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Descriptors: work clothing, protective clothing, fire fighting, design, sampling, safety, hazards, specifications, heat resistant materials, tests, marking, graphic symbols

English version

**Protective clothing for firefighters - Test methods  
and requirements for reflective clothing for  
specialized fire fighting**

Vêtements de protection pour sapeurs-pompiers  
- Méthodes d'essai et exigences relatives aux  
vêtements réfléchissants pour opérations  
spéciales de lutte contre l'incendie

Schutzkleidung für die Feuerwehr -  
Prüfverfahren und Anforderungen für  
reflektierende Kleidung für die spezielle  
Brandbekämpfung

This European Standard was approved by CEN on 1996-06-20. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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**CEN**

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Comité Européen de Normalisation  
Europäisches Komitee für Normung

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## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 162 "Protective clothing including hand and arm protection and lifejackets", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 1997, and conflicting national standards shall be withdrawn at the latest by January 1997.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

Annex A is informative.

For relationship with UE Directive(s), see informative Annex ZA, which is an integral part of this standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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## 0 Introduction

This standard specifies three types of reflective protective clothing, which provide higher levels of protection against radiant heat than the non-reflective clothing specified in EN 469. This reflective clothing may be used in certain techniques of specialized fire fighting.

However, protective clothing conforming to EN 469 may also be used with different specialized fire fighting techniques. The type of protective clothing employed should be appropriate for the fire fighting tactics.

## 1 Scope

This standard specifies test methods and minimum performance requirements for reflective protective clothing used in specialized fire fighting.

This clothing provides protection against flame lick and intense radiant heat and is worn for short periods only, to enable the firefighter to enter specific high-risk fire fighting and fire rescue situations which also require the use of breathing apparatus and head, hand and foot protection.

This standard only covers protective clothing that relies upon the ability of the outer material to reflect intense radiant heat. This type of reflective clothing may also be used for industrial applications involving high levels of radiant heat.

The reflective clothing specified in this standard is not covered in EN 469. Non-reflective protective clothing as specified in EN 469 may also be used for specialized fire fighting applications in conjunction with appropriate head, hand, foot and respiratory protection.

## 2 Normative references

This European standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 340

Protective clothing - General requirements

EN 344

Requirements and test methods for safety, protective and occupational footwear for professional use

EN 366 : 1993

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

EN 367

Protective clothing - Protection against heat and flames - Test method: Determination of the heat transmission on exposure to flame

prEN 443

Helmets for firefighters

EN 469:1995

Protective clothing for firefighters - Requirements and test methods for protective clothing for firefighting  
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EN 531:1995

Protective clothing for industrial workers exposed to heat (excluding firefighters' and welders' clothing)  
<https://standards.iteh.ai/catalog/standards/sist/f6dc6db9-d03e-474a-a0a3-320778e2618a/en-531-1995>

EN 532

Protective clothing - Protection against heat and flame - Test method for limited flame spread

EN 659

Protective gloves for firefighters

EN 702

Protective clothing- Protection against heat and flame- Test method: Determination of the contact heat transmission through protective clothing or its materials

ISO 1421

Fabrics coated with rubber or plastics: Determination of breaking strength and elongation at break

ISO 4674 : 1977

Fabrics coated with rubber or plastics: Determination of tear resistance

EN 25077

Textiles- Determination of dimensional change in washing and drying (ISO 5077:1984)

ISO 5081

Textiles- Woven fabrics: Determination of breaking strength and elongation ( Strip method )

### 3 Definitions

For the purposes of this standard, the following definitions apply:

**3.1 specialized fire fighting:** Fire fighting operations involving approach, proximity or entry fire fighting.

**3.2 approach fire fighting:** Limited, specialized fire fighting operations conducted at a distance from incidents involving very high levels of radiant, convective and contact heat, such as bulk flammable gas and bulk flammable liquid fires.

**3.3 proximity fire fighting:** Specialized fire fighting operations, which may include the activities of rescue and fire suppression at incidents involving very high levels of radiant, convective and contact heat, such as aircraft fires, bulk flammable gas and bulk flammable liquid fires. These operations are conducted close to the fire but do not involve fire entry.

**3.4 entry fire fighting:** Very specialized fire fighting operations, which may include the activities of rescue and fire suppression at incidents involving very high levels of radiant, convective and contact heat, such as aircraft fires, bulk flammable gas and bulk flammable liquid fires, and which may involve voluntary direct entry into flames.

**3.5 reflective protective clothing for specialized fire fighting:** Protective clothing designed to provide protection against high levels of radiant, convective, and contact heat, relying on the ability of the outer materials to reflect intense radiant heat, and appropriate for specialized fire fighting operations.

**3.6 garment:** A single item of clothing which may consist of single or multiple layers.

**3.7 component assembly:** The material combination found in a multilayer garment arranged in the order of the garment construction and including any liner

**3.8 closure system:** A method of fastening openings in the garment including combinations of more than one method of achieving a secure closure, e. g. a slide fastener covered by an overflap fastened down with a touch and close fastener.

**3.9 seam:** The junction of two edges of material which are permanently attached in the garment by sewing or any other method.

**3.10 hardware:** Non-fabric items used in protective clothing including those made of plastic or metal, e. g. fasteners, rank markings, buttons.

**3.11 melting:** Liquefaction of a material when exposed to heat to the extent of forming a hole in its structure, either by shrinking and/or dripping away under specified test conditions.

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## 4 General clothing design

### 4.1 Design

Reflective protective clothing for specialized fire fighting shall consist of either:

- a) a single garment, or
- b) two or more garments: in this case the jacket shall overlap the trousers by 30 cm, or
- c) a series of outer and under garments to be worn together.

The clothing should be worn with appropriate head (including neck), hand and foot protection which shall comply with the relevant standards.

Reflective protective clothing for specialized fire fighting is divided into three types with different designs (see Annex A) and different levels of the basic safety requirements as specified in clause 6.

Type 1 clothing consists of a protective hood with a sight grid. It is worn with hand and foot protection, and over other protective clothing e.g. clothing to EN 469, to provide additional protection to the head and shoulders.

Type 2 clothing consists of a coat including a protective hood with a sight-screen. It is worn with appropriate head and foot protection.

Type 3 clothing completely encloses the body. It includes a protective hood with a sight-screen, as well as heat protective boots with heat resistant soles. It is worn with appropriate hand protection. Protective clothing of type 3 may consist of a single garment but a division into several parts is possible.

Head, hand and foot protection used with type 2 or type 3 reflective clothing shall also comply with the basic safety requirements of the appropriate type as specified in this standard (see clause 6). The head and foot protection is normally achieved by the overlap of garments.

The reflective surface of each outer garment shall not be covered in any way except where the sight grid or screen is attached.

### 4.2 Sizes

The sizes of specialized fire fighting protective clothing shall be designated in accordance with EN 340.

### 4.3 Hand protection

The design of the hand protection shall be compatible with the clothing and shall also prevent the entry of burning debris past the wrist.

Hand protection shall be in accordance with EN 659. Hand protection used with type 2 or type 3 reflective clothing shall also comply with the basic safety requirements of the appropriate type as specified in this standard (see clause 6).

### 4.4 Head protection

The design of the head protection shall be compatible with the clothing and shall also prevent the entry of burning debris past the collar.

Head protection shall be in accordance with prEN 443. Head protection used with type 2 or type 3 reflective clothing shall also comply with the basic safety requirements of the appropriate type as specified in this standard (see clause 6).

### 4.5 Foot protection

The design of the foot protection shall be compatible with the clothing and shall also prevent the entry of burning debris past the legshafts.

Foot protection shall be in accordance with EN 344. Foot protection used with type 2 or type 3 reflective clothing shall also comply with the basic safety requirements of the appropriate type as specified in this standard (see clause 6).

### 4.6 Respiratory protection

The clothing shall be compatible with the appropriate respiratory protective devices. For type 2 and type 3 clothing the breathing apparatus shall be able to be worn under the protective clothing.

#### 4.7 Closure system

The closure system shall be designed so as to fulfil the same basic safety requirements (clause 6) as the clothing itself, e.g. by means of an overlap. It should be possible to remove the clothing rapidly.

#### 4.8 Hardware

Hardware penetrating the outer material shall not be exposed on the innermost surface of the component assembly.

#### 4.9 Seams

Seams shall be constructed to give the minimum loss in strength and protection and to maintain the integrity of the garment .

#### 4.10 Pockets

If pockets are required they shall not penetrate the outer material and shall be secured by flaps, which shall not be capable of being tucked into the pockets, to prevent the ingress of burning debris.

### 5 Sampling and pretreatment

#### 5.1 Sampling

Test specimens shall be taken from the material or materials as used in the component assembly. They may also be cut from the original garment, and shall not include construction features, such as seams, closure systems, or hardware.

NOTE: The basic safety requirements for the appropriate type also apply to the materials used in the head, hand, and foot protection. However, it may not be possible to obtain specimens of sufficient size from these parts themselves.

#### 5.2 Pretreatment

Metallised materials and component assemblies with a non-removable metallised layer shall be cleaned five times in accordance with the manufacturer's instructions. All other materials shall be pretreated according to 5.4 of EN 469 : 1995.

### 6 Basic safety requirements

#### 6.1 Limited flame spread

The component assembly of Type 1, Type 2 and Type 3 shall meet the following requirements when tested in accordance with EN 532.

- No specimen shall give burning to the top or either side edge;
- No specimen shall give hole formation;
- No specimen shall give flaming or molten debris;
- The mean value of afterflame time shall be  $\leq 2$  s;
- The mean value of the afterglow time shall be  $\leq 2$  s.

#### 6.2 Radiant heat

Metallised materials shall be pretreated in accordance with 5.2 and also with Annex A of EN 531 : 1995.

The component assembly shall meet the following levels of performance when tested in accordance with EN 366 method B with a heat flux density of 40 kW/m<sup>2</sup>.

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Table 1: Radiant heat  
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Type	t <sub>2</sub> in s
1	≥ 30
2	≥ 60
3	≥ 120



### 6.3 Convective heat

The component assembly shall meet the following levels of performance when tested in accordance with EN 367.

Table 2: Convective heat

Type	HTI
1	$\geq 4$
2	$\geq 13$
3	$\geq 21$

### 6.4 Contact heat

The component assembly shall meet the following levels of performance when tested in accordance with EN 702 at a contact temperature of 300 °C.

Table 3: Contact heat

Type	Threshold-time in s
1	$\geq 6$
2	$\geq 10$
3	$\geq 15$

### 6.5 Heat resistance

Each material used in the component assembly shall not melt, drip or ignite, and shall not shrink more than 5 %, when tested in accordance with the method given in EN 469 : 1995 Annex A.

## 7 Additional material requirements

### 7.1 Dimensional change

The materials of the component assembly shall give a dimensional change  $\leq 3$  % in both the length and transverse directions when tested in accordance with EN 25077 using the cleansing procedure specified in 5.2.

### 7.2 Tensile strength

The outer material used in the construction of the component assembly shall give a tensile strength of at least 600 N when tested in both the length and transverse directions in accordance with ISO 5081, or in accordance with ISO 1421 for metallised materials.

### 7.3 Tear strength

The outer material used in the construction of the component assembly shall give a tear strength of at least 25 N when tested in both the length and transverse directions in accordance with method A2 of ISO 4674:1977, or in accordance with method A1 of ISO 4674:1977 for metallised materials.

## 8 Marking

8.1 General marking requirements shall be as specified in EN 340.

8.2 The reflective protective clothing for specialized fire fighting protective clothing for which compliance with this standard is claimed shall be marked with the pictogram (see figure 1), with the number of this standard, i. e. EN 1486, and the type number in accordance with 4.1.

8.3 The letter "i" for information shall be marked next to the pictogram to indicate that the the user needs to consult the manufacturers' information (see clause 9), e. g. for warnings of misuse.