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Test and Evaluation Report For DOK-ING MV 10

(1 enclosure)

Enclosed please find the final T & E report concerning agreement signed by
SWEDEC and DOK-ING d.o.o.

Agreed tests to be carried out according to CEN Workshop Agreement
15044:2004 with DOK-ING MV 10 were Performance test and Survivability test.

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DOK-ING MV 10 Test and Evaluation
May 2008



Patrik Blomander, SWEDEC

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Abstract

A test of the DOK-ING MV 10 was performed in Sweden by SWEDEC in May 2008. Performance and survivability tests were done according to the European Committee for Standardisation (CEN) Workshop Agreement "CEN Workshop Agreement 15044; Test and Evaluation of Demining Machines", available at the international Test and Evaluation Website (www.itep.ws).

Executive summary

During the first week of May 1-8, 2008, the MV 10 was tested at SWEDEC facilities Norra Kulla near Eksjö, Sweden. This test was planned and facilitated almost entirely by SWEDEC. The methodology specified in CEN Workshop Agreement "CEN Workshop Agreement 15044; Test and Evaluation of Demining Machines" was used. It started with a performance test and ended with a survivability test. These tests make up the content of this report.

The tracked, remotely controlled DOK ING MV 10, at approximately 17 tonnes, fits into what is normally regarded as a medium double tool combined system (6-20 tonnes).

The DOK ING MV 10 triggered or neutralized 425 out of 450 mines - 95 % of the targets used in these trials.

The results in each lane were varying between 42 up to 50 broken or triggered mines. The penetration of the witnessboards during the tests was showing a variation (chapter 4), some of them had skip zones. This variation, (skip zones) comes from a to high speed during the performance. The speed is also one reason to a low result of triggered mines.

The machine demonstrated ability to penetrate well beyond the depth required to reach the deepest targets. In all but the most difficult soil, a smooth uniform cut across the whole width of the machine was observed.

The survivability test went very well. The machine drove across an anti-tank mine the Swedish m/41-47 placed at surface. The machine suffered very little damage from the mine. A few chains and tools were lost and the tiller had some visual damage (some missing and some bent tools).

This machine have already been tested by the Defence RoD Canada-Suffied in 2006. In the report from that test it was noted that the machine had some problems to maintain the right depth penetration. The machine that was tested at SWEDEC did not have any ground levelling system, so the problem was still remaining.

According to DOK-ING, all future serially produced MV 10 machines will be fitted with such a system. The operator needed to have visual contact with the machine to control the depth penetration and the speed.

The remote control for the MV 10 was a new version (see figure 4).

Table of contents

Abstract..... 2
Executive summary 2
Table of contents 3
1. Introduction 4
2 Machine Description..... 5
 2.1 DOK-ING MV 10 medium double tool combined system 5
3. Trial Description..... 6
 3.1 Test Team..... 6
 3.2 Trial Conditions 6
4. Test Results..... 6
 4.1 Results against mine targets 6
 4.2 Tabular Data and Explanations 7
 4.2.1 Debris and Scatter 8
 4.3 Depth and Consistency of Penetration 10
 4.3.1 General..... 10
 4.3.2 Sand 20
 4.3.3 Gravel 20
 4.3.4 Topsoil 21
5. Survivability Test 22
 5.1 Trial Descriptions..... 22
 5.2 Anti-Tank Mine..... 22
 5.3 Test Methods 23
 5.4 Test Results 23
6 Test Facilities and Tools..... 25
 6.1 Soil Compaction..... 26
 6.3 Test Targets..... 27
 6.4 Mine Target Burial 29
 6.5 Mine Target Level of Damage 30
 6.6 Witness Boards..... 32
 6.7 Test Methods 34

Annex A – Test Data Sheets

1. Introduction

During the first week of May 1-8, 2008, the MV 10 was tested at SWEDEC facilities Norra Kulla near Eksjö, Sweden.

Agreed tests to be carried out according to CEN Workshop Agreement 15044:2004 were Performance Test and Survivability Test.

These tests were planned and facilitated almost entirely by SWEDEC, and was requested and partially funded by DOK ING, the manufacturer of the machine.

An overall description of the test facilities, the test targets and the test methods are given in chapter 6. This information is relevant to any machine tested at this site.

During the test, personnel from the Australian Armed Forces participated with a delegation. They requested additional tests with the MV 10. These tests are not part of CWA, they are therefore not presented in this report. In case of requirement, address this issue to DOK-ING d.o.o., Zitnajak bb, 10000 Zagreb, Republic of Croatia.

2 Machine Description

2.1 DOK-ING MV 10 Midi Mine Clearance System

The DOK-ING MV 10 medium double tool combined system (hereinafter MV 10) is a remotely controlled tracked mechanical mine clearance machine, operated within visual line-of-sight by the operator.

A number of tools can be attached to the MV 10 including a combined flail and tiller, a double flail, a roller and a blade. During these tests the MV 10 was equipped with a combined flail and tiller.

The operator controls the machine from a man-portable transmitter unit using visual observation of the machine.



Figure 1. MV 10



Figure 2. Tiller head



Figure 3. MV 10 Flail Head



Figure 4. Remote Control

3. Trial Description

3.1 Test Team

Capt Patrik Blomander, SWEDEC (test leader)
Lt Leif Ribbefors, GÖTA Engineers
Anders Bredelius, SWEDEC
Joakim Engblom, SWEDEC

3.2 Trial Conditions

A complete description of the test areas, facilities, tools and the test procedures can be found in chapter 6.

Soil compaction levels (actual) can be found in the test data sheets in Annex A (Test protocol).

To summarize conditions¹ for the MV 10 test are indicated below:

- Sand: 90% (1.8 kg/dm³)
- Gravel: 94% (2.0 kg/dm³)
- Topsoil: 85% (1.7 kg/dm³)

Depths, number of mines and witness panels:

- Depths tested in each soil: 0cm, 10cm and 15cm DOB (Depth Of Burial)
- Number of test target mines at each depth: 50
- Witness panels included with each set of 50 targets: 3- one at the start, one at the mid-point and one at the end of each test area.

4. Test Results

4.1 Results against mine targets

This section summarizes the performance of the machine. In addition to simply tabulating numbers, the data is given a statistical treatment as suggested by the CEN Workshop Agreement.

¹Soil compaction levels (intended)

4.2 Tabular Data and Explanations

Table 1 shows the number of mines triggered, the number of mines with separated fuzes (neutralized), and the number of intact mines at each depth and in each soil condition. This table also indicates the number of untriggered fuzes which were found separated from their main charges. In total the machine drove over 450 mine targets, 50 mine targets at each depth.

During each test, at least three people were responsible for counting fuze detonations. After the test was complete, any remaining fuzes would be sought using metal detectors. If the fuzes can't be found right away additional steps can be taken - the soil will be turned over twice with a farm plough, once with a backhoe bucket and twice with an excavator bucket. During these tests there was no need to use any of the additional steps.

The first test done in sand, which is shown in the annex, had low resultant of triggered mines. The operator drove very fast and couldn't control the depth setting. The number of detonations was 17 during this test.

After the complete test was finished, the machine manufacturer was offered to do the sand 0 cm test again. The result is shown in the test protocols and in table 1.

Table 1. Mine targets triggered, separated fuzes and whole mines

	0 cm			10 cm			15 cm		
	Triggered	Separated fuzes	Intact mines	Triggered	Separated fuzes	Intact mines	Triggered	Separated fuzes	Intact mines
Sand 2 (Second drive)	49/50	1		50/50			42/50	2	6
Gravel	42/50	5	3	50/50			48/50	2	
Topsoil	47/50	3		43/50	2	5	48/50	1	1
Sand 1 (first drive)	17/50	5	26						

1 During the first test in sand (0 cm) the clearance velocity was very high – 1 min 9 sec for 25 m.

When the machine had a lower clearance result (sand 42 detonations and gravel 42 detonations) this was due to the clearance velocity. The times for these tests were 2 min 24 sec (sand) and 1 min 39 sec (gravel). When the machine used a clearance velocity (time) between 4 min 30 sec and 6 min 6 sec for 25 m the clearance results were much better.

The numbers are taken from the test protocol contained in the Annex A. This table combines detonated mines with those left damaged, non-functional. There were 50 targets in each test condition.

100% of the detonations were caused by the flail.

4.2.1 Debris and Scatter

When a demining machine (as the MV 10) engages a mine target it may leave the mine in a number of different conditions. The target may be left intact and fully functional or it may be intact but damaged. It may be lightly damaged or completely broken apart.

After each test in the series, the test lanes were searched as described above, and the materials of interest were assembled and inspected. These materials included fuzes, fuze components, intact mine targets, and mine bodies with most of or the entire (inert) main charge intact. The photos in figures 1-8 show the collected debris.



Figure 1, Sand 0 cm first drive



Figure 2, Sand 0 cm second drive



Figure 3, Sand 15 cm



Figure 5, Gravel 15 cm



Figure 4, Gravel 0 cm



Figure 6, Topsoil 0 cm



Figure 7, Topsoil 10 cm



Figure 8, Topsoil 15 cm

4.3 Depth and Consistency of Penetration

4.3.1 General

Fibreboards were used to measure the depth and consistency of penetration across the path of vehicle. Examples are shown in figure 9-39.

Sand witness board: mine DOB surface 0 cm



Figure 9. Sand 1, 0 cm first drive.



Figure 10. Sand 2, 0 cm first drive.



Figure 11 Sand 3, 0 cm first drive.

Comment:

During the first test (sand 0 cm), the machine manufacturer chose an inexperienced operator. He drove very fast (the velocity can be found in the annex) and couldn't control the depth. This can be seen on the witness boards above.

Sand Witness board: 0 cm, Second drive



Figure 12.Sand 1

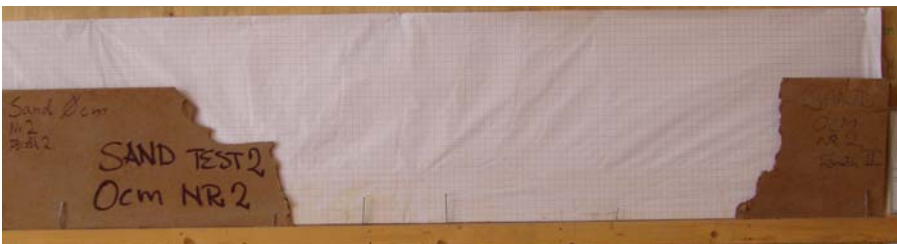


Figure 13.Sand 2

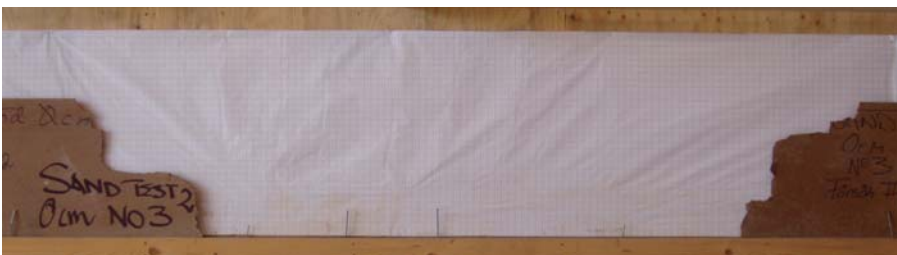


Figure 14.Sand 3

Comment:

During this test (the second for sand 0 cm) the result was much better. The clearance depth was over 40 cm on profile 2 and 3 though (the fibreboard is 40 cm).

Sand witness board: mine DOB surface 10 cm



Figure 15. Sand 1,10 cm



Figure 16. Sand 2,10 cm



Figure 17. Sand 3,10 cm

Comment:

Clearance depth about 25 cm.

Sand witness board: mine DOB surface 15 cm



Figure 18. Sand 1,15 cm



Figure 19. Sand 2,15 cm



Figure 20. Sand 3,15 cm

Comment:

The clearance depth about 25-30 cm.

Gravel witness board: mine DOB surface 0 cm.



Figure 21 Gravel 1, 0 cm



Figure 22. Gravel 2, 0 cm



Figure 23. Gravel 3, 0 cm

Comment

Clearance depth about 25-30 cm

Gravel witness board: mine DOB surface 10 cm.



Figure 24. Gravel 1, 10 cm

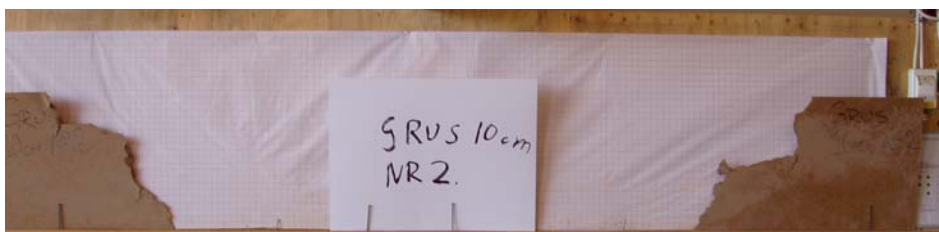


Figure 25. Gravel 2, 10 cm

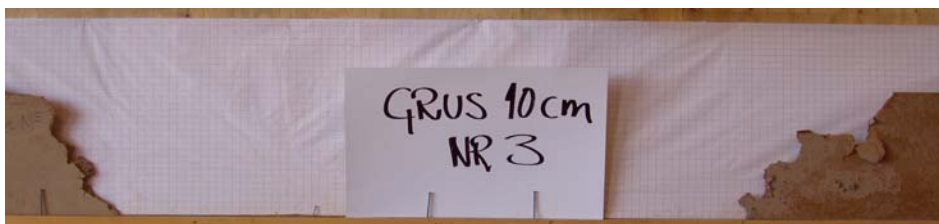


Figure 26. Gravel 3, 10 cm

Comment:

Clearance depth deeper than 40 cm!

Gravel witness board: mine DOB surface 15 cm.



Figure 27. Gravel 1, 15 cm



Figure 28. Gravel 2, 15 cm



Figure 29. Gravel 3, 15 cm

Comment:

Clearance depth; board 1 25-30 cm, board 2 over 40 cm and board 3 about 25-30 cm.

Topsoil witness board: mine DOB surface 0 cm.



Figure 30. 1, Topsoil 1, 0 cm



Figure 31. 1, Topsoil 2, 0 cm



Figure 32. 1, Topsoil 3, 0 cm

Comment:

Clearance depth about 30-35 on all boards.

Topsoil witness board: mine DOB surface 10 cm:

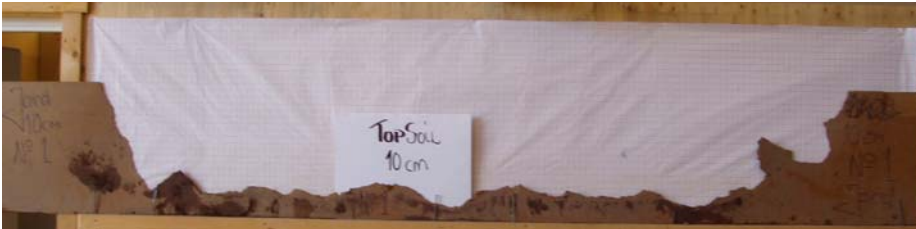


Figure 33. 1, Topsoil 1, 10 cm



Figure 34. 1, Topsoil 2, 10 cm



Figure 35. 1, Topsoil 3, 10 cm

Comment:

Clearance depth by board 1 about 30 cm, board 2-3 over 40 cm.

Topsoil witness board: DOB surface on mine 15 cm:



Figure 36. 1, Topsoil 1,15 cm



Figure 37. 1, Topsoil 2,15 cm



Figure 38. 1, Topsoil 3,15 cm

Comment:

Clearance depth; board 1 20-25 cm, board 2 about 25 cm and board 3 over 40 cm.

4.3.2 Sand

The depth of penetration in sand:

Sand 0 cm,

First run resulted in big skip zones in the witness board this because of to high clearing speed. The time for run one 1.09 min/ 25 m. The second run was slower and the penetration was 25-30 cm on the first witness board and 40 cm on the second and third. The time for second run was 4.33/ min/ 25 m.

Sand 10 cm,

The depth of penetration on all three witness boards was 25 cm. The time was 4.21 min/ 25 m.

Sand 15 cm,

The depth of penetration on all three witness boards was 30 cm. The time was 2.24/, min/ 25 m.

4.3.3 Gravel

Gravel 0 cm,

The depth of penetration on the first witness board was 30 cm and showed some small skip zones. The small skip zones is because of the speed. On the second and third witness board the depth was 25 cm. The time was 2.24 min/ 25 m.

Gravel 10 cm,

The depth of penetration on all three witness boards was over 40 cm. The time was 6.17 min/ 25 m.

Gravel 15 cm,

The depth of penetration on first witness boards was 30 cm. Second witness board over 40 cm and the third witness board 35 cm. The time was 4.50 min/ 25 m.

4.3.4 Topsoil

The depth of penetration in topsoil:

Topsoil 0 cm,

The depth of penetration on all witness boards was 35 cm. The time was 4.59 min/ 25 m.

Topsoil 10 cm,

The depth of penetration on first witness board 35 cm, second and third witness boards over 40 cm. The time was 4.32 min/ 25 m

Topsoil 15 cm,

The depth of penetration on the first witness board 25 cm, second witness board over 30 cm and the third witness board over 40 cm. The time was 6.20 min/ 25 m

5. Survivability Test

The CEN Workshop Agreement methodology calls for survivability testing using antipersonnel and/or antitank mines. Anti-personnel mines are required to test all machines for susceptibility to damage from normal operational conditions created by triggering anti-personnel mines. Machines which are advertised for use against anti-tank mines are also required to be tested against anti-tank mine charges to ensure that they are able to absorb anti-tank mine blasts without undue levels of damage.

The machine cleared a total of three anti-tank mines. According to the CEN Workshop Agreement it is satisfactory with only one mine, but the delegates from Australia requested to see how the machine coped with three mines - two mines at a depth of 0 cm and one mine at a depth of 35 cm (see figure). The net explosive weight should be about 8 kg of TNT according to CEN Workshop Agreement.

5.1 Trial Descriptions

The test facilities for survivability testing near Eksjö have been used to test different types of equipment in recent years. The blast range includes a gravel bed 5 m wide and 35 m long. The bed contains compacted 018 fraction gravel. The lane is located at an angle of about 45 degrees from the safe house. The operator manoeuvres the machine from the safe house and can decide both forward speed and course. Two cameras were used during the tests, One camera from the front and one camera from the rear.

5.2 Anti-Tank Mine

According to the CEN Workshop Agreement the mine should have a net explosive weight of 8 kg. The anti-tank mine used in this trial was the standard Swedish m/41-47B mine. The total weight of the m/41-47 mine is 6 kg and it contains 5 kg of TNT. The mine was boosted with 2.25 kg of plastic explosive (PETN), which corresponds to 3 kg TNT.

5.3 Test Methods

Following preparation of the test lane and installation of the mines as described above, the machine was prepared for a test run. The machine was positioned about 5 metres in front of the start of the test lane to allow the operator to get the machine operating in a consistent stable manner prior to the start of the lane. The camera was started and all personnel went into the safe house.

The operator started to flail the ground. The mine was triggered by the rotating flail. After the detonation the operator was told to stop the engine. The result from the detonation was first examined visually. When the test team was sure that no major damage or leaks had occurred, the MV 10 was started and all functions were tested.

5.4 Test Results

The 8 kg detonations only had a small effect on the machine. During the try only two chains with tools were destroyed and the tiller had some minor damage as one bend tiller tooth. The machine had no problem to continue to work after these tests. The time to fit new tools will take about twenty minutes. The Video and figures are stored at SWEDEC.

Figures from the survivability test.



Figure 39, MV 10 ready for m/41-47



Figure 40, Tiller after AT mine



Figure 41, AT-mine m/41-47



Figure 42, AT-Mine 41/47 in front of the MV 10

6 Test Facilities and Tools

The test facilities at Norra Kulla, near Eksjö, have been used to test various types of equipment in recent years. The site has three soil environments specifically for performance tests. Parallel lanes 5 m wide and 100 m long provide compacted sand, compacted gravel and compacted topsoil. The sand and gravel lanes are easily replicated almost anywhere. As the characteristics of topsoil may vary from one location to the next, data from the topsoil lane may not be quite as repeatable. The soil in each test lane is prepared as follows. Prior to a test the soil is loosened with ordinary agricultural or construction equipment, and then compacted using the vibratory compacter as shown in **Figure A-1**. The soil compaction and moisture content are monitored until the compaction reaches a defined level for that soil type. Compaction and moisture content are measured using the CPN International model MC-3 Portaprobe.



Figure A-1. Soil Preparation – Loosening and compacting the soil

6.1 Soil Compaction

Ideally the soil would be compacted to virtually 100%, or its theoretical maximum level of compaction. This is very difficult to achieve and depends on the moisture content of the soil. Based on the results of soil analyses conducted for SWEDEC, the compaction levels shown below were selected to allow testing over a range of soil moisture contents, and are reasonable and practical approximations of well compacted soil.

- Sand: 90% (1.8 kg/dm³)
- Gravel: 94% (2.0 kg/dm³)
- Topsoil: 85% (1.7 kg/dm³)

An example of a soil analysis for the topsoil is shown in Figure A-2. In this Swedish language chart, the horizontal axis refers to the moisture content (by weight), while the vertical axis shows the density, with a maximum occurring at 2.024 kg/dm³. A 95% compaction level (approximately 1.9 kg/dm³) can only be achieved with soil moisture contents between 6% and 12%; this might restrict testing if the moisture content were out of range on a given day. By comparison, compacting the topsoil to approximately 1.7 kg/dm³ results in the soil reaching 85% of its theoretical maximum compaction. For the topsoil this is a useful target since it can be achieved without undue difficulty, and also because it is achievable over a wide range of moisture contents up to 18% or greater. Similar analyses were done to select the compaction levels for the sand and gravel areas. Target compaction levels for the three soils were:

Curve chart Topsoil

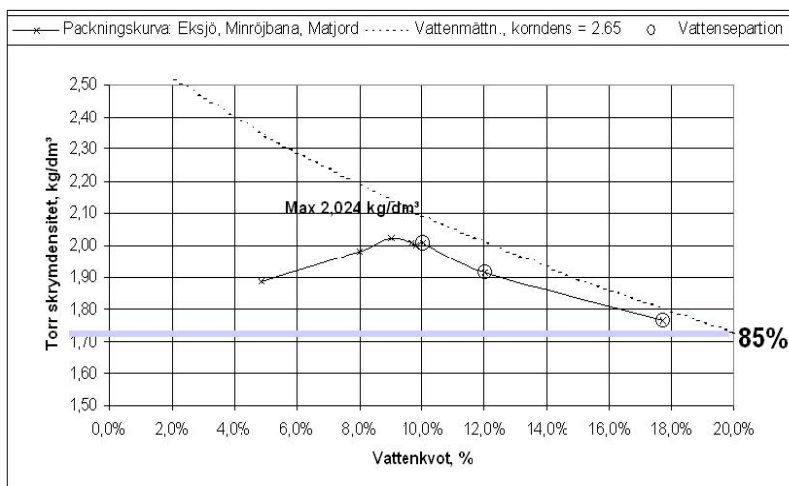


Figure A 2

6.2 Soil Particle Size Distribution

Samples from the sand, gravel and topsoil areas were analyzed to determine particle size distribution, with Figure A-4 showing the results.

Lane A-C

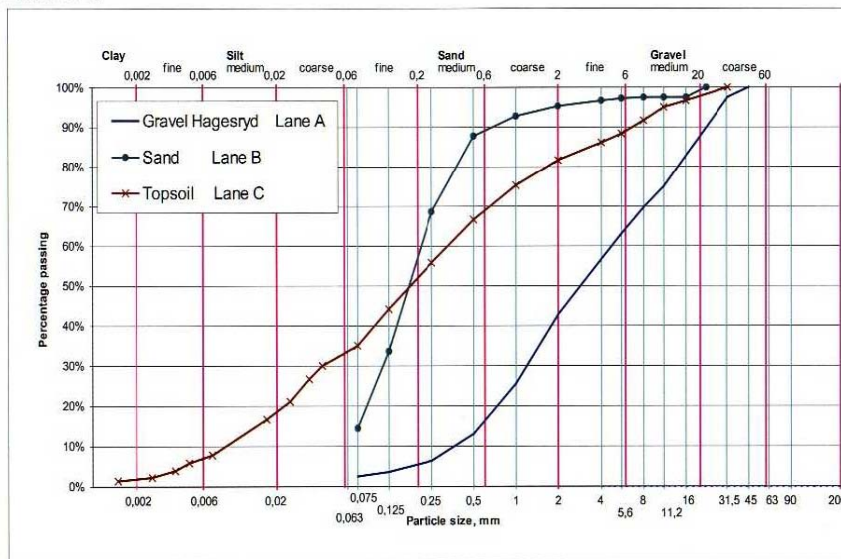


Figure A 2

6.3 Test Targets

The test targets used in this trial were the standard SWEDEC mine surrogates shown in **Figure A-3** and **Figure A-4**. The targets make use of live fuzes from the m/49 anti-personnel mine installed in inert, plaster-filled plastic bodies. These targets closely replicate many typical small antipersonnel land mines, which a machine might be expected to encounter.

For the trial, 50 targets are buried at each depth, in each soil. Based on three depths in each soil type, this translates to 450 individual mine targets for a complete trial. To simplify the test procedures and data collection, each test comprises 50 targets, all at a single depth. Once that test has been completed, another 50 targets are placed at a different depth or in a different soil.

The targets are located approximately 0.5 m apart to minimize the effects of soil disturbance from one target to another. They are laid in a path whose width is approximately 50% of the width of the machine working tool.

In other words, a machine with a 2 metre wide tool will have targets spread approximately 0.5m on either side of the machine centreline, for a total path width of 1 metre.



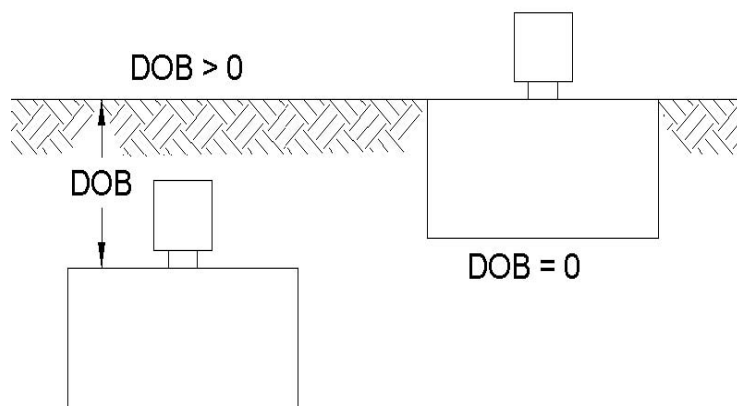
Figure A 3



Figure A 4

6.4 Mine Target Burial

In all cases, the mines are buried as shown in **Figure A-6**. The depth of burial (DOB) is measured from the top surface of the mine (not the top surface of the fuze), to the ground surface. Hence, a burial depth of 0 cm is illustrated in **Figure A-5**, above. To minimize soil disturbance, the tool shown in **Figure A-6** was used to pull out a soil core just slightly larger than the mine body. The live fuzes are installed moments prior to the beginning of the test.



DOB – Subsurface
Figure A 5



Figure A 6

6.5 Mine Target Level of Damage

In accordance with the CEN workshop agreement, the results of the tests against mine targets were evaluated as follows.

- Live, undamaged - Targets in this condition have not been damaged in any way, and remain fully functional.
- Damaged, functional - Targets in this condition have been damaged by the machine but remain functional. This could include mines which have had part of the main explosive charge broken away, but where the fuze/initiation train remains attached to the remaining explosive material. Alternatively it could be the fuze which has sustained damage, but remains functional and able to detonate the mine.
- Damaged, non-functional - Targets in this condition have not been triggered, but have been broken apart to the point where they can no longer function. This may be as simple as having removed an intact, functional fuze from an intact mine body or it may be a complete mechanical shredding of all components of the mine and fuze. Examples are seen in Figure A-7-8, in which the top row shows intact functional targets missed by a machine. The second row shows fuzes separated from their mine bodies and fuzes still attached to the upper parts of the mine bodies but separated from what would, in a real mine, be the main explosive charge. The bottom row shows the lower bodies of targets which were broken apart without triggering the fuze and where the bulk of the plaster (the main charge in a real mine) remains intact.
- Triggered - Mines in this category have been triggered by the machine. Since real mine fuzes are used in this trial, it is simple a matter of counting the detonations as the machine progresses.



Figure A 7

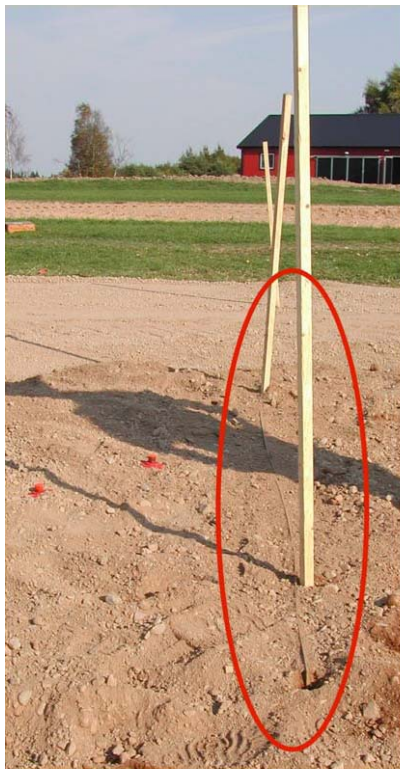


Figure A 8

6.6 Witness Boards

Along with the mine targets, witness boards are installed at three locations across each lane. At the start, middle and end of each test area, 3mm thick, 400 mm tall oil hardened (water resistant) fibreboards are installed across the full width of the flail head. Buried flush with the surface as shown in Figure A-9, the boards act as witness panels to record the depth of penetration of the tiller/flail hammers. This technique does not record the force with which the hammers strike, but it does give a clear, unambiguous indication of depth of penetration. Figure A-13 also show a typical example of the witness boards after a test when some of the neighbouring soil has been removed to expose the boards.

A simple 'pizza cutter' tool was devised to make installation of the witness boards quick and easy without excessive disturbance of the surrounding soil. This tool, shown in Figure A-10, works very well in sand, topsoil and gravel.



Ready For Test

Figure A 9



After Test



Figure A 10

6.7 Test Methods

Following preparation of the soil in the test lanes, and installation of the mine targets and witness boards as described above, the machine will be prepared for a test run. The machine will be positioned about 5-10 metres in front of the start of the test lane to allow the operator to get the machine operating in a consistent, stable manner prior to the start of the lane. Cameras will be started and personnel put in place to count detonations from the triggered fuzes.

In most cases, a manufacturer's representative will be used as a machine operator to ensure that the machine is operated in the most effective manner. When all is ready, the machine operator is signalled to begin, and the machine is driven through the test area containing 3 witness boards and 50 mine targets. With two or three people counting fuze detonations, the number of 'triggered mines' can easily be determined.

Following the machine process, metal detectors will be used to locate any untriggered fuzes and also the metal washers in the plaster-filled bodies. In this way, the untriggered fuzes can be examined and ultimately discarded in a safe manner, and any untriggered or damaged mine casings can be inspected to determine the probable level of damage inflicted by the machine. Finally, with all untriggered fuzes removed from the area, the witness boards can be removed, labelled, and photographed.

Along with the test lanes, the facilities at Norra Kulla provide office and administration space, warehouse and storage space, and basic workshop facilities.

SWEDISH ARMED FORCES

SWEDISH EOD AND DEMINING
CENTRE

Date
12 June 2008

Annex A

Page 1 (10)

TEST PROTOCOL

Manufacturer DOK-ING		Machine type MV 10	
Date 2008-05-02	Weather Rain	Temperature 6 °C	
Test number 1:1		Deployment depth 0 cm	
Test lane Sand		Rate of compaction 91%	Water content
Clearing depth 25-30 cm	Time/25 m 1.09	→	Clearing speed 1376 m/h

	AP blast PMA2	AP bounce PROM1	AP frag PMR2A	AT blast TMM1
Deployed:	50	N/A	N/A	N/A
Triggered (detonated)	17			
Mechanically neutralised	5			
Live Damaged:				
Live:	26			
Total:	50			

Comments:

Three fuzes with upperside of the mine case and two seperated fuzes.
All fuzes were in function after test.
Twenty six mines was left live, intact and fully functional.

SWEDISH ARMED FORCES

SWEDISH EOD AND DEMINING
CENTRE

Date
12 June 2008

Annex A

Page 2 (10)

TEST PROTOCOL

Manufacturer DOK-ING		Machine type MV 10	
Date 2008-05-03	Weather Cloudy	Temperature 8°C	
Test number 1:2		Deployment depth 10 cm	
Test lane Sand		Rate of compaction 92 %	Water content
Clearing depth 35 cm	Time/25 m 4.21	→	Clearing speed 356 m/h

	AP blast PMA2	AP bounce PROM1	AP frag PMR2A	AT blast TMM1
Deployed:	50	N/A	N/A	N/A
Triggered (detonated)	50			
Mechanically neutralised				
Live Damaged:				
Live:				
Total:				

Comments:

TEST PROTOCOL

Manufacturer DOK-ING		Machine type MV 10	
Date 2008-05-03	Weather Cloudy	Temperature 7 °C	
Test number 1:3		Deployment depth 15 cm	
Test lane Sand		Rate of compaction 93 %	Water content
Clearing depth 30 cm	Time/25 m 2.24	⇒	Clearing speed 669 m/h

	AP blast PMA2	AP bounce PROM1	AP frag PMR2A	AT blast TMM1
Deployed:	50	N/A	N/A	N/A
Triggered (detonated)	42			
Mechanically neutralised	2			
Live Damaged:				
Live:	6			
Total:	50			

Comments:

One fuze with upperside of the mine case and one seperated fuze.
All fuzes were in function after test.
Six mines was left live, intact and fully functional.

SWEDISH ARMED FORCES

SWEDISH EOD AND DEMINING
CENTRE

Date
12 June 2008

Annex A

Page 4 (10)

TEST PROTOCOL

Manufacturer DOK-ING		Machine type MV 10	
Date 200805-05	Weather Sunny	Temperature 12°C	
Test number 2:1 (Second drive)		Deployment depth 0 cm	
Test lane Sand		Rate of compaction 91 %	Water content
Clearing depth 25-30 cm	Time/25 m 4.33	→	Clearing speed 346 m/h

	AP blast PMA2	AP bounce PROM1	AP frag PMR2A	AT blast TMM1
Deployed:	50	N/A	N/A	N/A
Triggered (detonated)	49			
Mechanically neutralised	1			
Live Damaged:				
Live:				
Total:	50			

Comments:

Second drive in lane sand 0 cm

One fuze with upperside of mine case and one seperated fuze.
All fuzes were in function after test.

SWEDISH ARMED FORCES

SWEDISH EOD AND DEMINING
CENTRE

Date
12 June 2008

Annex A

Page 5 (10)

TEST PROTOCOL

Manufacturer DOK-ING		Machine type MV 10	
Date 2008-05-04	Weather Sunny	Temperature 12°C	
Test number 1:1		Deployment depth 0 cm	
Test lane Gravel		Rate of compaction 95 %	Water content
Clearing depth 35-40cm	Time/25 m 1.38	⇒	Clearing speed 1086 m/h

	AP blast PMA2	AP bounce PROM1	AP frag PMR2A	AT blast TMM1
Deployed:	50	N/A	N/A	N/A
Triggered (detonated)	42			
Mechanically neutralised	4			
Live Damaged:	1			
Live:	3			
Total:	50			

Comments:

One mine was left intact with fuze, but the fuze was damaged sufficiently that the mine would not function normally. This is not considered neutralized since the fuze is still in contact with the explosive charge and might be able to function under abnormal loading conditions. Three mines was left live, intact and fully functional. All fuzes were in function after test.

SWEDISH ARMED FORCES

SWEDISH EOD AND DEMINING
CENTRE

Date
12 June 2008

Annex A

TEST PROTOCOL

Manufacturer DOK-ING		Machine type MV 10	
Date 2008-05-04	Weather Sunny	Temperature 12°C	
Test number 1:2		Deployment depth 10 cm	
Test lane Gravel		Rate of compaction 95%	Water content
Clearing depth 35-40 cm	Time/25 m 6.17	➔	Clearing speed 243 m/h

	AP blast PMA2	AP bounce PROM1	AP frag PMR2A	AT blast TMM1
Deployed:	50	N/A	N/A	N/A
Triggered (detonated)	50			
Mechanically neutralised				
Live Damaged:				
Live:				
Total:				

Comments:

SWEDISH ARMED FORCES

SWEDISH EOD AND DEMINING
CENTRE

Date
12 June 2008

Annex A

Page 7 (10)

TEST PROTOCOL

Manufacturer DOK-ING		Machine type MV 10	
Date 2008-05-05	Weather Sunny	Temperature 13°C	
Test number 1:3		Deployment depth 15cm	
Test lane Gravel		Rate of compaction 94%	Water content
Clearing depth 35 cm	Time/25 m 4.50	→	Clearing speed 333 m/h

	AP blast PMA2	AP bounce PROM1	AP frag PMR2A	AT blast TMM1
Deployed:	50	N/A	N/A	N/A
Triggered (detonated)	48			
Mechanically Neutralised	2			
Live Damaged:				
Live:				
Total:	50			

Comments:

Two fuzes with the upperside of the mine case.
All fuzes were in function after test.

SWEDISH ARMED FORCES

SWEDISH EOD AND DEMINING
CENTRE

Date
12 June 2008

Annex A

Page 8 (10)

TEST PROTOCOL

Manufacturer DOK ING		Machine type MV 10	
Date 2008-05-06	Weather Sunny	Temperature 17 C	
Test number 1:1		Deployment depth 0 cm	
Test lane Top soil		Rate of compaction 83 %	Water content
Clearing depth 25-30 cm	Time/25 m 4.59	⇒	Clearing speed 326 m/h

	AP blast PMA2	AP bounce PROM1	AP frag PMR2A	AT blast TMM1
Deployed:	50	N/A	N/A	N/A
Triggered (detonated)	47			
Mechanically Neutralised	2			
Live Damaged:	1			
Live:				
Total:	50			

Comments:

One mine was left intact with fuze, but the fuze was damaged sufficiently that the mine would not function normally. This is not considered neutralized since the fuze is still in contact with the explosive charge and might be able to function under abnormal loading conditions.
Two fuzes with uperside of the mine case. All fuzes were in function after test.

SWEDISH ARMED FORCES

SWEDISH EOD AND DEMINING
CENTRE

Date
12 June 2008

Annex A

Page 9 (10)

TEST PROTOCOL

Manufacturer DOK ING		Machine type MV 10	
Date 2008-05-06	Weather Sunny	Temperature 18 °C	
Test number 1:2		Deployment depth 10 cm	
Test lane Top soil		Rate of compaction 84 %	Water content
Clearing depth 25 cm	Time/25 m 4.32	→	Clearing speed 347 m/h

	AP blast PMA2	AP bounce PROM1	AP frag PMR2A	AT blast TMM1
Deployed:	50	N/A	N/A	N/A
Triggered (detonated)	43			
Mechanically neutralized	2			
Live Damaged:				
Live:	5			
Total:	50			

Comments:

Two fuzes with the upperside of the mine case. All fuzes were in function after test.
Five mines was left live, intact and fully functional.

SWEDISH ARMED FORCES

SWEDISH EOD AND DEMINING
CENTRE

Date
12 June 2008

Annex A

Page10(10)

TEST PROTOCOL

Manufacturer DOK ING		Machine type MV 10	
Date 2008-05-07	Weather Sunny	Temperature 18 °C	
Test number 1:3		Deployment depth 15 cm	
Test lane Top soil		Rate of compaction 84 %	Water content 2.061
Clearing depth 30 cm	Time/25 m 6.20	→	Clearing speed 241 m/h

	AP blast PMA2	AP bounce PROM1	AP frag PMR2A	AT blast TMM1
Deployed:	50	N/A	N/A	N/A
Triggered (detonated)	48			
Mechanically neutralised	1			
Live Damaged:				
Live:	1			
Total:	50			

Comments:

One fuze .
The fuze were in function after test
One mine was left live, intact and fully functional.