CEN

WORKSHOP

AGREEMENT

CWA 15756

December 2007

WITHDRAWN pending amendment

Two ITEP activities carried out in the course of 2008 used the CWA 15756:2007 test guidelines to evaluate the blast performance of a face protection system (ITEP Project 5.2.5) and heat treated scratched visors (ITEP Project 5.2.4). The results of both trials (available at www.itep.ws) seem to indicate that the CWA 15756:2007 protocol for the blast test, and more specifically for the simulated mine's explosive content specification (Paragraph 6.3.2.4), do not lead to realistic face protection performance results. This might be due to the use of plastic explosives with an explosive equivalent to 240 g cast TNT.

Comment inserted by the ITEP Secretariat.

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N Members National Standard Bodies.

ch Republic, Denmark, Estonia, Finland,
Malta, Netherlands, Norway, Poland, Portugal,

Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No.:CWA 15756:2007 D/E/F

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Foreword

This CEN Wo tives of
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Members of C N, 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

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Two ITEP activities carried out in the course of 2008 used the CWA 15756:2007 test guidelines to evaluate the blast performance of a face protection system (ITEP Project 5.2.5) and heat treated scratched visors (ITEP Project 5.2.4). The results of both trials (available at www.itep.ws) seem to indicate that the CWA 15756:2007 protocol for the blast test, and more specifically for the simulated mine's explosive content specification (Paragraph 6.3.2.4), do not lead to realistic face protection performance results. This might be due to the use of plastic explosives with an explosive equivalent to 240 g cast TNT.

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Protective equipment issued to
losive threats is often uncertain.
quipment are based on NATO
and Combat Clothing. 31 July
and is often considered to be
be anticipated – in particular for
afety and occupational health -
tion 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

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Comment inserted by the ITEP Secretariat.

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y already exists in the European Standard EN 167:2001, Personal eye-protection - Optical test methods.

Humanitarian mine action (HMA) — Personal protective equipment (PPE) — Test and evaluation

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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.

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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

ion" [3] demonstrates clearly the

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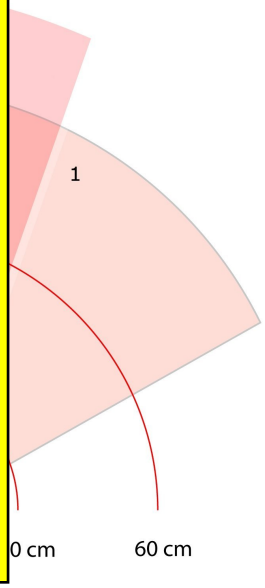

Key: 1 = High risk; 2 = Extreme high risk

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

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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

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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

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d filled sand container so the top d.

stem 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.

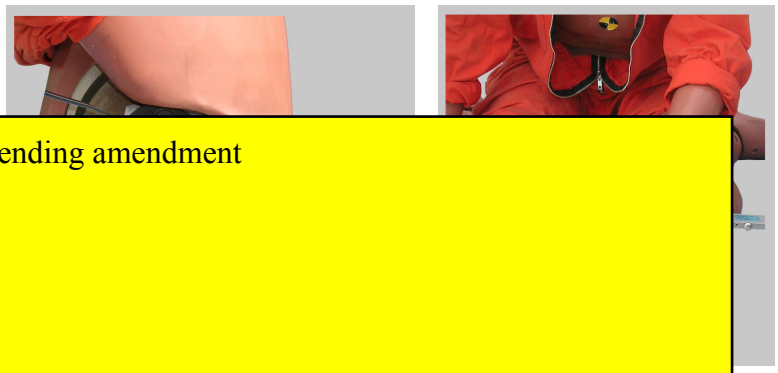
Dress the dummy with the selected PPE with the correct size for the 50th percentile Hybrid III so the dummy is dressed as a deminer would normally be dressed during operations and in accordance with information supplied by the manufacturer.

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)° 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.



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all 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

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Annex A
Ergonomic suitability test – Exercise, questionnaire and scoring

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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

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aken wearing such armour.

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.

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stays in place without excessive an PPE scoring 0
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less adaptable than an armour
not stay at its chosen position fortable, or it rapidly became

take it off again easily? Repeat

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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 there without strain? Undertake some vegetation

WITHDRAWN pending amendment

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Comment inserted by the ITEP Secretariat.

ring

ly;
rs, (Commonly if an arm has to
te, or need excessive effort;

ead up to look forward. Get up
n with your hands on the ground.
es twice more. Get down into a
o look down your body. Get up.
nts by the PPE. Does it contact
w 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

	e to chafing or bouncing of the
	test is completed;
	tion of breathing or body or leg

WITHDRAWN pending amendment

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Comment inserted by the ITEP Secretariat.

	nfort and psychological irritation
	ral inconvenience are important
	u become frustrated, or irritable
	or 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.

Bibliography

WITHDRAWN pending amendment

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Comment inserted by the ITEP Secretariat.

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