

Compliance

Protective hoods for structural firefighting should be certified to NFPA 1971.

Note: This may also be used for wildland firefighting at the AFAC member's discretion.

Design

The hood should be designed to afford emergency service personnel with head and face protection while engaged in structural firefighting. Design of the hood is not restricted to any particular style or shape. The hood should be compatible with the helmet and face mask used by the AFAC member.

Sizing

Hoods should be provided in a size that ensures correct fitting and compatibility with the helmet and breathing apparatus face mask.

Markings

A permanently affixed label should be attached to the inside of the hood, with provision for the wearer to insert name and service number identification.

1.2 – PPE requirements for wildland firefighting

1.2.1 – Protective clothing

Compliance

Protective clothing for wildland firefighting should be certified to AS/NZS 4824. This standard includes requirements and test methods for protective clothing used for wildland firefighting.

Sizing

The protective coat and protective trouser should be loose fitting in their cut and design. Sizing, style and functionality should be required to cover both male and female firefighters. Special sizes may also be required.

High visibility

High visibility trim should be applied in accordance with the requirements of AS/NZS 4824 and AS/NZS 4602.2.

External pockets

External flap pockets may be fitted to the coat. Where pockets are fitted, they should have bellows action and be sized to meet the functional requirements of the agency and able to incorporate flaps with a secure closure system.

Braces

Where braces are fitted, they should be constructed of a flame resistant material and incorporate an elasticised section. They may be removable.

Knee protection

Where knee protection is fitted, they should be provided to enhance comfort when kneeling.

Pockets

Pockets may be fitted to suit AFAC member requirements. Where pockets are fitted, they should have bellows action and be sized to meet the functional requirements of the AFAC member and able to incorporate flaps with a secure closure system.

1.2.2 – Protective helmets

Compliance

Protective helmets for wildland firefighting should be certified to AS/NZS 1801 Type 3.

Note: Standards Australia Committee SF049 has decided to adopt ISO 16073 by way of a direct text adoption. This does not allow for modifications to the standard.

Following the adoption of ISO 16073, currently under review, protective helmets for wildland firefighting should be compliant with ISO 16073 Section 7.

Design

The helmet should be designed to afford emergency service personnel with head protection while engaged in wildland firefighting. Design of the helmet is not restricted to any particular style or shape.

The protective helmet should have a chin strap or harness anchored in at least three points. The helmet should permit the wearer easy attachment, removal and adjustment of all components and accessories.

The colour of the helmet should be in accordance with AFAC member requirements. Where applicable, the helmet shell brim should be fitted with a full circumference fixed brim protector. The helmet should be fitted with a protective neck flap complying with the standard. The design may also incorporate a hanging loop (or similar) to the rear capable of hanging the helmet during storage.

Sizing

Helmets should be constructed to encompass a wide range of sizes, preferably achievable by adjusting the helmet liner band with single-handed action. Provision should be made to provide additional sizes other than regular (if required).

Mandatory requirements of ISO 16073 Section 7

The following requirements, specified in ISO 16073 Section 7, are listed as optional. To ensure consistency of performance requirements with the transition from AS/NZS 1801 Type 3 to the adoption of ISO 16073, the helmet should not be ventilated and the following requirements should be referenced as mandatory requirements (not optional as specified in ISO 16073).

Electrical insulation (ISO 16073, Clause 7.2.5): When tested by the method given in 7.8, the leakage current should not exceed 1,2mA. This requirement is intended to ensure protection from voltages of up to 440 V. Helmets claimed to meet this requirement should state this fact on the label attached to the helmet.

Lateral rigidity (ISO 16073, Clause 7.2.6): When tested by the method given in 7.9, the maximum lateral deformation of the helmet should not exceed 40mm, and the residual deformation should not exceed 15mm. Helmets claimed to meet this requirement should state this fact on the label attached to the helmet.

High temperature stability (ISO 16073, Clause 7.2.7): Head protective devices, when tested in accordance with D.4 (test 1), should show no visible distortion of the shell. Head protective devices under test should have been previously conditioned at 50°C. Any failure of headbands or other internal components during this test, e.g. melting or collapse of the headband, should not be the basis for rejection of the head protective device.

Note: The purpose of this test is to ensure the suitability of the shell material when it is exposed to radiant heat sources capable of raising the temperature of the shell to 120°C. Headbands within the head protective device and in contact with the wearer's head are not in contact with or exposed to such sources.

High radiant heat environments (ISO 16073, Clause 7.2.8): Head protective devices, when tested in accordance with D.5 (test 2), should meet the following requirements:

- no part of the head protective device shell should touch the headform
- no shell distortion in the posterior portion of the headform should extend more than 20mm below the original position of the head protective device
- no distortion of the anterior and lateral portions of the head protective device should extend more than 15mm below the original position of the device
- no ignition of any part of the head protective device assembly should occur
- no melting or dripping is allowed.

Any failure of headbands or other internal components during this test, e.g. melting or collapse of the headband, should not be the basis of rejection of the head protective device.

The purpose of this test is to ensure the suitability of the shell material when it is exposed to radiant heat sources capable of raising the temperature of the shell to 200°C for a short period of time. Headbands within the head protective device and in contact with the wearer's head are not in contact with or exposed to such sources.

1.2.3 – Protective footwear

Compliance

Protective footwear for wildland firefighting should be certified to AS/NZS 4821 Type 1.

Sizing

The footwear should be supplied in the following Australian (UK) sizes or equivalent sizes: 4, 4½, 5, 5½, 6, 6½, 7, 7½, 8, 8½, 9, 9½, 10, 10½, 11, 11½, 12, 12½, 13, 13½, 14, 14½, 15, 15½, 16. The manufacturer should be required to provide additional sizes, width fittings and custom fitted footwear or special modifications upon request.

1.2.4 – Protective gloves

Compliance

Protective gloves for wildland firefighting should be certified to AS/NZS 2161.6: 2003 Type 1.

Sizing

The gloves should be provided in a range of sizes, including extra small, small, medium, large, extra large and double extra large. The manufacturer should be required to provide additional sizes, custom fitted gloves or special modifications upon request. If numeric sizes are used, as opposed to the categories, the AFAC member should require the manufacturer to provide a sample handprint for each numeric size that is manufactured.

1.2.5 – Protective goggles

Compliance

Protective goggles for wildland firefighting should be certified to AS/NZS 1337 and AS/NZS 1338.

Protective goggles for wildland firefighting should have a frame compliant with the Thermal Stability test contained within AS/NZS 1801, Appendix F at both 120°C and 200°C. They should also have a frame compliant with the Hot Solids test contained within the EN166 and FR rated headband.

Design

The goggles should be designed to afford emergency service personnel with eye protection while engaged in bushfire firefighting and rescue activities. Design of the goggles is not restricted to any particular style or shape. The goggles should be compatible with the protective helmet used by the AFAC member.

Materials

Any combination of materials may be used in the construction of the goggles. However, AFAC members should specify that all individual components of the goggles are capable of meeting the required performance standards to gain the necessary certifications. The components of the protective goggles should be manufactured from materials that have fire resistant properties.

1.2.6 – Personal protective blanket

The personal protective blanket is intended to provide enhanced protection for wildland firefighters wearing PPC certified to AS/NZS 4824 who become entrapped outside of the cabin area of a firefighting appliance during firefighting activity.

Blankets intended for use inside the cabin area of a firefighting appliance – as part of vehicle crew protection system – may not require the same level of performance characteristics. To determine the appropriate level of performance, AFAC members should undertake a risk assessment that reflects the member’s operating procedures and considers what crew protection systems are provided.

If an AFAC member determines, following a risk assessment, that it requires a blanket that has higher or lower performance requirements than stated in this guideline, then that member should determine the performance required for the purpose of implementing the objective of this guideline.

The blanket should be as light as practicable, commensurate with the attainment of the required performance levels and constructed of materials that provide known levels of protection to the user from the impact of direct flame, molten debris and radiant heat during entrapment.

Design

The blanket should be a minimum of 2.0 metres by 1.8 metres in size, and provide adequate protection for users when in the sitting, kneeling, crouching and prostrate or prone positions. The blanket should be designed in such a way that either side of the blanket can be the outer and be compliant to all performance criteria specified.

Test methods

Pre-treatment: Where required, test samples should be subjected to five cleaning cycles in a front loading horizontal drum machine, and using 1g/L IEC detergent in accordance with the procedures of AS 2001.5.4. Washing should be carried out by procedure 5A (at 40 ±3°C) and drying by procedure E (tumble drying) unless otherwise specified in the care labelling. Materials that are labelled as 'dry cleanable only' should be dry cleaned five times in accordance with ISO 3175–1.

Flame spread, face ignition: After pre-treatment, the Flame Spread test should be carried out in accordance with ISO 15025 and by using Procedure A with the surface application procedure and a flame application time of 10 seconds. The following requirements should be satisfied on both surfaces of the blanket:

- no specimen should give hole formation
- no specimen should give molten or flaming debris
- mean value of the afterflame time should be ≤ 2 seconds
- mean value of the afterglow time should be ≤ 2 seconds.

Edge ignition: After pre-treatment, the Flame Spread test should be carried out in accordance with ISO 15025 and by using Procedure B with a flame application time of 10 seconds. The following requirements should be satisfied on all edges of the blanket:

- char length should not exceed 100 mm, as specified in Annex C of ISO 15025
- no specimen should give molten or flaming debris
- mean value of the afterflame time should be ≤2 seconds.

The hemmed fabric specimen should be prepared in the same manner as used in the construction of the blanket as applicable.

Heat transfer (flame exposure): The blanket assembly, when tested in accordance with ISO 9151 and after pre-treatment, should achieve the following performance.

HTI value	Performance
HTI_{24}	≥ 17 seconds
$HTI_{24}–HTI_{12}$	≥ 4 seconds

Heat transfer (radiant exposure): The blanket assembly, when tested in accordance with Method B of ISO 6942 at a heat flux density of 40 kW/m², and after pre-treatment, should achieve the following performance.

Heat transfer	Performance
t_2	≥ 22 seconds
$t_2–t_1$	≥ 6 seconds
Mean transmission factor 1	≤ 60%

Residual strength of material when exposed to radiant heat: One warp and one weft specimen of the blanket's outer material should be tested to ISO 13934–1 before and after pre-treatment of the complete assembly. This should be done to Method A of ISO 6942 at a heat flux density of 10 kW/m2 for 3 minutes. Each specimen should have a tensile strength ≥100 N.

Heat resistance: Each material used in the blanket assembly, when tested in accordance with ISO 17493 at a test temperature of 260°C, should not melt, drip, ignite, separate or shrink more than 10 per cent.

Heat resistance of sewing thread: Specimens of sewing threads – inclusive of seam construction threads and quilt threads used in the blanket – should be tested in accordance with the Hot Plate test in ISO 3146 and should not melt at a temperature less than 180°C.

1.3 – PPE requirements for fire investigation and post-incident analysis

The principal objective of this PPE is to safeguard emergency service personal undertaking fire investigation or post-incident analysis activities.

1.3.1 – Protective clothing

Compliance

The fabric used in the construction of PPE for fire investigation and post-incident analysis should provide a level of protection that draws on the performance requirements of AS/NZS 4824. ISO 11612 states that 'Protective clothing – clothing to protect against heat and flame – minimum performance requirements' or equivalent are relevant. However, during heat resistance testing a performance temperature of 180°C should be used.

Design

The protective coat, trouser and/or one piece coverall should be designed to afford emergency service personnel with protection whilst engaged in fire investigation and post incident analysis activities.

Sizing

The protective coat, trouser and/or one piece coverall should be loose fitting in their cut and design. Sizing, style and functionality should be required to cover both male and female. Special sizes may be required.

High visibility

Where high visibility trim is applied, the tape performance should be in accordance with the requirements of AS/NZS 4602.1.

Protective trouser

The protective trouser should be of a cargo design that incorporates:

- off-set side pockets with internal access at left and right
- thigh cargo pockets at left and right
- rear patch pockets at left and right
- radio pocket
- minimum of seven large belt loops.

Protective coat and/or shirt

The protective coat and/or shirt should be of an over shirt design that incorporates:

- chest pockets on front left and right chest
- sleeve pen pocket
- microphone loop
- epaulette holders.

One piece overall

The protective one piece coverall should incorporate:

- action back
- elasticised waist
- chest pockets on front left and right chest
- off-set side pockets with internal access at left and right
- thigh cargo pockets at left and right
- rear patch pockets at left and right
- radio pocket
- epaulette holders.

1.3.2 – Protective helmets

Compliance

Protective helmets for fire investigation and post-incident analysis should be certified as compliant with AS/NZS 1801 Type1 or Type 3.

Design

The helmet should be designed to afford fire investigators with head protection while engaged in fire investigation or post-incident analysis investigations. Design of the helmet is not restricted to any particular style or shape.

The protective helmet should have a chin strap anchored in at least three points. The helmet should permit the wearer easy attachment, removal and adjustment of all components and accessories. Colour of the helmet should be in accordance with the AFAC member requirements.

Identification

In addition to the required retroreflective material, AFAC members may require organisational specific markings, e.g. Fire Investigator, be provided with the helmets, both as standard and replacement issue items.

All materials utilised in the construction of the markings should be manufactured from an adhesive retroreflective material that will not adversely affect the performance requirements of the helmet. These specific markings should be in addition to the requirements specified in AS/NZS 1801, Type 1 or 3.

1.3.3 – Protective footwear

Compliance

As a minimum, protective footwear should be certified as compliant with AS/NZS 2210.3. Where additional protection is required, e.g. heat and flame protection, consideration should be given to referencing the requirements of AS/NZS 4821.

Design

The protective footwear should be designed to afford emergency service personnel with foot protection while engaged in fire investigation or post-incident analysis investigation activities. Design of the footwear is not restricted to any particular style or shape. However, it should incorporate the following features:

- water resistance
- toe protection
- antibacterial moisture wicking lining
- bellows tongue to ensure is waterproof
- rust proof zipper and eyelets
- dual density slip resistant sole
- heat and flame resistant (optional)
- penetration resistance.

Sizing

The footwear should be supplied in the following Australian (UK) sizes or equivalent sizes: 4, 4½, 5, 5½, 6, 6½, 7, 7½, 8, 8½, 9, 9½, 10, 10½, 11, 11½, 12, 12½, 13, 13½, 14, 14½, 15, 15½, 16. The manufacturer may be required to provide additional sizes, width fittings and custom fitted footwear or special modifications upon request.

1.3.4 – Additional PPE for fire investigation and post-incident analysis

The following additional PPE items should be available – appropriate to the level of hazard – for emergency service personnel to afford effective personal protection while engaged in fire investigation and post-incident analysis activities. The following PPE items should also be considered:

- tear resistant barrier gloves, e.g. Nitrile or similar worn under protective gloves to protect against absorption (These should be single use and provided in sizes small, medium, large, extra large and double extra large
- barrier gloves that comply with AS/NZS 4011.1, EN 374, EN 455 or equivalent standards
- protective gloves that provide protection against injection, graze or cuts
- high visibility safety vests compliant with AS/NZS 4602.1
- high visibility wet weather clothing compliant with AS/NZS 4602.1
- hearing protection compliant with EN 352
- eye protection compliant with AS/NZS 1337
- knee pads
- disposable overalls (for contaminated sites, biohazard sites (including fatalities) or as required)
- respiratory protective devices (guidance can be found in the AFAC *Selection of Appropriate Respiratory Protective Devices (RPDs) During Bushfires* guideline).

1.4 – PPE requirements for SES

PPE guidance in this section is for general rescue and search applications. It is not intended for speciality rescue operations such as swift water or vertical rescue.

1.4.1 – Protective clothing for SES

Compliance

The fabric used in the construction of the protective clothing should, as a minimum, be compliant with AS/NZS1906.4. In addition, the garment should be compliant with AS/NZS 4602.1, class D/N.

Design

The protective coat, trouser and one piece coverall should be designed to allow emergency service personnel to safely engage in SES activities such as search and rescue, storm and flood.

Sizing

The protective coat, trouser and one piece coverall should be loose fitting in cut and design. Functionality and style should be required to cover both male and female sizes. Special sizes may be required.

High visibility

High visibility trim that is applied should be in accordance with the requirements of AS/NZS 4602.1.

Protective trouser

Dependent on agency requirements, the protective trouser should be of a cargo trouser design and incorporate:

- off set side pockets with internal access at left and right
- thigh cargo pockets at left and right
- rear patch pockets at left and right
- radio pocket
- minimum of seven large belt loops
- knee pads
- secure fastening.

Protective coat and/or shirt

Dependent on agency requirements, the protective coat and/or shirt should be of an over shirt design and incorporate:

- stand up collar with Velcro tab
- chest pockets on front left and right chest
- sleeve pocket
- microphone loop
- epaulette holders
- elbow pads
- secure fastening.

One piece coverall

Dependent on agency requirements, the protective one piece coverall should incorporate:

- layback collar with Velcro tab
- action back
- elasticised waist
- chest pockets on front left and right chest
- off set side pockets with internal access at left and right
- thigh cargo pockets at left and right
- rear patch pockets at left and right
- radio pocket
- epaulette holders
- knee and elbow pads
- secure fastening.

1.4.2 – Protective helmets

Compliance

Protective helmets for SES should be certified to AS/NZS 1801 Type1 or Type3.

Design

Helmets should be designed to afford emergency service personnel with head protection while engaged in SES activities. Design of the helmet is not restricted to any particular style or shape. Protective helmets should have a chin strap anchored in at least three points and should permit the wearer easy attachment, removal and adjustment of all components and accessories. Helmet colour should be in accordance with the AFAC member requirements and all exposed edges should be fitted with a fixed protector.

The helmet design should incorporate:

- protective neck flap
- ear muff mounting clips
- torch mounting bracket
- visor.

1.4.3 – Protective footwear

Compliance

Protective footwear should be certified to AS/NZS 2210.3.

Design

Protective footwear should be designed to afford emergency service personnel with foot protection while engaged in SES activities such as search and rescue, storm and flood. Design of the footwear is not restricted to any particular style or shape. However, it should incorporate:

- waterproof membrane
- toe protection
- antibacterial moisture wicking lining
- bellows tongue to ensure is waterproof
- rust proof zipper, e.g. YKK, and eyelets
- dual density slip resistant sole.

Sizing

The footwear should be supplied in the following Australian (UK) sizes or equivalent sizes: 4, 4½, 5, 5½, 6, 6½, 7, 7½, 8, 8½, 9, 9½, 10, 10½, 11, 11½, 12, 12½, 13, 13½, 14, 14½, 15, 15½, 16. The manufacturer should be required to provide additional sizes, width fittings and custom fitted footwear or special modifications upon request.

1.5 – PPE Requirements for emergency services

1.5.1 – Protective gloves

Compliance

Gloves meeting this specification should be certified to AS 2161.6: 2003, Type 1. Additionally, gloves should comply with the Type 3 cut resistance requirement contained within AS/NZS 2161.6: 2003 Item 6.3.2, Table 6, and conform to all colour fastness tests contained within AS 2001.4.

Test description	Method	Performance
Flame resistance	ISO 15025	≤2s
Heat transfer (flame)	ISO 9151	$HTI_{24} \geq 9s$ and $(HTI_{24} - HTI_{12}) \geq 3s$
Heat transfer (radiant)	ISO 6942	$t_2 \geq 11s$ and $(t_{24} - t_{12}) \geq 4s$
Heat transfer (conductive)	ISO 12127	tt ≥ 6s
Heat resistance	ISO 17493	180 °C, shrinkage ≤ 5%
Abrasion resistance	ISO 5470–1	2000 cycles
Cut resistance	ISO 13997	≥ 4 N
Tear resistance	EN 388:1994, clause 6.3	≥25 N
Puncture resistance	ISO 13996	≥60 N

Design

Gloves should be designed to afford emergency service personnel with effective hand and wrist protection while engaged in a variety of technical rescue activities. Gloves should maintain a positive grip when soiled with hydraulic oil or bodily fluids. Such substances should not compromise the gloves integrity.

Gloves should have an effective wrist closure system designed to minimise the entry of foreign objects, e.g. glass splinters, and should incorporate a wing thumb, added palm protection and a pull patch on the palm face.

Gloves should not shrink past the allowable tolerance (≤ 5%) in size after being washed and dried in accordance with manufacturer instructions. The outer glove material should be colour fast.

Sizing

Gloves should be provided in a range of sizes; extra small, small, medium, large, extra large and double extra large. The manufacturer should be required to provide additional sizes, custom fitted gloves or special modifications upon request. If numeric sizes are used as opposed to the categories, the AFAC member should require the manufacturer to provide a sample handprint for each numeric size that is manufactured.

1.5.2 – High visibility safety vests

Compliance

High visibility safety vests for emergency service personnel should be certified to AS/NZS 4602.1.

Design

The high visibility safety vest should be designed to afford emergency service personnel with protection while engaged in a range of activities, particularly where they will be operating in traffic, day and night operations, and where visibility is paramount to the safety of emergency service personnel.

Materials

Any combination of materials may be used. However, key features should incorporate:

- UV protection
- anti-static
- flame resistance, where required.

High visibility material and trim should comply with the requirements specified in AS/NZS 4602.1 and AS/NZS 1906.4.

1.5.3 – High visibility wet weather clothing

Compliance

High visibility wet weather clothing for emergency services personnel should be compliant with AS/NZS 4602.1.

Design

The high visibility wet weather clothing should be designed to afford emergency service personnel with protection while engaged in a range of activities, particularly where they will be operating in traffic, day and night operations and where visibility is paramount to the safety of emergency service personnel.

1.5.4 – Personal protective blanket

A personal protective blanket designed to be used in conjunction with AS/NZS 4824 certified garments and fire appliance safety systems may be used by other emergency service personnel subject to a risk assessment being conducted. Refer to section 1.2.6.

2 – Batch testing

2.1 – Application of batch testing arrangements

Batch testing arrangements are managed by the AFAC Manager Standards to ensure that they remain current.

2.2 – Accredited laboratories

Reports should only be accepted from the National Association of Testing Authorities (NATA) or laboratories that are accredited within their scope to carry out PPE testing as specified in this document (including laboratories having a Mutual Recognition Arrangement with NATA). Test reports will not be accepted from a manufacturer who has an accredited laboratory in which the testing has been carried out and from which the report is subsequently issued. AFAC does not require or request copies of batch testing reports. These are to be maintained by the AFAC member.

2.3 – Test life for type testing

Test reports should have been issued within the last five years.

2.4 – Changes to certified product

Suppliers should not implement changes or modifications to the design or construction of a certified product that impacts on the product's current certification with the specified standard unless:

- written notification of any proposed changes that may affect certification is provided to the product certification body, prior to implementation, for the purpose of review and registration
- written approval for the changes to occur has been provided, prior to implementation, by those that may be the AFAC member agency procuring the item of PPE.

2.5 – Auditing

The supplier should – at least once in every twelve month period – engage a certification authority to undertake a random audit of the manufacturer’s processes, quality control procedures, test results and associated records.

2.6 – Type testing for AS/NZS 4967

For initial certification, full testing of the structural firefighters’ protective clothing will be required to confirm compliance with AS/NZS 4967. Issues identified during random audits may also lead to a requirement for full type testing.

2.6.1 – Batch testing

Fabrics

Testing should be conducted on each batch of fabric produced up to and not exceeding 5,000m.

Garments

The following structural firefighters’ protective clothing batch tests should be carried out at 1/400 garments for the first five batches of a new model. The 1/400 garment tested should be garment number 400, then numbered at the rate of 1/1000 with the 1/1000 garment tested being garment number 1000. If a failure occurs during the 1/1000 rate, batch testing will revert back to the original new model requirements of 1/400 for the subsequent next five batches.

Testing should be in accordance with the following AS/NZS 4967 clauses.

- Flame Spread Clause 3.13.1 (on outer fabric and innermost fabric only in accordance with the Standard)
- Heat Transfer Flame Clause 3.13.2 (total garment assembly)
- Heat Transfer Radiation Clause 3.13.3 (total garment assembly)
- Heat Resistance Clause 3.14 (on all fabrics used in the garment assembly)
- Tensile Strength Main Seams Clause 3.15.2 (total garment assembly)

2.7 – Type testing for AS/NZS 4824

For initial certification, full testing of the wildland firefighters’ protective clothing will be required to confirm compliance with AS/NZS 4824. Random audits may also include a requirement for full type testing.

2.7.1 – Batch testing

Fabric

For the purpose of batch testing to the requirements as specified within AS/NZS 4824 Clauses 6.1, 6.2 and 6.3, the pre-treatment of flame retardant treated fabric will be based on 50 wash and one drying cycle in accordance with the requirements of the standard, e.g. Procedure 2A (60+/–3degC) and Procedure E (tumble dry) as specified in ISO 6330. For all other inherent flame retardant fabric, washing should be as specified within AS/NZS 4824 clauses 6.1 Flame Spread, 6.2 Heat Transfer (radiation) and 6.3 Heat Resistance.

Testing should be conducted on each batch of fabric produced up to and not exceeding 5,000m. Formaldehyde testing in accordance with ISO 14184–1 should be conducted as part of the fabric batch testing process.

The maximum allowable formaldehyde level in parts per million (ppm) for wildland firefighters' protective clothing should be 100ppm or as otherwise specified by the Australian Competition & Consumer Commission (ACCC) for garments which contact the skin, whichever is the lesser value in ppm.

Garments

The following wildland firefighters' protective clothing batch tests are required to be carried out at 1/400 garments for the first five batches of a new model. The 1/400 garment tested should be garment number 400, then numbered at the rate of 1/1000 with the 1/1000 garment tested being garment number 1000. If a failure occurs during the 1/1000 rate, batch testing will revert back to the original new model requirements of 1/400 for the subsequent next five batches. An accredited laboratory should perform batch testing on the fabric of the garment only and the finished seam in the garment.

Testing should be in accordance with AS/NZS 4824 – Clause 7.3 Seam Strength, must be performed on a finished item's seams.

2.8 – Type testing for AS/NZS 4067

For initial certification, full testing of the structural firefighters' helmets will be required to confirm compliance with AS/NZS 4067. Random audits may also include a requirement for full type testing.

2.8.1 – Batch testing

The following structural firefighters' helmets batch tests are required to be carried out at 5/405 helmets for the first ten batches of a new model. The five helmets should be numbered 400 to 405, then numbered at a rate of 5/1000, with the five helmets being 1000 to 1005. If a failure occurs during the 5/1005 rate, batch testing will revert back to the original new model requirements of 5/405 for the subsequent next ten batches.

Testing should be in accordance with the following AS/NZS 4067 clauses:

- Electrical Insulation Clause 5.1
- Flame Propagation Exposure Clause 5.2
- Convective Heat Exposure Clause 5.3
- Radiant Heat Exposure Clause 5.4
- Impact Energy Attenuation Clause 5.5
- Penetration Resistance Clause 5.7
- Retention System Clause 5.8
- Faceshields Clause 5.9

2.9 – Type testing for AS/NZS 4821

2.9.1 – Batch testing

The following firefighters' footwear batch tests will be required to be carried out at 1/500 pairs of footwear for the first ten batches of a new model, and then at a rate of 1/1000 pairs of footwear. If a failure occurs during the 1/1000 rate, batch testing will revert back to the original new model requirements of 1/500 for the subsequent next ten batches. Batch testing should be performed by an accredited laboratory.

Requirement	AS/NZS 4821, Appendix ZZ	AS/NZS 4821, section 15090	ISO 20345
Whole of Footwear Heat Resistance	6.11		
Resistance to Hot Contact			6.4.1
Radiant Heat Clause	7.2		
Flame Resistance Clause 3.5.3		6.3.3	
Upper/Outsole Bond Strength			5.3.1.2
Electrical Resistance (insulating or antistatic) **			6.6.2 or 6.6.3
Impact Resistance (if applicable)			5.3.2.3
Chemical Resistance (if applicable) **	6.13		
Penetration resistance (if applicable)			6.2.1

Note: All requirements listed in this table are applicable for both wildland and structural PPE, except where denoted by ** which indicates requirements for structural only.

2.10 – Type testing for AS/NZS 1801 Type 3

For initial certification, full testing of the wildland firefighters' protective helmets will be required to confirm compliance with AS/NZS 1801, Type 3. Random audits may also include a requirement for full type testing.

Note: Standards Australia Committee SF049 has adopted ISO 16073 by way of a direct text adoption. This does not allow for modifications to the standard. Following the adoption of ISO 16073, expected in 2017, batch testing for protective helmets for wildland firefighting may alter to suit.

2.10.1 – Batch testing

The following firefighters' protective helmets batch tests will be required to be carried out at 4/400 helmets for the first ten batches of a new model, then at a rate of 4/1000 helmets. If a failure occurs during the 4/1000 rate, batch testing will revert back to the original new model requirements of 4/400 for the subsequent next ten batches.

Testing should be in accordance with the following AS/NZS 1801 clauses.

- Shock Absorption Clause 4.6
- Penetration Clause 4.7
- Resistance to Ignition Clause 4.8
- Thermal Requirements Clause 4.9

2.11 – Type testing for AS/NZS 2161.6: 2014

For initial certification, full testing of the structural firefighters' gloves will be required to conform to AS/NZS 2161.6:2014. Random audits may also include a requirement for full type testing.

2.11.1 – Batch testing

Table 1 is a guide to the quantity of gloves tested from the nominated batch size. The production testing of each of these batches should be conducted as per requirements below. If the production testing is rejected, then the production batch testing should use Table 2 to quantify gloves to be tested until 3 consecutive batches pass the requirements with no failures. Batch testing should be done on completed gloves and performed by an accredited laboratory.

Table 1: Batch inspection, normal inspection

Production batch size	Sample size	Accept	Reject
1,000 – 10, 000	10	0	1
10,001 – 35, 000	20	0	1

Table 2: Batch inspection, tightened inspection

Delivery batch size	Sample size	Accept	Reject
501 – 3,200	20	0	1
3,201 – 10,000	32	0	1
10,001 – 35,000	50	1	2

2.11.2 – Performance testing

Testing should be in accordance with the following AS/NZS 2161.6:2014 clauses.

- 6.2.1 Flame Resistance
- 6.2.3 Heat Transfer Radiant
- 6.2.4 Heat Transfer Conductive
- 6.3.1 Abrasion resistance
- 6.4.1 Water Penetration Resistance
- 6.4.2 Liquid Penetration Resistance
- 6.4.3 Whole Glove Integrity
- 6.5 Ergonomic Requirements

3 – Cleaning and decontamination of clothing

The following information is drawn from the DRAFT CEN/TR *Guidance for Selection, Use, Care and Maintenance of Protective Clothing Against Heat and Flame Risks* and has been modified for inclusion in this guideline. The same principles may be applied to other items of PPE.

Personal protective clothing standards require the manufacturer to provide certain information, including care instructions both on a label attached to the item or separately in writing. To ensure clothing performs in accordance with the standard it is certified to, the clothing should be cleaned in accordance with the care instructions provided especially when it becomes dirty or contaminated.

AFAC members are responsible for determining the arrangements used for cleaning and maintaining the clothing and should inform all parties who may become involved in the cleaning process, including the end user, of any risks associated with it.

When determining the arrangements for cleaning the clothing, AFAC members should consider:

- when and how often the clothing should be cleaned
- who will carry out the cleaning
- where the cleaning will be carried out
- the type of cleaning methods to be used
- any risks that may be associated with the cleaning process, e.g. cross contamination.

Clothing may become contaminated with hazardous materials during incidents, e.g. asbestos, body fluids and chemicals. When this occurs, additional processes and procedures are required to manage the contaminated clothing. When determining the arrangements for management, decontamination and cleaning of this clothing, AFAC members should consider:

- how the contaminated clothing is to be handled at the incident scene
- how it can be segregated from other items that could become contaminated, e.g. prevention of cross contamination
- how it is to be managed prior to transportation, e.g. bagged
- how it is to be transported
- how it is to be cleaned and treated and where that should occur, e.g. a specialist facility
- how it is to be disposed should decontamination not be viable or cost effective.

The fitness for purpose of clothing may change depending on age, usage and other factors. When determining when clothing should be replaced, AFAC members should consider:

- how often the clothing is used
- how often the clothing has or should have been cleaned or decontaminated
- wear and tear the clothing has or is likely to have been subjected to
- how the clothing is stored and its impact on performance, e.g. UV degradation.

Appropriately specified cleaning and maintenance practices will ensure that the clothing will provide optimal protection for its operational life, and the wearer or persons handling it will not be subjected to any foreseeable risks or exposures.

Supporting discussion

Instruction within guideline has been drawn from the following (now superseded) AFAC specifications.

- *Structural Firefighting Footwear Specification*
- *Structural Firefighting Glove Specification*
- *Structural Firefighting Helmet Specification*
- *Structural Firefighting Protective Clothing Specification*
- *Wildland Firefighting Footwear Specification*
- *Wildland Firefighting Protective Clothing Specification*
- *Wildland Firefighting Helmet Specifications*
- *Wildland Firefighting Gloves Specification*
- *Fire Rescue Glove Specification*
- *Rescue Glove Specification*
- *Personal Protective Blanket Specification*

Instruction within this guideline has been drawn from the following (now superseded) AFAC technical schedules.

- *Structural Firefighters' Protective Clothing Technical Schedule*
- *Structural Firefighters' Helmets Technical Schedule*
- *Structural Firefighters' Gloves Technical Schedule*
- *Wildland Firefighters' Protective Clothing Technical Schedule*
- *Wildland Firefighters' Protective Helmets Technical Schedule*
- *Firefighters' Footwear Technical Schedule*

Appendix A: Risk Assessment Guide for Selecting PPE for Emergency Service Personnel

This guide has been developed based on the work of CEN Technical Committee TC162, Joint Working Group for Firefighters Personal Protective Equipment and has been modified to encompass PPE worn by all emergency service personnel.

Where possible, the level of risk that a hazard presents to emergency service personnel should be eliminated or reduced to an acceptable level. The guidance given indicates how to carry out a risk assessment by acknowledging hazards that may be present, the likelihood of the emergency service personnel becoming exposed to them and possible consequence of such exposure. This guide is included to assist employers deciding on the most appropriate type of PPE for the emergency service personnel they are responsible for, and addresses:

- structural firefighting
- wildland firefighting
- incidents involving hazardous materials
- incidents involving mobile property e.g. motor vehicle, train, boat
- specialist rescue, e.g. USAR, swift water, vertical
- emergency medical response
- storm and flood recovery.

Basis of this guide

Risk is the probability that the harm or damage from a particular hazard is realised. Risk reflects both the probability and the consequences of the harm.

The Hazard Table lists many of the hazards likely to be encountered by emergency service personnel in the execution of their duties. It is very unlikely that all the hazards listed will be encountered during one incident, and this list of hazards is not definitive. Hazards may be deleted or added to by any AFAC member carrying out a particular risk assessment, subject to local conditions and requirements.

By considering all the various hazards that emergency service personnel may be exposed to, and by applying the risk assessment formula in this guide – line by line – the more serious risks should be identified by a higher score.

This should highlight where decisions should be taken to ensure adequate and correct levels of protection for emergency service personnel.

Risk assessment formula

R = L x S where **R = Risk**, **L = Likelihood** of the emergency service personnel being exposed to the hazard and **S = Severity / Consequences** to the emergency service personnel if exposed to the hazard. PPE should be chosen based on protecting the emergency service personnel against the identified risks.

Values of L and S

Likelihood	Severity / consequence
1. Never	Nil, e.g. no injury
2. Exceptional	Low, e.g. minor injury (small cuts, burns)
3. Occasional	Moderate, e.g. major injury (broken bones, serious burns)
4. Very likely	High, e.g. life threatening
5. Always	Extreme, e.g. death

Note: Never should only be allowed where there is absolutely zero chance of the hazard being encountered.

Risk assessment guide

Hazard Table where L x S = R

Assessment of risk					Reassessment						
Hazard Origin and type	L	S	R	Control measures	L	S	R	Outcome from action	Responsible officer	Timeline	Priority
1. Thermal hazards											
a. Convective heat											
b. Radiant heat											
c. Conductive heat											
d. Flame											
e. Contact heat											
f. Molten metal/ plastic drops											
g. Burning embers											
h. Flashover											
2. Radiation											
a. Non-ionizing radiation											
– UV, visible, laser, IR, microwave and radio frequency											
b. Ionizing radiation											
– radioactive contamination, alfa											
– beta, gamma, X-radiation											

Assessment of risk					Reassessment						
Hazard Origin and type	L	S	R	Control measures	L	S	R	Outcome from action	Responsible officer	Timeline	Priority
3. Electrical hazards											
a. Electric arc											
b. Static electricity											
c. Electrical current, high voltage >1000 – overhead wires etc – 3 phase industrial											
d. Low voltage <1000 – domestic power, house etc.											
4. Environmental hazards											
a. Ambient hot, e.g. heat exhaustion											
b. Ambient cold, e.g. hyperthermia											
c. Cold surfaces											
d. Air velocity high winds, e.g. working aloft etc.											
e. Rain and hail											
f. Discharge, e.g. steam, splashes											
g. Falling in water											
h. Loss of buoyancy control											

Assessment of risk				Reassessment							
Hazard Origin and type	L	S	R	Control measures	L	S	R	Outcome from action	Responsible officer	Timeline	Priority
5. Mechanical hazards											
a. Penetration, e.g. sharp objects etc											
b. Cut											
c. Abrasion											
d. Falling objects											
e. Flying particles											
f. Impact mechanical force											
g. Caught up e.g. Entrapment											
h. Pressure, e.g. compressed air, rescue equipment											
i. Falling down											
j. Slipping											
k. Vibration											
l. Bites											
m. Gunshot											
6. Noise											
a. Deafness											
7. Non-visibility hazard											
a. Not being seen											

Assessment of risk					Reassessment						
Hazard Origin and type	L	S	R	Control measures	L	S	R	Outcome from action	Responsible officer	Timeline	Priority
8. Biological / chemical hazards If full protection is required, EN 136, EN 137, AS 1716 EN 943–1 (gas), AS 3765.2 If protection against splashes EN 469, and AS/NZS 4967 with moisture barrier included. Editorial note: further validation of standards may be required											
a. Explosive substances and articles											
b. Flammable solids and liquids											
c. Oxidizing substances											
d. Toxic substances											
e. Infectious substances											
f. Corrosive substances											
g. Asphyxiant gases											
h. Compressed gases											
i. Other liquids and substances not listed above											
j. Contamination by body fluids											
k. Smoke											
l. Airborne particles											
9. Other hazards											
a. Getting lost											

The table below lists standards for firefighters' PPE in which requirements and levels of protection against particular hazards are given. This table contains some specific information that should be taken into account when PPE is selected to protect against any particular hazards given. Note that different PPE types are tested differently against particular hazards and the protection level they give is not always equal.

Hazard	Control measures, standards giving performance levels
Origin and type	When need for protection parallel against many hazards is identified, note that performance levels against all identified hazards should be met. When the full body protection is needed, check the compatibility of PPE.
1. Thermal hazards	**All PPE for structural and wildland firefighting.**
a. Convective heat	AS/NZS 4967, AS/NZS 2161.6 AS 4824, NFPA 1971
b. Radiant heat	ISO 15384, AS/NZS 4967, AS/NZS 2161.6, AS/NZS 4067, AS/NZS 4824, NFPA 1971
c. Conductive heat	AS/NZS 4967, AS/NZS 2161.6, AS/NZS 4067, AS/NZS 4821, AS/NZS 4824, NFPA 1971
d. Flame	ISO 15384, AS/NZS 4967, AS/NZS 2161.6, AS/NZS 4067, AS/NZS 4824, NFPA 1971
e. Contact heat	AS/NZS 2161.6, AS/NZS4821
f. Molten metal / drops	EN 531 (minimum performance level of D2), EN 168
g. Burning embers	AS/NZS 4967, AS/NZS 2161.6, AS/NZS 4067, AS/NZS 1801 Type 3, AS/NZS 4821, NFPA1971
h. Flashover	AS/NZS 4967, AS/NZS 2161.6, AS/NZS 4067, AS/NZS 4824, AS/NZS 4821, NFPA 1971
2. Radiation	
a. Non-ionizing radiation	
– UV, visible, laser, IR, microwave, radio frequency	EN 170, EN 172, EN 171, EN 207, EN 208
b. Ionizing radiation	
– radioactive contamination, alfa	EN 1073–1, EN 421
– beta, gamma, X-radiation	
3. Electrical hazards	
a. Electric arc	
b. Static electricity	EN 345, EN 1149, AS/NZS 4821, AS/NZS 4821, ISO 20345
c. Electrical current, high voltage	AS/NZS 4067
d. Electric current, low voltage	
4. Environmental hazards	
a. Ambient hot, e.g. heat exhaustion	

Hazard	Control measures, standards giving performance levels
Origin and type	When need for protection parallel against many hazards is identified, note that performance levels against all identified hazards should be met. When the full body protection is needed, check the compatibility of PPE.
b. Ambient cold, e.g. hyperthermia	ENV 342, EN 511
c. Cold surfaces	EN 511, Satisfactory footwear should also be worn to prevent slipping. Contact with some cold surfaces can cause serious burns. All contact with liquefied gas should be avoided
d. Air velocity high winds, e.g. working aloft	If this hazard is identified as a risk, consideration should be given to wearing suitable fall arrest equipment
e Rain and hail	ENV 343
f. Spraying	ENV 343
g. Falling in water	
h. Loss of buoyancy control	Free flow variable suit
5. Mechanical hazards	
a. Penetration, e.g. sharp objects etc	EN 388, AS 2161.6
b. Cut	EN 388, EN 381 (CHAIN SAW)
c. Abrasion	EN 388, AS 2161.6
d. Falling objects	AS 4067, AS/NZS 1801 AS/NZS 4821, ISO 20345
e. Flying particles	AS/NZS 1336, AS/NZS 1337
f. Impact mechanical force	AS 4067, AS 4821, ISO 20345
g. Caught up, e.g. entrapment	Design of PPE, strength of garment material in case of nails
h. Pressure, e.g. compressed air, rescue equipment	
i. Gravity when falling down	EN 341, EN 353–1, EN 353–2, EN 354, EN 355, EN 360, EN 361, EN 362, EN 363, EN 364, EN 813, EN 358, EN 1891, System which should be selected depending on the anchoring possibility, slippery properties of footwear has also to be considered.
j. Slipping	
k. Vibration	EN–ISO 10819
l. Bites	
m. Shooting	PrEN 14876–1

Hazard	Control measures, standards giving performance levels
Origin and type	When need for protection parallel against many hazards is identified, note that performance levels against all identified hazards should be met. When the full body protection is needed, check the compatibility of PPE.
6. Noise	**EN 352:1–3, EN 458 (selection and use)**
7. Non–visibility hazards	
a. Not being seen	AS/NZS 4602.1, AS/NZS 4602.2
8. Chemical hazards/biological	**If full protection is required, EN 136, EN 137, AS/ 1716 EN 943–1 (gas), EN 466–2 (liquids)**
a. Explosive substances and articles	As above
b. Flammable solids and liquids	As above
c. Oxidizing substances	As above
d. Toxic substances	As above
e. Infectious	As above
f. Corrosive substances	As above
g. Asphyxiate gases	As above
h. Compressed gases	As above, additional insulation layer
i. Other liquids and substances	EN 466–2 and above
j. Contamination by body fluids	As above
k. Smoke	EN 136, EN 137, AS/NZS 1716
l. Airborne particles	
9. Other hazards	
a. Getting lost	Radio, phone, tracking device, safety rope

Other factors to be considered

The training, tactics and operational procedures of each AFAC member will have an impact on any risk assessment, and will probably dictate how each hazard is regarded and indicate the figures to be applied to L and S.

Even if not identified as a potential serious risk under 7a of the Hazard Table, the physiological aspects of wearing PPE should also be considered when carrying out the risk assessment as these can have a serious impact on the health and safety of the firefighter.

Even with different risks being identified by the risk assessment, the decision taken will be to provide protection against the risk of the highest severity.

List of standards referenced in this risk assessment template

The following list of standards is for guidance only and is not exhaustive.

Protective clothing

AS/NZS 4602.1: *High visibility safety garments – Garments for high risk applications*

AS/NZS 4602.2: *High Visibility Safety Garments – Garments for fire service personnel*

AS/NZS 4824: *Protective clothing for firefighters – Requirements and test methods for protective clothing used for wildland firefighting (ISO 15384: 2003, MOD)*

AS/NZS 4967: *Protective clothing for firefighters – Requirements and test methods for protective clothing used for structural firefighting*

EN 1073–1: *Protective clothing against solid airborne particles including radioactive contamination Part 1: Requirements and test methods for compressed air line ventilated protective clothing, protecting the body and the respiratory tract*

EN 1149–1: *Protective clothing – Electrostatic properties Part 1: Test method for measurement of surface resistivity*

EN 342: *Protective clothing – Ensembles and garments for protection against cold*

EN 343: *Protective clothing – Protection against rain*

EN 381–5: *Protective clothing for users of hand-he*ld chain saws Part 5: Requirements for leg protectors

EN 381–9: *Protective clothing for users of hand-held chain saws Part 9: Requirements for chain saw protective gaiters*

EN 471: *High-visibility warning clothing for professional use – Test methods and requirements*

EN 531: *Protective clothing for workers exposed to heat*

ISO 15384: *Protective clothing for firefighters – Laboratory test methods and performance requirements for wildland firefighting clothing*

Protective Gloves

AS 2161.6: 2003: *Occupational protective gloves Part 6: Protective gloves for firefighters – Laboratory test methods and performance requirements*

EN 388: *Protective gloves against mechanical risks*

EN 511: *Protective gloves against cold*

EN ISO 10819: *Mechanical vibration and shock – Hand–arm vibration – Measurement and evaluation of vibration transmissibility of gloves at the palm of the hand (ISO 10819: 2013)*

Protective Footwear

AS/NZS 2210: *Occupational protective footwear (series)*

AS/NZS 4821: *Protective footwear for firefighters – Requirements and test methods (EN 15090: 2012, MOD)*

ISO 20345: *Personal protective equipment – safety footwear*

Respiratory protective devices

AS/NZS 1715: *Selection, use and maintenance of respiratory protection equipment*

AS/NZS 1716: *Respiratory protection devices*

EN 136: *Respiratory protective devices – Full face masks – Requirements, testing and marking*

EN 137: *Respiratory protective devices – Self-contained open-circuit compressed air breathing apparatus with full face mask – Requirements, testing and marking*

Personal eye protectors

AS/NZS 1336: *Eye and face protection – Guidelines*

AS/NZS 1337: *Personal eye protection – Eye and face protection – Vocabulary (ISO 4007:2012, MOD)*

Head protection

AS/NZS 1801: *Occupational protective helmets*

AS/NZS 4067: *Protective helmets for structural firefighting*

Personal protective equipment against falls

EN 341: *Personal fall protection equipment – Descender devices for rescue*

EN 353–1: *Personal fall protection equipment – Guided type fall arresters including an anchor line Part 1: Guided type fall arresters including a rigid anchor line*

EN 353–2: *Personal protective equipment against falls from a height Part 2: Guided type fall arresters on a flexible anchor line*

EN 354: *Personal fall protection equipment – Lanyards*

EN 355: *Personal protective equipment against falls from a height – Energy absorbers*

EN 358: *Personal protective equipment for work positioning and prevention of falls from a height – or positioning systems*

EN 360: *Personal protective equipment against falls from a height – Retractable type fall arresters*

EN 361: *Personal protective equipment against falls from height – Full body harness*

EN 362: *Personal protective equipment against falls from a height – Connectors*

EN 363: *Personal fall protection equipment – Personal fall protection systems*

EN 364: *Personal protective equipment against falls from a height – Test methods*

EN 365: *Personal protective equipment against falls from a height – General requirements for use, maintenance, periodic examination, repair, marking and packaging*

EN 813: *Personal fall protection equipment – Sit harnesses*

Appendix B: Industry terminology

The following are terms and definitions used in the development of international standards.

Abrasion resistance: Mechanical test that, together with other physical measurements such as tear strength, can be used to give an estimated wear life of a garment.

Absorption: Incorporation of one material in another.

Accessory: Optional part of an item of PPE which is removable without the use of tools.

Accessories (in the context of protective clothing): Non-fabric items forming part of or optional extras in a garment, e.g. metal or plastic buttons or fasteners. (see Hardware)

After flame (after burn): Period during which a fabric burns after the flame has been removed or extinguished.

Afterglow: Period during which a fabric glows after the flame has been removed or extinguished.

Aramids: Family of polymers with inherent protective properties useful in heat and flame protection.

Bloodborne pathogen: Pathogenic micro-organisms that are present in human blood and can cause disease in humans. These include, but are not limited to Hepatitis B, Hepatitis C and HIV.

Break-open: Formation of a hole in material during thermal exposure.

Burn injury: Burn damage that occurs at various levels of depth within human tissue and is categorised as first, second and third degree burns. Predicted burn injury measurement used in the manikin flash fire testing of clothing is the sum of the areas represented by the sensors with predicted 2nd and 3rd degree burn injury.

Calibration: Establishment of the relationship between a measuring instrument with standard values of the property being measured.

Cleaning cycle: Wash and dry cycles that are in accordance with ISO 6330.

Change in appearance of the specimen: All changes in appearance of the material being tested, e.g. shrinkage, formation of char, discoloration, scorching, glowing and melting.

Charring: Formation of a carbonaceous residue as a result of incomplete combustion, and that may be regarded as an imperfect carbonisation effect.

Closure system: Method of fastening the openings in the garment including combinations of more than one method of achieving a secure closure. (This term does not cover seams)

Clothing assembly: Series of outer and under garments to be worn together that is also known as composite.

Clothing ensemble: Combination of two or more garments that collectively provide protection to the body.

Compatibility: Ability for a combination of items of PPC / PPE harmonious in function and performance.

Compliance: Meeting or exceeding all applicable requirements of a standard.

Component: Any material, part or subassembly used in the construction of an item of PPE.

Component assembly: Combination of all materials of a multi-layer garment presented exactly as the finished garment construction, also known as composite.

Drip: To run or fall in drops or blobs, or the softening with material movement and consequent detachment.

Emergency services: AFAC members not involved in fighting fire.

Firefighters' gloves: Specific gloves providing protection for the firefighters' hands and wrists.

Firefighters' gloves gauntlet: Circular, flared, or otherwise expanded part of the glove that extends beyond the opening of the glove body to cover the wrist area.

Firefighters' gloves body: Part of the glove that extends from the tip of the fingers to 25 mm. beyond the wrist crease.

Firefighters' gloves wristlet: Circular, close fitting part of the glove usually made from knitted material that extends beyond the opening of the glove body to cover the wrist area.

Firefighters' protective clothing: Specific garments providing protection for the firefighters' upper and lower torso, neck, arms and legs but excluding the head, hands and feet.

Flame resistant (FR): Term used to describe a material that burns slowly or is self-extinguishing after removal of an external source of ignition.

Flame retardant treatment: Treatment whereby a chemical compound is incorporated into materials or textile fibres to reduce its flammability.

Flaming debris: Material separating from the specimen during the test procedure and falling below the initial lower edge of the specimen and continuing to flame as it falls.

Footwear upper: Vertical distance between the top surface of the extreme rear edge of the insole and the highest point of the back of the upper.

Footwear insole: Non-removable bottom inside component of the footwear adjacent to the foot.

Hardware: Non-fabric items used in protective clothing including those made of plastic or metal, e.g. fasteners, rank markings and buttons. (see Accessories)

Heat flux: Thermal intensity indicated by the amount of energy transmitted per unit area and per unit time.

Heat Transfer Index (HTI): Index used to measure the transfer of heat through a material / material assembly.

Heat transfer levels (t1, t2 and t3): Three different levels used in testing material / material assemblies for radiant heat transfer. The readings indicate the time from the start of the irradiation (t1) until the total heat is transmitted through the specimen (t2) or the momentary heat flux at the back of the specimen (t3) reaches a certain level. This is the time until a 2nd degree burn occurs.

Helmet: Headgear worn to protect the head, e.g. from falling objects.

Helmet Brim: Ridge protruding outwards from the basic shape of the helmet shell forming its lower edge.

Helmet Chinstrap: Type of retention system which passes underneath the wearer's chin and which helps to ensure that the helmet is correctly maintained in place.

Helmet Earflaps: Integral part or accessory of the helmet which protect the ears of the wearer.

Helmet facepiece fixing: System enabling a facepiece of a respiratory protective device to be fixed to the helmet in such a way that correct sealing around the face is achievable.

Helmet neck guard – also known as neck curtain: Integral part or accessory which protects the back of the neck from water or other liquids, materials and from radiant heat.

Helmet shell: Component which gives the helmet its general shape and on which may be fixed various accessories.

Helmet – jet style or jet style helmet: Helmet design that is sometimes also referred to as a euro style helmet designed to cover the ears and is similar in shape to an open face motorcycle helmet.

High visibility clothing: Warning clothing intended to provide visibility at all times, incorporating; background material, coloured fluorescent material intended to be highly conspicuous; fluorescent material, material that emits optical radiation at wavelengths longer than absorbed; and retroreflective material, material which is a retroreflector. (Retroreflective materials enhance night–time visibility, and fluorescent materials enhance daytime visibility.)

Hood: Balaclava style garment worn directly in contact with the head to protect exposed parts of the head and neck not covered by protective clothing, breathing apparatus and helmet.

Hood yoke: Area of the hood interfacing with the protective clothing covering the upper torso.

Inherent flame resistance: Flame resistance that derives from characteristics and chemical components which are an inseparable part of the fibre from which a fabric is manufactured.

Innermost lining: Innermost face of a component assembly closest to the wearer's skin, and where the innermost lining forms part of a material combination, the material combination should be regarded as the innermost lining.

Instrumented manikin (thermo man): Adult-sized human model fitted with sensors on the surface, excluding hands and feet, used in testing of clothing.

Integral part of an item of PPE: Part which cannot be removed from an item of PPE without the use of tools.

Interface area: Area of the body where items of PPE meet and / or overlap.

Interface component: Item(s) designed to provide limited protection to interface areas.

Interlining: Layer between the outermost layer and the innermost lining in a multilayer garment. **Limited flame spread index:** Number indicating that in testing, the material or material assembly achieved one of the levels specified in EN 533.

Material assembly: Two or more separate layers of the same or different materials. (A material assembly test specimen represents or is taken from the various layers in a single garment or in a series of garments in a clothing system, assembled in equal size and in the order of use.)

Material combination: Material produced from a series of separate layers, intimately combined prior to the garment manufacturing stage, for example a quilted material.

Melting: Liquefaction of a material when exposed to heat that results in a non-reversible change.

Moisture barrier: Part of the component assembly of a protective garment which prevents the transfer of liquids. (Moisture barriers might not prevent the passage of some chemical, biological or radiological agents and appropriate PPE should be provided to protect the wearer in such incidents.)

Molten debris: Molten material separating from the specimen during the test procedure and falling from the specimen without flaming.

Multilayer clothing assembly: Series of layers of garments arranged in the order as worn, and may contain multilayer materials, material combinations or separate layers of clothing material in single layers.

Personal protective equipment (PPE): Equipment which is intended to be worn or held by a person at work and which protects them against risks to their health or safety, and any addition or accessory designed to meet that objective.

Reflective protective clothing: Protective clothing relying on the ability of the outer material to reflect radiant heat.

Retention system: Means of securing an item of PPE in the correct position on the body, which enable adjustment and / or improved comfort.

Shrinkage: Decrease in one or more dimensions of an object or material.

Thermal barrier: Part of the component assembly of a protective garment designed to provide thermal protection.

Thermal protection: Property characterising overall protective performance of an item of PPE in reducing transfer of heat.

Thermal Protection Index (TPI): Total thermal energy that results in heat transmitted through a material and only causes a second degree burn in human tissue.

Thermal Threshold Index (TTI): Term used in testing materials to indicate the time in seconds for the heat transmitted through a material to begin to cause second degree burs in human.

Thermocouple: Device consisting of a junction between two dissimilar metals which is used in the measurement of temperature.