
**PPE ensembles for firefighters
undertaking specific rescue
activities —**

**Part 1:
General**

*Équipements de protection personnelle pour pompiers entreprenant
des activités de sauvetage particulières —*

Partie 1: Généralités

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Foreword

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

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

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

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

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

ISO 18639-1 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 14, *Fire-fighters' personal equipment*.

A list of all the parts in the ISO 18639 series can be found on the ISO website.

Introduction

ISO 18639 series of standards specify requirements of personal protective equipment (PPE) specifically designed to protect firefighters from injury and/or loss of life while engaged in special rescue activities. This document specifies the organisational structure of the ISO 18639 series of standards (see [Annex A](#)) with common standard design for easier end user access (see [Annex B](#) for ISO 18639-3 onward) and the drafting structure to be used consistently in the individual standards within the ISO 18639 series.

ISO/TS 11999-2 specifies design and performance requirements for the compatibility of the relevant parts of the ISO 18639 series when all or some of the items covered in these parts are worn together, thereby creating an ensemble standard. All items meet the general requirements for marking and manufacturer's instructions detailed in this document, as well as the specific marking and manufacturer's instructions of the respective parts.

Under best practice health and safety procedures, prior to choosing any PPE, a risk assessment of the workplace is carried out. Where hazards are identified and cannot be removed from a work place, the items of PPE chosen to protect personnel need to be fit for their intended use. They need to protect personnel whilst allowing them to carry out the work required in their workplace without unduly increasing the risk. In environments where firefighters can be required to work, not only needs the PPE protect the firefighter whilst enabling them to achieve the objectives of attendance at an incident, but it also needs safeguard them and allow a safe escape in the event that this becomes necessary. The risk assessment is the responsibility of the firefighting organisation that is purchasing the PPE. The PPE chosen will also allow the firefighter to carry out their duties without undue stress being caused by the PPE.

Some PPE, particularly PPE to protect against mortal danger, may have failure levels far above the limit of exposures of human beings. In situations such as this, it is important to ensure that proper and suitable safety procedures are in place that will both identify when personnel should be withdrawn from dangerous or potentially dangerous situations. In addition, they need to ensure that the relevant medical support is available for firefighters when they exit the incident, if rehydration or any other medical treatment is required.

As the risk assessment will dictate the performance parameters for the PPE, it is critical that decision-makers have the necessary knowledge of the risks against which the PPE is designed to protect. In addition, they also need to understand the limitations of the equipment. It is recommended that those who make the decision on the choice of PPE for particular work places should be competent in their knowledge and understanding of both the work place hazards and the PPE from which to choose, prior to making these decisions, to ensure that informed decisions are taken.

Further detail on carrying out risk assessment to ascertain the type of PPE required to protect personnel working in specific areas is included in [Annex C](#) of this document.

Hazards in the workplaces of firefighters are varied but may be common from workplace to workplace therefore some uses of PPE for firefighters can be multi-purpose. Because this Standard has been developed on a risk assessment approach, a number of different types, levels or classes are given for certain performance requirements of various parts of a PPE ensemble.

ISO 18639 series includes separate parts for each item of a firefighter's ensemble. As PPE to protect each part of the body can be so complex, this Standard draws from the expertise of other technical Committees in ISO, which specialise in such protection.

The results of the risk assessment for certain work places may require the use of PPE with higher and/or different levels or classes of performance than those in this Standard. PPE covered in this document will not protect from all possible exposures. Nothing in this document is intended to restrict any jurisdiction, purchaser or manufacturer from exceeding the minimum performance requirements specified in this Standard.

ISO/TC 94/SC 14 was established in 2000 with the purpose of standardisation of the performance of personal protective equipment (PPE) intended to safeguard firefighters against the hazards

encountered in the performance of their duties. Two of the objectives of the ISO/TC 94/SC 14 Business Plan are:

- to move away from prescriptive-based requirements in standards to a performance-based approach incorporating a risk assessment in all areas of firefighters personal protective equipment, and
- to ensure wherever practical, compatibility, integration and consistency between the components of firefighters PPE.

ISO/TC 94/SC 14 has developed a Technical Report on this subject, ISO/TR 21808. Firefighters are trained in the selection, use, care and maintenance of their PPE. Firefighters need also to be trained in the performance and limitation of their PPE.

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PPE ensembles for firefighters undertaking specific rescue activities —

Part 1: General

1 Scope

ISO 18639 series of standards specify requirements of personal protective equipment (PPE) specifically designed to protect firefighters from injury and/or loss of life while engaged in specific rescue activities.

ISO 18639 series provides the principles that govern the development of incident type and/or hazard specific minimum test methods including design and performance requirements for personal protective equipment (PPE) worn by firefighters and other rescue workers to reduce injury and/or the loss of life while engaged in rescue activities.

To assist with selection based on a risk assessment (see [Annex C](#)), type of PPE, (if applicable) and performance levels, for different categories of protection are included.

This document covers PPE for use in the rescue activities for road traffic crash (RTC) and urban search and rescue (USAR), but could also include other rescue activities depending on the risk assessment.

It does not include PPE for use in high risk fire exposures.

Similarly, this document does not include PPE to protect against chemical and biological hazards, except against short term and accidental exposures whilst engaged in rescue activities.

This document describes the general structure of the ISO 18639 series, including each subsection, sets design and performance requirements for PPE and includes requirements for marking and manufacturer's instructions.

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 11999-2, *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 — Part 2: Compatibility*

ISO 13688, *Protective clothing — General requirements*

EN 1149-3, *Protective clothing — Electrostatic properties — Test methods for measurement of charge decay*

EN 1149-5, *Protective clothing — Electrostatic properties — Material performance and design requirements*

3 Terms and definitions

There are no normative references in this document.

4 Abbreviated terms and subscripts

4.1 Abbreviated terms

RTC	Road Traffic Crash
USAR	Urban Search and Rescue
PPE	personal protective equipment
RPD	respiratory protective device
HTI ₁₂	heat transmission index (12 °C temperature rise)
HTI ₂₄	heat transmission index (24 °C temperature rise)
TTI	thermal threshold index
<i>m</i>	mass
<i>R'</i>	coefficient of retroreflection
RHTI ₁₂	radiant heat transmission index (12 °C temperature rise)
RHTI ₂₄	radiant heat transmission index (24 °C temperature rise)
<i>w_w</i>	mass fraction of water absorbed

4.2 Subscripts

12	at 12 °C temperature rise
24	at 24 °C temperature rise
<i>w</i>	water

5 Design and performance requirements for PPE items and ensembles

5.1 PPE ensembles

An ensemble of PPE items is classified as meeting the requirements of this document, if every item in the ensemble meets the appropriate requirements of the relevant parts of ISO 18639 series and provide as an ensemble protection to the whole body of the firefighter for rescue operations.

For example, any item of PPE or any PPE ensemble, which are intended to provide protection for the firefighter's upper and lower torso, head, neck, arms, hands, legs and feet, shall be in accordance with the requirements of relevant part of ISO 18639 series.

Nevertheless, an item of PPE, which is in accordance with the requirements of one of the relevant part of ISO 18639 series, can individually be designated and marked for that item of PPE according to the relevant part of the ISO 18639 series.

5.2 Combination of items of PPE

A PPE combination is the use of 2 or more PPE elements, each of which meets the requirements of the relevant individual part of ISO the 18639 series but is not classed as an ensemble (see [5.1](#)).

PPE combinations that claim compatibility shall be assessed according to the relevant interface compatibility testing method(s) described in relevant clause(s) or subclause(s) of ISO/TS 11999-2.

NOTE A combination is more than a single item of PPE but less than an ensemble, i.e. it is not an offering protection for the whole firefighter.

6 Marking

6.1 General

Marking requirements shall be as specified in ISO 13688 and in this clause.

ISO 13688 shall include the marking requirements specified in this clause and in additional specified requirements for the individual PPE elements of the relevant parts of ISO 18639 series.

Any marking in the form of labels shall not adversely affect the performance of any item to which they are attached or present a hazard to the wearer.

When required labels that shall be tested for flammability according to the requirements for labels in ISO 18639-3 only where placed on the exterior of the garment. Labels (interior and exterior) and closure systems shall be tested to the relevant requirements according to the PPE item they are attached.

Marking of PPE shall be under the specific requirements of the item in the relevant parts of ISO 18639 series.

6.2 Compliance marking requirements for an item of PPE

Each item of PPE, for which compliance with this document is claimed, shall have a label permanently and conspicuously attached in conformance with ISO 13688 and upon which the following information is printed in letters at least 1,5 mm high:

- a) identification of product standard — ISO 18639-X:YYYY;
- b) the name, trademark, or other means of identifying or tracing back to the manufacturer;
- c) the manufacturer's model number and/or user's specified number.

6.3 Additional marking for compatibility

Ensembles and combination of PPE items which are intended to be worn together and or assembled, shall be tested together according to the respective compatibility requirements clause(s) and subclause(s) of ISO/TS 11999-2 and meet the requirements of the individual parts of ISO 18639 series. An additional marking shall be added to the item individual markings, clearly listing and identifying all items that are compatible:

- compatible with[using information in [6.2 c\)](#)].

7 Manufacturer's instructions to be supplied with each item of PPE

7.1 User's information

The manufacturer shall meet the requirements of ISO 13688 and the minimum requirements in [7.1](#) and [7.2](#). Manufacturers shall also add additional relevant information from each part of ISO 18639 series.

The manufacturer shall provide user's information including, but not limited to, data showing conformity to the item of relevant part(s) of ISO 18639 series, any additional data required by this document, the results of any optional tests undertaken, warnings, information, and instructions with each PPE.

Instructions shall be supplied in the official language(s) of the country of destination.

The manufacturer shall provide at least the following instructions and information with each PPE:

- a) safety considerations,
- b) information about the markings,
- c) limitations of use,
- d) preparation for use,
- e) sizing,
- f) recommended storage practices,
- g) inspection frequency and details,
- h) donning and doffing procedures,
- i) maintenance and cleaning,
- j) retirement and disposal,
- k) known shelf life limitations, and
- l) information about the use of integrated devices.

The manufacturer shall attach the manufacturer's instructions, or packaging containing this information, to the relevant item of PPE in such a manner that it is not possible to use the item of PPE without being aware of the availability of the information and that a deliberate action is necessary to remove it.

The manufacturer shall provide notice that the information is to be removed ONLY by the end user.

Instructions shall give the following additional information:

- In the situation where a combination of PPE items or an ensemble, do not have the same rating, for example, different levels of heat and flame protection, the manufacturer's instructions shall indicate additional effects and risks which may result.

7.2 Additional user information for compatibility

The combination of PPE items which are intended to be worn and or assembled together, shall be tested together according to the respective compatibility requirements of ISO/TS 11999-2 and meet the requirements of the individual parts of ISO 18639 series.

For the compatible items of PPE, the manufacture shall provide a declaration for each compatible PPE, additional information on the conformity to the requirements of relevant clause(s) and subclause(s) of ISO/TS 11999-2 and any additional checks or warnings, such as but not limited to:

- compatible with[using information in [6.2 c](#)];
- testing and classification of performance for items of PPE, for combinations of items of PPE for ensembles;
- additional compatibility testing, including detailed instructions, that shall be completed by the end user before wearing the PPE in hazard situations.

Annex A (informative)

Structure of the ISO 18639 series

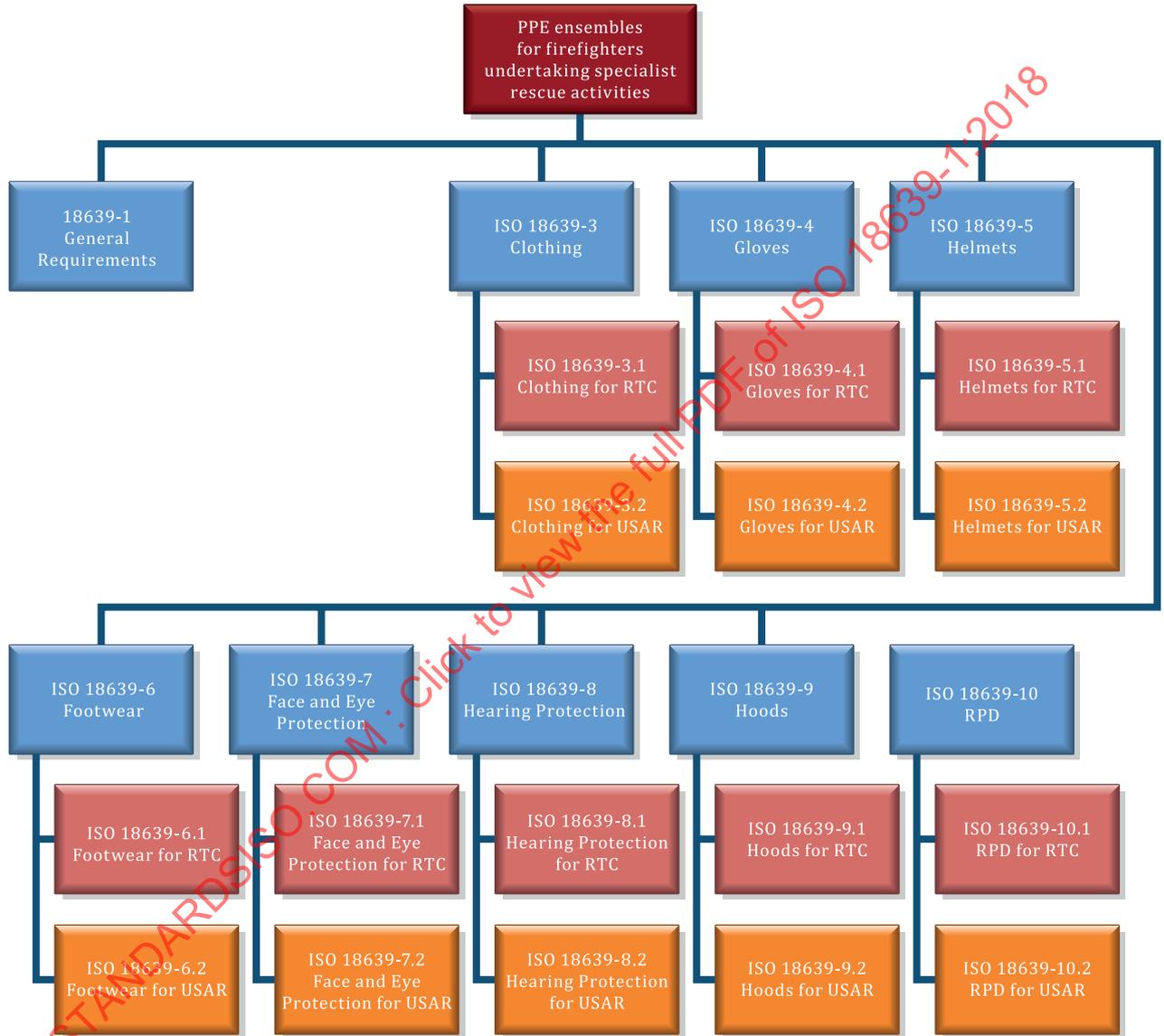


Figure A.1 — Representation of the structure of the ISO 18639 series

Annex B (informative)

Design of the ISO 18639 individual standards for Part 3 onward

Keep only first two levels as fixed: Foreword, Introduction, Clauses 1, 2, 3, 4, 5, 6, 6.1 to 6.8, 7 and 8. The titles of 6.3.1, 6.4.1, 6.5.1, 6.7.1-6.7.2, and 6.8.1 to 6.8.3 are given as examples.

Foreword

Introduction

1. Scope
2. Normative References
3. Terms and Definitions
4. Design and General Requirements
5. Pre-treatment, Conditioning and Sampling
6. Performance Requirements
 - 6.1 General
 - 6.2 Summary of Requirements and Classification

Requirements	RTC	USAR	Xxxx
Flame resistance 6.xx	Index	Index	
Radiant heat 6.xxx			
Contact heat 6.xx			
....			
Tensile strength			
— outer material	www	WWW	
— seams	xxx	XXX	
Tear strength	yyy	YYY	
Abrasion resistance (rubs)	zzz	ZZZ	
...			

6.3 Thermal/arc requirements

6.3.1 Flame spread

6.3.2 ...

6.4 Mechanical protection requirements

6.4.1 Tensile Strength

6.4.2 ...

6.5 Environmental Protection requirements

6.5.1 Surface wetting

- 6.5.2 ...
- 6.6 Visibility requirements
- 6.7 Biological and chemical requirements
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 - 6.8.1 Ergonomics
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 - 6.8.4 ...
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Annex C (informative)

Information on risk assessment

C.1 General

Personal protective equipment is only one part of an effective system of firefighter safety. Well-trained, closely supervised and properly staffed fire departments are equally essential elements of minimizing the operational risk.

Regardless of location, the primary goals of rescue work are to control an incident as quickly as possible and at the same time take steps to minimize eventual damage to and loss of persons and materials. In order of priority, the objectives of a firefighter reaching an incident are to:

- save lives and to prevent or minimize injury;
- prevent or minimize damage to property;
- prevent or minimize damage to the environment.

The role of firefighters' personal protective equipment (PPE) is to protect the firefighter and to enable the firefighter to achieve these objectives.

However, at an incident where the firefighter is unable to achieve these objectives, the PPE shall also provide sufficient protection to enable the firefighter to escape whilst eliminating or minimising the possibility of injury. The choice of PPE and the protection it offers shall be selected on the basis of a risk assessment specific to the incidents and where hazards are identified and selecting specific performance requirements for the PPE used which eliminate or reduce these hazard.

C.2 General approach for conducting a risk assessment

The three major steps of the risk assessment process are as follows.

- 1) **Risk identification:** for every aspect of the operation of the fire department or brigade, list potential problems and hazards. The following are examples of sources of information that may be useful in this process:
 - a list of the risks to which members are or may be exposed;
 - records of previous accidents, illnesses, and injuries, both locally and nationally and internationally;
 - facility and apparatus surveys, inspections, etc.
- 2) **Risk evaluation:** evaluate each item listed in the risk identification process using the following questions.
 - What is the level or potential severity of the occurrence?
 - What is the potential frequency or likelihood of the occurrence?
 - What are the potential consequences of the occurrence?

This will help to set priorities in the developing specifications for PPE performance. Some sources of information which may be useful are:

- safety audits and inspection reports;
- prior accident, illness, and injury statistics;
- application of national data to local circumstances;
- professional judgement in evaluation risks unique to the jurisdiction.

3) **Risk control:** once the risks are identified and evaluated, a control for each should be implemented and documented. The hazard controls in the hierarchy are, in order of decreasing effectiveness represented in Figure C.1:

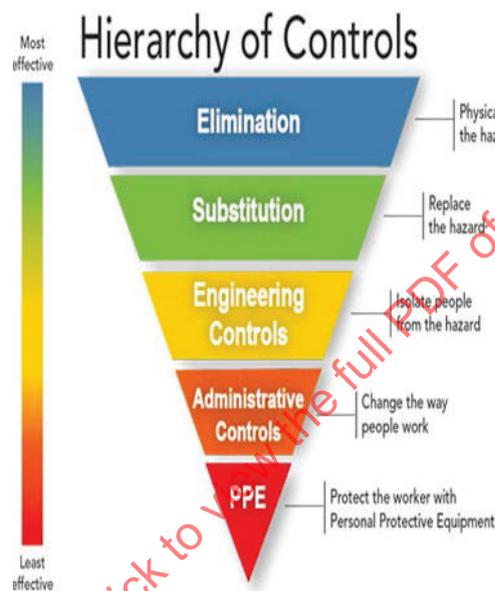


Figure C.1 — Hazard controls in the hierarchy

— **Elimination**

Eliminating the hazard—physically removing it—is the most effective hazard control. For example, if employees shall work high above the ground, the hazard can be eliminated by moving the piece they are working on to ground level to eliminate the need to work at heights.

— **Substitution**

Substitution, the second most effective hazard control, involves replacing something that produces a hazard (similar to elimination) with something that does not produce a hazard.

To be an effective control, the new product shall not produce another hazard.

— **Engineering**

The third most effective means of controlling hazards is engineered controls. These do not eliminate hazards, but rather isolate people from hazards.

— **Administration**

Administrative controls are changes to the way people work. Examples of administrative controls include procedure changes, employee training, and installation of signs and warning labels (such as those in the Workplace Hazardous Materials Information System. Administrative controls do

not remove hazards, but limit or prevent people's exposure to the hazards, such as completing road construction at night when fewer people are driving.

— Personal protective equipment

PPE is often referred to as the Last Line of Defence. Additionally, some PPE in the Firefighting service is designed to protect the firefighter from the unforeseen event or exposure and better facilitate their retreat to a safe place.

Firefighters often use some or a combination of all of these controls at emergency incidents.

In the case of PPE, this should include determining the appropriateness of specific tests and requirements for eliminating or reducing risk. Normally, the two primary methods of controlling risk, in order of preference, are as follows:

- wherever possible, totally eliminate and/or avoid the risk or activity that presents the risk;
- where it is not possible to or practical to avoid or eliminate the risk, steps should be taken to control it
- such as developing appropriate PPE specifications.

Specification of appropriate PPE shall be part of any overall safety program which includes Standard Operating Procedures, training, and inspections. As with any program, it is important to evaluate whether the plan is working. Periodic evaluations should be made, and if the program elements are not working satisfactorily, then modifications to the program should be made. If the methods are changed, a new risk assessment should be performed.

[Annex B](#) provides a format for specifically identifying and evaluating firefighter risks.

C.3 Recommended factors for identifying and evaluating firefighter risks

In using this document for purchasing appropriate clothing, some of the factors that should be considered in a risk assessment, include the following:

- The **level of training and experience**. Well-trained and experienced firefighters are more likely to recognize hazards and appropriately respond in ways to minimize their potential for injury. The quality, amount, and frequency of training will also have an impact on the firefighter's potential for injury. Firefighters should be specifically trained in the use of the selected PPE.
- The **level of fitness and health of the firefighter**. Firefighters who are in good health and physical shape are more likely to respond safely and be less subject to stress-related injuries than firefighters having poor health and physical conditioning.
- The **function of the firefighter at the incident scene**. Some organizations may segregate firefighter responsibilities and subsequently require different levels of protection. Other organizations may require each firefighter to be equipped to perform any function at the incident scene, recognizing the possibility that any individual may be required to respond under emergency conditions. In all cases, the specific activities of firefighters in responding to incidents shall be accounted for in determining risk of injury.
- **Environmental conditions at the incident scene**. Hot and humid conditions as well as cold conditions can affect firefighter protection at the response scene. In addition, the physical environment in which the response is conducted and its impact on firefighters performing assigned duties shall be accounted for. For example, firefighters may become wet. Water inside clothing systems may have a negative impact on its performance.
- **Specific hazards to be faced at the incident scene**. Thermal as well as physical and other hazards should be considered in evaluating response risks. The type, level, and duration of heat exposure as well as the physical environment in which it is contained will have a significant effect on the potential risks faced by firefighters. Other hazards, low visibility, stored chemicals, and rough physical surfaces are known to create additional risks for injury at the fire or rescue scene.

- **Known limitations of the protective clothing and other PPE.** While protective clothing is designed to prevent or minimize injury, the specific limitations of protective clothing in providing protection under all situations shall be recognized. Clothing performance may be limited and based on certain design features or material performance characteristics. In addition, these characteristics may be diminished as the clothing is worn. Protective clothing shall be properly maintained to ensure continued performance. Methods for integrating other PPE such as helmets, gloves, boots, and self-contained breathing apparatus shall be done in a manner that provides protection to the wearer.
- **Type and application of command system at the incident scene.** The amount of discipline and coordination of firefighters at the accident/response scene can have an impact on the risk of injury. Firefighters who have clear responsibilities and are closely supervised are less likely to be injured as compared to firefighters who act more independently and in a less coordinated fashion.

Consideration should also be given to the build-up of heat stress by prolonged use of the PPE when undertaking specialist rescue activities. Heat stress and other stress-related conditions are some of the more frequent causes of firefighter fatalities and injuries. Heat stress is affected by a number of factors including those described above.

C.4 A recommended approach

C.4.1 Introduction

During specialist rescue activities undertaken by firefighters, many different hazards may be encountered. Where possible, the level of risk that each hazard presents to the firefighter should be eliminated or reduced to an acceptable level. The guidance given in this document indicates how to carry out a risk assessment by acknowledging the hazards that may be present, the likelihood of the firefighter becoming exposed to them and the possible consequences of such exposure.

These guidelines have been produced to assist employers in making the decision on choosing the correct type of PPE for firefighters for whom they are responsible.

C.4.2 Basis of this guideline

A definition of "risk" is "the probability that the harm or damage from a particular hazard is realized". Risk reflects both the probability and consequences of the harm (see [Table C.1](#) and [C.2](#)).

A Hazard Table, [Table C.3](#), is also included in paragraph [C.4.9](#) that lists the body portions for which the risk most applies. This analysis will indicate where certain types of protection are needed more or less on the body. This table has been populated with the paragraphs indicating the performance required by this standard.

C.4.3 Risk assessment formula

$$R = L \times S$$

where

R is the risk;

L is the likelihood of the firefighter being exposed to the hazard;

S is the severity/consequences to the firefighter if exposed to the hazard.

PPE should be chosen based on protecting the firefighters against the identified risks.

NOTE Values of L and S are listed in [Table C.1](#).

C.4.4 Values of *L* and *S*

Table C.1 — Values of *L* and *S*

Value	Likelihood	Severity/Consequence	
0	Never	Nil	
1	Exceptional	LOW	e.g. Minor injury: small cuts; etc.
2	Occasional	MODERATE	e.g. Major injury; broken bones; etc.
3	Very likely	HIGH	e.g. Life threatening
4	Always	EXTREME	Death

"0" should only be allowed where there is absolutely NO chance of the hazard being encountered.

C.4.5 Risk assessment guidelines

Table C.2 — Hazard $L \times S = R$

Hazard origin and type	Likelihood of firefighter being exposed to hazard	Severity consequences to the firefighter if exposed to hazard	Risk (Total of $L \times S$)	Control measures
1. Electrical hazards				
a. Electric arc				
b. Static electricity				
c. Electrical current, high voltage				
d. Low voltage				
2. Heat and Flame hazards				
a. Contact heat				
b. Convective heat				
c. Radiant heat				
3. Environmental hazards				
a. Ambient cold				
b. Ambient hot				
c. Contact heat				
d. Cold surfaces				
e. Air velocity — mechanical				
f. Air velocity — wind				
g. Rain				
h. Splashes				
i. Work in water				
l. Falling in water				
4. Mechanical hazards				
a. Penetration				
b. Cut				
c. Abrasion				
d. Falling objects				
e. Impact				
f. Falling/slipping				
5. Non-visibility hazards				

Table C.2 (continued)

Hazard origin and type	Likelihood of firefighter being exposed to hazard	Severity consequences to the firefighter if exposed to hazard	Risk (Total of $L \times S$)	Control measures
a. Not being seen				
6. Biological/chemical hazards				
a. Liquid				
b. Contamination by body fluids				
c. Gas				
d. Smoke				
e. Radioactivity				
7. Other hazards				
a. Physiological/heat stress				

C.4.6 Other factors to be considered

The training, tactics and operational procedures of each organization 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 paragraph 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.

Decide whether the risk assessment is carried out for the actual incident or from when the firefighter leaves the station until he/she returns e.g. environmental issues may not be a serious hazard whilst tackling the incident but may be, if a firefighter shall stand by in bad weather conditions whilst waiting to tackle the incident.

Consider whether the risk assessment is carried out on the basis of the firefighter having no protection or having existing levels of protection, e.g. under normal conditions, firefighters wearing full ISO 18639 compliant clothing will have reasonable protection from unintentional exposure to small heat sources.

It may be decided by some that even with different risks being identified by the risk assessment, the decision taken will be to provide protection against the risk of highest severity protection to ISO 18639 will be required.

The introduction of national databases for recording incidents of firefighters being exposed to hazards would be a valuable source of information when assessing the likelihood of events occurring.

C.4.7 Electro-static hazards

Firefighters need to be aware of the hazards of static electricity. This is because under certain conditions, less than one millijoule (mJ) of energy, much less than the static that builds up in the human body can ignite hydrocarbon vapour/air mixtures, and other explosive gases. Also nuisance static can cause clothing to be uncomfortable to wear.

Energy stored in the body poses a much greater hazard than static clothing, because the body is made almost entirely of water and electrolytes and can store up to 40 mJ of energy.

Garments and fabrics used for protective clothing for firefighters often have anti-static fibres built into the fabric to reduce static hazards. There are two basic types of anti-static fibre. Conductive fibres and inductive or non-conductive fibres.

The fabrics containing conductive fibre may be tested according to EN 1149-1[2], to measure the surface resistivity of the fabric. The performance shall be evaluated according to EN 1149-5.