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Humanitarno protiminsko delovanje (HMA) - Osebna varovalna oprema (PPE) - Preskus in ocena

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

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

This CEN Workshop Agreement has been drafted and approved by a Workshop of representatives of interested parties, the constitution of which is indicated in the foreword of this Workshop Agreement.

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

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

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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.

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

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.

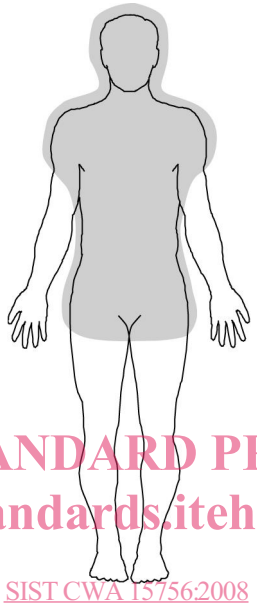


Figure 1 — Designated areas for protection

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.

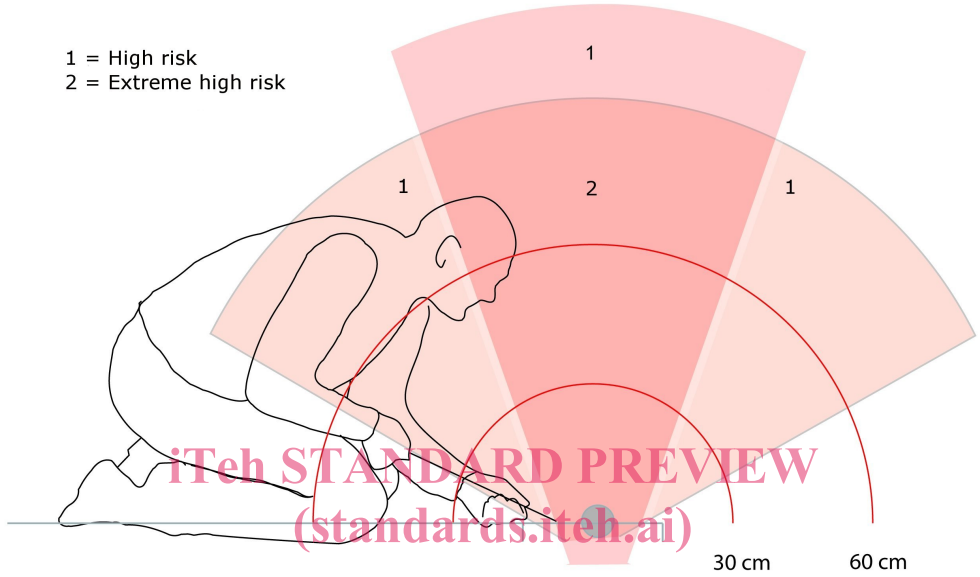
NOTE For the purposes of this document and related testing, secondary fragments are fragments that are picked up and ejected from the seat of the explosion including remains from parts of AP blast mines.

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.