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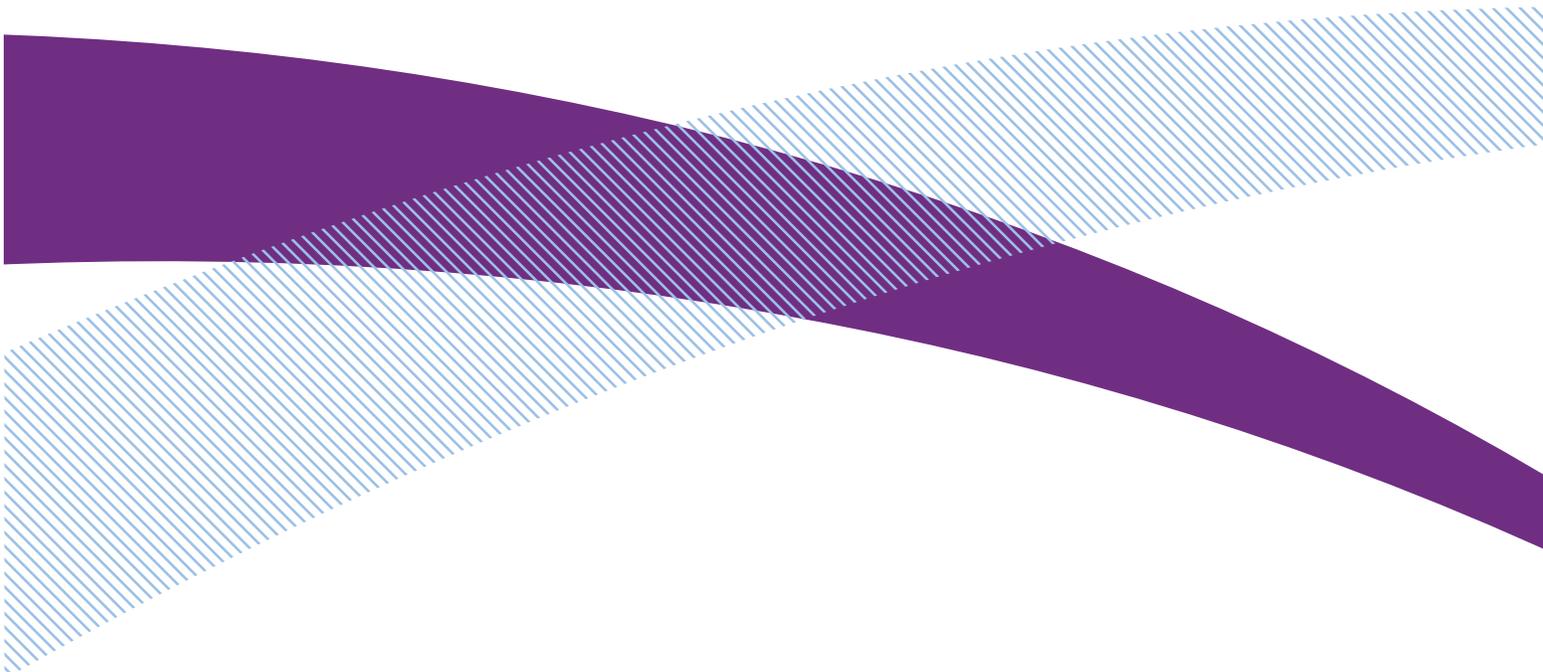
# HOSDB Flame Retardant Overalls Standard for UK Police (2008) (Incorporating Guidance for End Users)

Publication No. 89/08

In association with



C Malbon  
R Prior (Guidance for End Users)





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## Foreword

The Home Office Scientific Development Branch (HOSDB), at the request of the Association of Chief Police Officers (ACPO) Training and Tactical Equipment Working Group, has developed this police specific standard for Flame Retardant Overalls (FROs) to address the threats faced by UK police officers in situations of public disorder.

The standard covers protective clothing used by police officers to reduce the risk of injury from burns from flammable liquids and other heat sources, such as those that may be present in public disorder events. It does not consider threats posed by ballistic, bladed weapons, hand thrown missiles or hand wielded weapons or protection to the head, which are covered in other HOSDB standards.

The standard is in two main sections, the first section - Guidance for end Users - has been developed with practitioners to provide guidance and advice on fitment, usage and maintenance of the flame retardant overall. The second section details the testing methodologies necessary to enable manufacturers and suppliers to achieve compliance to this standard. Issues such as ergonomics or suitability for role are not considered in the standard but should be considered during the procurement procedure.

This standard is supported by the ACPO Public Order Working Group, part of the ACPO Conflict Management Portfolio. In addition it is supported by the Police Federation of England and Wales.

This document will enable the UK police service to issue guidance on the selection of flame retardant overalls to assist Chief Officers when conducting risk assessments, which are required to comply with the Police (Health and Safety) Act.

Handwritten signature of Mr I Arundale.

Mr I Arundale  
Chief Constable  
ACPO Conflict Management  
Portfolio Holder

Handwritten signature of Alan Pratt.

Alan Pratt  
Director  
Home Office  
Scientific Development Branch



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# 1 Management Summary

This standard has been developed to provide UK Police and associated services with user guidance and test methodologies for Flame Retardant Overalls (FRO). The standard has been developed to meet the 2004 Police Operational Requirements (POR) prepared by HOSDB on behalf of the ACPO Training and Tactical Equipment Working Group for the ACPO Public Order Working Group.

The guidance section has been developed in consultation with end users and written by Chief Inspector Richard Prior who has many years experience as a Public Order Officer and Trainer and is currently seconded to HOSDB as a Police Advisor. The guidance is aimed at bringing together best practice from around the UK. The guidance section includes information on sizing, maintenance, comfort, ergonomics, design considerations and several other topics. The information contained in this section is guidance only and is not a compulsory part of this standard.

The technical testing requirements have been developed to assess whether any particular FRO meets the minimum requirements specified in the POR. The development of these test methodologies included a review of the British Standard BS7971-10:2004-Protective Clothing and Equipment for use in violent situations and in Training – Part 10: Coveralls-Requirements and test methodologies. The review determined that BS7971-10:2004 met the requirements of the POR with a few exceptions.

To gain compliance to this standard HOSDB has provided two test routes which a manufacturer may select according to their circumstances. These are:

- **Route 1-** For FROs that do not hold accredited compliance to BS7971-10:2004 - Submission of declaration to HOSDB with subsequent submission of test samples to a HOSDB accredited test facility for full compliance testing in accordance with this HOSDB standard.
- **Route 2-** For FROs that already hold accredited compliance to BS7971-10:2004 - Submission of declaration to HOSDB complete with documentation of accredited compliance to BS7971-10:2004 with subsequent submission to a HOSDB accredited test facility of test samples for multi exposure testing and additional liquid run off tests that will give full compliance to this HOSDB standard.

Route 1 specifies standardised European test methodologies for flame resistance, heat transfer, liquid run off and material strength. It does not specify requirements for ergonomic testing. HOSDB recommend that end users perform ergonomic testing as part of the procurement process.

In addition to meeting the requirements for compliance with this standard and before certification is awarded, manufacturers or supplies must provide HOSDB with documentation of their proposed batch testing methodology.

## 2 Guidance for End Users

This section of the standard has been developed to provide guidance on Flame Retardant Overalls for use by UK Police to comply with the 2004 Police Operational Requirements (POR). Other organisations such as the Prison Service and Military may also find the guide useful but it is not intended for use outside of these environments (e.g. Industry, Motor Sport, Fire Service etc).

The guidance has been developed with the cooperation of experienced practitioners to aid users when working with FROs. It is intended to be informative and highlight, where possible, good practice already in existence. HOSDB is committed to providing appropriate independent advice to end users to ensure that any advice is relevant and current. As such, this document should be considered as a living document, which will be revised as necessary.

FROs are an item of Personal Protective Equipment (PPE) designed to provide limited protection to the user from flames and heat. They are not designed to enable a user to remain immobile in an incendiary environment for any longer than 4 (four) seconds. FROs have a limited lifespan and once exposed to heat, the garment shall where practical be checked. If the protection is found to be compromised, the user should be withdrawn from the area until the garment can be exchanged.

### 2.1 Sizing

It is imperative that FROs are correctly sized. A FRO needs to be loose (baggy) fitting as this looseness introduces an air gap between the inside of the FRO and the skin of the user. This air gap helps to provide insulation, reducing the possibility of a burn injury to the user. It is important that the reason for the looseness of the FRO is fully explained to the user.

Within each force or region there should be suitably trained personnel who can ensure appropriate sizing is provided for the individual wearer. These trained personnel should be given guidance by the manufacturer to ensure that all appropriate measurements are correctly made before a FRO is supplied. This will ensure that the garment fits correctly and takes into full consideration other PPE and equipment carried/worn (see also Compatibility) and the need for air gaps etc.

Each brand or model of FRO may have unique properties which could impact on the fitting requirements. At the time of sizing, the officer being fitted should be dressed in any other equipment intended to be worn under the FRO.

Further to the basic requirements of sizing a FRO, it is important to note the needs of each wearer can often differ and some may not be able to wear the “issue” FRO (due to allergy, fitting, disability etc.). In this case the trained personnel should be aware of alternatives to ensure that a FRO is appropriate not only by **size** but also **wearability**.

Consideration should also be given to operational replacements and the ease of providing them. If a FRO was sized in such a way that it was bespoke to an individual officer, it will be harder to replace when compromised or damaged whilst being worn. A suitable option could be that a range of generic sized FROs are stocked and to ensure that the trained personnel are fully conversant with selecting the correct size.

It may be possible to tailor FROs in force, however, any modifications to a FRO must not compromise the design, which may invalidate compliance with the standard. Any alterations carried out shall use the same materials and threads used by the manufacturer. However, a manufacturer may regard such actions by anyone except themselves or their appointed agents as an invalidation of the warranty.

## **2.2 Compatibility with other equipment**

Associated with sizing, a FRO must be compatible with all other PPE worn and/or equipment carried or used by the officer.

Any procurement of FROs must take into consideration any other equipment to be worn and also ensure that any prospective supplier is conversant with this associated equipment e.g. body armour, limb guards etc.

This responsibility does not end once a contract is placed but should be a rolling process whereby the supplier is advised of any alteration, additions or removal of associated equipment.

Any decision by a force or region to change any element of the equipment worn by an officer wearing FROs may have an impact on the whole ensemble. Consequently the protection offered by the FROs may be reduced, increasing the risk of injury to an officer (e.g. a larger limb guard will reduce the air gap on the limb and thereby increase the risk of heat transfer).

FROs should be worn over all other equipment. Placing any item over the FRO may cause a flammable liquid trap increasing the risk of the officer receiving a burn injury. However, it is accepted that in certain circumstances equipment has to be worn over the FRO for operational or role specific responsibilities, e.g. equipment vests for specialist roles such as medics. In these circumstances every effort should be made to ensure the design of this equipment is such that it minimises the risk of creating a flammable liquid trap. It is the responsibility of the force to carry out the appropriate risk assessments for these roles; HOSDB can provide guidance and assistance if required.

A further equipment issue is the use of fire extinguishers. If this is the case, the compatibility and performance of the FRO and fire extinguisher should be assessed.

## 2.3 Identification/Insignia

The addition of any form of identification or insignia should be given careful consideration. The attachment of anything to a FRO which contains incompatible materials may increase the risk of a burn injury to an officer.

The placement of identification or insignia on a FRO is possible, but consideration should be given to the following:

- Is the material used flame retardant?
- Does the attachment create any liquid traps?
- Will the attachment cause any holes/damage to the FRO which could compromise its safety?

In addition, the manufacturer of the garment should be consulted to ensure they are aware and consent to the intended attachment method.

## 2.4 Selection

The selection of a FRO should be based on two main factors:

- Technical- Does the FRO meet the required standards
- Practical – Does the FRO enable the wearers to perform their duties and do they have confidence in the PPE they are wearing?

The technical consideration can be confirmed by ensuring the FRO selected meets the requirements specified in the technical section of this document. HOSDB will provide any guidance and assistance in ensuring the technical requirements are met.

The practicality should be determined by those who ultimately wear and use FROs and this will probably have a major influence in the selection process. These end users are the people who wear the FRO on a regular basis and can provide the most honest and accurate feedback possible.

At the earliest stages of procurement, experienced users from as wide a population spread as possible should be involved in the decision making process. It is also highly advisable that user evaluation and trials are the final arbiter in selection once the technical requirements have been met.

Ergonomic assessment of the FRO is essential and the most appropriate means of assessing this is by those who will wear them, by structured, auditable means. This should be carried out in the environment in which they are intended, both training and operational for a reasonable time period.

Items that may be considered in any ergonomic trial may include the following:

- Wearability – How easy can the FRO be put on or taken off whilst wearing any other equipment (e.g. limb protectors, body armour, etc), do they irritate the skin, etc?

- Mobility – Can a wearer run around, get in and out of vehicles, sit down etc?
- Heat/stress management – Do the FROs make the wearer uncomfortable if worn for long periods of time, or after duress?
- Use with other equipment – do the FROs interfere with the shield, helmet, etc?

This is not an exhaustive list and a force or region may wish to consider other issues.

An additional consideration may be that the force or region might consider the environment in which the FRO is required does not have an incendiary risk. Therefore, the FRO may be in excess of what is required and could possibly result in additional complications e.g. heat degradation. This decision must be based on suitable risk assessment and intelligence and can only be made by each individual organisation.

## **2.5 Material**

The selection of a FRO based purely on its material/s will limit the options of an organisation. In addition, HOSDB cannot provide information on “best material”. If the FRO has been approved by HOSDB, it has met the entire technical requirements and is deemed suitable for its end use.

From a users perspective the FRO should meet their needs in relation to robustness, maintenance etc. If a FRO is not practicable and as comfortable as possible this may result in a reluctance to wear the garment or inappropriate practices such as non-compliant under garments etc. See section 2.9 Undergarments.

## **2.6 Inspection**

Regular inspection of FROs during their lifespan is essential. The process of inspection should start when the FRO is first issued by an organisation. This inspection should include:

- Checking all the stitching is intact;
- Checking all the closers (e.g. zips poppers etc) work correctly;
- Checking that the fabric has no rips or tears;
- Checking that the appropriate labels are attached.

Any defects detected at this point should result in the FRO being rejected and returned to the supplier for replacement or repair.

Ideally FROs should be individually or batch numbered to enable tracking or recall should any issues arise. This also enables information on the life expectancy and performance of the FRO to be recorded.

Personnel trained in sizing should also be trained in how to inspect the FRO at the time of issue. It would also be good practice to add an individual

identifier and date of issue at the time the FRO is issued. This would assist in intelligence gathering in relation to the longevity and performance of the FROs and possible post incident actions.

Instructors (and others if appropriate) should also be fully trained in how to visually inspect FROs. This could include inspection whilst training or in operations to ensure users that FROs have not been compromised. The end user should also receive training to ensure they are conversant with the limitation of the FRO and how to identify when a FRO has been compromised. Good practice could be mutual inspection of FROs (and all PPE) prior to training or deployment to confirm that the items are still fit for purpose and correctly fitted.

Manufacturers should be required to provide training and guidance on inspection protocols as they may differ from model to model.

FROs should be routinely checked before and after usage to ensure they are fit for purpose. General wear and tear is understandably likely to impair a FRO performance; even incorrect storage can affect the performance of the FRO. The use of regular inspection should help to reduce the resultant risks and enhance both performance and confidence in the garment.

## **2.7 Maintenance and cleaning**

Correct maintenance and cleaning of a FRO is as important as inspection.

The manufacturer should be required to provide comprehensive guidance on the maintenance of their FRO.

Organisations should ensure that all personnel who are involved in issuing, using and maintaining FROs are correctly trained and fully conversant with any guidance given by a manufacturer.

Good practice would include maintenance guidelines in the form of a label attached to the garment. Additionally, because most manufacturers will specify a maximum number of wash cycles that a FRO can endure, a label or system to indicate wash cycles or other maintenance should be included.

Where maintenance goes beyond washing or storage to actual repairs, the guidance should specify the quality of the materials used in any such repair, e.g. “fire retardant cotton as specified in the original declaration of construction” and should be fully documented. Good practice could suggest that any repairs should be carried out by the manufacturers or suppliers approved body, co-ordinated centrally by the respective organisation to provide an audit system of repairs.

The degree of maintenance required and its effect on the longevity of the FRO will normally be a consideration during the procurement process. It should not be an onerous task but within the means of all to achieve.

There are increasing opportunities in relation to maintenance and cleaning contracts provided by trained service providers. This could provide an alternative solution to many of the issues raised above.

## 2.8 Batch testing

When setting up a procurement contract for FROs, a process for ensuring batch quality should be included. Guidance is provided in the technical section of this document with regard to a batch testing process.

An additional quality assurance process would be the introduction of a system of dip testing of in-service FROs.

The purpose of dip testing is to ensure that, after normal usage, the FRO still provides the required level of protection to meet this standard. A FRO taken for dip testing would be subjected to the same tests as for a batch testing. This could be incorporated into the initial contract requesting that the manufacturer provides this service at their expense. Alternatively the force or region could perform this testing at their own expense. HOSDB can provide guidance and names of suitable test facilities.

## 2.9 Undergarments

HOSDB recommend that the FRO should be worn over either 100% natural fibres or specifically designed FR undergarments tested to appropriate standards e.g. ENISO11612:2008<sup>1</sup> A and either B1 or C1.

Originally FROs were expected to be worn over the standard issue beat duty uniform (including tunics) and the materials used for the uniform were naturally fire-retardant. However, current beat duty uniforms may consist of man-made fibres which may not be flame retardant.

It is possible to have specified undergarment and FROs that work together to provide systematic protection to an officer. However, where this system is used they should be tested for compliance as a combination. This system will place an additional responsibility upon the organisation, supervisors and users to ensure the combination is worn correctly. Where this type of system is used, clear labelling should be provided to ensure that it is always worn as a system.

Where the undergarments are generic item(s) of clothing, selected more for practicality and comfort reasons, these undergarments must be manufactured from materials which are appropriate for the environment e.g. non melting, resistant to flame spread etc. This option requires the FRO to provide all the protection and any undergarment is not considered in the original assessment but may provide some additional protection. Additionally, it reduces the associated risks of a user failing to ensure a correct combination of FRO and FR under garment is worn.

In selecting, or issuing guidance on appropriate undergarments the following points should be considered:

- Tight or close fitting undergarments will minimise any air gap between the wearer's skin surface and the first layer of clothing. This may increase the risk of a burn injury due to heat transfer.

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<sup>1</sup> Supersedes BS EN531:1995

- Loose under garments would provide an air gap, but they may not be as comfortable.

The undergarment could retain perspiration which could lead to an increased risk of scald burns. (Note: FROs are by necessity not made of breathable material therefore any perspiration will not be rapidly dissipated.)

Unfortunately there is no ideal solution, and as with the selection of a FRO, the knowledge of experienced users will be of most value. Any user trial of FROs must be carried out with the undergarments that would normally be worn operationally.

## **2.10 Design consideration (1 or 2 piece, pockets etc)**

The design requirements of a FRO may vary from one force or region to another. As a general guide, anything can be incorporated into a design of a FRO, as long as it meets the requirements specified in the technical section of this document.

The requests for two piece suits, extra pockets, map pockets etc. are all usually as a result of experience and the need to make wearing public order FROs more comfortable and/or more user friendly.

The incorporation of additional pockets to a FRO requires the consideration of flammable liquid traps, both with the pockets empty and also with the pockets loaded with the required equipment. Map pockets which have a clear section may introduce an additional risk of melting

It should be noted that additional pockets could compromise the loose fitting of the FRO and if misused by the wearer could reduce air-gaps and increase the risk of snags or points whereby “combatants” could grab hold of the officer. Additionally there is a risk that the greater the number of pockets on a FRO, the greater the risk of a combustible material being carried, which could have adverse effects.

The design of a 2 piece FRO has its own implications; the seal between the two sections must not enable heat or flames to pass under one of the layers. In addition it may require additional time for a user to dress, with a second user ensuring that the seal is secure all around the FRO.

It is impossible to classify all variations of design which will also evolve and change with time. Wherever possible a FRO should be tested with all varying design features and when a new design element is added a re-test would be advisable but HOSDB accept that, as with equipment carriage, there may be times when an operational need may outweigh the compliance to a standard. Providing this decision is fully documented, audited and reflected in a risk assessment it may be justified.

## **2.11 Limitations**

Sometimes a lack of understanding as to what exactly a FRO is capable of providing leads to false expectations. FROs are not fire proof, and they are by design far different to the PPE worn by fire-fighters, for example.

A FRO is designed to provide very short term protection against direct heat (e.g. naked flame) and transferred (conducted) heat. The time element is measured generally in seconds (4 seconds maximum) and it only takes a relatively small rise in skin temperature (12°C) to result in a burn injury. Hence, whilst the protection offered is, in the very short term, genuine it is **NOT** comprehensive; organisations and user/practitioners **must** be made fully aware of these facts.

Avoidance is an essential part of protection in relation to the incendiary threat, to remain motionless within the affects of either flame or heat transference will exacerbate injury.

FROs are also, by nature, not the ideal garment to wear whilst engaged in physical exertions. The material does not breath, perspiration is not dissipated away and they will inevitably cause heat management issues to the wearer. This limitation to the FRO is in opposition to the very physical acts that are essential to policing tactics in a public order environment. Consideration to the physiological effects to users must be given and appropriate means of providing regular breaks and fluids is essential for user well being

As always the balance between protection from flame and operational effectiveness will involve compromise.

There has been reference made to the use of flame retardent over-trousers to be worn over the FRO to reduce the damage almost inevitably caused during training which potentially leads to the expensive replacement of the whole garment. These concerns could be alleviated in the case of two piece suits or a rigorous maintenance and care program. However, where the use of "Training Over-Trousers" is the chosen option, consideration should be given to the following:

- In consultation with the manufacturer of the FRO ensure that any FR over-trousers are compatible, complementing the FRO protective values and in no way reducing those safety margins;
- Precautionary measures would be necessary to ensure such garments were not worn operationally, perhaps by using a distinctive colour (e.g. orange);
- The over trousers should ensure that they provide protection not only to the end user but also the FRO, and the FROs must still be inspected after use to ensure they have not been damaged;
- The over trouser must still meet the requirements for liquid run off, flame spread and heat transference (although this may be considered as part of the overall system).

## 2.12 Heat management

FROs are designed to protect against direct and transferred heat from outside the garment by acting as an insulator. However, by acting as an insulator, any heat built up inside the FRO, generated for example by the wearer's body during physical exertion or by intense exposure to heat, e.g.

petrol bombs, cannot escape. This build up of heat may lead to an increased chance of a burn injury or heat management issues for the wearer.

The only known method to remove this heat build up is to open the FRO fully to air to allow the heat to escape.

## **2.13 Summary**

This guidance document is not a requirement for compliance to this standard, but has been developed to answer some of the questions that end users may have. Inevitably there will still be questions which this document does not answer, but the document has been developed as a 'living' document and as such will be updated as the need arises.

In considering the use of FROs, forces or regions may wish to consider whether the environment in which an overall is required actually does have an incendiary risk i.e. is the use of a FRO appropriate? The use of a FRO may result in additional complications e.g. heat degradation. This decision must be based on a suitable risk assessment and intelligence and can only be made by each individual organisation.

Chief Inspector Richard Prior  
Police Advisor to HOSDB

## 3 Technical Testing

### 3.1 Introduction

The following sections of this document provide information to manufacturers and end users regarding the two testing routes available to achieve compliance to the requirements specified by this part of the HOSDB standard.

For a manufacturer to achieve full compliance to this standard, two test routes are available. These are detailed below:

- Route 1: for FROs not certified to BS7971-10:2004
- Route 2: for FROs certified to BS7971-10:2004

All FROs submitted for compliance testing to HOSDB shall meet the general requirements specified in this document and all manufacturers/suppliers shall agree to the requirements for batch testing specified in this document.

## 4 General Requirements Applicable to Both Test Routes

### 4.1 Labelling

A label providing the following information as a minimum shall be permanently attached to the garment.

- The manufacturer's name;
- Model designation (name/number);
- Date of manufacture and batch number;
- Test house reference number;
- A set of instructions for maintenance and cleaning (any necessary detailed instructions shall be provided in a separate leaflet)

Garments compliant with this standard shall include the following statement on the garment label or accompanying documentation:

#### **Certification**

The manufacturer certifies that [insert model designation] has been tested at an HOSDB approved testing facility and has been found to comply with HOSDB Flame Retardant Overall Standard for UK Police (2008)

This statement shall not appear on any garment that has failed HOSDB compliance testing or on products that have not been fully tested at an HOSDB approved test facility for compliance to this standard.

### 4.2 Sizing

The FRO shall be made available in a large enough range of sizes to allow varying sizes of male and female officers to be accommodated and so that a reasonable air gap can be maintained between the fabric and the wearer without leaving excess material that may cause a flammable liquid trap.

Each set of end users may have different styles of blunt trauma protectors and body armour, which must be taken in account when sizing overalls.

### 4.3 Comfort/Ergonomics

HOSDB does not specify ergonomic testing as a requirement for compliance.

Each purchasing authority is advised that wearability trials should be conducted prior to awarding any contract (see the guidance section of this document).

#### **4.4 Undergarments**

If a FRO is designed to be compliant to this standard without the addition of other materials such as undergarments, it must be tested without any of these additional materials.

If a FRO is design to protect as a two layer system, i.e. an undergarment layer followed by a separate over suit, then the following requirements must be met:

- Both the layers must be clearly marked/labelled to ensure that the end user is aware that only by wearing both layers will they be offered full protection to the levels defined;
- The manufacturer shall not provide only one of the layers at any time, unless they can provide assurance of the following;
  - i. The end user already has the other garment
  - ii. The garment is still fully serviceable.

#### **4.5 Quality of manufacture**

Manufacturers of FROs should ensure that their processes are controlled by a documented quality system such as the ISO9001 management system.

#### **4.6 Design**

The design shall take into consideration the following criteria:

- All stitching shall be flame retardant and the design shall minimise the number of seams exposed to the threat;
- Any pockets included in the garment shall be covered by a flap which cannot fold into the pocket conforming to the materials used in the garment construction. Pockets shall not form a flammable liquid trap;
- Any linings, fasteners or other attachments shall meet the flame retardant requirements of this standard. Any surface identification or markings shall be non-flammable and shall not affect the performance of the garment;
- Metal fasteners that penetrate the fabric shall be protected on the inside by linings or flaps so that they do not provide a heat conduction path through the garment;
- Openings shall be kept to a minimum and covered on the outside by a flap to prevent liquid ingress;
- The collar shall be closed to the chin;
- Openings around wrist and ankles shall form seals to prevent heat or flames entering when fully closed;

- There shall be no pleats or elastic that could cause the fabric to gather creating a flammable liquid trap;
- FROs shall be compatible with existing public order equipment – particularly blunt trauma protectors.

#### **4.7 Life span and durability**

FROs shall:

- Be provided with manufacturers instructions for suggested shelf life, cleaning, repair or replacement;
- Withstand laundering in accordance with the manufacturer's instructions without reduction of the protective properties for the lifetime of the garment;

#### **4.8 Batch testing**

The manufacturer shall supply details of its proposed batch testing regime to HOSDB for approval along with the declaration. Guidance relating to the minimum expected tests can be found in section 8.

## 5 Definitions

### 5.1 Afterflame

Flame on the specimen after the source of ignition has been removed.

### 5.2 Afterglow

Glowing material persisting after the removal of the ignition source (flame) or after flaming of the specimen has stopped.

### 5.3 Batch

A number of garments produced from the same supply of materials.

### 5.4 Debris

Material falling or expelled from the test specimen during a test. This may be non-flaming, flaming or molten.

### 5.5 External surface

The outermost surface of the garment.

### 5.6 Model designation

The unique name or number given to the garment by the manufacturer. This reference must be permanently attached to the FRO.

### 5.7 Outer face

The fabric surface intended to face the threat e.g. flame or liquid.

### 5.8 Penetration index

The percentage of a liquid by volume penetrating the fabric.

### 5.9 Repellency index

The percentage of a liquid by volume that runs off the fabric during a liquid run-off test.

## 6 Route 1 Compliance Testing

This route to HOSDB Standard Compliance enables a manufacturer whose product/s have not achieved certification to BS7971-10:2004 to achieve full compliance to this HOSDB standard.

### 6.1 Submission for approval

On initial submission to HOSDB the manufacturer shall supply the following:

#### 6.1.1 Declaration

A declaration is the documentation fully describing the construction of the garment, which may be in the form of a technical file.

This documentation shall include the following statement:

##### **Declaration**

Any product produced as model designation \*\*\*\* as a result of successful compliance testing to HOSDB Flame Retardant Overalls Standard for UK Police (2008), will be of the same construction, using the same materials, from the same manufacturer as the test sample.

NOTE: Any deviation from the original declared construction may invalidate the compliance test.

The construction of the garment shall be described, giving manufacturers references, trade names, number of layers, thickness, weave, stitch pattern etc.

A sample declaration form showing the information required, which may be photocopied, is shown in Appendix A. This form is also available in electronic format upon request from HOSDB and when completed may be submitted to HOSDB by email to - [declarations@homeoffice.gsi.gov.uk](mailto:declarations@homeoffice.gsi.gov.uk).

On initial submission for compliance testing, a sample garment shall be supplied to HOSDB, which will be kept by HOSDB for a minimum period of 5 years, after which it will be securely disposed of by HOSDB.

All information supplied to HOSDB will be classified **PROTECT-COMMERCIAL**

Once a declaration has been deemed satisfactory by HOSDB, the test facility will be informed of the manufacturer/supplier intention to submit the model number/s agreed with HOSDB for testing. The manufacturer or supplier will then be invited to contact the test facility to arrange a test date and subsequently submit the samples for compliance testing.

**The test facility is not authorised to carry out compliance testing to the HOSDB Standard until a satisfactory declaration has been received and approved by HOSDB.**

### **6.1.2 Submission of the test garment**

The manufacturer shall supply to the test facility - three complete FROs<sup>2</sup>, one small, one medium and one large, in an 'as sold' condition. The test facility will use samples from these garments for testing. If the test facility is unable to complete the testing from the submitted garments they may request additional samples from the manufacturer. These additional samples may be sample packs instead of a full garment. The test facility shall ensure that any additional sample packs are of identical construction to the original submitted sample garment.

## **6.2 Pre-conditioning the samples**

Samples used in the testing of the FRO shall be pre-treated by the test authority by laundering (washing or dry-cleaning) for 5 cleaning cycles in accordance with the manufacturers recommended care instructions.

FROs shall be inspected after pre-conditioning to ensure that they have not been damaged and any visual changes shall be noted. Shrinkage of the outer fabric will be measured and must not exceed  $\pm 3\%$  in any direction.

## **6.3 Selection of specimens**

Where the FRO is of multilayer construction or system, the layers shall be assembled in the correct order as stated in the declaration.

Where the FRO features areas of different construction (e.g. collars, cuffs) this fabric will also be tested. Seams, fastenings and pocket assemblies shall also be tested.

Seam samples shall have a continuous seam running down the centre length of the specimen. In addition any insignia or attachments included as part of the FRO system shall be subjected to testing.

Once all samples have been selected the following tests shall be performed and the results submitted to both HOSDB and the manufacturer:

## **6.4 Resistance to flame spread**

This test is used to determine the flame retardant properties of a fabric under controlled conditions in a laboratory setting. In the extreme conditions posed by exposure to petrol bombs it is likely that damage will occur to the FRO.

### **6.4.1 Sample selection**

Samples shall be selected from a pre-conditioned garment and shall include the following:

- Three samples of the garment containing no seams;
- Three samples of the garment containing seams;

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<sup>2</sup> If a 2 layer system, both layers must be submitted.

- Any other samples from the garment that are of different construction i.e. collars and cuffs, insignia etc.

#### **6.4.2 Methodology**

Testing shall be carried out according to BS EN ISO 15025:2002, Procedure A – Surface Ignition.

Where seams or other surface features such as embroidered insignia are to be tested they should be positioned such that the seam/feature is exposed to the test flame.

#### **6.4.3 Requirement**

A garment shall be deemed to have met the requirements for resistance to flame spread if the following requirements are met:

- Mean afterflame time:  $\leq 2$  seconds;
- Mean afterglow time:  $\leq 2$  seconds;
- No flame shall reach the upper edge or either vertical edge of any test specimen;
- No holing of the outer layer of the fabric assembly will be allowed;
- No debris;

### **6.5 Heat transfer on exposure to flame**

This test exposes the outer surface of the fabric to a flame and measures the time it takes for the rear of the fabric to rise in temperature. This test is purely an indicative laboratory test used to set a minimum standard for a material; it is not intended to represent the conditions a user may experience.

#### **6.5.1 Sample selection**

Samples shall be selected from a pre-conditioned garment and shall include the following:

- Three samples of the garment containing no seams;
- Any other samples from the garment that are of different construction i.e. collars and cuffs, insignia etc.

#### **6.5.2 Methodology**

Testing shall be carried out according to BS EN 367:1992

The outer surface of the FRO fabric sample shall be exposed to a convective heat source (flame) with an incident heat flux of  $80 \text{ kWm}^{-2}$

- Record: time to  $12^\circ\text{C}$  above background ( $\text{HTI}_{12}$ )
- Record: time to  $24^\circ\text{C}$  above background ( $\text{HTI}_{24}$ )

### **6.5.3 Requirement**

A garment shall be deemed to have met the requirements for heat transfer on exposure to flame if the following requirements are met:

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

## **6.6 Heat transfer on exposure to radiant heat**

This test exposes the fabric to a non contacting heat source and measures the time taken for the rear of the fabric to rise in temperature. This test is purely an indicative laboratory test used to set a minimum standard for a material; it is not intended to represent the conditions a user may experience.

### **6.6.1 Sample selection**

Samples shall be selected from a pre-conditioned garment and shall include the following:

- Three samples of the garment containing no seams;
- Any other samples from the garment that are of different construction i.e. collars and cuffs, insignia etc.

### **6.6.2 Methodology**

Samples will be tested according to the procedures set out in BS EN ISO 6942:2002 test B. Samples will be exposed to a heat source at an incident flux density of  $20 \text{ kWm}^{-2}$

- record: time to  $12^{\circ}\text{C}$  above background ( $RHTI_{12}$ )
- record: time to  $24^{\circ}\text{C}$  above background ( $RHTI_{24}$ )

### **6.6.3 Requirement**

A garment shall be deemed to have met the requirements for heat transfer on exposure to radiant heat if the following requirements are met:

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

## **6.7 Protection from liquids**

This test exposes the fabric to various liquids to determine the ability of the material to resist penetration and absorbency of these liquids. Liquids that

are absorbed or penetrate a fabric may pose an additional risk to the user as these may increase the risk of a fabric burning if exposed to a heat source.

### **6.7.1 Sample selection**

A suitable number of samples containing no seams shall be selected from a pre-conditioned garment. Where possible the samples set should contain the following:

- samples of the material in the machine direction (no seams);
- samples of the material in the cross machine direction (no seams);

### **6.7.2 Methodology**

Each type of sample shall be tested in accordance with the procedures defined in BS EN ISO 6530:2005 using 10ml of the following liquids applied over a 10 second period

- 50% iso-octane / 50% toluene (petrol substitute);
- Methyl isobutyl ketone (solvent used in CS sprays);
- 50% ethanol / 50% water (solvent used in PAVA sprays);
- 30% aqueous sulphuric acid;
- 40% aqueous sodium hydroxide;
- Water +20 ±5°C;
- Water +85 ±15°C.

### **6.7.3 Requirement**

A garment shall be deemed to have met the requirements for protection from liquids if the following requirements are met:

- Repellence index  $\geq 80\%$ ;
- Penetration index  $\leq 10\%$ .

In addition, one sample for each type of liquid used shall be tested for and meet the requirements for resistance to flame spread, section 6.4. Each sample shall be allowed to air dry at room temperature for a minimum of 2 hours (-0 +30 minutes) prior to resistance to flame spread testing.

## **6.8 Fabric strength and resistance to abrasion of the outer material**

These tests are used to ensure that the garment and materials used are designed with consideration given to the environment in which they are used.

### **6.8.1 Sample selection**

Samples shall be selected from a preconditioned garment and shall include the following:

- Twelve samples of the material in the machine direction (no seams);
- Nine samples of the material in the cross machine direction (no seams);
- Nine samples of each type of structural seam;

### **6.8.2 Tensile strength**

Using the test methodology defined in BS EN ISO 13934-1:1999 test the following prepared samples:

- Three samples of the material in the machine direction (no seams);
- Three samples of the material in the cross machine direction (no seams);

The mean failure force of the samples shall be  $\geq 450\text{N}$  and no individual failure force shall be  $< 350\text{N}$ .

Using the test methodology defined in BS EN ISO 13935-1:1999 test the following prepared sample:

- Three samples of each type of structural seam;

The mean failure force of the samples shall be  $\geq 450\text{N}$  (no individual failure force shall be  $< 350\text{N}$ ).

### **6.8.3 Tensile strength after exposure to heat**

Using the test methodology defined in BS EN ISO 6942:2002 test A, expose the following samples to a heat source at an incident flux density of  $10 \text{ kWm}^{-2}$  for a period of 3 minutes.

- Three samples of the material in the machine direction (no seams);
- Three samples of the material in the cross machine direction (no seams);
- Three samples of each type of structural seam.

Once all samples have been exposed to the heat source and allowed to cool the samples shall be tested

Using the test methodology defined in BS EN ISO 13934-1:1999 test the following prepared samples:

- Three samples of the material in the machine direction (no seams);
- Three samples of the material in the cross machine direction (no seams).

The mean failure force of the samples shall be  $\geq 340\text{N}$  (no individual failure force shall be  $< 230\text{N}$ ).

Using the test methodology defined in BS EN ISO 13935-1:1999 test the following prepared sample

- Three samples of each type of structural seam;

The mean failure force of the samples shall be  $\geq 340\text{N}$  (no individual failure force shall be  $< 230\text{N}$ ).

#### **6.8.4 Abrasion resistance**

Using the test methodology defined in BS EN 530:1995 test the following prepared samples

- Three samples of the material in the machine direction (no seams).

For the purposes of testing the following conditions shall be used:

- Test methodology 1;
- Crossbred worsted abradant;
- 12kPa pressure.

Failure is defined as two broken threads in one sample. The material will have passed the test if this failure does not occur at  $< 20000$  cycles.

### **6.9 Repeated resistance to heat transmission on exposure to flame**

This test is designed to test the performance of the sample to multiple short exposures such as an end user might be exposed to.

#### **6.9.1 Methodology**

A single test sample containing no seams shall be prepared in accordance with section 6.2. The sample shall be exposed to a heat flux density of  $80\text{kWm}^{-2}$  as specified in BS EN 367:1992 using the following procedure.

- Record the temperature;
- Expose to heat source for 3 seconds;
- Record the temperature for a further 30 seconds;
- Wait for two minutes;
- Repeat steps 1 to 4 to complete three exposures.

#### **6.9.2 Requirement**

The maximum temperature rise within 30 seconds must not be  $> 24^{\circ}\text{C}$  after the 3<sup>rd</sup> exposure.

## **6.10 Optional testing**

In addition to the mandatory testing requirements, a manufacturer may (if they wish) also have the following testing performed, which will be included on the final compliance document:

## **6.11 Slash resistance<sup>3</sup>**

If the FRO is intended to provide resistance to slashing attacks then the garment shall be tested according to the procedures described in HOSDB Slash Resistant Standard for UK Police (2006) Publication 48/05. Labelling must make clear which areas of the FRO are slash resistant e.g. arm patches, lower legs.

Labels shall indicate that the garment has met the requirements of both standards.

## **6.12 Cut resistance<sup>4</sup>**

If the FRO is intended to provide resistance to cuts then the garment shall be tested in accordance with the procedures described in BS EN 388:2003. Labelling must make clear which areas of the FRO are cut resistant e.g. arm patches, lower legs.

Labels shall indicate that the garment has met the requirements of both standards.

## **6.13 Electrostatic testing**

If the FRO is designed to minimise the effects of electrostatic build up it shall be tested to a nationally recognised standard, such as BS EN1149-4.

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<sup>3</sup> HOSDB define a Slash as an aggressive attack with a sharp edged weapon.

<sup>4</sup> HOSDB define a cut as a non aggressive action with a sharp edged weapon (e.g. slicing bread)

## 7 Route 2 Compliance Testing.

This route of approval enables a manufacturer whose product/s have achieved certification to BS7971-10:2004 to achieve approval to this HOSDB standard.

### 7.1 Submission for approval

On initial submission to HOSDB the manufacturer shall supply HOSDB with the following:

#### 7.1.1 Accredited test results

The manufacturer shall supply HOSDB with certification documentation to BS7971-10:2004. Where a manufacturer has an exemption from any section of BS7971-10:2004 they must supply documentary evidence as to the exemption. The test results must be from a verifiable source and HOSDB must be given authorisation to confirm any details with the test authority.

#### 7.1.2 Declaration

Documentation describing the construction of the garment (the construction must be identical to that supplied for BS accreditation). The document may be in the form of a technical file.

This documentation shall include the following statement:

**Declaration**

Any product produced as model designation \*\*\*\* as a result of successful compliance testing to HOSDB standards, will be of the same construction, using the same materials, from the same manufacturer as the test sample.

NOTE: Any deviation from the original declared construction may invalidate the compliance test.

The construction of the garment shall be described, giving manufacturers references, trade names, number of layers, thickness, weave, stitch pattern etc.

A sample declaration form showing the information required, which may be photocopied, is shown in Appendix A. This form is also available in electronic format on request from HOSDB and when completed may be submitted to HOSDB by email at [declarations@homeoffice.gsi.gov.uk](mailto:declarations@homeoffice.gsi.gov.uk).

On initial submission for compliance testing, a sample garment shall be supplied to HOSDB for reference and will be kept by HOSDB for a minimum period of 5 years, after which it may be securely disposed of by HOSDB.

All information supplied to HOSDB will be classified as **PROTECT-COMMERCIAL**

## **7.2 Additional testing**

Once the declaration and submitted test results have been deemed satisfactory by HOSDB, the test facility will be informed of the manufacturer/supplier intention to submit the model number/s agreed with HOSDB for additional testing. The manufacturer/supplier will then be invited to contact the test facility to arrange a test date and subsequently submit the samples for compliance testing.

**The test facility is not authorised to carry out compliance testing to the HOSDB Standard until a satisfactory declaration has been received and approved by HOSDB.**

## **7.3 Submission of the test garment**

The manufacturer shall supply to the test facility two complete FROs in an 'as sold' condition. The test facility will use samples from these garments for testing. If the test facility is unable to complete testing from the submitted garments they may request additional samples from the manufacturer. These additional samples may be sample packs instead of a full garment. The test facility shall ensure that any additional sample pack is of identical construction to the original submitted sample garment.

## **7.4 Pre-conditioning the sample**

Samples used in the testing of the FRO shall be pre-treated by the test authority in accordance with BS7971-10:2004 section 6.

FROs shall be inspected after pre-conditioning to ensure that they have not been damaged and any visual changes shall be noted. Shrinkage of fabric will be measured and must not exceed  $\pm 3\%$  in any direction.

## **7.5 Selection of specimens**

Where the FRO is of multilayer construction or system, the layers shall be assembled in the correct order as stated in the declaration.

Where the FRO features areas of different construction (e.g. collars, cuffs) this fabric will also be tested. Seams, fastenings and pocket assemblies shall also be tested.

Seam samples shall have a continuous seam running down the centre length of the specimen. In addition any insignia or attachments included as part of the FRO system shall be subject to testing.

Once all samples have been selected the following test shall be performed and the results submitted to both HOSDB and the manufacturer:

## **7.6 Protection from liquids**

### **7.6.1 Protection against additional specified chemicals and water**

This test is to be carried out in accordance with the methodology specified in BS7971-10:2004 section 5.13 'Resistance to penetration by liquids'. The following liquids shall be used:

- methyl isobutyl ketone (solvent used in CS sprays)
- 50% ethanol / 50% distilled water (solvent used in PAVA sprays)
- water +85±15°C

### **7.6.2 Requirement**

The garment shall meet the level specified (either type 1 or type 2) by the manufacturer when the garment was first tested against the requirements of BS7971-10:2004.

## **7.7 Repeated resistance to heat transmission on exposure to flame**

This test is designed to test the performance of the FRO to multiple short exposures that an end user might be exposed to.

### **7.7.1 Methodology**

A single test sample containing no seams shall be prepared in accordance with BS7971-10:2004 section 6. The sample shall be exposed to a heat flux density of 80kWm<sup>-2</sup> as specified in BS EN 367:1992 using the following procedure.

- Record the temperature;
- Expose to heat source for 3 seconds;
- Record the temperature for a further 30 seconds;
- Wait for two minutes;
- Repeat steps 1 to 4 to complete three exposures.

### **7.7.2 Requirement**

The maximum temperature rise within 30 seconds must not be > 24°C after the 3<sup>rd</sup> exposure.

## **7.8 Optional testing**

In addition to the mandatory testing requirements, a manufacturer may (if they wish) also have the following testing performed, which will be included on the final compliance document. Inclusion of materials to

provide additional protection specified must not compromise the garments compliance with BS7971-10:2004.

### **7.9 Slash resistance<sup>5</sup>**

If the FRO is intended to provide resistance to slashing attacks then the garment shall be tested according to the procedures described in HOSDB Slash Resistant Standard for UK Police (2006) Publication 48/05. Labelling must make clear which areas of the FRO are slash resistant e.g. arm patches, lower legs.

Labels should indicate that the garment has met the requirements of both standards.

### **7.10 Cut resistance<sup>6</sup>**

If the FRO is intended to provide resistance to cuts then the garment shall be tested in accordance with the procedures described in BS EN 388:1994. Labelling must make clear which areas of the FRO are cut resistant e.g. arm patches, lower legs.

Labels should indicate that the garment has met the requirements of both standards.

### **7.11 Electrostatic testing**

If the FRO is designed to minimise the effects of electrostatic build up it shall be tested to a nationally recognised standard, such as BS EN1149-4.

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<sup>5</sup> HOSDB define a slash as an aggressive attack with a sharp edged weapon.

<sup>6</sup> HOSDB define a cut as a non aggressive action with a sharp edged weapon (e.g. slicing bread)

## 8 Batch Testing

Manufacturer's shall provide details of the batch testing process that they perform to ensure that all garments supplied under the model designation tested for compliance with this standard continue to be for purpose.

This batch testing shall (as a minimum) incorporate:

- Radiant heat testing;
- Resistance to heat transfer on exposure to flame;
- Resistance to flame spread;
- Liquid testing.

This testing may be performed on sample packs made from the same batch of material as the supplied garment. These samples may be tested without the requirement for pre-conditioning. The sample packs shall also include samples of any stitched seams and also any other closing system (Velcro etc) that is incorporated into the garment.

The number of submitted samples shall be proportional to the number of garments that are expected to be made from any single batch of fabric.

# Appendix A: Sample Declaration

## Declaration of Content and Construction of Garment to: HOSDB Flame Retardant Overalls Standard for UK Police (2008)

When completed this document will be classified “PROTECT - COMMERCIAL”

<b>Garment Model</b> .....		
(This number must also be displayed on the garment label)		
<b>One - piece</b> <input type="checkbox"/> <b>Two - piece</b> <input type="checkbox"/> <b>(tick as appropriate)</b>		
	Description of Materials (from outer face to inner surface) Include manufacturers' references, trade names, number of layers, weight (g/m <sup>2</sup> ), thickness, weave pattern as appropriate	Sketch/photograph showing garment construction/design.  Locations of fastenings, attachments and seams to be recorded.
<b>Outer face</b>  ↓  <b>Inner</b>	<i>Use additional pages if required</i>	<i>Use additional pages if required</i>

**(Insert Company Name here)..... hereby declare that all garments produced as Model ..... as a result of successful Compliance Testing to the HOSDB standard (89/08) will be of the same construction, using the same materials from the same manufacturer as the test sample/s listed above. In addition, if the overall is supplied to UK police, they will be submitted to batch testing in accordance with Section 8 of the standard.**

Signed..... Date.....

## Appendix B: Reference Documents

British Standards can be purchased from:

BSI British Standards  
389 Chiswick High Road  
London  
W4 4AL  
United Kingdom

Telephone: +44 (0)20 8996 9001

Fax: +44 (0)20 8996 7001

Email: [cservices@bsigroup.com](mailto:cservices@bsigroup.com)

Web: [www.bsigroup.com/en/Standards-and-Publications](http://www.bsigroup.com/en/Standards-and-Publications).



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Website: <http://science.homeoffice.gov.uk/hosdb/>