Test and Evaluation Protocol

22/09/2007

Version 1.0
22 September 2007

Personnel Protective Equipment

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Document type: **Error! Reference source not found.**
Document subtype: **Error! Reference source not found.**
Document stage: **Error! Reference source not found.**
Document language: **Error! Reference source not found.**

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Warning

This document is current with effect from the date shown on the cover page. As with the International Mine Action Standards (IMAS) these documents are subject to regular review and revision, users should consult the IMAS project website in order to verify its status at (http://www.mineactionstandards.org/, or through the UNMAS website at http://www.mineaction.org)

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Foreword

This CEN Workshop Agreement has been drafted and approved by a Workshop of representatives of interested parties on 2006-06-18, the constitution of which was supported by CEN following the public call for participation made on 2006-06-18.

A list of the individuals and organizations which supported the technical consensus represented by this CEN Workshop Agreement is available to purchasers from the CEN Management Centre. These organizations were drawn from the following economic sectors: non governmental organizations, national authorities and producers and users of demining equipment.

The formal process followed by the Workshop in the development of this CEN Workshop Agreement has been endorsed by the National Members of CEN but neither the National Members of CEN nor the CEN Management Centre can be held accountable for the technical content of this CEN Workshop Agreement or possible conflict with standards or legislation. This CEN Workshop Agreement can in no way be held as being an official standard developed by CEN and its members.

The final review/endorsement round for this CWA was started on 2007-03-13 and was successfully closed on 2007-09-22 .The final text of this CWA was submitted to CEN for publication on 2007-10-10.

This CEN Workshop Agreement is publicly available as a reference document from the National Members of CEN: AENOR, AFNOR, ASRO, BDS, BSI, CSNI, CYS, DIN, DS, ELOT, EVS, IBN, IPQ, IST, LVS, LST, MSA, MSZT, NEN, NSAI, ON, PKN, SEE, SIS, SIST, SFS, SN, SNV, SUTN and UNI.

Comments or suggestions from the users of this CEN Workshop Agreement are welcome and should be addressed to the CEN Management Centre.

0 Introduction

0.1 The presence of landmines and other explosive remnants of war represent a serious safety hazard and a major obstacle to reconstruction and development. Landmine Monitor, 2006, from the International Committee to Ban Landmines, estimates at least 86 countries in eight areas in the world to be contaminated. Recent conflicts have added a new generation of threats, which those engaged in Humanitarian Mine Action have to deal with alongside the more familiar mines and booby traps.

The current methodologies for clearance are varied and include elements such as mechanical ground preparation, scent detection by animals and the processing of ground by human deminers. This latter activity is the most common, forming part of the fundamental core of every demining programme.

Globally, the most common approach to ground mine clearance is still the use of manual deminers covering the ground with the aid of a variety of tools and assets that may include Explosive Detecting Animals and machines. When animals are used, human assets control the animals and check their indications. When machines are used, they can assist the process and may sometimes be effective in reducing the area that must be cleared, but human assets are still used to check their effectiveness and deal with discovered devices. All currently recognised methods of manual mine clearance involve people being inside a zone of increased risk at some period of time. Protective equipment issued to these individuals varies widely, and its proven effectiveness against explosive threats is often uncertain. The methods currently used to determine appropriate protective equipment are based on NATO STANAG 2920 (Ballistic Test Method for Personal Armour Materials and Combat Clothing. 31 July 2003) which is designed for ballistic protection against projectiles and is often considered to be inappropriate for demining activities and the range of threats that can be anticipated – in particular for AP blast mines with low metal content. For example, IMAS 10.30 (Safety and occupational health - Personal protective equipment), states: “Such tests for ballistic protection do not realistically replicate mine effects, but will continue to be used until an accepted alternative is developed as an international standard".

Some accidental initiation of devices is recognised as being inevitable during demining. Processes, procedures and good management form the core basis for protection, but personal protective equipment (PPE) provides the final line of defence against human errors and malfunctions. In many cases, effective PPE can prevent seriously disabling injuries. Humanitarian principles and the legal aspects of an employer’s “duty of care” make it essential to limit the injuries that result by the provision of effective PPE. To achieve this reliably, it is necessary to provide a baseline and clearly defined set of test and evaluation agreed methodologies.

0.2 The Communication from the Commission to the European Parliament and the Council, “Action against Anti Personnel Landmines: Reinforcing the Contribution of the European Union”, calls for the establishment of international Specifications and Methodology and their implementation, in close co-operation with CEN, ISO, and the UN. The CEN BT/WG 126 “Humanitarian Mine Action” delivered the CEN response to the EC “Mandate to the European Standardisation Bodies on Technologies for Humanitarian Demining” (M/306), interpreted to cover humanitarian mine action as an action plan in March 2002. A particular action to identify a PPE standard for deminers was identified and subsequently confirmed in October 2005.

0.3 With the focus on deminers’ needs, a methodology for testing PPE has been developed. It is scientifically vigorous, repeatable and with results that give the possibility to compare the performance of other equipment on the market. It requires a scenario with typical threats, test facilities where deminers’ working positions can be replicated and the effects from the blast of simulated buried mines can be measured. Although it is not within the scope of this workshop to set specific levels of protection, the workshop felt that some definitions were required in a number of areas and these will be seen throughout the document. To be able to form a test procedure an idea of type and size of the PPE is needed. Protective equipment will usually reduce the performance of the user. There is a point at which the discomfort and degradation in performance of the deminer will exceed the benefit provided to him.

While this workshop does not define this point, the procedures outlined in the section on ergonomic testing can be used as guidance for evaluating different PPE.

The conclusions are based on experiences from the field, available data of accidents occurring during mine clearance and knowledge of existing techniques. The results of this workshop agreement can provide guidance to the IMAS Review Board.

0.4 The test methodology is intended to give guidance to key stakeholders involved in the design, utilisation and procurement of PPE. It should be noted that the individual tests are designed to be pragmatic and relatively cost-effective and as such, not all tests may be statistically valid.

Current standards require PPE to provide eye protection at a safety distance of 60 cm from the threat, but observations as part of this workshop indicated that deminers were operating with their eye protection closer to 45 cm from the threat. As the deminer moves closer, the risk of injuries caused by blunt trauma and blast, increase. These injuries are not included in this document and should be the subject of further investigation.

The V_{50} values used in this document are based on the current materials used for the manufacture of PPE. In the future, as new materials become available, the values may need to be revised in light of such developments.

A repeatable test methodology for testing the protective material's capacity to protect against hot fragments is currently not available. The workshop recommends that actions are taken to develop a test methodology covering this aspect of protection.

Current IMAS give no guidance on the requirements for the optical quality of eye protection. The need for such a requirement has been acknowledged in the work within this workshop. Within the framework of this workshop it was not possible to investigate the technical possibility to set a level for optical quality together with a high level of ballistic protection. It is recommended that further investigation is undertaken on this subject. A methodology to measure the optical quality already exists in the European Standard EN 167:2001, Personal eye-protection - Optical test methods.

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WARNING - This standard does not purport to address all safety problems associated with its use. It is the responsibility of the user to establish appropriate health and safety practices and to ensure compliance with any national regulatory conditions when conducting the tests within this CWA. The local safety regulations for the test site should also be read and followed.

1 Scope

This document specifies methods for the testing, evaluation, and acceptance of PPE for mine action against anti-personnel blast mines.

Testing for protection against anti-personnel fragmentation mines is excluded.

Only critical, life threatening and vision affecting injuries are addressed.

NOTE It is recognised that hazards from AP fragmentation mines do occur and that it may be desirable to assess this specific requirement as part of a separate process.

2 References

The documents referenced are listed in the bibliography.

3 Definitions

For the purposes of this document, the terms and definitions given in the international mine action standards IMAS 04.10 [1] (second edition incorporating amendments 1, 2 and 3) apply.

4 Background to the database of demining accidents and brief analysis.

The Database of Demining Accidents (DDAS) held at the Geneva International Centre for Humanitarian Demining (GICHD) was used for the purposes of this workshop. The threat to deminers is reasonably well documented and the database offers a good overview of the casualties that occur to deminers during operations. Based on these data, the focus is on the situation when the deminer is working close to, or with, the anti-personnel blast mine.

5 Risks, protection and test scenarios

5.1 Background

The PPE provided for the deminer shall minimise the risk of fatal and critical (life-threatening) injuries as well as injuries affecting the vision.

All PPE will cause the deminer some degradation in performance due to increased weight, reduced opportunity for body cooling, reduced mobility/flexibility and so on. It is therefore important that the level of protection should be balanced against the need for protection and the operating environment. If this balance is not achieved, the performance degradation can be counter-productive and possibly be a contributory factor in any accident. Annex A establishes procedures for testing ergonomic suitability.

5.2 Protection

This CWA describes tests that are designed to test PPE which covers the torso (excluding the back) including the shoulders, front of armpits, neck, and groin. See figure 1.

The face, extending to the full height of the head, should also be protected. The face is defined as the frontal part of the head extending to just in front of the ears, just below the chin and extending to the top of the head.

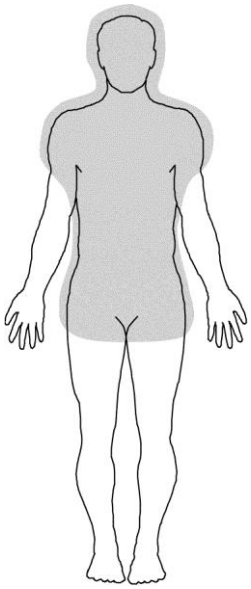


Figure 1 — Designated areas for protection

In the event of an exploding anti-personnel blast mine, the deminer is exposed to acceleration forces that come from the combination of the pressure from the blast wave and the streaming flow from the blast ejecta. This causes “blunt trauma” to the body. Based on the report "Effectiveness of Personal Protective Equipment (PPE) for Use in Demining AP Landmines"[2], blunt trauma on the torso has been demonstrated not to be critical with a chest-mine distance of 60 cm. This appears to be reinforced with the data from the DDAS.

There is currently insufficient data available to define the risk of blunt trauma to the head and more studies are needed. As a result, measurement and consideration of blunt trauma to the head and body have not been included.

All regions to be protected should have ballistic protection that will withstand secondary fragments from exploding anti-personnel blast mines.

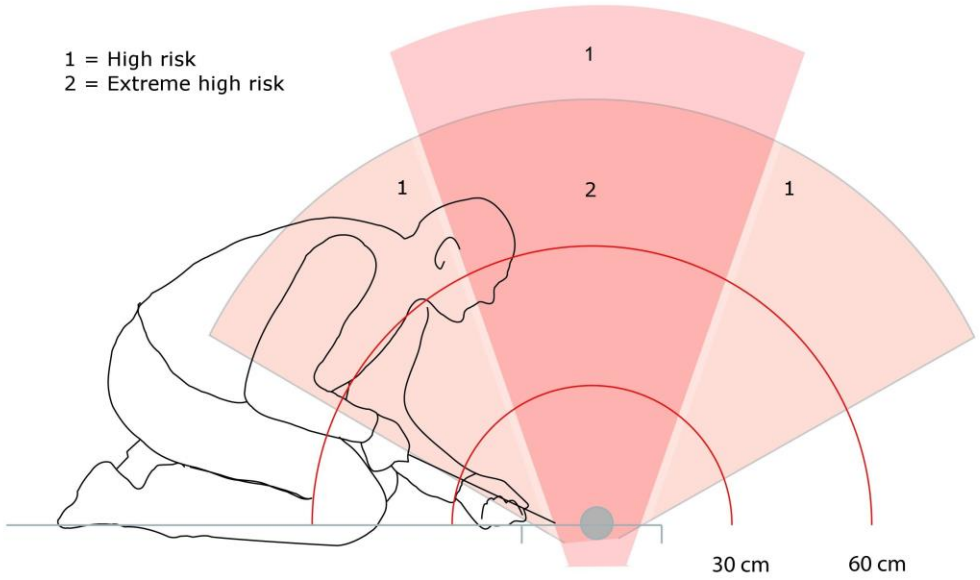
NOTE For the purposes of this document and related testing, secondary fragments are fragments that are picked up and ejected from the seat of the explosion including remains from parts of AP blast mines.

5.3 Distances

An exploding anti-personnel blast mine will normally form a blast cone. The blast effect of an explosion is quickly reduced over distance. If the operator is too close to a mine (depending on a number of factors including size of charge, distance, type of soil and burial depth), the blast impact will be so significant that no viable PPE will protect the deminer.

The deminer's working position when prodding for or exposing an AP blast mine, as well as the distance from the AP blast mine, are critical. The blast impact and the blast ejecta decrease quickly with distance and the further away from the centre of the cone of "extreme high risk", the safer the deminer will be, see Figure 2. It is likely, for example, to be safer for the deminer's head to be close to the seat of the explosion, but low down, as opposed to the same distance away vertically, in the "extreme high risk" zone, identified in figure 2.

The report "Enhancing Deminer Safety Through Consideration of Position" [3] demonstrates clearly the effect that distance has on the risk the deminer is exposed to.



Key: 1 = High risk; 2 = Extreme high risk

Figure 2 — Example of a kneeling deminer relative to a blast cone

The greatest threat for a deminer occurs when exposing a mine, which is normally conducted in a squatting or kneeling position. These positions present the highest threat to the deminer in the event of an explosion and are therefore assumed to be the most dangerous.

For test purposes the following position applies: a kneeling operator, with the tip of his nose 550 ± 10 mm from the simulated mine and at an angle of 70° ± 2º from horizontal to top centre, of the simulated mine.

5.4 Hazard levels

One of the most widespread anti-personnel blast mines is the PMN with an explosive content of 240 grams of TNT. Whilst there are anti-personnel blast mines with a higher explosive content, the PMN has been chosen as most representative for this category of mine. Most other anti-personnel blast mines have a much lower content of explosive.

6 Test Methodologies

6.1 Background

PPE shall be tested as follows:

- Ballistic test to evaluate the protection against secondary fragments (6.2);

- Blast test to show how the different pieces of equipment function as a system (6.3);

- Ergonomic suitability test to assess the degree to which the PPE is fit for purpose (6.4).

For the ballistic test the V_{50} value in NATO STANAG 2920 [4] has been chosen, but with fragment simulated projectiles (FSP) that will be more appropriate to replicate secondary fragments in the mine action environment.

For the blast test a method based on a test developed in a joint project has been chosen. It is important that the complete system is tested, because of the potential problems of combining different items.

For the ergonomic suitability test a field test has been included where the evaluation of the PPE is based on interviews of deminers using the PPE in a controlled field environment.

6.2 Ballistic test

6.2.1 Background

NATO STANAG 2920 [4] is a widely used standard for testing the protection levels against primary fragments. However, the behaviour of secondary fragments has been shown to be different to that of primary fragmentation by the Canadian Centre for Mine Action Technology [5]. The STANAG has therefore been amended for this CWA, to use FSP that are more representative of the likely threat of secondary fragments from an AP blast mine explosion. The chosen FSP has the density and brittleness of an average stone likely to be thrown by a blast.

6.2.2 Test parameters

The test shall follow NATO STANAG 2920 [4] with the modifications in a), b), c) and d).

a) The FSP shall be a right circular cylinder 4 ± 0,05 mm long and with 4 ± 0.05 mm diameter.

b) The FSP shall be made of an aluminium alloy EN AW-6082, T6 (Rm= 295 MPa and hardness, 90-100 HBS), see EN 485-2 [6], and with a mass of (0.14 ± 0.003) g

c) The FSP velocity shall be 1000 m/s.

The same test shall be applied to eye, face and body protection.

The V_{50} value is valid for woven type materials such as Aramid and Polycarbonate. Other armour components involving different materials may result in a different V_{50} value for the same level of protection.

NOTE The modifications are based on research results presented in FOI-R-2278-SE [7].

6.3 Blast test

6.3.1 Background

The purpose of this blast test is to demonstrate that different parts of PPE work together as a system for the protection of the deminer and show the integrity of PPE during a blast.

The blunt trauma from a blast has not been demonstrated to be a significant contributing (life threatening) factor, for the conditions tested, to deminer injuries, as presented in "A Methodology for Evaluating Demining Personal Protective Equipment (PPE) for Antipersonnel Landmines"[8]. A number

of simplifications have, therefore, been made to ensure more effective application for the mine action environment. The threat increases with proximity to the charge and the assumption is made that a reasonable distance is maintained between the deminer and the hazard.

6.3.2 Test equipment

6.3.2.1 Test dummy

The test shall be undertaken with a pedestrian version 50th percentile male Hybrid III anthropomorphic dummy (see NHTSA/49 CFR/Part 572 [9]) as wearer of the PPE during the test together with a system allowing correct positioning of the dummy into a kneeling position. While it is recognised that obtaining dummies may be problematic for some regional manufacturers of PPE, the use of this system allows for repeatability of the test and dummies should be available to most manufacturers.

6.3.2.2 Witness sheet and cling film

To evaluate if secondary fragments are able to penetrate through openings in the PPE, or if the PPE is not held in position when exposed to the blast a witness sheet shall be used. As a witness sheet, a white woven cotton fabric as specified below, shall be used and shall cover the dummy, as a minimum, over the areas to be protected by the PPE. The dust that will be spread by the blast complicates the evaluation and therefore the witness sheet shall be covered with non-adhesive cling film (e.g. Saran wrap).

The woven cotton fabric shall meet the following specification:

— fibre content: 100% cotton

— mass per unit area: (160 ± 7) g/m2

— number of threads per unit length: (50 ± 3) threads per cm in both warp and weft

— weave construction: plain weave

6.3.2.3 Sand filled steel container

The steel container shall be a square box, sealed at the bottom, with minimum dimensions (600 x 600 x 600) mm. As an alternative, it is possible to use a cylindrical steel tube, sealed at the bottom, with a minimum diameter of 600 mm and 600 mm in length. The container shall be designed so that it will withstand several explosions without any significant deformations. The steel container shall be filled with medium grained dry sand with grain size distribution as specified in Table 1:

Table 1 — Grained dry sand – Size distribution

Sieve openings (mm)	Percentage of passing material
4,75	100
2,36	97 - 100
1,18	93 - 100
0,600	78 - 96
0,425	48 - 65
0,300	15 - 35
0,150	0 –6
0,075	0 – 2
Pan	0 - 1

The sand shall have no visible dampness.

6.3.2.4 Simulated mine

The simulated mine shall be a container of Urethane plastic or equivalent, with minimum 70 Shore D hardness (measured according to ISO 868 [10]) and with an outer diameter of (110 ± 2) mm and a thickness of (2 ± 0,5) mm.

The container shall be filled with an explosive equivalent to (240 ± 1) g cast tri-nitro toluene (TNT) with the following properties:

— density (1 650 ± 50) kg/m^3;

— specific energy (4 200 ± 500) J/g;

— detonation velocity (6 900 ± 500) m/s.

There shall be a space for the detonator to be placed in the centre bottom of the charge with the head of the detonator located as close as possible to the centre point of the simulated mine.

6.3.3 Preparation

6.3.3.1 Mine set up

Place the simulated mine, with its detonator, at the centre of the levelled filled sand container so the top surface of the simulated mine has an overburden of (20 ± 2) mm of sand.

6.3.3.2 Dummy set up

The test shall be undertaken with the test dummy (6.3.2.1) using a system allowing correct positioning of the dummy into a kneeling position. Different systems may be used to hold the dummy in correct position.

Cover the dummy with the witness sheet (6.3.2.2). Mark the outer edges of the personal protective equipment to be tested on the witness sheet and then over-wrap with non-adhesive cling film (e.g. saran wrap). Overlap of the witness sheet should be minimised.

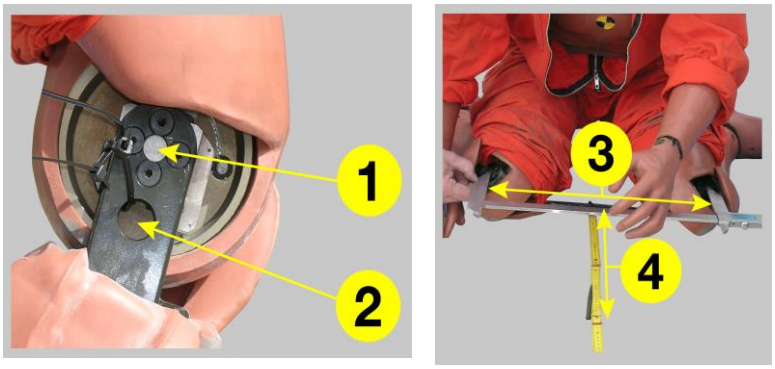
Dress the dummy with the selected PPE with the correct size for the 50^{th} percentile Hybrid III so the dummy is dressed as a deminer would normally be dressed during operations and in accordance with information supplied by the manufacturer.

Set the dummy into a kneeling position by using a fixture system that is able to hold it in position so the distance from the centre of the top surface of the simulated mine to the nose of the dummy is (550 ± 10) mm and at (70 ± 2)º from the horizontal. The feet of the dummy shall be rotated outwards to its maximum. The distance between the knees shall be fixed at (400 ± 2) mm measured from the outside of the pivot point of the knee joints (see fig 3). The distance is held with a wire attached in the pre-made hole at the knee joints (see fig 3). The horizontal distance from the wire to the centre of the top surface of the simulated mine shall be (385 ± 2) mm. The dummy shall sit as low as the limitations in the joint of the dummy allows. The hands of the dummy shall be placed on thighs just behind the knee joint with the palm towards the thighs.

NOTE The purpose of the dummy set up is to hold the front of the dummy in the same position in a repeatable way. However, the Hybrid III dummy does not have the same flexibility in the joints and spine as humans.

If a set of PPE has problems fitting in the groin of the dummy caused by the dummies limitation in flexibility it has to be considered in the evaluation by the test leader and deviations shall be noted in the test report.

If the sand container used is a square one, the dummy shall be positioned with the shoulders parallel to a side of the box with the centre line of the dummy in-line with the centre of the box.



Key: 1 = Pivot point of knee joint
2 = Pre-made hole and wire
3 = 400 mm (measured from the outside of the pivot point of knee joint)
4 = 385 mm (measured from the midpoint of the stretched wire to the centre of the simulated mine)

Figure 3 — Details of the Hybrid-III dummy

6.3.3.3 Test

Control the position and anchoring of the dummy. Put the simulated mine with its detonator in place as described 6.3.3.1.

Connect the mine to the initiation device, detonate the simulated mine and observe the result.

A new set of complete PPE shall be provided for each test. The test shall be carried out twice.

After each test remove the PPE and cling film. The witness sheet shall be visually examined for penetrations. Record the number, location and size of penetrations for each test. If there is any penetration of the witness sheet in the area marked and identified in the setting up process (with a margin on the torso of 25 mm from the marked edge and no margin of error in the facial or neck area), the test shall be considered a failure.

If either of the tests is a failure, the test shall be undertaken once more. If this additional test is a failure, the PPE has failed the test.

If the cling film in the region of the eyes shows signs of heat damage, it shall be noted in the observations.

All sand in the sand container that was affected by the detonation shall be replaced before the new test is undertaken.

6.4 Ergonomic Suitability test

6.4.1 Background

The aim of the ergonomic suitability test is to ensure that the end users shall be comfortable with the PPE and that performance degradation shall be limited. This workshop agreement offers guidance for testing the ergonomic suitability of PPE.

The ergonomic suitability test is a field test that may be carried out by any demining organisation without need of expensive equipment. The procedures at Annex A detail the requirements for these tests to allow the organisation to undertake a standardised methodology to define whether the equipment is suitable for purpose.

6.4.2 Ergonomic assessment by the wearer

This part of the test follows the procedure described in Annex A

Annex A
Ergonomic suitability test – Exercise, questionnaire and scoring

A.1 General

This Annex provides details of the process of testing PPE for suitability for purpose.

A.2 PPE for general examination and ergonomic testing

PPE shall be supplied by the manufacturer complete with labels, or copies of the proposed labels, and the Information Supplied by the Manufacturer that will be supplied with the products. The sizes should be suitable for the body size of the deminer in the environment to be operated in.

A.3 Examination of PPE

A.3.1 Principles

PPE shall be examined by deminers.

A.3.2 Test panels for user trials

The members of the test panel shall be habitual wearers of PPE (deminers). They shall be selected to represent the typical user of the PPE but shall be fitted with the proper size, as per A3.4. They shall be medically fit. At least three deminers shall be available as test panel members for the practical ergonomic tests. There shall be an Assessor to oversee the tests and record the results.

A.3.3 Preliminary examination of PPE

Before PPE is put on by test panel members it shall be inspected for sharp edges, rough surfaces, protruding wire ends or any other feature that might cause harm to a deminer. If serious faults are found no user trials shall be carried out. The results of the examination shall be recorded in the test report.

If the end user desires, the following elements of the PPE may be examined for consideration.

a) The nature and extent of tapered or thinned areas in closures;

b) The extent of overlap of full thickness combinations of materials in overlapping closures;

c) The extent of overlap between torso protection and facial protection;

d) Whether there are any particular small areas or points where the PPE may appear to have a reduced performance.

A.3.4 Procedure for size verification

The deminers shall put on the PPE that fits correctly. The PPE shall be fitted and adjusted according to the instructions supplied by the manufacturer. The deminers shall wear their normal working clothes.

The assessor and deminer shall agree whether the fit is adequate or not.

A.4 Ergonomic assessment by wearer trial

A.4.1 General

Three deminers shall complete the movements described below and shall complete the questionnaire. The movements shall be carried out both while wearing the PPE and without it. Around half the movements are to be carried out without the PPE first. The deminers shall answer the questions by comparing their comfort, their sense of impediment, their sense of effort, the accuracy of their accomplishment of the movement, and their fatigue, when wearing the PPE and when not wearing it. The scores given shall be based on the summary below taking into account the differences between carrying out the movements with and without the PPE.

Score 0 - No problems;

Score 1 - A slight problem of comfort or impediment;

Score 2 - Problems of comfort or impediment and of fatigue or accuracy of movement;

Score 3 - More severe problems of comfort and fatigue that would limit the duration of tolerable use of the PPE;

Score 4 - A severe problem that makes the PPE unsafe, or hazardous to wear because of severe impediment to movements, or gross shifts of the armour on the body that interfere with the wearer's ability to complete further movements, or because it obstructs vision. No armour would normally be acceptable that scores 4 except in movements that would not be undertaken wearing such armour.

When a score of 4 is given the reason shall be noted.

A.4.2 Calculation of the ergonomic score

Add the question scores of all panel members together and calculate the average score of the three test panel members.

A.4.3 Interpretation of the ergonomic score

The PPE shall be considered satisfactory ergonomically if the score is 3 or below.

A.4.4 Questions, prescribed movements, and scoring

Section A.5 gives the details of the movements to be performed, the questions to be considered and a guide to scoring responses.

The tests may be undertaken at different points in the day.

A.5 Exercise, questionnaire and scoring

A.5.1 General

This section gives the details of the movements to be performed the questions to be considered and a guide to scoring responses.

A.5.2 Fit and adjustability

Has the PPE adequate adjustability? Would it adjust to different amounts of clothing and to small personal weight changes? Can you ”pull it in” so that it goes from loose on the body to firm on the body? During body movements did the particular setting of the adjusters feel continuously appropriate? Is it adjustable for waist, and chest girth over at least 100 mm, or with elasticised closures allowing at least 100 mm movement and adjustment combined.

Table A.1 — Fit and adjustability - Scoring

Score	Description
0	Stays firmly against the body during movements such as changing from standing to sitting, and bending forwards;
1	Adjustable at the waist only. Probably not elasticised, but stays in place without excessive tightness during movements. May be looser on the chest than PPE scoring 0
2	Only comfortable in certain body positions at any one adjustment setting. Only adaptable to different body positions by changing adjustments
3	Cannot be adjusted to be a good comfortable close fit; less adaptable than an armour scoring 2
4	Not effectively adjustable, or the adjustment system did not stay at its chosen position during movements, therefore it was initially not comfortable, or it rapidly became uncomfortable

Putting on and taking off

Can you easily put on the PPE without help and adjust it, and can you take it off again easily? Repeat putting it on and off five times.

Table A.2 — Put on and take off - Scoring

Score	Description
0	Yes, no problems after practice
1	Awkward to put on fast
2	Requires large body or arm movements to put it on
3	Requires strenuous effort to put it on
4	Cannot be put on and adjusted without assistance

Standing with arm movements

Stand upright and raise your outstretched arms from your sides till your wrists are level with your eyes. Swing your arms back and then forward till your hands touch in front of you with your arms straight. Is the effort required excessive and do any hard edges of the PPE cause discomfort?

Table A.3 — Standing with arm movements - Scoring

Score	Description
0	No problem
1	Some effort is needed to complete the movement

2	Effort is needed and discomfort is experienced in completing the movement
3	The effort needed and discomfort slowed or disturbed the movement
4	Could not complete the movement in a reasonable time

A.5.3 In front of body reach

Reach across the front of your body with your dominant hand to touch your opposite hip. Raise your dominant hand to place it on your hip on the same side. Raise your dominant hand to place it on the front of your opposite shoulder. Can you maintain it here without strain? Undertake some vegetation cutting activities. Do you feel more constraint than normal?

Table A.4 — In front of body reach - Scoring

Score	Description
0	No problems;
1	Needs some effort to execute at least one movement quickly;
2	One of the movements needs effort, and discomfort occurs, (Commonly if an arm has to press against hard edges of the armour);
3	Two of the movements are difficult, and need care to execute, or need excessive effort;
4	All of the movements are difficult.

A.5.4 Lying down and getting up

From standing, get down quickly into a prone position. Hold your head up to look forward. Get up quickly. Repeat the moves twice more. Get down into a kneeling position with your hands on the ground. Hold your head up and look down your body. Get up. Repeat the moves twice more. Get down into a squatting position with your hands on the ground. Hold your head up to look down your body. Get up. Repeat the moves twice more. Assess the impediment to the movements by the PPE. Does it contact or press firmly on the throat, chin or the back of the neck? Assess how well the PPE stays in place. Manual normal adjustments are permitted for assuming very different postures e.g., squatting to prone.

Table A.5 — Lying down and getting up - Scoring

Score	Description
0	No problem except the weight;
1	Some restriction of mobility noted, but the movements can be completed almost normally and at a normal speed;
2	Movements noticeably difficult and were significantly slower (at least 50 % longer) than without PPE;
3	PPE digs into or presses hard against the throat or chin or neck, but does not further reduce the speed of movements;
4	PPE rides up the body significantly, makes movements much slower (at least 100 % longer) and more difficult, and digs into the throat, chin or neck.

A.5.5 Exercising

Walk 250m forwards and return to the start point. Do this three times with a 5 minute break in between. Do this on flat ground without obstacles. Assess the restriction of breathing movements and leg movements, and whether the armour chafes the body or bounces up and down causing discomfort.

Table A.6 — Exercising - Scoring

Score	Description
0	Test completed with no problems;
1	Test completed with a sense of effort;
2	Test completed with strain and significant discomfort due to chafing or bouncing of the PPE;
3	Severe strain, and there is excessive discomfort before the test is completed;
4	Walking sequence not completed due to strain, or restriction of breathing or body or leg movements, or there is excessive discomfort.

A.5.6 Irritation

After completing the tests above assess the level of physical discomfort and psychological irritation caused by the PPE; internal texture, bulk, stiffness, mass and general inconvenience are important considerations. Are there any rough, sharp or irritating parts? Did you become frustrated, or irritable while wearing the PPE?

Table A.7 — Irritation - Scoring

Score	Description
0	No undue discomfort or irritation experienced during wear-for 3 hours;
1	Slight discomfort experienced before 3 hours of wear reached;
2	Significant discomfort within 2 hours of putting it on, great relief experienced on taking it off;
3	Not acceptable for 3 hours wear; physical and/or psychological irritation excessive;
4	Immediate severe physical discomfort or skin abrasion is anticipated if the garment is not taken off.

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