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Protective clothing and equipment for use in violent situations and in training

Part 10: Coveralls – Requirements and test methods

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 14, an inside back cover and a back cover.

Foreword

Publishing information

This part of BS 7971 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 28 February 2014. It was prepared by Subcommittee PH/3/12, *Protective clothing and equipment for use in violent situations and training* under the authority of Technical Committee PH/3, *Protective clothing*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 7971-10:2004, which is withdrawn.

Information about this document

Text introduced or altered by Corrigendum No.1 is indicated in the text by tags [C1] 〈C1〉. Minor editorial corrections are not tagged.

This British Standard has been substantially revised in association with the Home Office. The aims of the revision were to amalgamate appropriate content from BS 7971-1, BS 7971-2 and BS 7971-10, together with content from the Home Office publication, *Flame retardant overalls standard for UK police (2008)* [1]. This British Standard contains public sector information licensed under the Open Government Licence v2.0.

This is a full revision of the standard and introduces requirements covering:

- innocuousness;
- sizing;
- pre-treatment processes;
- marking;
- user information;
- cleaning;
- modified resistance to chemicals;
- repeated resistance to heat transmission on exposure to flame;
- testing for flame spread after exposure to chemicals.

Ergonomics is not included. Annex A explains the rationale for this decision.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Attention is drawn to the following Directive:

- Personal Protective Equipment Directive (PPE), 89/686/EEC (as amended) [2].

Introduction

Coveralls are used in specialist operational situations and in training to reduce the risk of injury to the user, who might be faced with threats such as heat, flame and the effects of certain liquids, which in some circumstances could also be burning liquids.

Coveralls are intended to provide protection for a limited period only. They cover the whole body, excluding the head, hands and feet. A coverall is intended to be worn externally to other protective items, such as blunt trauma protectors and body armour, base layer garments and duty clothing.

In the period of time since the first publication of the BS 7971 suite of standards, products in general use have evolved to reflect the changing threat and operational needs of the user. The Home Office publication, *Flame retardant overalls standard for UK police (2008)* [1], introduced additional testing methodology including the need for protection from more penetrative chemical threats and repeated heat exposure. In the selection of coveralls, optimum protection has to be balanced with operational requirements in an environment where the option of increasing protection levels as a threat escalates might not be viable.

Operational requirements were taken into account during the preparation of this revision, including an option for protection to be achieved by use of combined undergarment and outer layer systems, which has been included from the Home Office standard.

NOTE As an aid to specifiers purchasing undergarments which do not fall into the definition of "functional undergarment" in accordance with this standard, guidance on suitable material and reference standards is given in Annex B.

Principal changes between this and the previous edition are outlined in the Foreword.

1 Scope

This British Standard specifies requirements and test methods for coveralls, which are to be used predominantly but not exclusively by police and prison officers in specialist operational situations and in training, and which are intended to provide protection against heat and flame and small volumes of certain liquids.

It is applicable to single and two-piece garments, single-layer garments, multi-layer garments and garment assemblies requiring use of a specific undergarment.

This British Standard does not cover other protective features such as electrostatic, cut or slash resistance.

NOTE Civilian groups working alongside police or prison services in specialist operational situations might find by risk assessment that this standard offers additional protection for such activities and threats not considered by other standards.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 530:2010, *Abrasion resistance of protective clothing material – Test methods*

BS EN 702, *Protective clothing – Protection against heat and flame – Test method: Determination of the contact heat transmission through protective clothing or its materials*

BS EN 31092, *Textiles – Physiological effects – Measurement of thermal and water-vapour resistance under steady-state conditions (sweating guarded-hotplate test)*

BS EN ISO 105-B02:2013, *Textiles – Tests for colour fastness – Part B02: Colour fastness to artificial light: Xenon arc fading lamp test*

BS EN ISO 105-C06:2010, *Textiles – Tests for colour fastness – Part C06: Colour fastness to domestic and commercial laundering*

BS EN ISO 105-E04:2013, *Textiles – Tests for colour fastness – Part E04: Colour fastness to perspiration*

BS EN ISO 105-X12:2002, *Textiles – Tests for colour fastness – Part X12: Colour fastness to rubbing*

BS EN ISO 5077, *Textiles – Determination of dimensional change in washing and drying*

BS EN ISO 6330:2012, *Textiles – Domestic washing and drying procedures for textile testing*

BS EN ISO 6530, *Protective clothing – Protection against liquid chemicals – Test method for resistance of materials to penetration by liquids*

BS EN ISO 6942:2002, *Protective clothing – Protection against heat and fire – Method of test: Evaluation of materials and material assemblies when exposed to a source of radiant heat*

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

BS EN ISO 13935-1, *Textiles – Seam tensile properties of fabrics and made-up textile articles – Part 1: Determination of maximum force to seam rupture using the strip method*

BS EN ISO 13937-4, *Textiles – Tear properties of fabrics – Part 4: Determination of tear force of tongue-shaped test specimens (double tear test)*

BS EN ISO 15025:2002, *Protective clothing – Protection against heat and flame – Method of test for limited flame spread*

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

3 Terms and definitions

For the purposes of this part of BS 7971, the following terms and definitions apply.

3.1 closure system
system for fastening openings in a coverall

NOTE 1 A closure system can include several different closures used together to fasten an opening, for example a slide fastener covered by an overflap which is fastened down with a touch and close fastener.

NOTE 2 A seam is not deemed to be a closure system.

3.2 coverall
one-piece or two-piece outer garment providing protection to the upper and lower torso, neck, arms and legs, including the wrists and ankles, but excluding the head, hands and feet; consisting of a single layer or multiple layers of material, or a system of inner and outer clothing

3.3 functional undergarment
specific undergarment intended to be worn with a specific coverall and which forms part of the combined protective garment assembly

3.4 hardware
non-fabric items used in coveralls including items made of metal or plastics

NOTE Examples of hardware are press fasteners.

3.5 interlining
layer of material between the innermost layer and the outer material in a multi-layer coverall

NOTE An interlining can be used to provide a moisture barrier.

3.6 outer material
outermost material or layer of material of a coverall

3.7 structural seam
seam which, if ruptured, would expose an undergarment, lining, interlining or inner layer, or a region of the user's body

4 Requirements

4.1 Sizing

Coveralls shall be available in a range of sizes to fit the user population.

Coveralls shall be oversized in order to fit over blunt trauma protectors and body armour, and to allow for an air gap to be maintained between the fabric and the user. The over measurement shall be provided by the manufacturers in the user information.

NOTE Functional undergarments are not required to be oversized.

4.2 Innocuousness

The manufacturer shall ensure by testing or by declaration that the materials or their derivatives shall not be known to harm the user, i.e. that they are not known to contain any toxic, carcinogenic, allergenic or otherwise harmful substances that could be released under foreseeable conditions of use.

4.3 Cleaning

Coveralls and functional undergarments shall be able to be cleaned and shall be marked with suitable cleaning instructions.

NOTE 1 An example of cleaning instructions is pictograms conforming to BS EN ISO 3758.

User information shall include any additional instructions the user might need to ensure chemical repellent finishes are correctly reactivated, for example by ironing.

NOTE 2 This British Standard does not cover cleaning by industrial processes. Any user intending to use such processes should carry out additional validation checks on the durability of the performance of the system to the industrial cleaning process selected.

4.4 Material composition

Coveralls and, where applicable, functional undergarments shall be marked with the material composition, which shall also be declared in the information to the user.

4.5 Design and construction

4.5.1 General

Design features shall be subjected to a visual assessment.

Design features which might be necessary for ease of movement and fit, for example elastication or pleats at waist, wrists and ankles, shall not allow the fabric to gather excessively as this could create flammable liquid traps.

The collar shall be able to be closed up to the chin.

Pockets shall be constructed either from the outer material of the coverall or from an alternative flame retardant material meeting the requirements of this British Standard and shall be covered by a flap which cannot fold into the pocket to ensure they do not form a flammable liquid trap.

*NOTE If the pocket is constructed from a material other than the outer material, it should be treated as a different construction in relation to heat and flame testing (see **5.3**).*

All external openings shall be constructed entirely from the outer material of the coverall and each external opening shall be provided with a closure system which shall be covered by a protective flap constructed of the outer material.

The coverall shall have closure systems at the ends of the sleeves and the bottoms of the legs such that they can be adjusted and closed over gloves and boots. Exposed knitted material closure systems shall not be used.

Metal components which penetrate the outer material shall be covered with a suitable material (for example, the outer material or an alternative flame retardant material).

4.5.2 Multi-layer coveralls

The layers of multi-layer coveralls shall be permanently attached to each other in such a way that they cannot be detached and worn separately.

4.5.3 Two-piece coveralls

Two-piece coveralls shall have a closure system which enables them to be joined together to produce a one-piece item.

The closure system which fastens the jacket to the trouser shall be a single continuous closure running from the centre front around the back to the centre front.

The closure system shall be completely covered by a protective flap constructed of the outer material to minimize exposure to direct flame.

4.6 Test performance

4.6.1 General

Test samples shall be taken from garments unless otherwise indicated.

Where prepared manufactured seams or material samples are used for testing, the manufacturer shall declare that these are of the same composition and construction as the final garments.

Intended cleaning instructions including any details for reactivation of applied finish shall be provided by the manufacturer. Reference detergents 2 or 3 conforming to BS EN ISO 6330:2012 shall be selected for all laundering tests based on the information provided by the manufacturer.

NOTE Reference detergent 2 is a biological detergent without optical brightners and reference detergent 3 is a non-biological detergent without optical brightners.

Intended maximum cleaning cycles shall be specified where this is greater than five cycles.

4.6.2 Testing of materials in original state

4.6.2.1 Colour fastness

When tested in accordance with BS EN ISO 105-B02:2013, the colour fastness of the outer material of the coverall shall be greater than or equal to blue wool standard 4.

When tested in accordance with BS EN ISO 105-X12:2002, the dry colour fastness of the outer material of the coverall and any functional undergarment shall be greater than or equal to grade 4.

When tested in accordance with BS EN ISO 105-C06:2010, using the manufacturer's declared care instructions, the colour fastness of the outer material of the coverall and any functional undergarment shall be greater than or equal to grade 4 colour change.

When tested in accordance with BS EN ISO 105-E04:2013, the colour fastness of the outer material of the coverall shall be greater than or equal to grade 4 colour change.

4.6.2.2 Dimensional change due to cleaning

The dimensional change due to cleaning shall be evaluated on material samples.

The dimensional change for length and width shall be less than or equal to 3% shrinkage for woven materials or less than or equal to 5% shrinkage for knitted materials after five complete wash and dry cycles when tested in accordance with the manufacturer's instructions. Measurement shall be in accordance with BS EN ISO 5077, and cleaning procedures shall be in accordance with BS EN ISO 6330.

The component parts of multi-layer material composites shall be sewn together for testing and all layers marked for shrinkage measurement. Differential shrinkage between layers shall be no greater than a 2% variance. Failure of either part for dimensional stability shall constitute failure of the composite.

4.6.3 Testing of materials following pre-treatment processes

4.6.3.1 General

All testing in **4.6.3.2** to **4.6.3.12** shall be completed after pre-treatment conforming to **5.1** and, where indicated, in accordance with other additional pre-treatment processes.

4.6.3.2 Tensile strength

The mean tensile strength in the length and the width of woven coverall outer material shall be greater than or equal to 450 N and no individual result shall be less than 350 N when tested in accordance with BS EN ISO 13934-1.

In addition, tensile strength shall be tested after a combined pre-treatment conforming to **5.1** and **5.2**. The mean tensile strength in the length and the width of woven coverall outer material shall be greater than or equal to 450 N and no individual result shall be less than 350 N when tested in accordance with BS EN ISO 13934-1.

4.6.3.3 Seam strength

The seam strength test shall be carried out on all types of structural seams of coveralls. Test samples shall be taken from stitched garments but shall be checked for seam construction against the garment sample.

Testing shall be in accordance with BS EN ISO 13935-1. When samples are taken from garments, at least three samples of each type of seam shall be tested. When using manufacturers' prepared samples, three samples in each of the length and width direction for each type of seam shall be tested.

The mean seam strength shall be greater than or equal to 450 N and no individual result shall be less than 350 N.

In addition, seam strength shall be tested after a combined pre-treatment conforming to **5.1** and **5.2**. The mean seam strength shall be greater than or equal to 450 N and no individual result shall be less than 350 N.

[C1⟩ *Text deleted* ⟨C1]

4.6.3.4 Tear strength

The mean tear strength in the length and the width of woven coverall outer materials shall be greater than or equal to 50 N when tested in accordance with BS EN ISO 13937-4 with the crosshead speed increased to 500 mm/min.

4.6.3.5 Abrasion resistance

An abrasion resistance test shall be carried out on coverall outer materials in accordance with BS EN 530:2010, Method 1, using a standard crossbred worsted abradant and a pressure of 12 kPa. The end point shall be taken as two broken threads in one of the test samples and shall be greater than or equal to 20 000 rubs.

4.6.3.6 Water vapour resistance

A water vapour resistance (Ret) test shall be carried out on coveralls (including all layers of a composite material or a multi-layer assembly, and including any functional undergarments). The mean water vapour resistance of the test samples shall be less than or equal to 20 m^2Pa/W when tested in accordance with BS EN 31092.

4.6.3.7 Resistance to flame spread

A resistance to flame spread test shall be carried out on coveralls including multi-layer composite test samples, the outer and inner garments of systems which require a functional undergarment, and functional undergarments on their own.

Testing shall be in accordance with BS EN ISO 15025:2002, Procedure A and the additional requirements in **5.3**.

The following requirements shall be met:

a) flaming shall not reach the upper edge or either vertical edge of any test sample;

b) the afterglow shall not spread beyond the flame spread area of any sample;

c) for single layer test samples, no sample shall have hole formation;

d) for multi-layer test samples no sample shall have hole formation in any layer except an interlining which is not intended to provide heat and/or flame protection;

e) no sample shall give flaming or molten debris;

f) the mean afterflame time shall be less than or equal to 2 s;

g) the mean afterglow time shall be less than or equal to 2 s;

h) structural seams shall remain intact when exposed to heat and flame.
[C1⟩ *Text deleted* ⟨C1]

4.6.3.8 Resistance to heat transmission on exposure to flame

A resistance to heat transmission on exposure to flame test shall be carried out on coveralls including multi-layer composite test samples, and the outer and inner garments of systems which require a functional undergarment.

Testing shall be in accordance with ISO 9151, at an incident heat flux of 80 kW/m^2, and the additional requirements in **5.4**.

The following minimum requirements shall be met:

- $HTI_{12} \geq 4$ s;
- $HTI_{24} \geq 7$ s;
- $HTI_{24} - HTI_{12} \geq 2$ s.

4.6.3.9 Resistance to heat transmission on repeated exposure to flame

A resistance to heat transmission on repeated exposure to flame test shall be carried out on coveralls including multi-layer composite test samples, and the outer and inner garments of systems which require a functional undergarment. Testing shall be in accordance with ISO 9151, at an incident heat flux of 80 kW/m^2, and the additional requirements in **5.5**.

The maximum temperature rise within the final 30 s period shall be less than or equal to 24 °C.

4.6.3.10 Resistance to heat transmission on exposure to a radiant heat source

A resistance to heat transmission on exposure to radiant heat test shall be carried out on coveralls including multi-layer composite test samples, and the outer and inner garments of systems which require a functional undergarment.

Testing shall be in accordance with BS EN ISO 6942:2002, Test B, at an incident heat flux of 20 kW/m^2 and conforming to the additional requirements in **5.6**.

The following minimum requirements shall be met:

- $RHTI_{12} \geq 7$ s;
- $RHTI_{24} \geq 13$ s;
- $RHTI_{24} - RHTI_{12} \geq 5$ s.

4.6.3.11 Resistance to contact heat transmission

A resistance to contact heat transmission test shall be carried out on coveralls including outer materials, multi-layer composite test samples, and the outer and inner garments of systems which require a functional undergarment. Testing shall be in accordance with BS EN 702 at a contact temperature of 100 °C.

Composite and multi-layer test samples shall be stitched or otherwise held in their assembled order for testing.

Each test sample shall have a threshold time of at least 20 s.

4.6.3.12 Resistance to penetration by liquids

Test samples, where possible, shall be taken from garments but may be taken from manufacturers' prepared samples.

Test samples shall comprise all functional layers of a coverall or composite system including outer materials, multi-layer composite test samples, and the outer and inner garments of systems which require a functional undergarment.

Testing shall be carried out in accordance with BS EN ISO 6530 and the additional requirements in **5.7**.

The following minimum requirements shall be met:

a) For all coveralls:
   - mean index of repellency: ≥80%;
   - mean index of penetration: ≤10%;
   - mean index of absorbancy: ≤10%.

b) For higher liquid repellency coveralls:
   - mean index of repellency: ≥80%;
   - mean index of penetration: ≤0.2%;
   - mean index of absorbancy: ≤10%.

A single test sample which has been exposed to each of the following chemicals:

1) 50% iso-octane/50% toluene (petrol substitute);
2) Methyl Isobutyl Ketone (AR grade);
3) 50% ethanol/50% water;

shall then be tested for resistance to flame spread in accordance with **4.6.3.7** after being allowed to dry at ambient conditions for a minimum of 2 hours ±30 min.

5 Test methods and method guidance

5.1 Cleaning pre-treatment

Coveralls and functional undergarments or, where indicated, material samples shall be subjected to five complete wash and dry cycles in accordance with the manufacturer's instructions using the appropriate procedures in accordance with BS EN ISO 6330.

If the manufacturer's instructions indicate that ironing is required after any drying process to reactivate a finish then a single cycle of hand ironing shall be performed after the last cleaning cycle as instructed in the manufacturer's information.

5.2 Heat exposure pre-treatment

Sufficient material for three length and three width tensile or seam test samples as specified in **4.6.3.2** and **4.6.3.3** shall be exposed to a heat source at an incident flux density of 10 kWm² for a period of 3 min. Heat exposure shall conform to the test methodology in BS EN ISO 6942:2002, Test A. Test samples shall be allowed to cool for at least 10 min before tensile testing.

5.3 Resistance to flame spread sampling and test method guidance

Testing shall be in accordance with BS EN ISO 15025:2002, Procedure A.

Each type of structural seam in the coverall shall be tested, taking three test samples. Each test sample shall be orientated with the seam running vertically down the centre line so that during the test, the flame impinges directly on the seam.

Composite and multi-layer test samples shall be stitched or otherwise held in their assembled order for testing.

If the coverall contains areas of different constructions, for example a different wristlet or collar materials, insignia, badging and external labels, areas of touch and close fasteners, which could be exposed in wear, then representative samples of these materials and features shall also be tested, arranged so that the flame is applied to the outer surface of the feature. The combination consisting of the item and the outermost layer of the garment shall conform to **4.6.3.7**.

Samples to be tested for resistance to flame spread after cleaning and liquid exposure (see **4.6.3.12**) shall be allowed to dry at ambient conditions for a minimum of 2 hours ±30 min prior to testing.

The flame shall be applied to the outer material face.

5.4 Resistance to heat transmission on exposure to flame test method guidance

Testing shall be in accordance with ISO 9151 at an incident heat flux of 80 kW/m^2.

Composite and multi-layer test samples shall be stitched or otherwise held in their assembled order for testing.

In addition to testing of the main material constructions, if the coverall contains areas of different constructions, for example a different wristlet or collar materials, insignia, badging and external labels, areas of touch and close fasteners, which could be exposed in wear, then representative samples of these materials and features shall also be tested, with the flame impinging on the feature and its stitching.

5.5 Resistance to heat transmission on three repeated exposures to flame test method guidance

Testing shall be based on ISO 9151 at an incident heat flux of 80 kW/m^2.

Only a single sample without seams shall be required to be tested.

Composite and multi-layer test samples shall be stitched or otherwise held in their assembled order for testing.

The following repeated exposure procedure shall be followed:

1) record the temperature;
2) expose to heat source for 3 s ±0.5 s;
3) record the temperature for a further 30 s ±1 s;
4) wait for 2 min ±5 s;
5) to complete three exposures, repeat the first four steps twice more;
6) record the final temperature.

5.6 Resistance to heat transmission on exposure to a radiant heat source test method guidance

Testing shall be in accordance with BS EN ISO 6942:2002, Test B, at an incident heat flux of 20 kW/m^2.

Composite and multi-layer test samples shall be stitched or otherwise held in their assembled order for testing.

In addition to testing of the main material constructions, if the coverall contains areas of different constructions, for example a different wristlet or collar materials, insignia, badging and external labels, areas of touch and close fasteners, which could be exposed in wear, then representative samples of these materials and features shall also be tested with the exposure on the feature and its stitching.

5.7 Resistance to penetration by liquids test method guidance

Testing shall be in accordance with BS EN ISO 6530 using the following liquids:

a) 50% iso-octane/50% toluene (petrol substitute);
b) Methyl Isobutyl Ketone (AR grade);
c) 50% ethanol/50% water;
d) 30% aqueous sulfuric acid;
e) 40% aqueous sodium hydroxide;
f) water at 20 °C ±5 °C;
g) water at 85 °C ±15 °C.

Samples shall be free from seams in the test area. Samples from chemical tests a), b) and c) shall be further tested for resistance to flame spread after cleaning and liquid exposure conforming to **4.6.3.12**.

NOTE 1 Care should be taken to follow exactly the manufacturer's instructions for reactivation of any applied finish as part of the pre-treatment process.

NOTE 2 Care should be taken to follow the equipment requirements of BS EN ISO 6530 exactly as the diameter of the needle, for example, can effect the pressure of the jet of liquid on the sample and subsequent penetration effects, and the use of the gutter ensures a consistent pressure is applied in the seconds following the test. If, following the tapping of the sample prior to weighing, excessive beading of liquid remains on the sample, this should be noted for reference on the test report.

6 Marking

All coveralls and functional undergarments shall be marked with the following information:

- size;
- material composition;
- manufacturer;
- unique style identification;
- date of manufacture and batch number;
- reference to this British Standard;
- cleaning instructions;
- where applicable, a space for the user to record the number of cleaning cycles the item has been subjected to in use.

In addition, two-piece coveralls or coveralls with functional undergarments and any replacement parts of sets or ensembles shall be marked with the following information:

- the part with which the item shall be worn to provide full protection.

NOTE Additional optional markings could include an indication that the coverall offers higher chemical resistance.

7 Manufacturer's information to users

All coveralls and functional undergarments shall be provided with an information leaflet containing as a minimum the following user instructions and information:

- how to fit and adjust the coverall;
- material composition;
- manufacturer's details;
- unique style identification;
- reference to this British Standard;
- information on which parts of a two-piece coverall or coverall with functional undergarment shall be worn together to provide full protection and a statement that full protection is only provided when that requirement is fulfilled;
- information for two-piece coveralls or coveralls with functional undergarments to identify which replacement parts to purchase should the need arise;
- reference numbers for the various replacement parts;
- information on the expected longevity of any liquid repellent finish;
- cleaning instructions and additional detail relating to reactivation of any applied liquid repellent finishes required to provide chemical protection;
- an indication that the coverall offers higher liquid resistance, if applicable.

The following warnings to users shall also be included.

- Coveralls can only provide protection if junctions with other garments at the neck, wrists and ankles are adequate.
- The air trapped between layers of material plays an important part in providing heat insulation. The protection provided by a coverall is reduced in areas where it is tight fitting or which are compressed by a belt or straps.
- The coveralls should not be expected to provide protection against all chemicals.
- The coveralls should not be expected to provide protection against impacts, against firearms, or against radiation or biological or electrical hazards.
- Two-piece coveralls and coveralls requiring functional undergarments are specially marked. It is important that the correct replacement parts are procured and that the correct items are worn together or protection might be reduced.
- It is recognized that thermal shrinkage can cause coveralls to tighten round the body in use on exposure to heat and flame. Users should ensure a sufficient oversize is worn to allow for large air gaps particularly at the back of the legs and thighs.

Annex A (informative) Rationale for removal of ergonomic evaluation

Coveralls are intended to be worn over bulky inner protective items such as blunt trauma protectors (see BS 7971-4) or body armour. The design, structure, materials and features of such items varies greatly and at any one time different users might be using different combinations of these items.

Coveralls are oversized to minimize restriction in movement caused by poor interaction between the coverall and the inner protective items and to allow for air gaps between the coverall, inner protective items and the body.

A standard ergonomic evaluation with one specific inner ensemble cannot suitably predict issues that might occur with the interaction of the coverall to the variety of inner protective items currently available and in use. In addition, in future years, any selected standard inner ensemble might no longer be representative of product in general use. Equally, a standard ergonomic evaluation with no inner protective items would be ineffective in identifying potential issues.

As a consequence of these considerations, it was decided that the emphasis of this British Standard would be placed on evaluation of the ensemble by the user or specifier at the point of purchase. This is intended to help ensure that the coverall is evaluated in simulated conditions of use by assessors familiar with the specific combination of product with which the coverall is intended to interact after purchase.

Annex B (informative) Functional undergarments

This British Standard considers coveralls whose protective capabilities might or might not include the need for functional undergarments.

For coveralls which do not rely on functional undergarments for their protective capability, any garments worn under the coveralls should not present a risk to the user due to softening, melting, or dripping if exposed to heat or small localized flames.

In addition, in the feet, neck and face areas (areas not protected by the coverall or gloves), garments (head over, socks) should be worn which do not present a risk to the user due to softening, melting, or dripping if exposed to heat or small localized flames.

Such items should be made from natural fibres such as cotton, wool, silk or materials which conform to BS EN ISO 14116 as a minimum.

Large amounts of synthetic fibres prone to melting and dripping on application of heat should be avoided other than in specific localized areas where they might be necessary to ensure retention of the item in place on the body.

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 7971-4, *Protective clothing and equipment for use in violent situations and in training – Limb protectors – Requirements and test methods*

BS EN ISO 3758, *Textiles – Care labelling code using symbols*

BS EN ISO 14116, *Protective clothing – Protection against heat and flame – Limited flame spread materials, material assemblies and clothing*

Other publications

[1] HOME OFFICE SCIENTIFIC DEVELOPMENT BRANCH. *HOSDB Flame retardant overalls standard for UK police (2008).* Publication No. 89/08. St Albans: Home Office, 2008.

[2] EUROPEAN COMMUNITIES. 89/686/EEC. Council Directive 89/686/EEC of 21 December 1989 on the approximation of the laws of the Member States relating to personal protective equipment. Luxembourg: Office for Official Publications of the European Communities, 1989.

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