



HOSDB Slash Resistance Standard for UK Police (2006)

Publication No. 48/05

C Malbon
J Croft

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Foreword

This standard is the culmination of a major piece of work carried out by the Crime Investigation and Officer Safety (CIOS) sector at the Home Office Scientific Development Branch (HOSDB). The work was carried out at the request of:

- The Association of Chief Police Officers (ACPO), Self Defence, Arrest and Restraint (SDAR) Sub Committee of the Conflict Management Portfolio;
- The Police Federation of England and Wales.

The PSDB Body Armour Standards (2003), for ballistic and stab resistant armours were produced by HOSDB at the request of the SDAR Sub-Committee of ACPO. The standard provides protection for police officers against ballistic threats and stabbing from edged weapons.

HOSDB have now developed this new standard to address the specific requirement for slash resistant protection relative to areas of the body that cannot be protected by standard ballistic and stab resistant armours.

The standard will allow forces to choose and issue equipment in response to risk assessments that chief officers make to comply with the Police (Health and Safety) Act 1997.

Mike Tonge
Chief Constable
ACPO Conflict Management
Portfolio Holder

Alan Pratt
Director
Home Office Scientific
Development Branch

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1 Introduction

This standard provides information on the test methodology and protection levels required for slash resistant protection. The test is performed on slash resistant samples of material of a defined size and not any particular garment that may incorporate slash resistant protection.

This standard has a single level of protection determined from analysis of slash attacks performed by volunteers using an instrumented knife on a target.

It is not intended that slash resistant protection will provide resistance to ballistic or stab threats

1.1 Scope

This standard applies to slash resistant materials, which may be incorporated into clothing or other items of Personal Protective Equipment (PPE) that are intended to resist a slashing attack by an edged weapon. This standard does not address stabbing and ballistic attacks, which are covered in the HOSDB Body Armour Standards for UK Police.

This standard shall be used in conjunction with other relevant standards where the slash resistant packs are incorporated into other garments or PPE.

1.2 Testing

Compliance testing of slash resistant packs to this standard shall only be performed at HOSDB approved test facilities. Development testing of slash resistant packs by manufacturers to this standard may be performed using any test facility they wish. HOSDB will provide details of the test equipment used by HOSDB approved test facilities on request

1.3 Publication of Results

The results of compliance testing to this standard will be held by HOSDB and treated as **RESTRICTED – COMMERCIAL**, and as such, the information will not be made available to competing manufacturers and suppliers.

A non-restricted listing of slash resistant material packs that are certified as being compliant to this standard will be published on the Home Office website. Full details are available on request from HOSDB (see page ii for contact details).

2 General Requirements

2.1 Labelling

An information panel, providing the following information, shall be permanently attached to the garment containing the slash resistant pack:

- The manufacturer's name;
- The date of manufacture and batch identifier;
- The model designation (see definitions Section 3);
- The test house reference e.g. HOSDB/FPE/JC/1234/FEB/2006. This reference is present on all documentation supplied as a result of compliance testing. It uniquely identifies the product as having a specified construction common to all examples of the slash resistant protection. The test house reference shall be clearly marked on each protective pack produced as a result of successful testing to this standard.

Additionally, where the slash resistant pack is of a suitable size the following shall also be attached:

- A set of instructions for maintenance and cleaning.
- For slash resistant material packs that have been successfully tested for compliance to this standard at an HOSDB approved testing facility, the following statement shall be included on the label:

“The manufacturer certifies that model designation (insert) has been tested at a HOSDB approved testing facility and has been found to comply with HOSDB Slash Resistance Standard for UK Police (2006)”.

The above statement and labelling shall not appear on any slash resistant protection that has failed HOSDB compliance testing, or on products that have not been fully tested at a HOSDB approved test facility for compliance to this standard.

If the slash resistant panel is not of a suitable size to incorporate this information, a separate document shall be included with the garment in its packaging.

Garments constructed incorporating different models of slash resistant material packs shall have labels for each different model used. Additionally the label must state the area of the body protected by that model of slash resistant pack.

2.2 Sizing

Any slash resistant panel shall be of an appropriate size to provide protection to the area for which it is intended.

2.3 Comfort

A slash resistant panel should not unduly restrict the movement of the wearer, or cause excessive heat and sweat build up. The slash resistant material packs shall not undergo any appreciable alteration through the effects of perspiration or toilet products or cause any adverse reaction to the user (e.g. skin allergy).

2.4 Quality of Manufacture and Audit Trail

Each slash resistant pack shall be free from wrinkles, blisters, cracks or fabric tears, crazing, chipping or sharp corners or other evidence of inferior workmanship. Manufacturers providing slash resistant panels for compliance testing must be able to demonstrate consistency of manufacture through membership of a recognised Quality Assurance Standard e.g. ISO 9001:2000.

2.5 Batch Testing

Batches of slash resistant panels shall be manufactured from materials of consistent quality. The manufacturer is responsible for ensuring suitable batch testing is performed and HOSDB may request to see the results of this batch testing at any time.

2.6 Construction

The slash resistant panels shall be designed and fabricated with due regard to the properties and limitations of the materials used. All methods of shaping, moulding, attachment and stitching shall not produce any localised areas of weakness or stress concentrations that may reduce the level of protection provided.

2.7 Incorporation into Garments

Any garment produced that incorporates a slash resistant panel shall, in addition to meeting the requirements of this standard, also meet the requirements of any other national standards applicable to the style of garment e.g. BS EN 471:2003 High-Visibility warning clothing for professional use: Test methods and requirements.

3 Definitions

3.1 Batch

A quantity of slash resistant panels produced in a single production run using materials produced in any one production run.

3.2 Batch Identifier

A unique identifier allocated to a single batch which enables the manufacturer to identify a product made in a single production run. A separate production run or the use of any material from a new material batch would be classed as a new batch and would require a new batch identifier.

3.3 Batch Test

Consistency testing of a slash resistant panel in production that has already passed compliance testing to this standard.

3.4 Fair Strike

A fair strike is that which strikes the slash resistant panel at a velocity no greater than $\pm 0.5\text{ms}^{-1}$ from the intended value. The slash must not be closer than 50mm to the edge of the test sample or to a previous slash.

3.5 Model Designation

A manufacturer's designation (name, number or other description) that serves to uniquely identify a specific slash resistant panel design. *Each sample type submitted for testing shall carry this unique identification*

3.6 Slash Resistance

The property of a material or product showing resistance to a slash attack by an edged weapon

3.7 Slash Resistant

A description of a material or product showing resistance to a slash attack by an edged weapon.

3.8 Slash Resistant Pack

The material or materials used to provide resistance to a slash attack that may be incorporated into other garments.

3.9 Strike Face

The side of the slash resistant pack designed by the manufacturer as the surface that must face the threat.

3.10 Test Blade

The test blade shall be from a batch calibrated set and used only once. The blade is a standard Stanley® knife blade model 1992Ô.

3.11 Test Reference

This reference (unique to each model designation) is present on all documentation issued by the test house and on the certification document issued by HOSDB. *The test reference must be displayed on each slash resistant panel label adjacent to the model designation¹.*

3.12 Test Sample Pack

The slash resistant pack supplied by the manufacturer for testing to this standard.

3.13 Witness / Insulating Material

A layer of polyart® paper of weight 80gm⁻², which is placed between the back plate and the test sample. This layer of paper is used to ensure only true penetrations are recorded and to confirm a penetration as the result of a slash.

¹ This applies only to production slash resistant packs produced as a result of successful compliance testing to HOSDB Standards.

4 Test Methodology

4.1 Test Equipment

Certification testing shall be performed using the HOSDB designed guided drop assembly, shown in figure 1. This assembly enables the slash missile to fall under the influence of gravity and contact the slash panel at a pre-determined point on a force table mounted at 2° from vertical. Details of the setup and calibration of the test equipment used for certification testing at HOSDB approved test facilities are in Appendix A.

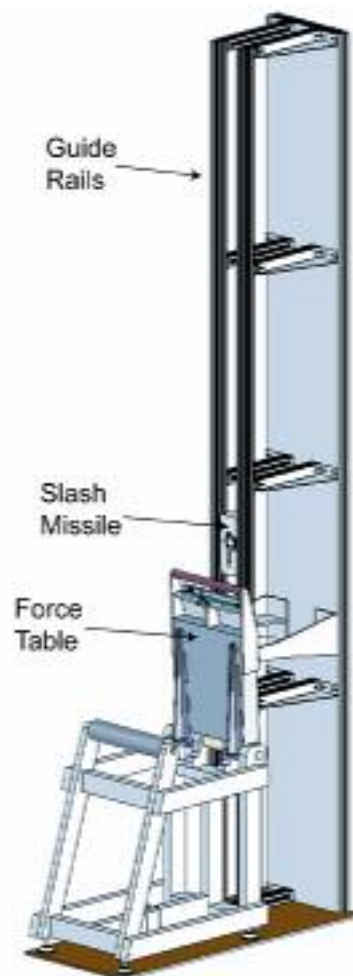


Figure 1. Overview of the HOSDB designed guided drop assembly

The guided drop assembly prevents the slash missile from rotating about its vertical axis during its descent. The guided drop assembly must be rigidly secured to a supporting wall or frame, and care must be taken to ensure the assembly is mounted vertically. The force table must be mounted on a base of suitable rigidity that ensures it does not move during the test. Drawings of

the guided drop assembly, slash missile and force table are available from HOSDB.

4.1.1 The Slash Missile²

The slash missile consists of a supporting arm that securely holds the test blade and a piston system housed in a nylon casing. The missile has a total mass of $2 \pm 0.1\text{kg}$, and is shown in figure 2. The casing is designed to ensure minimum friction between the missile and the guides of the guided drop assembly during its falling motion.

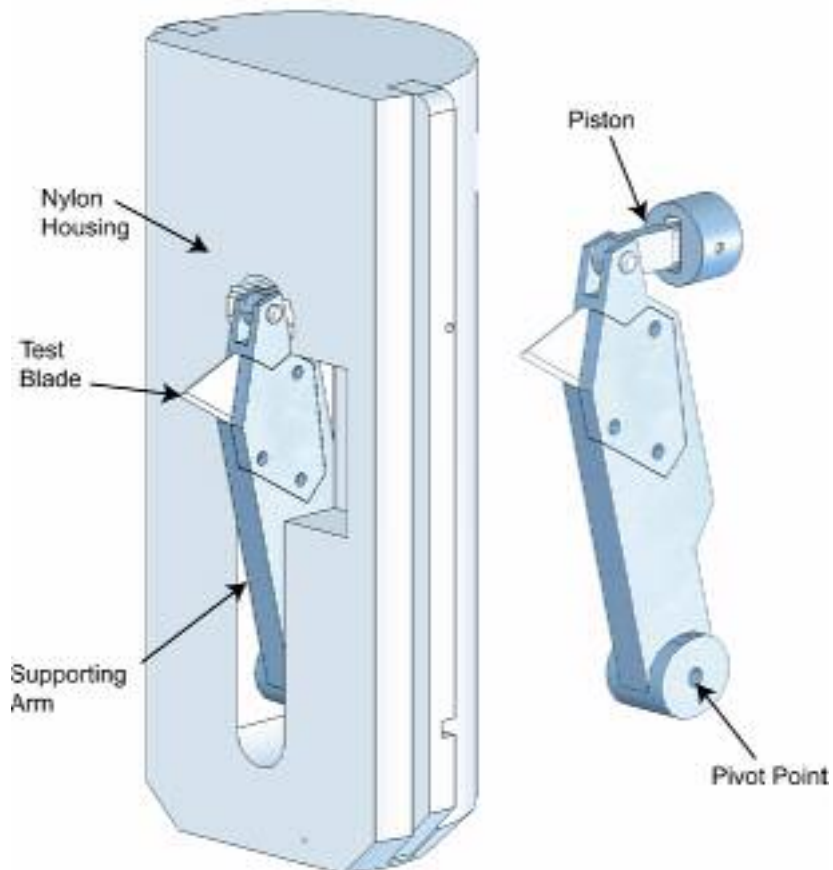


Figure 2. Slash missile and exposed view of supporting arm

The supporting arm is free to move within the nylon casing around a pivot point and is designed to hold the test blade at an angle of $30^\circ \pm 1^\circ$ from the horizontal when at rest, figure 3. The movement is limited by the use of a calibrated force spring between the piston and the nylon casing. An electrical connection is required to the supporting arm to form part of the contact circuit.

² Engineering drawings of the slash missile are available upon request from HOSDB.

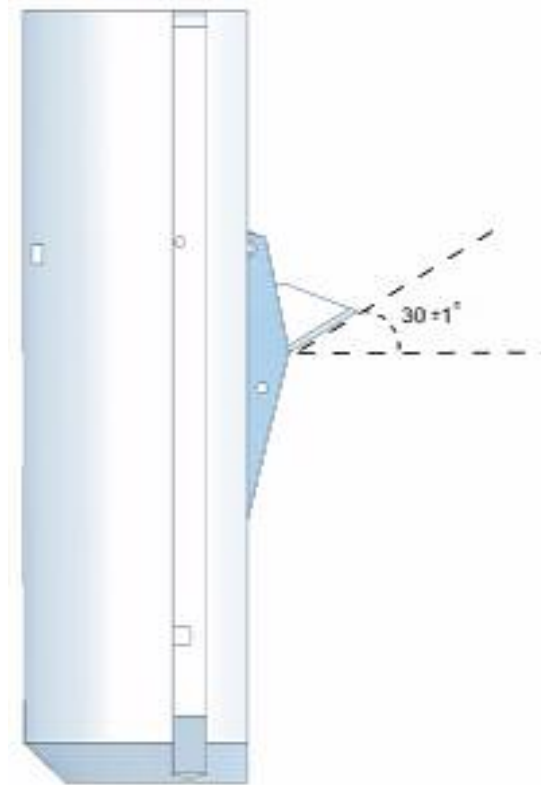


Figure 3. Side view of slash missile showing angle of test blade at rest

4.1.2 The Force Table³

The force table consists of two load cells sandwiched between layers of stainless steel, figure 4. The load cells are preloaded to a force of 30% of their rated value when they are installed. The force table is mounted at an angle such that the blade tip force reaches the minimum force required within 200mm from the point of contact. The force table has a protective layer of steel on the strike surface, which is securely attached to the top plate of the force table. The area to each side of the contact plate shall be built up using foam of nominal density 33kgm^{-3} to a minimum width of 300mm which is continuous for the full length of the force plate. An electrical connection is made to the contact plate to enable the contact circuit to be made.

³ Engineering drawings of the force table are available upon request from HOSDB.

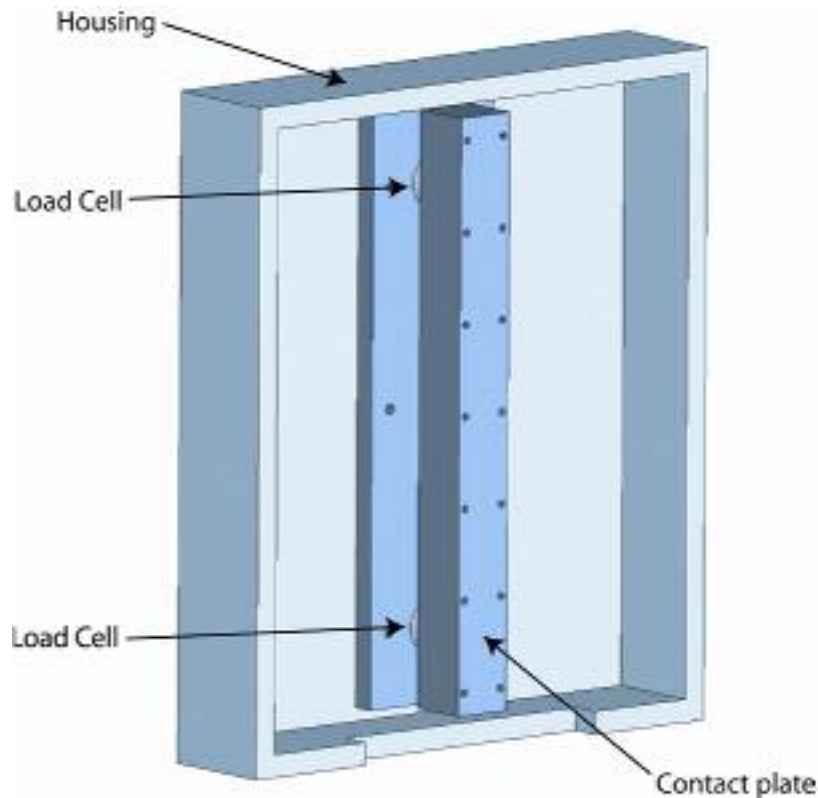


Figure 4. Overview of the Force Table (without foam)

4.1.3 The Test Blade

The test blade used is a standard Stanley® knife blade model 1992Ô and was selected as it represents a common bladed weapon used in assaults on police officers. Each blade used shall be from a set which has been subjected to a 1% batch test for edge sharpness in accordance with ISO 8442.5 using a 25mm stroke length and have an Initial Cutting Performance (ICP) of 75 – 85mm.

4.1.4 Velocity Measurement

A suitable method of accurately measuring the velocity of the missile within $25 \pm 2\text{mm}$ of the contact point shall be used. The measuring equipment used shall be calibrated so that it is capable of measuring the velocity to an accuracy of $\pm 0.1\text{ms}^{-1}$. Test calibration records must be maintained to the requirements of a national standard e.g. UKAS, ISO17025.

4.1.5 Charge Amplifier

A suitable calibrated charge amplifier connected to the summed signals from the load cells shall be used. The charge amplifier shall be connected to a data collection device (e.g. a calibrated oscilloscope connected to a computer) to enable the data recorded to be analysed and saved. Test calibration records must be maintained to the requirements of a national standard e.g. UKAS, ISO17025.

4.1.6 Contact Circuit

An electrical circuit is used to determine point of failure of the slash resistant sample. This circuit is created when the blade penetrates the slash resistant pack and makes contact with the force plate. A suitable method of monitoring this contact is required which shall also link to the data collection device.

4.2 Test Sample

For the purposes of compliance testing, 3 test packs 500mm long and 300mm wide are required. The construction must conform exactly to the description specified in the declaration. If the slash resistant pack is manufactured from more than one layer, all layers of the test sample shall be stitched together along each edge in addition to any stitching pattern which is inherent to the protection provided by the panel. If the weave pattern of the materials used in the slash resistant panel is not homogeneous, 1 panel must be manufactured to the size required with the weave rotated through 90°. The weave directions shall be clearly marked by the manufacturer or supplier for the purpose of compliance testing.

4.3 Submission for Testing

Before submitting any test samples to a HOSDB accredited test house for compliance testing, manufacturers and suppliers are required to inform HOSDB, in writing, of their intention to submit the samples for testing. Documentation describing the construction of the test sample shall be included. This documentation shall be in the form of a declaration stating that “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 will invalidate the certification.**

The materials used in the construction of the slash resistant pack shall also be listed starting from the strike face, giving manufacturer’s references, trade names, thickness, etc.

The information supplied on this declaration will be treated as “**RESTRICTED COMMERCIAL**” by HOSDB.

A sample declaration form showing the information required, which may be photocopied, is shown in Appendix B. An electronic version of this form may be obtained from HOSDB. Declarations can be either posted or faxed to HOSDB, alternatively the declaration can be submitted by email to declarations@homeoffice.gsi.gov.uk⁴

4.3.1 Test Sample Submission

Once the declaration has been approved by HOSDB, the test house will be informed of the manufacturer or supplier’s intention to submit the model agreed with HOSDB for testing.

⁴ This email address is for the submission of declarations only, for all other enquiries please use the contact details specified on page ii

The manufacturer or supplier will then be invited to contact the test facility directly to arrange a test date and submit the required number of samples to the test house for compliance testing. The test house is not authorised to carry out compliance testing to HOSDB standards until a satisfactory declaration has been received and approved by HOSDB.

4.4 Pre Test Calibration

4.4.1 Force Spring

The force spring used shall be from a set which has been calibrated. A new spring shall be used for each compliance test. The springs shall be stored at a temperature of 17 to 23°C and a humidity of 40 to 70%. The spring specification is given in Appendix C.

4.4.2 Slash Missile Velocity Calibration

The slash missile shall be raised to a height in the drop tube so that the velocity recorded at the velocity gate is $6 \pm 0.5 \text{ ms}^{-1}$. This shall be confirmed prior to each compliance test by recording 3 consecutive drops at the specified velocity.

4.4.3 Force Table Calibration

The force table calibration shall be checked at the start of each compliance test using the method detailed in appendix B. The temperature shall be maintained between 17 to 23°C at 40 to 70% humidity.

4.5 Test Blade Selection

Nine test blades shall be selected at random from a batch tested set for slash resistance testing. Each blade shall be used only once, using only one tip of the blade. Each blade shall be visual inspected to ensure the overall finish of the test blade is free from rough edges. Each blade used shall be carefully cleaned to remove any traces of lubricant immediately prior to its use.

4.6 Sample Pack Preparation

The sample packs shall be stored laid flat at 17 to 23°C 40 to 70% humidity for 24 hours immediately prior to testing. Each sample pack shall have a single sheet of 80gm^{-2} Polyart® paper, cut to the same size as the sample pack, attached to it. The paper shall be attached using a single layer of wide parcel tape. The sample packs shall be numbered 1 to 3, with sample pack 2 being the non homogeneous pack, if supplied. If the packs are homogeneous the numbering shall be random.

4.7 Force Table Alignment

Using a suitable datum point the force table shall be aligned such that the blade tip just contacts the force plate $250 \pm 5\text{mm}$ from the bottom and centred

across the plate. A suitable method of ensuring the force table is located at the same point for each slash should be used.

4.8 Blade Insertion⁵

The blade is held in place by a sprung clamping plate on the side of the slash arm. A blade is installed as follows:

- (a) Loosen (but do not remove) the three screws that hold the plate onto the slash arm.
- (b) Without touching the tip of the blade to be used, carefully slide the blade into the gap between the slash arm and the sprung mounted plate as shown in figure 5.
- (c) Adjust the blade so that it slots into the notches in the slash arm, shown in figure 6 (these cannot be seen under normal conditions).
- (d) Hand tighten the three screws whilst carefully supporting the blade.
- (e) Ensure the blade is secure in the slash arm.

Care must be taken during the installation process to not damage, or contact the tip of the blade being used for the test.



Figure 5. Test blade being inserted into the HOSDB designed supporting arm.

⁵ using the HOSDB design test equipment.



Figure 6. Test blade located in notches (clamping plate removed)

4.9 Test Procedure

4.9.1 Test Pack 1

Attach test pack 1 to the force table ensuring that the pack is kept parallel to the force plate. Perform the following series of tests using a new blade for each test slash.

Test Slash 1

Align the test sample over the force plate such that the blade will strike the pack 50 ± 5 mm from the left edge of the sample pack. Ensure the sample pack is laying flat on the surface of the force table. Record the test sabot velocity, force-time data and any penetration of the sample pack.

Test Slash 2

Align the test sample over the force plate such that the blade will strike the pack 50 ± 5 mm from the right edge of the sample pack. Ensure the sample pack is laying flat on the surface of the force table. Record the test sabot velocity, force-time data and any penetration of the sample pack.

Test Slash 3

Align the test sample over the force plate such that the blade will strike the pack in the centre of the sample pack. Ensure the sample pack is laying flat on the surface of the force table. Record the test sabot velocity, force-time data and any penetration of the sample pack.

Carefully remove pack 1 from the force table and place to one side for analysis.

4.9.2 Test Pack 2

Attach test pack 2 to the force table ensuring that the pack is kept parallel to the force plate. Perform the following series of tests using a new blade for each test slash.

Test Slash 4

Align the test sample over the force plate such that the blade will strike the pack in the centre of the sample pack. Ensure the sample pack is laying flat on the surface of the force table. Record the test sabot velocity, force-time data and any penetration of the sample pack.

Test Slash 5

Align the test sample over the force plate such that the blade will strike the pack 50 ± 5 mm from the right edge of the sample pack. Ensure the sample pack is laying flat on the surface of the force table. Record the test sabot velocity, force-time data and any penetration of the sample pack.

Test Slash 6

Align the test sample over the force plate such that the blade will strike the pack 50 ± 5 mm from the left edge of the sample pack. Ensure the sample pack is laying flat on the surface of the force table. Record the test sabot velocity, force-time data and any penetration of the sample pack.

Carefully remove pack 2 from the force table and place to one side for analysis.

4.9.3 Test Pack 3

Attach test pack 3 to the force table such the vertical edges are at an angle of 30° to the long axis of the force table. Perform the following series of tests using a new blade for each test slash.

Test Slash 7

Align the test sample over the force plate such that the blade will strike the pack in the centre of the sample pack. Ensure the sample pack is laying flat on the surface of the force table. Record the test sabot velocity, force-time data and any penetration of the sample pack.

Test Slash 8

Align the test sample over the force plate such that the blade will strike the pack 50 ± 5 mm from the left edge of the sample pack. Ensure the sample pack is laying flat on the surface of the force table. Record the test sabot velocity, force-time data and any penetration of the sample pack.

Test Slash 9

Align the test sample over the force plate such that the blade will strike the pack 50 ± 5 mm from the right edge of the sample pack. Ensure the sample pack is laying flat on the surface of the force table. Record the test sabot velocity, force-time data and any penetration of the sample pack.

Carefully remove pack 3 from the force table and place to one side for analysis.

5 Performance Assessment

For the samples to have successfully passed slash resistance compliance testing the following criteria must be met:

- No penetration shall have occurred with a force less than 60N
- The average force, from all 9 slashes, of penetration shall be 80N or greater

Upon successful completion of testing, the slash resistant pack and test data will be supplied to HOSDB for evaluation. Each test pack will be checked against the declaration for construction, and the weight per metre squared (kgm^{-2}) will be determined.

Once the test samples have been checked and are satisfactory, HOSDB will issue a compliance certificate to the manufacturer, along with a copy of the test report. Additionally the model and manufacturers and/or suppliers details will be added to the HOSDB Protective Equipment database on the Home Office web site.

Any submission which has failed testing will be returned to the manufacturer, directly from the test house with a copy of the test report. No listing will be made on the HOSDB Protective Equipment database.

HOSDB reserve the right to request a sample of any final garment made as a result of successful certification testing to this standard as a condition of issuing a certificate.

Once a certificate has been issued, no changes in construction may be made to the model without the written consent of HOSDB. Under normal circumstances, any change in construction would require the submission of a new declaration with a new model designation and subsequently a new compliance test.

6 Acknowledgements

Grateful thanks are given to the following committees and people in helping produce this standard.

ACPO Body Armour sub-group;

ACPO Uniform and Equipment Working Group;

Dr Ian Horsfall, Mrs Celia Watson, Mr Stephen Champion and Mr Ian Harrod of the Royal Military College of Science, Cranfield University;

Mr Matthew Symons, Dr Nick Xydas, Mr Philip Alexander-Pye, Mr Duncan Barrier, Mr Chris Georgiou and Mr Sam Davies, PSDB/HOSDB.

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Bleetman A., Watson C. H., Horsfall, S., Champion S. M.; *Wounding patterns and human performance in knife attacks; optimising the protection provided by knife-resistant body armour*. The Journal of Clinical Forensic Medicine (2003) 10, 243-248 October/Nov 2003

Watson C. H., Horsfall, S., Champion S. M., Harrod C.; *Human performance in Slash Attack*. Presented at PASS 2000 5-8 September 2000, DCTA Colchester. UK

Croft J.; *PSDB Body Armour Standards for UK Police (2003) Parts 1 to 3*. Published by HOSDB.

Appendix A – Test Equipment and Calibration

Equipment

Kistler 9031A Quartz Load Washer preloaded to 30% F.S.

Kistler Type 5011 Charge Amplifier

Pico Technology Limited Picoscope 3205 PC Oscilloscope Dual Channel
(Charge amplifier contacted to channel A, contact circuit to channel B)

For contact circuit:

- 5 Volt regulated power supply
- 10k Ω resistor

Test Equipment Setup for Calibration

Kistler 5011 Charge amplifier

- Sensitivity 1pC/N
- Scale 100N/V
- Time Constant Long
- Low Pass Filter 10kHz

PicoScope 3205 Channel A

- 1V / division
- 1s / division
- Single sequence

PicoScope 3205 Channel B

- OFF

Calibration mass

- 80N

Calibration Procedure

1. Ensure charge amplifier has been switched on a minimum of 30 minutes prior to start of calibration, and all cables are securely connected.
2. Lay the housing containing the force plate horizontal.

3. Place the calibration mass on the centre of the force table ensuring that all the mass is only supported by the force plate.
4. Switch the charge amplifier to operate and start the picoscope.
5. Within 5 seconds remove the calibration mass from the force plate.
6. Calculate the voltage drop recorded.
7. Repeat steps 3 to 6 to record 3 voltage drops.
8. Calculate the mean voltage drop.
9. Calculate the sensitivity of the force table using the following equation

$$Force_Table_Sensitivity = \frac{Mean_voltage_drop \times 100}{80}$$

Equipment Setup for Testing

Kistler 5011 Charge amplifier

- Sensitivity Force Table Sensitivity from Calibration
- Scale 20N/V
- Time Constant Medium
- Low Pass Filter 10kHz

PicoScope 3205 Channel A

- 1V / division
- 0.02s / division
- Single sequence

PicoScope 3205 Channel B

- 1V / division
- 0.02s / division
- Single sequence


PicoScope 3205 Trigger

- Trigger Channel A
- Level 0.1V
- Pretrigger 10%

Appendix B – Declaration of Construction Form

Declaration of Content and Construction of Slash Resistant Protection to: HOSDB Slash Resistance Standard for UK Police (2006)

When completed this document will be classified “**RESTRICTED COMMERCIAL**”

Model Designation (This number must also be displayed on all slash resistant panels)	
No of Layers	Description of Materials (from strike face) Including manufacturers' references, trade names, number of layer, thickness weave, stitch pattern etc, and where applicable orientation of each layer within the slash resistant protection sample.
Strike Face 	(This area is left blank for the user to provide details.)
List the intended item(s) of clothing that the slash resistant protection will be incorporated into, and the area(s) of intended coverage.	

(Insert Company Name here) hereby declare that all Slash Resistant Protection 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) and stitch patterns as the test sample/s listed above in accordance with Section 4.3 of HOSDB Slash Resistance Standard for UK Police (2006) Publication No 48/05. Also, if the Slash Resistant Protection is supplied to UK police, the correct labels will be fitted in accordance with section 2.1

Signed..... Date

HOSDB Use Only

Model Designation.....	Test House Ref.....
Signed on behalf of HOSDB.....	Date.....

Appendix C - Spring Specification

Spring type:	Round wire compression
Design to:	BS 1726-1:1987
Tolerance:	BS 1726-1:2002
Material:	BS 5216 Patented carbon
End type:	Closed and Ground
Wire diameter:	1.83mm
Outside diameter:	18.29mm
Spring rate:	8.41 Nmm ⁻¹
Free length:	22.23mm

Appendix D - Suppliers Details

Force Spring

Harris Springs Limited
Clifford House
Ruscombe Business Park
Ruscombe,
READING
Berkshire
RG10 9LR
Tel: +44 (0)118 934 0024
Fax: +44 (0)118 934 1365
Web Site: <http://www.harris-springs.com>

Baumann UK
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Sherborne
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01935 818119
Fax: +44 1935 814141
Web Site: www.baumann-springs.co.uk

Test Knife

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Email: info@catra.org
Web Site: www.catra.org

Paper

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