

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

Part 9: Training suits and equipment — Requirements and test methods

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- 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
- Home Office
- Medicines and Healthcare products Regulatory Agency
- Ministry of Defence — UK Defence Standardization
- National Association of Healthcare Safety and Risk Practitioners
- National Health Service
- Personal Safety Manufacturers' Association
- Police Federation of England and Wales
- Police Purchasing Manager Association
- Police Uniform Project Group
- SATRA Technology Centre
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Foreword

This Draft for Development has been prepared by Subcommittee PH/3/12. It addresses the special requirements for clothing and equipment for use in training of personnel who might be exposed to attack and assault in the course of their duties, in the techniques of self defence, and the control, restraint and apprehension of violent individuals. The clothing and equipment is for use by trainees and instructors in training scenarios where resistance, non-compliance and aggression are played out using special training models of weapons or actual operational weapons in “less than lethal” and in “deadly force” training.

The following parts of BS 7971 are currently published or 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 hazards — Requirements and test methods;*
- *Part 7: Slash-resistant gloves — Requirements and test methods;*
- *Part 8: Blunt trauma torso, 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;*
- *Part 11: Foot and ankle and foot protectors — Requirements and test methods.*

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

WARNING 1. This Draft for Development 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.

WARNING 2. This Draft for Development does not describe or endorse any particular training programme or operational tactics for use in training. It is the responsibility of those in charge of the training to ensure that adequate risk assessments are carried out.

This publication is not to be regarded as a British Standard.

It is being issued in the Draft for Development series of publications as it is of a provisional nature because of concern that the head protectors specified could prove dangerous in certain circumstances. The design of head protectors includes the presence of full thickness apertures in the vicinity of the ears to enable the wearer to hear instructions. There is concern about the potential for a flat blow to completely seal one of these apertures and to over-pressurize the ear sufficiently to rupture the eardrum. The document should be applied on a provisional basis so that information on, and experience of, its practical application can be obtained, and so that this problem can be addressed. Advice and suggestions on how this can be achieved will be welcomed.

Commentaries on additional points on which feedback is particularly invited are given at the relevant points in the text.

A review of this Draft for Development will be carried out not later than 2 years after its publication. Notification of the start of the review period, with a request for the submission of comments from users of this Draft for Development, will be made in an announcement in the appropriate issue of *Update Standards*.

According to the replies received, the responsible BSI Committee will judge whether the Draft for Development can be converted into a British Standard or what other action should be taken.

Observations which it is felt should receive attention before the official call for comments will be welcomed.

These should be sent to the Secretary of BSI Technical Committee PH/3 at British Standards House, 389 Chiswick High Road, London W4 4AL.

Users of this Draft for Development are encouraged to send comments as soon as possible.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iii, a blank page, pages 1 to 45 and a back cover.

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Introduction

The protective clothing and equipment covered by this Draft for Development is used in significantly different situations to those for which the clothing and equipment covered by other parts of this series of documents are intended. In operational use of protective clothing and equipment the hazards to which operatives are exposed are determined by their opponents and external circumstances. Those in charge of the operations have limited control of the situations. In operational situations a certain level of injuries has to be anticipated as they are not all preventable. In simulation training scenarios, however, those in charge are accountable for the hazards to which trainees and instructors are exposed, and injuries are much less acceptable.

For this reason, the training suits specified in this Draft for Development provide a greater degree of coverage and a higher level of protection than protective clothing specified for operational use in the published parts of BS 7971. This makes the suits more cumbersome and onerous to wear than protective clothing for operational use. However, this is likely to be acceptable in a training situation because the wearer can call a halt and take off the suit when necessary.

Protective suits of four different performance levels are specified, which are suitable for different training scenarios according to the level of force to be used. A fifth performance level is specified for striking shields and additional body protection units.

1 Scope

This Draft for Development specifies performance requirements and test methods for training suits and equipment for use in the training of personnel who might be exposed to attack and assault in the course of their duties, in the techniques of self defence, and the control, restraint and apprehension of violent individuals in scenarios where resistance, non-compliance and aggression are played out. Suits and equipment suitable for use by instructors and suits and equipment suitable for use by trainees are specified. Training models of weapons for use with the training suits are also specified.

NOTE 1 Guidance on the selection and use of protective clothing and equipment for training is given in Annex A. More detailed information on the practical performance of the training suits and equipment specified in this Draft for Development is given in Annex B.

NOTE 2 Guidance on risk assessment and the selection, care and maintenance of protective clothing and equipment for use in violent situations and in training is given in BS 7971-2.

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 amendments) applies.

BS 7971-1, *Protective clothing and equipment for use in violent situations and in training — Part 1: General requirements*.

BS 7971-4:2001, *Protective clothing and equipment for use in violent situations and in training — Part 4: Limb protectors — Requirements and test methods*.

BS 7971-8:2003, *Protective clothing and equipment for use in violent situations and in training — Part 8: Blunt trauma torso, shoulder, abdomen and genital protectors — Requirements and test methods*.

BS EN 340, *Protective clothing — General requirements*.

BS EN 420, *General requirements for gloves*.

BS EN 471, *High-visibility warning clothing for professional use — Test methods and requirements*.

BS EN 960:1995, *Headforms for use in the testing of protective helmets*.

BS EN ISO 10256:2003, *Head and face protectors for use in ice hockey*.

3 Terms and definitions

For the purposes of this Draft for Development, the terms and definitions given in BS 7971-1 and the following apply.

3.1

simulation training

supervised, reality-based drills in which an instructor acts as an attacker, suspect or fugitive and students act in self-defence or as enforcers

3.2

protective suit

assemblage of separate or joined units supplied by a manufacturer to provide protection to particular areas of the body when used together

NOTE Protective suits usually include units to provide head, face, neck, torso, abdomen, genital, limb, hand and foot protection.

3.3

head protector

device intended to reduce the risk of impact head injuries to the wearer, comprising a soft outer covering, a shock attenuating system (which can include a hard shell), a closure and retention system and a means of attachment for a face protection grill or face protection visor

3.4

face protection grill

device intended to reduce the risk of injury to the eyes and face of the user, which is constructed of opaque material with holes to permit vision and ventilation

3.5

face protection visor

device intended to reduce the risk of injury to the eyes and face of the user, which is constructed of transparent material permitting vision and sometimes with holes for ventilation

4 Performance levels

Training suits and equipment shall be of one of five performance levels in accordance with the requirements specified in Clause 5.

NOTE 1 The five performance levels are summarized in Table 1.

NOTE 2 Not every type of suit or equipment is available conforming to every performance level. In some cases items conforming to one performance level only are available.

Table 1 — Performance levels for training suits and equipment

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 Batons are specified in 5.8.	
^b Includes such items as striking shields and additional body protection units.	

5 Construction and performance requirements

5.1 General

Training suits and equipment shall conform to the general requirements for protective clothing and equipment for use in violent situations and in training specified in BS 7971-1, with the exception of the requirement for resistance to chemicals.

NOTE As training drills are not anticipated to include attacks with chemicals, training suits are not required to be resistant to chemicals.

5.2 Indication of “no strike” zones and gaps

5.2.1 On level 3 and level 4 suits, the manufacturer shall identify “no strike” zones around permitted gaps over primary and secondary target areas, as specified in 5.4.3.3. The no strike zones shall be indicated by a fluorescent yellow material with chromaticity coordinates and luminance factor conforming to BS EN 471:2003, Table 2, extending for at least 40 mm on each side of the gap.

NOTE This identification and indication of “no strike” zones is normally done on prototypes at the design stage, in collaboration with a test house, and can be an iterative process.

5.2.2 In order to make completely penetrating gaps visible, the manufacturer shall provide, with each performance level 3 and level 4 suit, a set of fluorescent yellow underwear, sized to fit the intended wearer of the suit, made of material with chromaticity coordinates and luminance factor conforming to BS EN 471:2003, Table 2. The instructions for use (see Clause 8) shall advise the user to wear the underwear under the suit whenever they participate in a training scenario.

5.3 Sizing

5.3.1 *General*

All components of protective suits shall be marked with a size designation. The size shall be related to the body dimensions of the intended user, using the relevant control body dimensions as specified in **5.3.2** to **5.3.6** and the relationship shall be explained in the information supplied by the manufacturer as specified in BS 7971-1. Sizing shall be verified in accordance with **6.7**. For components that are stated to fit a range of differently sized people, the values of the control body dimensions for the largest size of user that the components is stated to fit shall be used for sizing.

For each component, the sizes of intended users shall be indicated on an appropriate sizing pictogram, as described in BS EN 340. The sizing pictograms shall be printed on a label attached to the component, or given in the information supplied by the manufacturer (see Clause 8).

5.3.2 *Sizing of limb protectors and body protectors*

The control dimensions listed in Table 2 shall be used for sizing limb protectors and body protectors.

5.3.3 *Sizing and dimensions of hard genital protectors*

NOTE Hard genital protectors include hard cup-shaped structures incorporated in soft genital protectors, and independent hard genital protectors as specified in BS 7971-8, which may be attached to an abdomen protector (see Note to **5.7.2**).

Sizing and dimensions of hard genital protectors shall be in accordance with BS 7971-8:2003, **5.2.5.1**. Dimensions of hard genital protectors shall be measured as specified in BS 7971-8:2003, **6.6.1**.

5.3.4 *Sizing of soft genital protectors*

Soft genital protectors shall be sized using the waist girth and total crotch length as control dimensions.

5.3.5 *Sizing of gloves and hand protectors*

Gloves and hand protectors shall be sized in accordance with BS EN 420.

5.3.6 *Sizing of head protectors, face protection grills and face protection visors*

Head protectors, face protection grills and face protection visors shall be sized using the maximum horizontal head circumference of the largest and the smallest intended users as the control dimensions.

Table 2 — Control dimensions to be used for sizing limb protectors and body protectors

Body part covered by the protector		Dimension of protector (see 5.4.1)	Control dimension
Protectors for men	Protectors for women		
Shoulder	Shoulder	Width	Chest girth or under bust girth
Upper arm	Upper arm	Length Width Circumference	Height Chest girth or under bust girth Chest girth or under bust girth
Elbow	Elbow	Width Circumference	Chest girth or under bust girth Chest girth or under bust girth
Elbow and forearm	Elbow and forearm	Length Width Circumference	Height Chest girth or under bust girth Chest girth or under bust girth
Thigh	Thigh	Length Width Circumference	Height Waist girth Waist girth
Hip	Hip	Width	Waist girth
Knee	Knee	Width Circumference	Waist girth Waist girth
Knee and shin	Knee and shin	Length Width Circumference	Height Waist girth Waist girth
Torso	—	Circumference Length	Chest girth and waist girth Waist to waist over shoulder length
—	Front of torso	Width Length	Bust girth and waist girth Waist to waist over shoulder length
—	Breasts	Width	Bust girth
—	Back of torso	Width Length	Under bust girth and waist girth Waist to waist over shoulder length
Abdomen	Abdomen	Width Length	Waist girth Total crotch length

Commentary. Regarding Table 2, there is concern as to whether it is adequate to give width as the dimension for sizing protectors for shoulders and protectors for hips. Comments are invited on this.

5.4 Coverage to be provided by components of training suits, and impact test areas

5.4.1 General

Coverage and the designation of impact test areas shall be based on the position and size of the relevant anatomical structures beneath the components of the protective suit as specified in 5.4.2 and 5.4.3. The following convention shall be used for surfaces, based on a person standing upright and looking forwards with their arms hanging down beside them with their palms facing forwards:

- *anterior*: surfaces visible from the front;
- *posterior*: surfaces visible from the rear;
- *lateral*: surfaces visible from the side;
- *medial*: surfaces of the limbs facing the body or the other limb, that are only partially visible;
- *top*: surfaces of the head and feet only visible from above.

The following conventions shall be used for proportions of surfaces.

a) Body surfaces.

- For the width of a surface, the angle subtended at the centre of the relevant body part shall be used.

NOTE 1 Thus the maximum width would be given by an angle of 180° when the whole visible surface is to be included. However when a surface, for example that of a limb, is equally divided between the four aspects, the maximum width would be given by an angle of 90°. This is illustrated in Figure 1.

- For the length of a surface, the distance between the centres of two joints, or between two other stated and unambiguous landmarks on the relevant body part, shall be used.

NOTE 2 For example the length of the anterior lower half of the lower leg would be given by the distance between the centre of the front of the lower limb from the level of the centre of rotation of the ankle joint to a point half way to the level of the centre of rotation of the knee joint.

b) Surfaces of components of suits.

For the surfaces of components of suits the conventions given in item a) shall be used. For widths, the angle subtended at the centre of the relevant body part shall be projected to the surface of the component. For lengths, horizontal projections from the relevant points to the surface of the component shall be used.

5.4.2 Performance level 1 suits

5.4.2.1 Coverage

With the exception of the following areas, the body shall be fully covered when all components of the suit are worn:

- in the armpit (axilla), an oval area of maximum width $0.16 \times$ chest girth or under bust girth of the largest intended user, and maximum length $0.1 \times$ chest girth or under bust girth of the largest intended user, extending from the centre of the armpit down the lateral aspect of the torso, measured with the user's arm raised vertically above the head;
- the medial 90° of the upper arm;
- the anterior 100° of the forearm and wrist;
- the hand and digits;
- the medial 90° of the thigh;
- gaps between components covering the thighs and the buttocks not exceeding 40 mm in width;
- on the posterior surface of the knee, an oval area of maximum width $0.15 \times$ waist girth of the largest intended user, and maximum length $0.2 \times$ waist girth of the largest intended user, measured with the leg straight;
- gaps between upper arm and elbow protectors, and between thigh and knee protectors not exceeding 40 mm in width;
- the foot apart from the instep and lateral and medial aspects of the ankle joint.

5.4.2.2 Dimensions of impact test areas

Impact test areas on performance level 1 suits shall be all aspects of the body except the areas listed in 5.4.2.1 and an area (30 ± 3) mm wide bordering these areas. The test areas for impact testing of different components shall be those specified in 5.7.1 and 5.7.2 that fall within the coverage provided by performance level 1 suits, as specified in 5.4.2.1. Impacts required to be made at specific points, such as on head protectors, shall be made at those points irrespective of any construction details of the protector.

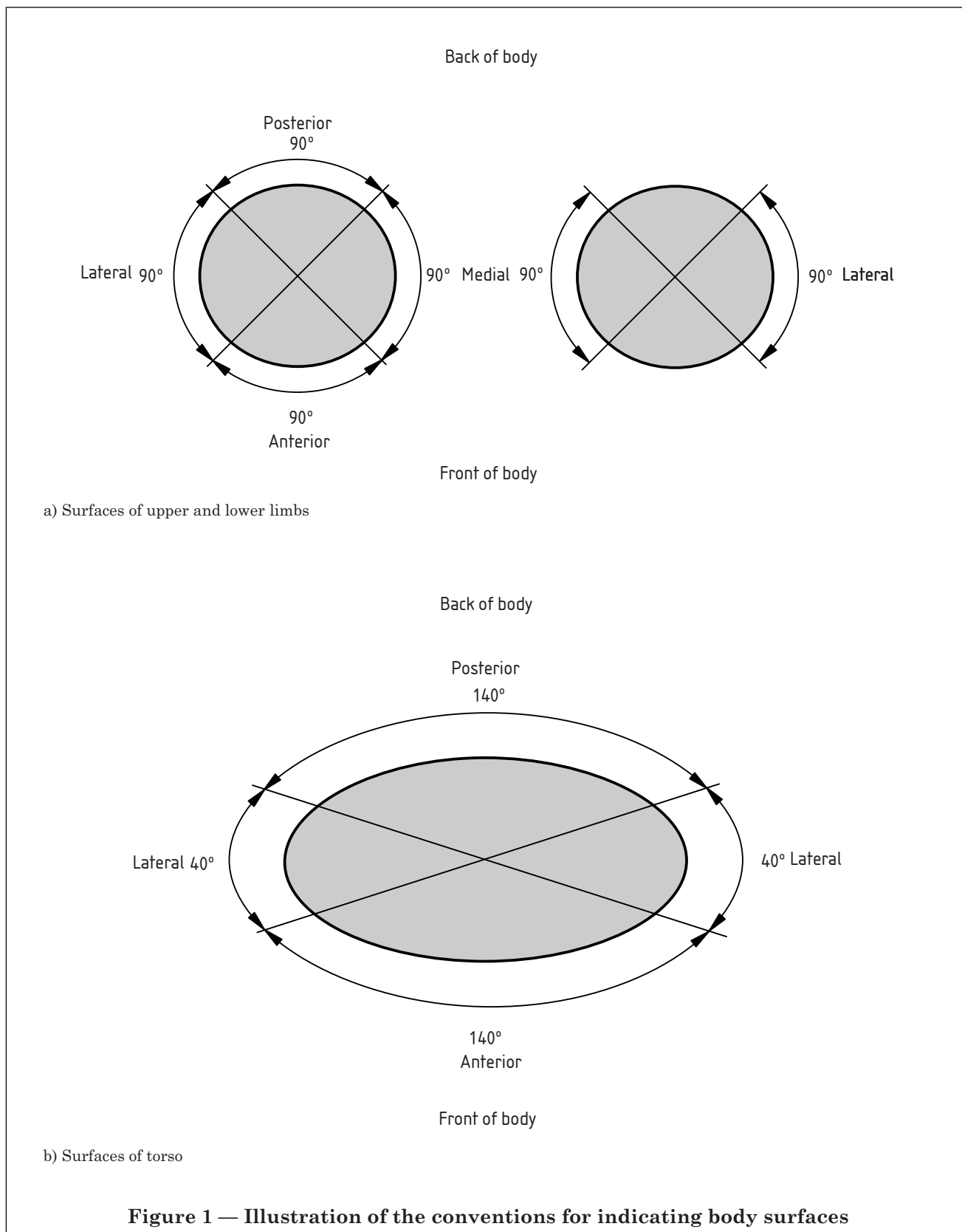


Figure 1 — Illustration of the conventions for indicating body surfaces

5.4.3 Performance level 2, level 3 and level 4 suits

5.4.3.1 Coverage

With the exception of the following areas, the body shall be fully covered when all components of the suit are worn:

- in the armpit (axilla), a circular area of maximum radius $0.06 \times$ chest girth or under bust girth of the largest intended user, measured with the user's arm raised vertically above the head;
- the upper three quarters of the medial 40° of the upper arm;
- the palm of the hand and palmar surfaces of the digits;
- the upper three quarters of the medial surface of the thigh with a width of 20° at the top and 5° at the lower end;
- the sole of the foot.

5.4.3.2 Prohibited gaps in coverage

There shall be no gaps in coverage detectable by the method described in 6.8.2.2, using the cylindrical and the edge probes, in the following areas, which are the tertiary target areas:

- over the whole cranium, face and neck;
- over the whole spine including the coccyx in an area with a width of 200 mm;
- over the posterior and lateral torso to below the top of the pelvis;
- over the anterior 180° surface of the torso from the neck to the groin and including all the anterior abdomen and genitals;
- over the anterior 180° surface of the thigh;
- over the top of each shoulder from a point halfway between the base of the neck and the point of the shoulder, to the point of the shoulder.

Apart from in the areas listed in 5.4.3.1, there shall be no gaps in coverage detectable by the method described in 6.8.2.2, using the edge probes, over the remaining parts of the body, which are the primary and secondary target areas.

5.4.3.3 Permitted gaps in coverage

In performance level 2 suits, gaps in coverage shall be permitted in primary and secondary target areas, that are detectable by the method described in 6.8.2.2, using the 30 mm edge probe at a force of (25 ± 1.25) N, but are not detectable using the 60 mm edge probe at the same force.

In performance level 3 and level 4 suits, gaps in coverage shall be permitted in primary and secondary target areas, that are detectable by the method described in 6.8.2.2, using the 15 mm edge probe at forces of (50 ± 2.5) N and (75 ± 3.75) N, respectively, but are not detectable with the 30 mm probe at the same forces.

5.4.3.4 Dimensions of impact test areas

Impact test areas on performance level 2, level 3 and level 4 suits shall be all aspects of the body except the areas listed in 5.4.3.1, an area (30 ± 3) mm wide bordering these areas, and a zone (60 ± 6) mm wide centred on any gap permitted in accordance with 5.4.3.3. The test areas for impact testing of different components shall be as specified in 5.7.1 and 5.7.2 that fall within the coverage provided by the suit as specified in 5.4.3.1, 5.4.3.2 and 5.4.3.3. Impacts required to be made at specific points, such as on head protectors, shall be made at those points irrespective of any construction details of the protector.

5.5 Restraint, and security of closures

When protective suits are tested in accordance with 6.9 the following requirements shall be met.

- Gloves, hand protectors, footwear and foot protectors shall not be removed from the body, and closures shall not open, when a force of (20 ± 2) N is applied.
- Head protectors, face protection grills and face protection visors, and neck and throat protectors shall not be removed from the body, closures shall not open and the subject's field of vision shall not be substantially obscured, when a force of (50 ± 5) N is applied.
- Other components shall not be removed from the body, and closures shall not open, when a force of (100 ± 5) N is applied.

5.6 Ergonomic performance and compatibility

5.6.1 Whole suits

When assessed in accordance with **6.10.1** the whole suit shall be deemed to be “fit for purpose” by the test subject(s) and by the person in charge of the testing.

5.6.2 Field of vision permitted by head protectors, face protection grills and face protection visors

When the head protector, fitted with the face protection grille or face protection visor with which it is to be used, is assessed in accordance with **6.10.2**, there shall be no occultation in the field of vision bounded by the following angles, as illustrated in Figure 2:

- a) upwards 25° from the reference plane (from points L1 and L2);
- b) downwards 35° from the basic plane (from points K1 and K2);
- c) horizontally at each side, 90° lateral to the sagittal plane through each of the pupils (from points L1 and K1 and points L2 and K2).

5.6.3 Apertures in face protection grills and face protection visors and gaps around them

When all apertures in face protection grills and face protection visors, and all gaps around them, are tested in accordance with **6.10.3**, no aperture or gap shall permit the passage of the probe.

5.7 Impact resistance

5.7.1 Components in contact with the area protected (other than genital protectors)

When components of suits are impact tested in accordance with **6.11.3.2** and **6.11.3.4**, within the relevant test area as detailed in Table 3, the mean peak transmitted force shall be below the value given in Table 4 and no single value shall exceed this value by more than 50 %.

5.7.2 Genital protectors

NOTE Genital protectors can be made exclusively of thick soft foam, from foam with plates of hard plastics material incorporated, or from foam with a hard plastics cup-shaped structure intended to provide a space for the genitalia in which they will not be crushed. Such cup-shaped structures may be permanently included or may be independent hard genital protectors as specified in BS 7971-8. These systems have different modes of action, and thus they require different testing. A particular hazard with the cup-shaped structures is that under impact they can fail suddenly and inflict more serious injuries to the genitalia than would have occurred if they had been absent. Thus all genital protectors containing cup-shaped structures are required to remain intact when subjected to impacts of 15 J or above.

5.7.2.1 Soft genital protectors, soft genital protectors containing plates and soft areas of protectors containing a hard cup-shaped structure

5.7.2.1.1 Test area

The test area for soft genital protectors, soft genital protectors containing plates and soft areas of protectors containing a hard cup-shaped structure shall be of a length corresponding to the distance from 50 mm above the pelvic bones anteriorly down, between the legs to a point level with the top of the thighs posteriorly. The width of the test area at the top, anteriorly, shall be $0.1 \times$ the waist girth of the largest intended user. The width of the test area shall taper to a minimum, at a point corresponding to the mid coronal line between the legs, of $0.05 \times$ the waist girth of the largest intended user.

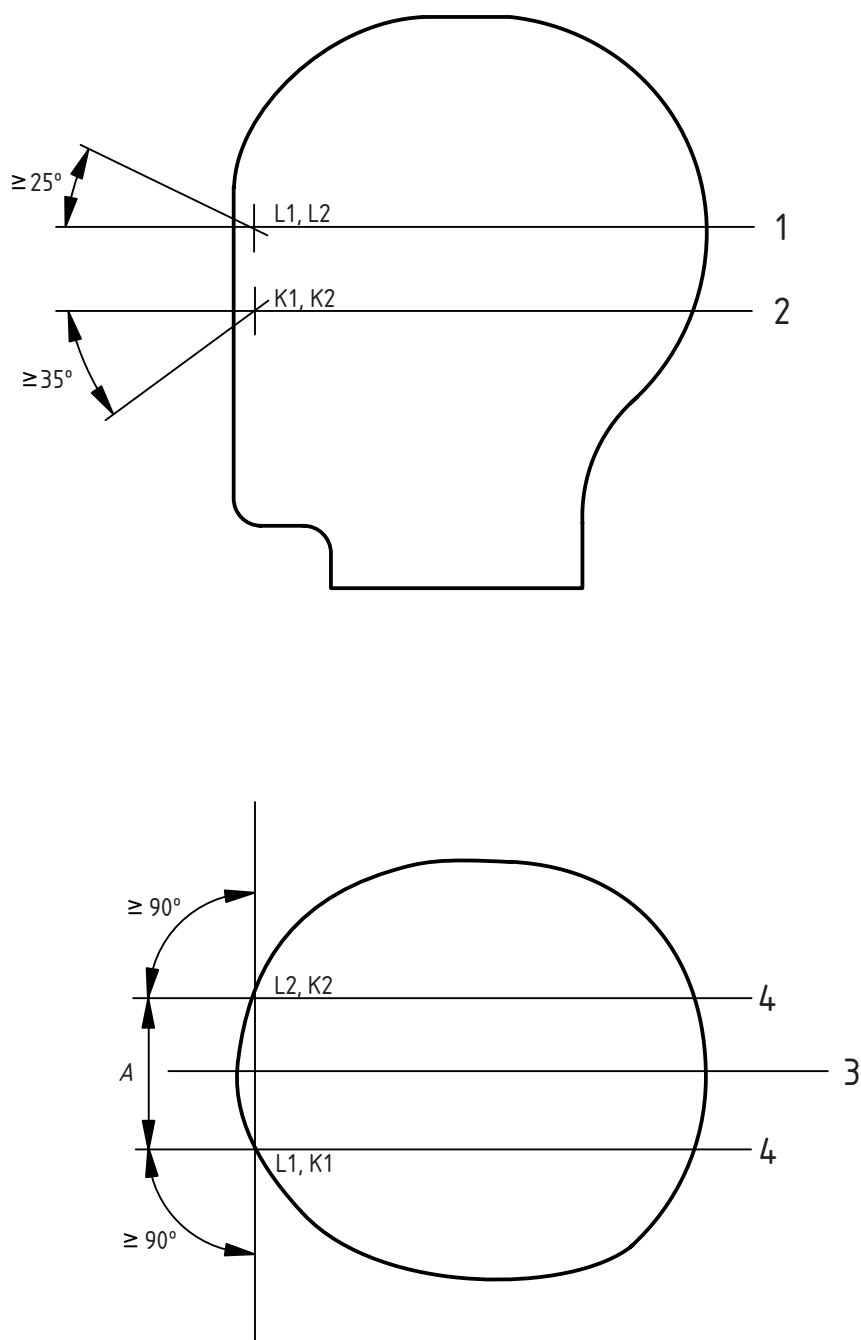
Test areas shall be marked on the protectors in accordance with **6.5.2**.

5.7.2.1.2 Impact resistance

When soft genital protectors, soft genital protectors containing plates and soft areas of protectors containing a hard cup-shaped structure are tested in accordance with **6.11.3.3.1** using the horizontal anvil specified in **6.11.2.9** and the ball impactor specified in **6.11.2.11**, the mean peak transmitted force shall be below the value given in Table 5, and no single value shall exceed this value by more than 50 %.

5.7.2.2 Hard cup-shaped structures in genital protectors

When hard cup-shaped structures in genital protectors are tested in accordance with **6.11.3.3.2** using the horizontal anvil specified in **6.11.2.9** and the ball impactor specified in **6.11.2.11**, the mean peak transmitted force shall be below the value given in Table 5, and no single value shall exceed this value by more than 50 %. In addition, the cup-shaped structure shall not shatter or crack, the rubber membrane shall not be perforated, and the internal depth of the cup shall not fall to a value more than 5 mm below the minimum internal depth specified for the relevant type and size of protector in BS 7971-8:2003, Table 4.

**Key**

- 1 Reference plane (L)
- 2 Basic plane (K)
- 3 Longitudinal vertical median plane
- 4 Sagittal planes through pupils
- A Inter-pupillary distance, $0.11 \times$ circumference of headform

L1 and L2 Points at which the sagittal planes through the pupils intersect the reference plane (L)

K1 and K2 Points at which the sagittal planes through the pupils intersect the basic plane (K)

Figure 2 — Field of vision