

CONFIRMED
DECEMBER 2007

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

Part 1: General requirements

ICS 13.340.01

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee PH/3, Protective clothing, to Subcommittee PH/3/12, Protective clothing and equipment for use in violent situations, upon which the following bodies were represented:

- APSS — Association of Police and Public Security Suppliers
- Association of Chief Police Officers in Scotland
- BSIF Test and Certification Association
- British Association for Chemical Specialities
- British Association of Women Police
- British Clothing Industry Association
- British Glove Association
- British Textile Technology Group
- Defence Industries Association
- Department of Health — Medical Devices Agency
- Home Office
- Ministry of Defence — UK Defence Standardization
- National Association of Healthcare Safety and Risk Practitioners
- Personal Safety Manufacturers' Association
- Police Federation of England and Wales
- Police Purchasing Manager Association
- Police Uniform Project Group
- SATRA Technology Centre
- Co-opted members

This British Standard, having been prepared under the direction of the Health and Environment Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 26 November 2002

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Amendments issued since publication

Amd. No.	Date	Comments

The following BSI references relate to the work on this British Standard:
Committee reference PH/3/12
Draft for comment 00/565110 DC

ISBN 0 580 38500 0

Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
Introduction	1
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Performance levels	3
5 Construction and performance requirements	4
6 Test methods	7
7 Marking	8
8 Information to be supplied by the manufacturer	9
Annex A (informative) Interpretation of regulations and terms and their application to protective clothing and equipment for use in violent situations	10
Annex B (normative) Procedures for evaluation of chemical safety	16
Annex C (normative) Procedures for assessment of ergonomic performance and compatibility	17
Annex D (normative) Chemicals for testing chemical resistance of clothing and equipment	29
Bibliography	30
Table 1 — Performance levels for protective clothing and equipment for use in violent situations and in training	3
Table 2 — Performance levels for protective clothing and equipment exclusively for use in training	4
Table C.1 — Compatibility test clothing and equipment to be used for testing ergonomic performance and compatibility	18
Table C.2 — Activities and movements to be carried out	20
Table C.3 — Example of an ergonomic and compatibility score sheet	29

Foreword

This part of BS 7971 has been prepared by Subcommittee PH/3/12.

This part of BS 7971 specifies the general requirements applicable to all protective clothing and equipment for use in violent situations and in associated training activities. Requirements for particular types of clothing and equipment are specified in other parts of this British Standard.

The following parts of BS 7971 are currently published or are in preparation:

- *Part 1: General requirements;*
- *Part 2: Guidance on risk assessment and on the selection, use, cleaning and maintenance of protective clothing and equipment;*
- *Part 3: Personal defence shields — Requirements and test methods;*
- *Part 4: Limb protectors — Requirements and test methods;*
- *Part 5: Footwear — Requirements and test methods;*
- *Part 6: Gloves for protection against mechanical, thermal and chemical risks — Requirements and test methods;*
- *Part 7: Slash-resistant gloves — Requirements and test methods;*
- *Part 8: Blunt trauma body, shoulder, abdomen and genital protectors — Requirements and test methods;*
- *Part 9: Training suits and equipment — Requirements and test methods;*
- *Part 10: Coveralls — Requirements and test methods.*

It has been assumed in the drafting of this standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

WARNING. This British Standard calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Product certification/inspection/testing. Users of this British Standard are advised to consider the desirability of third-party certification/inspection/testing of product conformity with the relevant parts of BS 7971. Appropriate conformity attestation arrangements are described in BS EN ISO/IEC 17025. Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

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 does not of itself confer immunity from legal obligations.

In particular, attention is drawn to the legislation listed in Annex A.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 31 and a back cover.

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Introduction

Protective clothing and equipment for use in violent situations and associated training activities is worn or held by employees facing threats of violence in the course of completing their work duties. Users include police officers, prison officers, private security personnel, bullion handlers, escorts and couriers. The clothing and equipment can be used either exclusively in training or in training and in operational situations.

Protective clothing and equipment for use in violent situations and associated training activities is intended to reduce the severity of, or prevent, soft tissue injuries to the areas covered, resulting from blunt trauma, slashes, bites, splashes of burning petrol, and exposure to specific chemicals. Trauma can arise as the result of impact from airborne missiles (house bricks, full or empty bottles, including “petrol bombs”, metal bars, pieces of timber, fragments of wood and/or glass, skimmed roofing slates, etc.). Trauma can also be due to assault by individuals using weapons such as bars, baseball bats or pieces of timber, or by individuals kicking or making violent physical contact with the wearer. In training simulations many of the above threats are replicated. Experience has shown that all parts of the body are at risk in the attack and training simulation scenarios described above.

Some components of protective clothing and equipment for use in violent situations and associated training activities are also required to provide protection from specific hazards, such as flame, chemical agents, abrasions, cuts, and punctures of the soft tissues by fragments of glass, wood, plastics and human and/or animal (generally dog) bites. Other protective clothing and equipment not covered by BS 7971 can contribute to the overall protective performance of the clothing and equipment specified. Different products, each conforming to the requirements of the relevant standards, need to be compatible and complementary in order to be combined within a complete system to provide the end user with an optimum overall level of protection.

1 Scope

This part of BS 7971 specifies general requirements and test methods for protective clothing and equipment for use in violent situations and associated training activities.

Requirements for marking and for information to be supplied with the clothing or equipment are also specified.

This part of BS 7971 is intended only for use with the part of BS 7971 which specifies the particular requirements for a specific type of protective clothing or equipment.

2 Normative references

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

BS 7971-9¹⁾, *Protective clothing and equipment for use in violent situations and in training — Part 9: Training suits and equipment — Requirements and test methods.*

BS EN 131-1, *Ladders — Part 1: Specification for terms, types, functional sizes.*

BS EN 131-2, *Ladders — Part 2: Specification for requirements, testing, marking.*

BS EN 420, *General requirements for gloves.*

BS EN 1811, *Reference test method for release of nickel from products intended to come into direct and prolonged contact with the skin.*

BS EN 20105-A02, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

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

BS EN ISO 4045, *Leather — Determination of pH.*

ISO 3071, *Textiles — Determination of pH of the aqueous extract.*

¹⁾ In preparation.

3 Terms and definitions

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

3.1

protective clothing and equipment

clothing and equipment worn or held by the user to reduce the severity of, or prevent, injuries from specific hazards

3.2

zone of protection

area of protective clothing or equipment intended to provide protection

3.3

coverage

area of the body covered by the entire item of protective clothing or equipment and its attachments

3.4

test area

designated part of a zone of protection of an item of protective clothing or equipment that is to be tested in particular ways

3.5

control body dimension

body dimension used in determining the required dimensions of zones of protection and areas of coverage, and in designating the sizes, of protective clothing and equipment

3.6

template

piece of flexible material used to assess the dimensions and sizing of an item of protective clothing or equipment and to mark test areas

3.7

compatibility test clothing and equipment

protective clothing and equipment worn or carried adjacent to, over or under the protective clothing and equipment under test during ergonomic performance and compatibility assessments

3.8

target

anatomical region of the body at which a blow is aimed

3.9

primary target

part of body least likely to be seriously injured when struck

NOTE Primary targets are generally considered to be the forearm, buttock, thigh, shin, calf, back of the heel and the instep. Mainly these are areas where muscle masses protect skeletal elements and there are no vital organs.

3.10

secondary target

part of body that can be irreversibly injured when struck, but where blows do not normally result in fatalities

NOTE Secondary targets are generally considered to be the back of the hand, inside of the wrist, elbow joint, upper arm, shoulder, shoulder blade, collar bone and knee joint.

3.11

tertiary target

body part that can be so damaged when struck that permanent disability, unconsciousness, shock or death can result

NOTE Tertiary targets are generally considered to be every part of the face, cranium and neck, the spine and rib cage, the area just below the rib cage all round the body covering the liver, solar plexus, spleen and kidneys, the lower abdomen, the groin and the coccyx or tail bone.

3.12**no strike zone**

area of an item of protective clothing or equipment for use in training, or a gap within such an item or between items, designated as not to be targeted during training

3.13**incidental light force blow**

incidental blow in which no deliberate force is put into the contact

NOTE These blows are the result of ricochets or secondary strikes when the force of the blow is spent. No significant discomfort would be felt if such a blow made contact with an unprotected primary or secondary target.

3.14**deliberate light force blow**

deliberate reduced speed low power blow delivered in an unarmed training scenario where the participants are minimally protected

3.15**moderate force blow**

significant strength blow delivered with a padded body part, such as a sparring glove, or the side of a padded lightweight training baton

3.16**high force blow**

full strength blow delivered responsibly with a fist, knee, elbow or training baton

3.17**very high force blow**

full strength blow delivered with a duty baton

3.18**frenzied force blow**

blow delivered by an incensed assailant

4 Performance levels

NOTE 1 The performance level of an item of protective clothing or equipment is a number used to give an indication of the degree of protection provided by the item, as determined by performance testing. The higher the number, the greater the degree of protection provided.

NOTE 2 Performance testing of particular items of protective clothing and equipment is specified in the relevant parts of BS 7971, together with the requirements that have to be met for each performance level. Details are also given of the degree of protection that items at each performance level can be expected to provide.

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

The protective clothing and equipment for use in violent situations and in training shall be of one of three performance levels as specified in the relevant part of BS 7971.

NOTE The three performance levels are summarized in Table 1.

Table 1 — Performance levels for protective clothing and equipment for use in violent situations and in training

Performance level	Hazard level	Examples of intended use
1	Low	Where opponents are expected to be bare handed or at some distance
2	Moderate	Where close contact with opponents is expected
3	High	Where close contact with determined opponents and frenzied force blows are expected

4.2 Protective clothing and equipment exclusively for use in training

NOTE 1 In simulation training scenarios those in charge are accountable for the hazards to which trainees and instructors are exposed, and injuries are much less acceptable than under operational conditions. Therefore the performance requirements specified in BS 7971-9 and other relevant parts of the standard are intended, in so far as is possible, to prevent injuries during training. Some areas of protective clothing and equipment for use in training may be designated as no strike zones.

The protective clothing and equipment exclusively for use in training shall be of one of five performance levels as specified in BS 7971-9.

NOTE 2 The five performance levels are summarized in Table 2.

Table 2 — Performance levels for protective clothing and equipment exclusively for use in training

Performance level	Protection provided
1	Protection against bruising in unarmed training scenarios, involving deliberate light force blows to primary and secondary targets and incidental light force blows to tertiary targets. Protection during baton training where the instructor acts as “assailant” (see Note 1)
2	Protection against moderate force blows with Class A very light training batons ^a to primary targets, deliberate light force blows to secondary targets, and moderate force and high force accidental (i.e. misdirected) blows to tertiary targets
3	Protection against high force blows with Class B reduced weight training batons to primary targets, moderate force blows to secondary targets, and moderate force and high force accidental (i.e. misdirected) blows to tertiary targets (see Note 2)
4	Protection against very high force blows with Class C duty batons to primary targets, high force blows to secondary targets and high force and very high force accidental (i.e. misdirected) blows to tertiary targets (see Note 3)
5 ^b	Protection against high force blows from knees, elbows and feet and very high force blows from Class C duty batons during training in full strength delivery
NOTE 1 The instructor would wear a suit giving a higher level of protection.	
NOTE 2 The level of protection provided does not make it safe to deliberately direct moderate force or high force blows to tertiary targets.	
NOTE 3 The level of protection provided does not make it safe to deliberately direct high force or very high force blows to tertiary targets.	
^a Training batons are specified in BS 7971-9.	
^b Includes such items as striking shields and additional body protection units.	

5 Construction and performance requirements

5.1 General

Protective clothing and equipment for use in violent situations and in training shall conform to **5.2** to **5.9** and to the specific requirements specified for the particular type of clothing or equipment in the relevant part of this British Standard.

5.2 Innocuousness

NOTE The General Product Safety Directive (92/59/EEC) [1] establishes the principle that products placed on the market have to be safe.

Each item of clothing and equipment shall be examined visually and by hand and shall be free from the following:

- a) sharp edges;
- b) rough surfaces;
- c) hard parts that could harm the user or others during use;
- d) parts that could cause physical irritation to the user;
- e) features such as seams or buckles on the surface of the clothing or equipment that could harm the user or others during use.

5.3 Chemical safety

NOTE 1 Annex A gives information on the legal responsibilities of manufacturers and suppliers with specific reference to the safety of products sourced through a supply chain.

NOTE 2 Attention is drawn to Annex II of the PPE Directive (89/686/EEC) [2] which specifies that protective clothing and equipment shall be innocuous and shall not adversely affect the health of the user.

Protective clothing and equipment shall be constructed from materials the constituents of which can be shown to be chemically suitable for the purpose, i.e. they can be shown to conform to the following requirements:

- a) they shall not contain any toxic, carcinogenic, allergenic or otherwise harmful substance that will be released under foreseeable conditions of normal use;
- b) they shall not adversely affect the user; and
- c) they shall not degrade to release any harmful substances under foreseeable conditions of normal use.

Verification of chemical suitability shall be carried out by the collation of relevant safety data or by testing, as detailed in Annex B.

The protective clothing and equipment shall also conform to the following requirements, as applicable.

- 1) The chromium VI content of leather in clothing and gloves shall conform to BS EN 420.
- 2) All metallic materials which could come permanently into contact with the skin (e.g. studs, fittings and buckles) shall have an emission of nickel of less than $0.5 \mu\text{g}/\text{cm}^2/\text{week}$ when tested in accordance with BS EN 1811.
- 3) The pH value of protective clothing material shall be greater than 3.5 and less than 9.5 when tested according to the method for leather described in BS EN ISO 4045 or the method for other materials described in ISO 3071, as applicable.
- 4) Protective clothing material shall be tested for colour fastness to perspiration in accordance with BS EN ISO 105-E04. The colour change shall be not worse than grade 4 on the grey scale when assessed in accordance with BS EN 20105-A02.

Records shall be maintained by the manufacturer to enable tracing of all constituents of all components of the protective clothing and equipment to particular batches or deliveries of materials and, if appropriate, to their certificates of conformity to a stated specification.

The manufacturer shall list in the information supplied with the product (see Clause 8) the substances used in the main components of the product and shall label any product containing substances or preparations generally known to be hazardous, to which the user would normally not be exposed but that might present a hazard during maintenance and/or disposal of the product.

5.4 Sizing

5.4.1 General

Protective clothing and equipment shall be marked with a size designation. The size shall be related to the body dimensions of the intended wearer, and the relationship shall be explained in the information supplied by the manufacturer [see Clause 8d)]. Sizing shall be verified in accordance with the procedures given in the relevant part of BS 7971. The following control body dimensions shall be used for sizing:

- chest girth; or
- bust girth;
- under bust girth;
- waist girth;
- waist-to-waist over shoulder length;
- body height;
- total crotch length;
- vertical trunk circumference.

Sizing of each item of protective clothing and equipment shall be based on the control body dimensions specified in the relevant part of BS 7971. For protective clothing or equipment that is stated to fit a range of differently sized people, the values of the control body dimensions of the largest size of user that the item is stated to fit shall be used for sizing. If the manufacturer obtains values for control body dimensions by measuring subjects, the measurements shall be carried out using the procedures specified in 5.4.2.

5.4.2 Measuring procedures

5.4.2.1 Chest girth

The maximum horizontal girth shall be measured during normal breathing with the subject standing upright and the tape-measure passed over the scapulae under the armpits and across the chest.

5.4.2.2 Bust girth

The maximum horizontal girth shall be measured during normal breathing with the subject standing upright and the tape-measure passed over the scapulae under the armpits and across the breasts. Normal underclothing shall be worn.

5.4.2.3 Under bust girth

The maximum horizontal girth shall be measured during normal breathing with the subject standing upright and the tape-measure passing immediately below the breasts.

5.4.2.4 Waist girth

The maximum horizontal girth shall be measured during normal breathing with the subject standing upright and the tape-measure passed around the body in the plane of the waist, a measured distance above the supra-cristal plane which is at the level of the highest points of the iliac crests. For a subject 1.78 m tall this distance shall be 50 mm and it shall be scaled pro rata for subjects of other heights.

5.4.2.5 Waist-to-waist over shoulder length

The maximum length from the front in the plane at which the waist girth is measured, as specified in 5.4.2.4, over the shoulder and down to the same plane at the back, shall be measured. The tape-measure shall be taken across the shoulder at the mid point between the point of the shoulder and the junction of the shoulder and the neck. Anteriorly the tape-measure shall be passed over the chest (or bust) to a point a measured distance lateral to the midline of the body on the plane at which the waist girth is measured. Posteriorly the tape-measure shall be taken by the shortest distance to a point the same distance lateral to the midline of the body on the plane at which the waist girth is measured. For a subject with a waist girth of 85 cm the lateral distance shall be 90 mm and this distance shall be scaled pro rata for subjects of other waist girths. Normal underclothing shall be worn.

5.4.2.6 Body height

The vertical distance between the crown of the head and the ground shall be measured with the subject standing upright without shoes and with their feet together.

NOTE This body dimension is not a good predictor of torso length, and use of the waist-to-waist over the shoulder length (see 5.4.2.5) is preferable.

5.4.2.7 Total crotch length

The length from the centre of the front in the plane at which the waist girth is measured, as specified in 5.4.2.4, between the legs, to the side of the genitalia, to the centre of the back in the same plane, shall be measured.

NOTE This measurement is also known as the lower trunk length.

5.4.2.8 Vertical trunk circumference

The length from the top of the right shoulder at the mid point between the point of the shoulder and the junction of the shoulder and the neck, down the back, over the right buttock, between the legs to the right of the genitalia, up the abdomen and chest, and across the right nipple to the top of the right shoulder, shall be measured. The same measurement shall be made on the left side, and the larger value recorded. The measurements shall be made with the subject wearing normal underclothing and standing upright with their arms relaxed by their sides.

5.5 Adjustability

Where designed to fit people of different sizes, protective clothing and equipment shall be provided with a means of adjustment. The range of adjustment shall be sufficient for all users within the size range specified by the manufacturer such that the item conforms to 5.6.

5.6 Coverage and zones of protection

Protective clothing and equipment shall have one or more zones of protection which shall have the dimensions required for the largest size of user for whom the item is designated by the manufacturer, as specified in the relevant part of BS 7971. The positions and dimensions of the zones of protection, relative to the coverage provided by the entire item of protective clothing or equipment, shall be stated in the information supplied by the manufacturer [see Clause 8e)].

Assessment shall be made in accordance with the procedures specified in the relevant part of BS 7971.

5.7 Restraint

Where applicable, protective clothing and equipment shall be fitted with a means of restraint to ensure that the item of clothing or equipment cannot easily be displaced during use from the area it is designed to protect. The means of restraint shall conform to the relevant part of BS 7971.

5.8 Ergonomic performance and compatibility

Assessment of the ergonomic performance and compatibility of protective clothing and equipment for operational and training use shall be carried out in accordance with Annex C. Each test subject shall be able to perform all the movements specified in Annex C for the particular type of clothing or equipment under test and the item of clothing or equipment shall remain in place during the test. The test score of the clothing or equipment shall not exceed the value specified in the relevant part of BS 7971.

NOTE Requirements and test methods for ergonomic performance of training suits and equipment are given in BS 7971-9.

5.9 Resistance to chemicals

Chemical resistant clothing and equipment shall be tested in accordance with the relevant part of BS 7971 using the chemicals listed in Annex D, and shall conform to the requirements specified in that part of BS 7971.

6 Test methods

6.1 General

Unless otherwise specified for a particular test, measuring instruments shall be accurate to within $\pm 2\%$ of the pass/fail level of the characteristic being measured.

For each sequence of measurements performed a corresponding estimate of the uncertainty of the final result shall be determined. This uncertainty (U_m) shall be given in the test report in the form $U_m = \pm X$. It shall be used in determining whether a “pass” performance has been achieved. If the specified value is a maximum, U_m shall be added to the test result. If the specified value is a minimum, U_m shall be subtracted from the test result. The method used to calculate U_m shall be stated in the test report.

6.2 Test specimens

At least one specimen of every design of protective clothing and equipment, in each size produced by the manufacturer, shall be submitted for assessment and/or testing. For each design of an item produced in more than one size, a minimum of two sizes and a maximum of five sizes shall be tested for conformity to 5.2, 5.3, 5.7 and 5.8. For each design, the sizing, coverage and adjustability of every size shall be assessed for conformity to 5.4, 5.5 and 5.6.

Test specimens shall comprise items of clothing or equipment as supplied by the manufacturer, complete with all labels, and shall be accompanied by all the manufacturer’s information.

Before testing, each test specimen shall be washed, or cleaned, five times according to the manufacturer’s instructions with thorough drying between each washing or cleaning cycle. Each test specimen shall then be subjected to the conditioning procedure specified in the relevant part of BS 7971.