

Performance test of Demining machines performed by SWEDEC (Swedish EOD and Demining Centre).

The following report on performance test of demining machines are from tests performed by SWEDEC (Swedish EOD and Demining Centre), an independent body within the Swedish Armed Forces.

NOTE: The reports are translated into english by Scandinavian Demining Group AB (SDG) and SDG make a reservation for the content and translation and refer to SWEDEC for questions around the content of the report.

The aim of the tests was to test different mine clearing systems under the same repeatable conditions. The tests aimed and verify the capability of commercial available systems and therefore, three different kind of systems were hired, a Double flail system – Scanjack 3500- a Single flail system – Hydrema MCV910 – a tiller system – Bofors Mine Guzzler. These three were picked as significant for its respective category.



Below follow a short summary of these reports, performed year 2001. In appendix 1-3 the full reports will be found.

The general description of test methods are the same for all machines and are in line with test procedures described in the proposed CEN-standard.

General

Description of test method

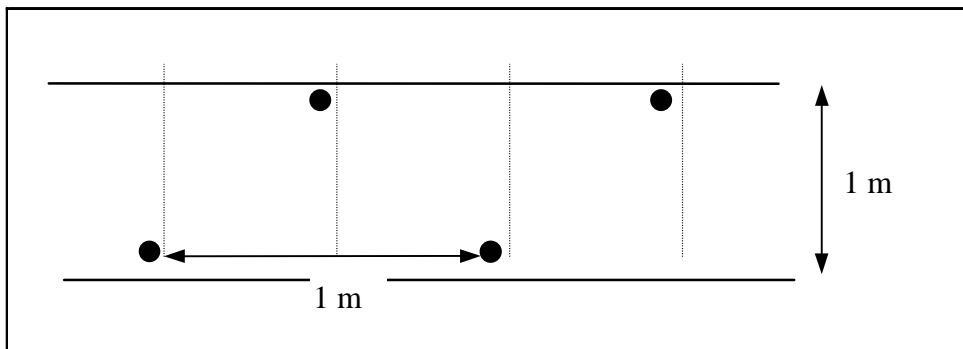
During the probability test, test objects similar to antipersonnel mine (PMA 2) and antitank mine (TMM 1) are used. The test objects are provided with **live mine igniters**.

The test is carried out on the following soil types:

- Arable ground track 1 degree of compaction: approx. 85% of max.
- Sand track 2 degree of compaction: approx. 90% of max.
- Pit run track 3 degree of compaction: approx. 94% of max.

Test mines with live igniters from antipersonnel mine m/49B or mine igniters m/47 are used to indicate whether the mine is active or detonates. The test objects are provided with a metal plate so as to verify the status of the mine after the clearing.

1. Present track is cleared with regard to electrically conducting material (no deflection on the mine detector).
2. The mines are laid out at 1 m distance and with varying depths of 0 cm, 10 cm and 20 cm and they are also armoured. See sketch/photo.



3. The machine clears the lane. The manufacturer himself operates the machine and selects the speed, clearance depth etc. so as to achieve the best results. The test-leader observes and records the number of detonations as well as the time for 50 m clearing.
4. The test-leader/helper locates the remains of cleared mine objects and render safe the unexploded fuses.
5. Evaluation according to the following aspects:
 - destroyed, separated and damaged are considered as cleared.
 - missing mine/mine object is considered as cleared as it is unlikely that an entire mine object is left behind after locating using mine detector.

Assessment of clearance result is done as below:

-destroyed (only the plate found or separated mine object with <50% of the Explosive remaining).



Example of destroyed mine

-unaffected (the mine object still in working condition after clearing)



Example of unaffected mine

-separated (>50% explosive remaining, igniters detached)



Example of separated mine

-damaged (reduced functioning of mine or igniters)



Example of damaged mines

6. Evaluation whether the machine is affected by the soil condition.
7. Preparation as well as repacking of respective tracks up to degree of compaction as given above.

Time required for each execution for 100 nos. AP as well as 10 AT is approx. 1 day.

The procedure requires 300 AP-mines and 30 AT-mines in each soil type. The machine clears the lane at one time (single passage).

Equipment used during the test, peripheral equipment:

Test objects AT/AP

Mine igniter's m/49B

Mine igniter's m/47

Break triggers m/49 with pressure star

Metal detector/mine detector (Vallon/Schiebel)

Earth borer/spade

Aggregate exposure equipment

Equipment to destroy unexploded ammunition.

Personal protective gear

In order to restore the tracks, the following are required in addition:

-Wheelloader

-Tow-roller with vibro function with tow-carriage

-Isotope meter for determination of degree of compaction

-Test was carried out with three teeth plough designed to find mines below detectable depth.

Scanjack 3500

Summary (for the full clearance probability test)

Clearance probability test was carried out with 800 AP-mine objects as well as 80 AT-mine objects.

Test 1:3 not carried out due to the weather conditions. Rain and bad weather have made the water level in the ground to exceed top level (>19% water contents).

The results were as given below (based on 3.4). The machine:

- left **1,9 %** of the laid **AP-mines unaffected** (15/800).
- left **0 %** of the laid **AT-mines unaffected** (0/80).
- Destroyed, damaged or separated **98,1%** of the laid **AP-mines** if the missing mine objects are considered as destroyed.
- destroyed, damaged or separated **100%** of the laid **AT-mines**

	AP	%	AT	%
Number laid:	800		80	
Destroyed:	729	91,1	80	100
Unaffected:	15	1,9	0	0
Separated:	37	4,6	0	
Damaged:	19	2,4	0	
Sum:	800		80	
Detonations	559		79	

Hydrema 910 MCV

Summary (for the full clearance probability test)

Clearance probability test was carried out with 900 AP-mine objects as well as 90 AT-mine objects.

The results were as given below (based on 3.4). The machine:

- left **8.2 %** of the laid **AP-mines unaffected**. (74//900)
- left **1.1 %** of the laid **AT-mines unaffected**. (1/90)
- destroyed, damaged or separated **91.8 %** of the laid **AP-mines** if the missing mine objects are considered as destroyed.
- destroyed, damaged or separated **98.9 %** of the laid **AT-mines**

	AP	%	AT	%
Number laid:	900		90	
Destroyed:	767	85.2	89	98.9
Unaffected:	74	8.2	1	1.1
Separated:	37	4.1	0	
Damaged:	22	2.4	0	
Sum:	900		90	
Detonations	639		86	

Bofors Mineguzzler

Summary (for the full clearance probability test)

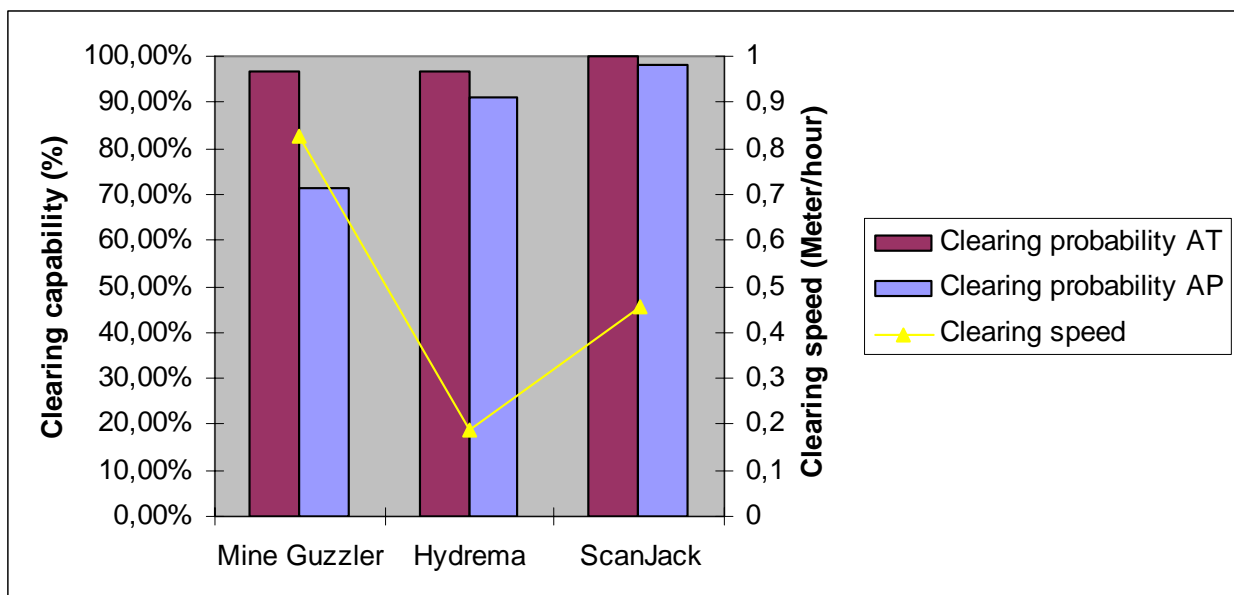
Clearance probability test was carried out with 900 AP-mine objects as well as 90 AT-mine objects.

The results were as given below (based on 3.4). The machine:

- Left **28,4 %** of the laid **AP-mines unaffected**. (256/900)
- left **1.1 %** of the laid **AT-mines unaffected**. (1/90)
- destroyed, damaged or separated **71,6 %** of the laid **AP-mines** if the missing mine objects are considered as destroyed.
- destroyed, damaged or separated **98,9 %** of the laid **AT-mines**

	AP	%	AT	%
Number laid:	900		90	
Destroyed:	560	62,2	89	98,9
Unaffected:	256	28,4	1	1,1
Separated:	65	7,2	0	
Damaged:	19	2,1	0	
Sum:	900		90	
Detonations	512			

Summary of all three tested systems



BOFORS MINEGUZZLER

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Clearance probability test

General

Description of test method

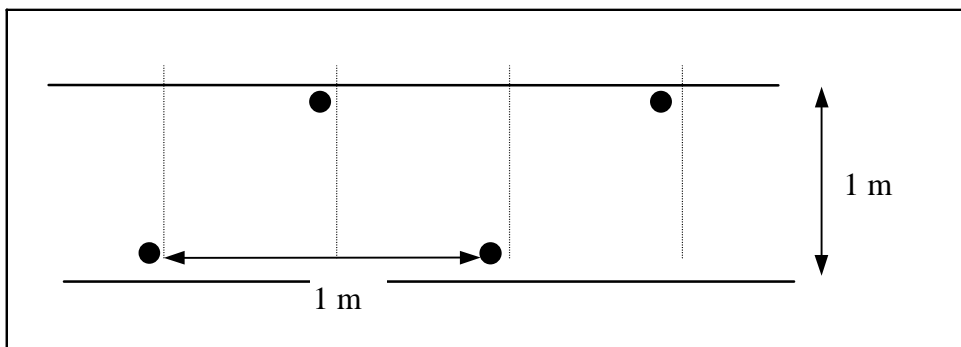
During the probability test, test objects similar to antipersonnel mine (PMA 2) and antitank mine (TMM 1) are used. The test objects are provided with live mine igniters.

The test is carried out on the following soil types:

- Arable ground track 1 degree of compaction: approx. 85% of max.
- Sand track 2 degree of compaction: approx. 90% of max.
- Pit run track 3 degree of compaction: approx. 94% of max.

Test mines with live igniters from antipersonnel mine m/49B or mine igniter m/47 are used to indicate whether the mine is active or detonates. The test objects are provided with a metal plate so as to verify the status of the mine after the clearing.

1. Present track is cleared with regard to electrically conducting material (no deflection on the mine detector).
2. The mines are laid out at 1 m distance and with varying depths of 0 cm, 10 cm and 20 cm



and they are also armoured. See sketch/photo.



3. The machine clears up laid mines. The manufacturer himself operates the machine and selects the speed, clearance depth etc. so as to achieve the best results. Testing person/clearing person observes and records the number of detonations as well as the time for 50 m clearing.
4. Testing person/clearing person locates the remains of cleared mine objects and defuses the unexploded ammunition.
5. Evaluation according to the following aspects:
 - destroyed, separated and damaged are considered as cleared.
 - missing mine/mine object is considered as cleared as it is unlikely that an entire mine object is left behind after locating using mine detector.

Assessment of clearance result is done as below:

-destroyed (only the plate found or separated mine object with <50% of the explosive remaining).



-unaffected (the mine object still in working condition after clearing)



-separated (>50% explosive remaining, igniter detached)



-damaged (reduced functioning of mine or igniter)



6. Evaluation whether the machine is affected by the soil condition.
7. Preparation as well as repacking of respective tracks up to degree of compaction as given above.

Time required for each execution for 100 nos. AP as well as 10 AT is approx. 1 day

The procedure requires 300 AP-mines and 30 AT-mines in each soil type. The machine clears up laid mining at one time (single passage).

Equipment used during the test, peripheral equipment:

Test objects AT/AP
Mine igniter m/49B
Mine igniter m/47
Break trigger m/49 with pressure star
Metal detector/mine detector (Vallon/Schiebel)
Earth borer/spade
Aggregate exposure equipment
Equipment to destroy unexploded ammunition.
Personal protective gear

In order to restore the tracks, following are required in addition:

- Wheel-mounted loader
- Tow-roller with vibro function with tow-carriage
- Isotope meter for determination of degree of compaction
- Test was carried out with three teeth plough designed to find mines below detectable depth.

Date:

The test was carried out between 06-08-2001 and 17-08-2001.

ID number of the machine:

Bofors Mineguzzler

Summary (for the full clearance probability test)

Clearance probability test was carried out with 900 AP-mine objects as well as 90 AT-mine objects.

The results were as given below (based on 3.4). The machine:

- Left **28,4 %** of the laid **AP-mines unaffected**. (256/900)

- left **1.1 %** of the laid **AT-mines unaffected**. (1/90)
- destroyed, damaged or separated **71,6 %** of the laid **AP-mines** if the missing mine objects are considered as destroyed.
- destroyed, damaged or separated **98,9 %** of the laid **AT-mines**

	AP	%	AT	%
Number laid:	900		90	
Destroyed:	560	62,2	89	98,9
Unaffected:	256	28,4	1	1,1
Separated:	65	7,2	0	
Damaged:	19	2,1	0	
Sum:	900		90	
Detonations	512			

Clearance probability test

Testing persons:

Mj G Danielsson DAN
Lt L Ribbefors RIB

from Testing dept. Ing 2
from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts for restoration as well as preparation of tracks from Testing dept. Ing 2

Drivers of deep-mine clearing vehicle:

Bengt Karlén
Torbjörn Nilsson

from Bofors
from Bofors

Clearance test 1:1

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date 2001-06-14	Weather conditions Cloudy	Temperature 15 deg
--------------------	------------------------------	-----------------------

Test number/description/laid depth 1:1 Probability	0 cm
-------------------------------------------------------	------

Structure Arable ground	Degree of compaction 86,72	Water content 14,833
----------------------------	-------------------------------	-------------------------

Clearance depth 30 cm	Clearance time/50m 3.59.87	⇒	Clearance speed 750 m/h
--------------------------	-------------------------------	---	----------------------------

	AP	AT	
Number laid:	100	10	
Destroyed:	65	**10	62 plates found
Unaffected:	21		
Separated:	11		
Damaged:	3		
Sum:	100		
Detonations	57	10	audible

Remark:

** One igniter did not detonate. All explosive substance was spread out.

One damaged mine was found, in full view proximally a meter to the left of the machined path.

Missing igniters. AP: 97 % of igniters found (number of detonations + number unaffected + number damaged + number of loose igniters)

No missing igniters AT:100% of igniters found

Three mines were not found. Counted as destroyed.

Comment:

- The AT test was accomplished 2001-06-07 (test 3:3) for that reason that AT test mines were not available in the earlier test.

** Cover damaged, yet still full functional. (see picture)



Clearance test 1:2

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date 2001-06-06	Weather conditions Scattered clouds	Temperature 13 deg
--------------------	----------------------------------------	-----------------------

Test number/description/laid depth 1:2 Probability	10 cm
-------------------------------------------------------	-------

Structure Arable ground	Degree of compaction 86,045	Water content 13,512
----------------------------	--------------------------------	-------------------------

Clearance depth 30 cm	Clearance time/50m 4.13.35	⇒	Clearance speed 710 m/h
--------------------------	-------------------------------	---	----------------------------

	AP	AT	
Number laid:	100	10	
Destroyed:	85	10	76 plates found
Unaffected:	12		
Separated:	2		
Damaged:	1		
Sum:	100		
Detonations	83	10	

Remark:

A loose igniter found

Missing igniters. AP: 97 % of igniters found (number of detonations + loose igniter + unaffected + damaged)

No missing igniters. AT: 100% of igniters found

Missing 3 nos. are considered as destroyed

Clearance test 1:3

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date 2001-06-12	Weather conditions Scattered clouds	Temperaturee 12 deg
--------------------	----------------------------------------	------------------------

Test number/description/laid depth 1:3 Probability	20 cm
-------------------------------------------------------	-------

Structure Arable ground	Degree of compaction 86,72	Water content 14,833
----------------------------	-------------------------------	-------------------------

Clearance depth 30 cm	Clearance time/50m 2.43.12	Clearance speed 1103 m/h
--------------------------	-------------------------------	-----------------------------

	AP	AT	
Number laid:	100	10	
Destroyed:	53	10	45 plates found
Unaffected:	28		
Separated:	14		
Damaged:	5		
Sum:	100	10	
Detonations	29		

Remark:

No side spread

11 nos. of igniters broken off. Were found loose on the track, of which 2 nos. remained in mine object

Missing igniters. AP: 92 % of igniters found (number of plates + unaffected + separated + damaged)

No missing igniters. AT: 100% of igniters found

Missing 8 nos. are considered as destroyed

Reported clearance depth was questioned. DAN experienced that the machine cleared shallower than usual. (is possibly due to the unevenness in the track structure and poorly adjusted deep attitude)

Clearance test 2:1

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date 2001-05-30	Weather conditions Scattered clouds	Temperature 12 deg
--------------------	----------------------------------------	-----------------------

Test number/description/laid depth 2:1 Probability	0 cm
-------------------------------------------------------	------

Structure Sand	Degree of compaction 88,42	Water content 10,403
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Clearance depth 30 cm	Clearance time/50m 3.59.60	Clearance speed 750 m/h
--------------------------	-------------------------------	----------------------------

	AP	AT	
Number laid:	100	10	
Destroyed:	51	10	42 plates found
Unaffected:	37		
Separated:	10		
Damaged:	2		
Sum:	100	10	
Detonations	51		

Remark:

Two unaffected mine objects found, clearly visible at the side around the cleared track (10 cm and 2.5 m)

The AT test carried out on 07-06-2001 because the armoured test tank mine 1 was not available at the earlier test time.

The degree of compaction for the test was low due to high water content

Missing igniters AP: 91 % of igniters found (number of plates + unaffected + separated + damaged)

No missing igniters AT: 100% of igniters found.

Missing 9 nos. are considered as destroyed

Clearance test 2:2

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date 2001-06-01	Weather conditions Scattered clouds	Temperature 15 deg
--------------------	----------------------------------------	-----------------------

Test number/description/laid depth 2:2 Probability	10 C m
-------------------------------------------------------	-----------

Structure Sand	Degree of compaction 91,911	Water content 6,043
-------------------	--------------------------------	------------------------

Clearance depth 30 cm	Clearance time/50m 4.12.33	Clearance speed 713 m/h
--------------------------	-------------------------------	----------------------------

	AP	AT	
Number laid:	100	10	
Destroyed:	73	**10	90 plates found
Unaffected:	23		
Separated:	3		
Damaged:	1		
Sum:	100	10	
Detonations	68		

Remark:

9 nos. of loose igniters found

****Base of the mine severed, the explosives discharged. The igniter was not triggered.**

Missing igniters. AP: 99 % of igniters found (number of plates + unaffected + separated + damaged)

No missing igniters. AT: 100% of igniters found

Missing 1 no. is considered as destroyed

Clearance test 2:3

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date 2001-06-07	Weather conditions Scattered clouds	Temperature 12 deg
--------------------	----------------------------------------	-----------------------

Test number/description/laid depth 2:3 Probability	20 cm
-------------------------------------------------------	-------

Structure Sand	Degree of compaction 91,017	Water content 3,729
-------------------	--------------------------------	------------------------

Clearance depth 30 cm	Clearance time/50m 5.04.51	Clearance speed 591 m/h
--------------------------	-------------------------------	----------------------------

	AP	AT	
Number laid:	100	10	
Destroyed:	62	10	62 plates found
Unaffected:	32		
Separated:	5		
Damaged:	1		
Sum:	100	10	

Detonations

Remark:

Nine loose igniters found

Missing igniters.AP: 100 % of igniters found (number of plates + unaffected + separated + damaged)

No missing igniters.AT: 100% of igniters found

Clearance test 3:1

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date 2001-05-29	Weather conditions Rain	Temperature 6 deg
--------------------	----------------------------	----------------------

Test number/description/laid depth 3:1 Probability	0 cm
-------------------------------------------------------	------

Structure Pit run	Degree of compaction 92,04	Water content Not measured
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Clearance depth 30 cm	Clearance time/50m 5.30.60	Clearance speed 544 m/h
--------------------------	-------------------------------	----------------------------

	AP	AT	
Number laid:	<input type="text" value="100"/>	<input type="text" value="10"/>	
Destroyed:	<input type="text" value="52"/>	<input type="text" value="9"/>	47 plates found
Unaffected:	<input type="text" value="35"/>	<input type="text" value="**1"/>	
Separated:	<input type="text" value="11"/>	<input type="text"/>	
Damaged:	<input type="text" value="2"/>	<input type="text"/>	
Sum:	<input type="text" value="100"/>	<input type="text" value="10"/>	

Detonations

51

Remark:

Missing igniters. AP: 95 % of igniters found (number of plates + unaffected + separated + damaged)

No missing igniters. AT: 100% of igniters found

Missing 5 nos. are considered as destroyed

Clearance test 3:2

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date 2001-05-29	Weather conditions Scattered clouds	Temperature 12 deg
--------------------	----------------------------------------	-----------------------

Test number/description/laid depth 3:2 Probability	10 cm
-------------------------------------------------------	-------

Structure Sand	Degree of compaction 96,29	Water content 5,299
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Clearance depth 30 cm	Clearance time/50m 2.41.07	Clearance speed 1117 m/h
--------------------------	-------------------------------	-----------------------------

	AP	AT	
Number laid:	100	10	
Destroyed:	56	10	53 plates found
Unaffected:	37		
Separated:	6		
Damaged:	1		
Sum:	100	10	
Detonations	54		

Remark:

Missing igniters.AP: 97 % of igniters found (number of plates + unaffected + separated + damaged)

No missing igniters.AT:100% of igniters found

Missing 3 nos. are considered as destroyed

Clearance test 3:3

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date 2001-06-05	Weather conditions Scattered clouds	Temperature 15 deg
--------------------	----------------------------------------	-----------------------

Test number/description/laid depth 3:3 Probability	20 cm
-------------------------------------------------------	-------

Structure Pit run	Degree of compaction 98,844	Water content 3,971
----------------------	--------------------------------	------------------------

Clearance depth 30 cm	Clearance time/50m 2.35.98	Clearance speed 1153 m/h
--------------------------	-------------------------------	-----------------------------

	AP	AT	
Number laid:	100	10	
Destroyed:	63	10	65 plates found
Unaffected:	31		
Separated:	3		
Damaged:	3		
Sum:	100	10	
Detonations	62		

Remark:

More (102) destroyed mine objects found than the ones laid. The machine lifted loose plates from earlier actions up to detectable depth

Missing igniters.AP: 102 % of igniters found (number of plates + unaffected + separated + damaged)

No missing igniters.AT:100% of igniters found

Operation

No disturbance in function was reported. The machine has been available in every insisted occasion to accomplish these tests.

Action on the machine

The machine has not shown an unexpected high degree of tear or in other way been negative effected by machining the soil in these tracks.

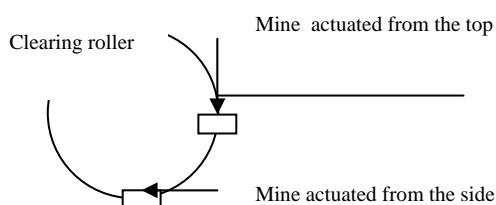
Discussion of results

Analyses have been carried out for the purpose to identifying possible relationship between, e.g.

- Clearance speed and clearance result.
- The mine's depth of displacement and clearance result.
- The structure of the track and clearance result.
- Side spread and deep placement of mines.
- Damaged/separated mines and deep placement of mines.

At present we can not find any relationship. However the clearance result was slightly better in the soil track than the other tow.

Damaged mines are related to the depth of displacement.



The sketch shows the theoretics, which explains why the number of damaged mines increases with increased laid depth

- The soil track proved a larger number of lost mines: hard to find missing mines when the degree of compaction was high in caterpillar treads behind the vehicle together with disturbance.
- The tests in the soil track sown a better total clearance result. Assumable because soil support the mine in a higher range which produce a higher pressure against the aggregate. Clearance test 3.2 sown only 12 mines unaffected. That trend should have been strengthened in test 3.3. During that test (DAN) opinion was that the clearance depth was less than 30 cm. The driver insisted he had programmed a clearance depth of 30 cm. The result of the test 3.3 was 28 unaffected mines.

Conclusions

No obvious relations are found way conclusions can not be made yet.

The testing person's observations

The machine gives a solid impression. All manoeuvres appear smooth and easy. The engine has worked at an even and calm level. The engine seems to be well dimensioned since the vehicle has not sown more overloading sounds or jerks than what could be expected. The transmission works without problem and the machine is manoeuvrable on small spaces obstinacy its size. The clearing devise has worked well and has not been overloaded. The depth sense system has worked satisfying. It should be mentioned that the skis (for the depth sense system) was shifted before clearance in vegetation. Only normal maintenance has been necessary. No extra preparation has been necessary. The vehicle has been available one every time on our request. (DAN)

Compilation of results of clearance probability test

The compilation shows complete results of respective track structure. Each one of the three performances of track structure at a depth of 0-20 cm is indicated in a test report.

In the paragraph 1.8.4, all the performances are presented in a report (900 AP as well as 90 AT).

Synthesis Pit run track 3

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date	Weather conditions	Temperature
------	--------------------	-------------

Test number/description/laid depth Probability Pit run	0-20 cm
-----------------------------------------------------------	---------

Structure Pit run	Degree of compaction 95% Average	Water content 4,6 % Average
----------------------	-------------------------------------	--------------------------------

Clearance depth 30 cm	Clearance time/50m	⇒	Clearance speed Average 940 m/h
--------------------------	--------------------	---	------------------------------------

	AP	AT
Number laid:	300	30
Destroyed:	171	29
Unaffected:	103	1
Separated:	20	0
Damaged:	6	0
Sum:	300	30
Detonations	168	

Remark:

6 nos. of mine objects missing after the test was carried out. These are considered as destroyed.

Synthesis Sand track 2

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date	Weather conditions	Temperature
------	--------------------	-------------

Test number/description/laid depth Probability Sand track	0-20 cm
--------------------------------------------------------------	---------

Structure Sand	Degree of compaction 90 % Average	Water content Average 6,7 % Average
-------------------	--------------------------------------	----------------------------------------

Clearance depth 30 cm	Clearance time/50m	⇒	Clearance speed Average 685 m/h
--------------------------	--------------------	---	------------------------------------

	AP	AT
Number laid:	300	30
Destroyed:	186	*30
Unaffected:	92	0
Separated:	18	0
Damaged:	4	0
Sum:	300	30
Detonations	175	

Remark:

- 10 mine objects missing after the test was carried out. These are considered as destroyed
- * One igniter was not triggered. The mine was devoid of explosives.

Synthesis Arable ground track 1

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date	Weather conditions	Temperature
------	--------------------	-------------

Test number/description/laid depth Probability Arable ground	0-20 cm
-----------------------------------------------------------------	---------

Structure Arable ground	Degree of compaction 86 % Average	Water content 14,4 % Average
----------------------------	--------------------------------------	---------------------------------

Clearance depth 30 cm	Clearance time/50m	⇒	Clearance speed 854 Average m/h
--------------------------	--------------------	---	------------------------------------

	AP	AT
Number laid:	300	30
Destroyed:	203	*30
Unaffected:	61	0
Separated:	27	0
Damaged:	9	0
Sum:	300	30
Detonations	169	

Remark:

- * The mine object destroyed. The igniter was not triggered
- 14 mine objects missing after the test was carried out. These are considered as destroyed.

Overall compilation of clearance probability track 1-3

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type
Mineguzzler

Manufacturer
Bofors

Date	Weather conditions	Temperature Deg
------	--------------------	--------------------

Test number/description/laid depth Probability TOTAL	0-20 cm
---------------------------------------------------------	---------

Structure	Degree of compaction	Water content
-----------	----------------------	---------------

Clearance depth 30 cm	Clearance time/50m	⇒	Clearance speed ca 826 Average m/h
--------------------------	--------------------	---	---------------------------------------

	AP	AT
Number laid:	900	90
Destroyed:	560	89
Unaffected:	256	1
Separated:	65	0
Damaged:	19	0
Sum:	900	90
Detonations	512	

Remark:

Clearing performance in vegetation

General info

The test was carried out with live fuse material only in the AT-mines.

Equipment used during the test, peripheral equipment.

Test objects AT/AP
Mine igniter m/47
Break trigger m/49 with pressure star
Earth borer/spade
Metal detector/mine detector (Vallon/Schiebel)
Aggregate exposure equipment
Equipment to destroy unexploded ammunition.
Personal protective gear
IST detectors as well as ID-chips

Testing persons:

Mj G Danielsson from Testing dept. Ing 2
Lt L Ribbefors from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts from Testing dept. Ing 2

Drivers of deep-mine clearing vehicle:

Bengt Karlén form Bofors
Torbjörn Nilsson form Bofors

Time required:

The test lasted two days

Any modifications/changes for deep-mine clearance from trial start date:

Special skis adapted for depth- control were mounted while operating in vegetation.

Description of the testing range

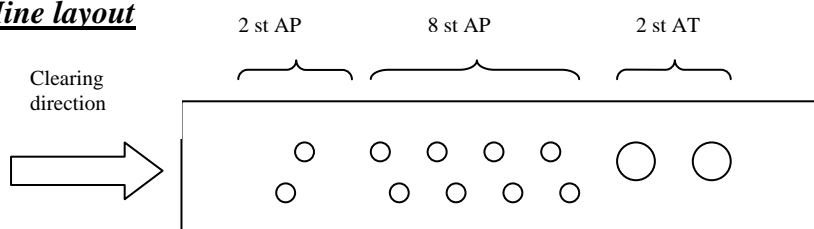
The ground and terrain conditions, sketch/photo.



The figure shows the location of testing before vegetation clearing

The test section was 20 m long and contained impenetrable vegetation < 10 cm.
Two trees >10 cm were cut before the test

Mine layout



Summary



The figure shows cleared range after an action

The vehicle machined the ground efficiently. No uncleared zones could be observed after the test. After an action, the ground was cleared properly before manual clearers took over since long earth-bound branches and knots can possibly trigger the left behind mine objects.

Results of clearing performance in vegetation

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date 2001-06-18	Weather conditions Cloudy	Temperature 12 gr
--------------------	------------------------------	----------------------

Test number/description/laid depth Clearance in vegetation	10 cm
---------------------------------------------------------------	-------

Structure Pit run with vegetation <10 cm	Degree of compaction	Water content
---------------------------------------------	----------------------	---------------

Clearance depth 20 cm	Röjtid/20m 2.49.15	⇒	Clearance speed 426 m/h
--------------------------	-----------------------	---	----------------------------

	AP	AT
Number laid:	10	2
Destroyed:	10	2
Unaffected:		
Separated:		
Damaged:	**	
Sum:	10	2
Detonations	9	1 Audible

Remark:

- ** 1 no. of completely functioning loose igniter found in cleared track
- The mine objects provided with ID-chips
- Ground tracking without any problem. Still a replacement of other skids was made for deep attitude. (see photo)



Operation

No disturbance in function was reported. The machine has been available in every insisted occasion to accomplish these tests.

Effect on the machine

The machine has not shown an unexpected high degree of tear or in other way been negative effected by machining the ground.

Discussion of results

Conclusions

- The vehicle machines the bed well. The function of the ground guide system works without criticism. No missed zone was detected.
- Vegetation mixed with unsorted material seams to have a positive effect on the clearance result.

The testing person's observations

It is extremely time-consuming to find mines or fragment of mines in the ground behind the vehicle since the area is normally used as a military training area. There is plenty of conductive material on and in the ground which disturbs the search. The mines have been set with an ID-chip to facilitate the search. Yet possible loose undamaged lighter had to be found. (DAN)

When the schedule for the tests is under pressure can timesaving be made by accomplishing all tests outside a military training area but than without live igniters. (DAN)

Clearing performance at different sloping conditions

General

The test was carried out with live igniters in both AP- and AT-mines.

The test was carried out beyond the test track in unprepared terrain. The 10% and 20% sloping condition is determined with measuring tape, pegs and sight rods.

The test was carried out on 2001-06-13 and 2001-06-15

Clearing in 10% side slope

General info

Equipment used during the test, peripheral equipment.

Test objects AT/AP
Mine igniter m/49B
Mine igniter m/47
Break trigger m/49 with pressure star
Earth borer/spade
Metal detector/mine detector
Aggregate exposure equipment
Equipment to destroy unexploded ammunition.
Personal protective gear
IST detector as well as ID-chips

Testing persons:

Mj G Danielsson from Testing dept. Ing 2
Lt L Ribbefors from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts from Testing dept. Ing 2 for restoration as well as preparation of tracks

Drivers of deep-mine clearing vehicle:

Bengt Karlén from Bofors
Torbjörn Nilsson from Bofors

Time taken for each activity e.g. preparation of track, clearing, searching:

The test lasts 2 days with upward slope

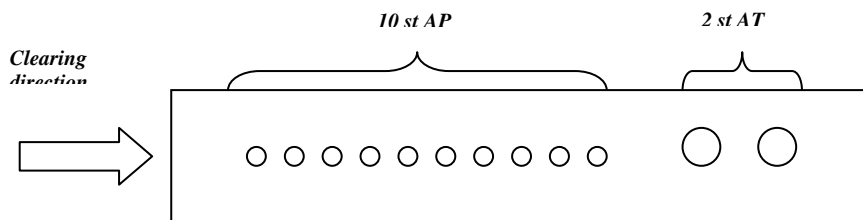
Description of the testing range

The ground and terrain conditions, sketch/photo.

- 10 % sloping condition
- Grassy grazing ground



Mine layout



The mine objects provided with ID-chips



The picture shows laid AP mine



The picture shows laid AT mine

Results for the 10% side slope case

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date 2001-06-13	Weather conditions Sunny	Temperature 17 deg
--------------------	-----------------------------	-----------------------

Test number/description/laid depth 10 % side sloping field	10 cm
---------------------------------------------------------------	-------

Structure Running wild field	Degree of compaction	Water content
---------------------------------	----------------------	---------------

Clearance depth 30 cm	Röjtid/25m 1.23.66	⇒	Clearance speed 1076 m/h
--------------------------	-----------------------	---	-----------------------------

	AP	AT
Number laid:	<input type="text" value="10"/>	<input type="text" value="2"/>
Destroyed:	<input type="text" value="5"/>	<input type="text" value="2"/>
Unaffected:	<input type="text" value="3"/>	<input type="text"/>
Separated:	<input type="text" value="1"/>	<input type="text"/>
Damaged:	<input type="text" value="1"/>	<input type="text"/>
Sum:	<input type="text" value="10"/>	<input type="text"/>
Detonations	<input type="text" value="5"/>	<input type="text" value="2"/>

Remark:

- Ground tracking of clearing unit without any problem
- 10 nos. of AP laid with 1 m spacing provided with ID-chips. 2 nos. of AT laid after the AP objects. 1 m between the mine objects.

Operation

No operational problems to report. The machine was completely functional at the time of the required operations.

Effect on the machine

The machine did not show any abnormal wear nor was affected adversely by the preparation of the soil in any other manner.

Discussion of results

Conclusions

10 % side slope does not limit the clearing performance of the machine.

Observations of the testing person on 10% side slope

The vehicle machines the ground efficient. Processed material is disintegrated which is seen as favourable to clear up with, for example, following manual methods.

It is extremely time-consuming to search for mine objects and mine parts in the terrain, since the terrain is used as a training area. There are a number of electrically conducting materials which hamper the search. In order to facilitate searching, the mine objects have been provided with ID-chips. Still any loose intact igniters must be retrieved. (DAN)

As the test requires lot of time, a time-saving measure could be to carry out all tests outside the test track without live igniter (DAN)

Clearing in 20% downward slope

General info

Equipment used during the test, peripheral equipment.

Test objects AT/AP
Mine igniter m/49B
Mine igniter m/47
Break triggers m/49 with pressure star
Earth borer/spade
Metal detector/mine detector
Aggregate exposure equipment
Equipment to destroy unexploded ammunition.
Personal protective gear
IST detector as well as ID-chips

Testing persons:

Mj G Danielsson	from Testing dept. Ing 2
Lt L Ribbefors	from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts for restoration	from Testing dept. Ing 2
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Drivers for deep-mine clearing vehicle:

Bengt Karlén	from Bofors
Torbjörn Nilsson	from Bofors

Time taken for each activity e.g. preparation of track, clearing, searching:

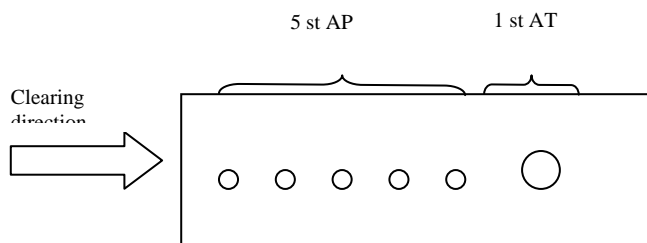
The test lasts 2 days with upward slope

Description of the testing range

The ground and terrain conditions, sketch/photo.

- Sloping conditions: 20 %.
- Bigger stones, etc. were found in the terrain where the machine was supposed to clear up.

Mine layout:



Results of 20% downward slope

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date 2001-06-15	Weather conditions Sunny	Temperature 18 gr
--------------------	-----------------------------	----------------------

Test number/description/laid depth Downward slope 20%	10 cm
----------------------------------------------------------	-------

Structure Gravel with vegetation	Degree of compaction	Water content
-------------------------------------	----------------------	---------------

Clearance depth 20 cm	Clearance time/50m 0.36.76	⇒	Clearance speed m/h
--------------------------	-------------------------------	---	------------------------

	AP	AT
Number laid:	5	1
Destroyed:	0	1
Unaffected:	5	
Separated:		
Damaged:		
Sum:	5	1
Detonations	0	1

Remark:

- The machine slid down the slope. Possibly due to ball bearing effect in cleared masses
- Problem with grip in the belt in spite of favourable conditions.(dry)
- Ground tracking without any problem.

Operation

No operational problems to report. The machine was completely functional at the time we wished to undertake the activity

Effect on the machine

A number of (4-6) teeth and their holders attached on the clearing roller were exchanged after the test was accomplished.

Conclusions

20 % downward slope definitely limits the performance of the machine. If slopes with sloping condition corresponding to 20% are required, then the other conditions must be favourable. The ground at the location of testing consists of unsorted masses of gravel with both big and small earth-bound stones.

Observations of the testing person on 20% downward slope

The driver reversed up the slope in order to come into position for the following clearing.

The machine slid in some places down the slope while clearing and the driver could not change either the speed or the direction. The reason was considered to be the so-called ball bearing effect as machine drove into the clearing masses.

It is extremely time-consuming to search for mine objects and mine parts in the terrain, since the terrain is used as a training area. There are a number of electrically conducting materials which hamper the search. In order to facilitate the search the mine objects have been provided with ID-chips. Still any loose intact igniters must be retrieved. (DAN)

As the test requires a lot of time, a time-saving measure can be to carry out all tests outside the test track without live igniter (DAN)

Clearing in 20% upward slope

General info

Equipment used during the test, peripheral equipment.

Test objects AT/AP
Mine igniter m/49B
Mine igniter m/47
Break trigger m/49 with pressure star
Earth borer/spade
Metal detector/mine detector (Vallon/Schiebel)
Aggregate exposure equipment
Equipment to destroy unexploded ammunition
Personal protective gear
IST detector as well as ID-chips

Testing persons:

Mj G Danielsson from Testing dept. Ing 2
Lt L Ribbefors from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts for restoration from Testing dept. Ing 2

Drivers of deep-mine clearing vehicle:

Bengt Karlén from Bofors
Torbjörn Nilsson from Bofors

Time taken for each activity e.g. preparation of track, clearing, searching:

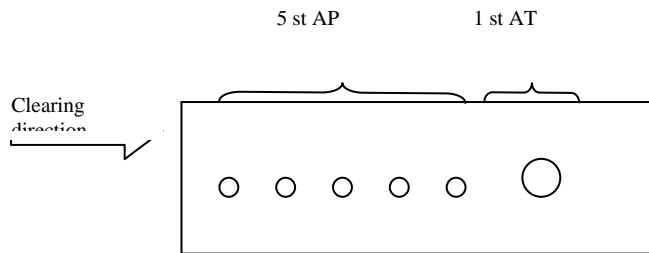
The test lasts 2 days with upward slope included.

Beskrivning av försöksområdet

The ground and terrain conditions, sketch/photo.

- Sloping conditions: 20% (above slope is >20%).
- Bigger stones, etc. were found in the terrain where the machine was supposed to clear up.

Mine layout:



Results of 20% upward slope

TEST REPORT OF DEEP-MINE CLEARANCE

Machine type Mineguzzler	Manufacturer Bofors
-----------------------------	------------------------

Date 2001-06-15	Weather conditions Sunny	Temperature 18 Deg
--------------------	-----------------------------	-----------------------

Test number/description/laid depth 20% upward slope	10 cm
--------------------------------------------------------	-------

Structure Gravel with vegetation	Degree of compaction	Water content
-------------------------------------	----------------------	---------------

Clearance depth 20 cm	Clearance time/20m 1.20.49	→	Clearance speed m/h
--------------------------	-------------------------------	---	------------------------

	AP	AT
Number laid:	<input type="text" value="5"/>	<input type="text" value="1"/>
Destroyed:	<input type="text" value="3"/>	<input type="text" value="1"/>
Unaffected:	<input type="text" value="2"/>	<input type="text"/>
Separated:	<input type="text"/>	<input type="text"/>
Damaged:	<input type="text"/>	<input type="text"/>
Sum:	<input type="text" value="5"/>	<input type="text" value="1"/>
Detonations	<input type="text" value="3"/>	<input type="text" value="1"/>

Remark:

- The machine has to plough harder on the upward slope.
- Difficult to get grip with the belt in spite of favourable conditions (dry ground).
- Ground tracking without any problem

The mines laid in a line with 1 m spacing
 The mines provided with ID-chips

Operation

No operational problems to report. The machine was completely functional at the time of the required operations.

Action on the machine

A number (4-6) of igniters and tooth holders on the left-hand side of the rollers were replaced after the test.

See Bofors report

Discussion of results

Conclusions

The machine has some limitations on this test occasion. On few occasions the belt could not get a proper grip on the ground. Yet the result proves to be comparable with the previous test with the machine.

Observations of the testing person on 20% upward slope

It is extremely time-consuming to search for mine objects and mine parts in the terrain, since the terrain is used as a training area. There are a number of electrically conducting materials which hamper the search. In order to facilitate the search, the mine objects have been provided with ID-chips. Still any loose intact igniters must be retrieved. (DAN)

As the test requires a lot of time, a time-saving measure could be to carry out all tests outside the test track without live igniter (DAN)

Manoeuvrability/navigability

General info

Equipment used during the test, peripheral equipment.

Chronograph
Measuring tape
Iron tipped oak beam 30x30 cm
Trench 1.5mx0.5m

Testing persons

Mj G Danielsson	from Testing dept. Ing 2
Lt L Ribbefors	from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts for restoration as well as preparation of tracks	from Testing dept. Ing 2
-----------------------------------------------------------------	--------------------------

Drivers of deep-mine clearing vehicle:

Bengt Karlén	from Bofors
Torbjörn Nilsson	from Bofors

Summary

See remarks of respective tests

Description of the testing range

The ground and terrain conditions, sketch/photo.



The picture shows 30x30 cm obstacle



The picture shows trench 1.5x 0.5 m



The picture shows minimum turning radius test



The picture shows reversing on cleared track



The picture shows turning on cleared track

Results of manoeuvrability/navigability during clearing

Minimum Turning radius

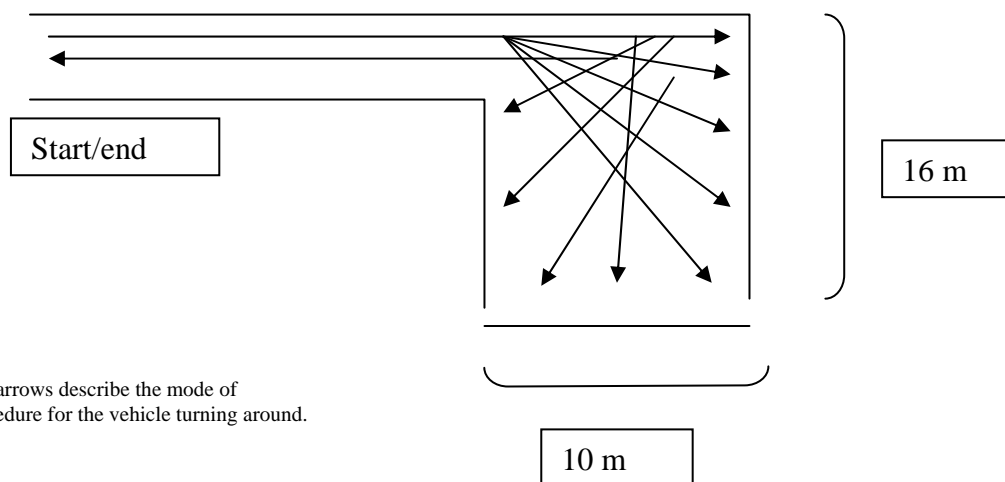
How large is the minimum turning radius of the machine while clearing with guaranteed safety for belt/wheel, m?

The turning radius was measured up to 23 m.

The clearance depth was 20 cm in the test case. The driver had to raise the unit on one occasion in order to avoid stones. This is considered not to affect the result.

Turning of the machine on cleared track

The extent of range required in order to turn the machine on cleared track, m², m, sketch/photo.



The arrows describe the mode of procedure for the vehicle turning around.

Time taken for turning on cleared track:

16 min

Clearance depth:

20 cm

Remark:

Due to the small overlap the machine has between the roller width and track width (approx. 15 cm) per side, a side shift manoeuvre becomes extremely time-consuming and dangerous. The machine easily moves outside the cleared track with either the driving wheel or leading wheel.

Results of manoeuvrability/navigability during execution of sub-series 1

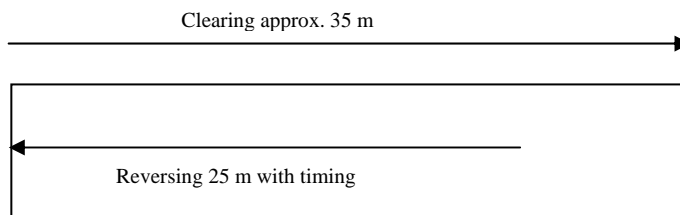
Capability to reverse on cleared track

Maximum speed with guaranteed safety, km/h.

The test was carried out twice. The machine managed to stay within 15 cm tolerance in the case of test number 2. The driver drove the machine to the right in both tests. The machine has no limitations apart from the overlapping between clearing width and track width being only 15 cm/side.

Test 1 rejected as the driver drove beyond the cleared track.

Sketch/photo: deviations from cleared track.



The machine cleared a 35 m long track. Then the machine reversed 25 m. Time for reversing manoeuvres:

- Test 1: 43.68 sec ? approx. 2 km/h
- Test 2: 44.66 sec ? approx. 2 km/h

Trench

Number of successful/unsuccessful tests to cross the trench, nos..

The machine cleared the obstacle in the first attempt both forward as well as backward

Sketch/photo: description of the trench.



The picture shows forward trench stay



The picture shows backward trench stay

Obstacle

Number of successful/unsuccessful tests to overcome the obstacle, nos.

The machine cleared the obstacle in the first attempt both forward as well as backward.

Sketch/photo: description of the obstacle.



Operation

No operational problems to report. The machine was completely functional at the time we wished to undertake the activity

Effect on the machine

The machine did not show any abnormal wear nor was affected adversely by the test in any other manner.

Tabulation discussion of results manoeuvrability

Conclusions

The only restriction related to manoeuvrability during clearance operation is the overlapping between the width of cleaning roller and the width of the track for vehicle. Only 15 cm/side. This means there is a risk for some part of the caterpillars to roll over not cleared ground correlation to transportation backward or in close bends.

Transportation sideward is very time-consuming and risky. The machine easily leaves cleared ground with either driving or leading wheel.

The testing person's opinions-Manoeuvrability during clearing (the full test)

The vehicle seems easy manageable in spite of its size and weight.

Additional test: Survivability test

During the testing certain pressure and acceleration tests as well as high-speed photography were also carried out through FMV/FFK. This additional contains only the undertaking of Ing 2.

General info 5.5 kg

Equipment used during the test, peripheral equipment.

Antitank mine m/47 M4730-000011 STRVMINA 47 (5.5 kg TNT)
Mine igniter m/47
Thrust cover 310 mm.
Supplies for placement of the mine
ID-chips in order to facilitate searching

Testing persons:

Mj G Danielsson	from Testing dept. Ing 2
Lt L Ribbefors	from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts for restoration	from Testing dept. Ing 2
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Driver of deep-mine clearing vehicle:

Bengt Karlén	from Bofors
Torbjörn Nilsson (reservförare)	from Bofors

Date

The test was carried out on 2001-06-27

Description of the action

The mine was planted sideward the centre of the roller to allow two detonations without reparation had to be made between the tests. The driver drove the machine while sitting in the cabin and received orders from within the common shelter via radio. The driver himself determined the clearance speed and clearance depth in order to achieve best results. The machine cleared up approx. a stretch of 10 m before it drove over the mine. The mine was destroyed by the machine. The test was stopped and the driver reversed the machine. Vital functions such as driving the roller, lift it up, lower it or driving the whole vehicle was in full function after the test. No damage except those on the clearing devise could be verified.

The ground and terrain conditions, the nature of the tracks.

A roadbed with length 20 m, width 6 m and height 50 cm is constructed at 45 ° angles from the common shelter. This is so that the driver will be able to drive the machine from the shelter and at the same time being able to determine the speed and direction. The roadbed is made from sorted natural gravel of 0-18 mm. Compaction with 4 ton tow-roller was carried out after each 20 cm layer of piled material.

The roadbed was damp during the test.

Weather conditions

Sunny, 22 deg

Any modifications/changes made on the deep-mine clearing machine from the starting date of the test.

No reported or known modifications.

Time taken for each activity e.g. preparation of track, clearing, searching.

The test lasts 1 day excluding preparations for construction of roadbeds.

Results of blasting test 5.5 kg

Course of events

The test was carried out completely according to the description in 5.2
The blast stroke left side of the roller.

Measured forces

See FMV/FFK report

Damages to the machine

What damages were caused to the machine? Sketch/photo



The picture shows the clearing roller where the mine was detonated



The picture shows formation of cracks in attachments of clearing arm



The picture shows destroyed shark fin

- 4 nos. of tooth holders missing
- 12 nos. of bits missing
- 1 no. of shark fin missing
- 1 no. of shark fin destroyed
- Formation of cracks in weld seam for clearing arms

Discussion of results of 5.5 kg blasting test.

The damages to the roller are considered to be less after the 10 kg mine than the 5.5 kg one. The roller showed insignificant splinter damages after the 10 kg detonation whereas 5.5 kg caused significantly more. The reason is considered to be that the antitank mine 5 does not have a casing whereas the antitank mine m/47 has sheet-metal casing.

Conclusions

The machine is considered to be operative again after some deposit welding is carried out on the roller. Estimated repair time: approx. 4 hours. Alternatively it is possible to replace damaged rollers with UE (spare unit). This is not yet tested.

Observations of the testing person on 5.5 kg blasting test

The path object was dry in the test case.

Weather conditions

Sunny, temp approx. 22°

Any modifications/changes to the deep-mine clearing machine from the starting date of the test.

No modifications reported or known.

Time taken for every action, e.g., preparation of track, clearing, searching.

The test lasts 1 day excluding preparations for construction of the path object.

Results of the 10 kg blasting test

Course of events

The test was carried out completely according to the above description
The detonation was done displaced side wards on the right-hand side of the roller.

Measured forces

See FMV/FFK report

Damages to the machine

What damages were caused to the machine? Sketch/photo



The picture shows damages caused by strv 5 on the clearing roller



The picture shows damaged shark fin



The picture shows destroyed shark fin

- 5 nos. of tooth holder (of which 1 no. clearing arm) was missing
- 12 nos. of bits missing
- 1 no. of shark fin missing
- 1 no. of shark fin damaged
- The mudguard behind the roller is loose

Discussion of results of 10 kg blasting test.

The damages to the roller are considered to be less after the 10 kg mine than the 5.5 kg one. The roller showed insignificant splinter damages after the 10 kg detonation whereas 5.5 kg caused significantly more. The reason is considered to be that the antitank mine 5 does not have a casing whereas the antitank mine m/47 has sheet-metal casing.

Conclusions

The machine is considered to be in operative condition after some deposit welding is carried out on the roller. Estimated repair time: approx. 4 hours. Alternatively it is possible to replace damaged rollers with UE (spare unit). This is not yet tested.

Observations of the testing person on 10 kg blasting test



*The picture shows horizontal shock absorber
Clamp =motion reserve*



*The picture shows vertical shock absorber
Clamp =motion reserve*

The machine was experienced as very robust. One of the disadvantages is still its weight. Presumably the machine can be optimised for weight, as certain parts on it are considered as oversized. After the blasting test 2 (10 kg) it could be established that the shock absorbers moved between 10-15 mm. Consequently a much large reserve for the movement is available. An optimisation/sizing of, among other things, shock absorbers, etc. will even reduce damages to the roller, etc., and the unit will become more versatile. (DAN)

HYDREMA 910 MCV

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Clearance probability test

General

Description of test method

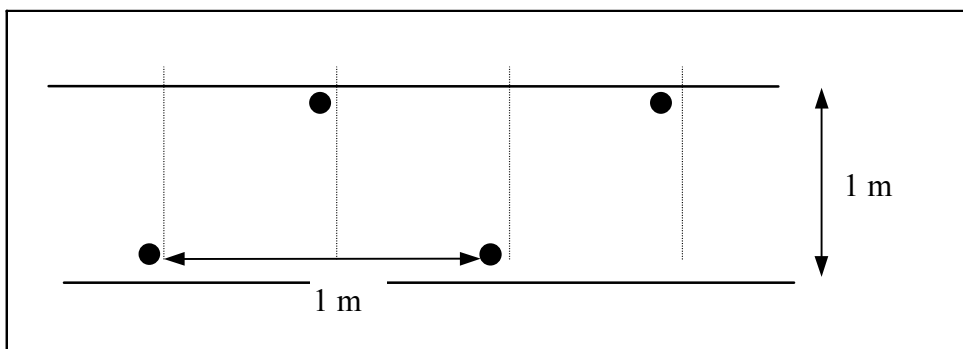
During the probability test, test objects similar to antipersonnel mine (PMA 2) and antitank mine (TMM 1) are used. The test objects are provided with live mine igniters.

The test is carried out on the following soil types:

- Arable ground track 1 degree of compaction: approx. 85% of max.
- Sand track 2 degree of compaction: approx. 90% of max.
- Pit run track 3 degree of compaction: approx. 94% of max.

Test mines with live igniters from antipersonnel mine m/49B or mine igniter m/47 are used to indicate whether the mine is active or detonates. The test objects are provided with a metal plate so as to verify the status of the mine after the clearing.

1. Present track is cleared with regard to electrically conducting material (no deflection on the mine detector).
2. The mines are laid out at 1 m distance and with varying depths of 0 cm, 10 cm and 20 cm



and they are also armoured. See sketch/photo.



3. The machine clears up laid mines. The manufacturer himself operates the machine and selects the speed, clearance depth etc. so as to achieve the best results. Testing person/clearing person observes and records the number of detonations as well as the time for 50 m clearing.
4. Testing person/clearing person locates the remains of cleared mine objects and defuses the unexploded ammunition.
5. Evaluation according to the following aspects:
 - destroyed, separated and damaged are considered as cleared.
 - missing mine/mine object is considered as cleared as it is unlikely that an entire mine object is left behind after locating using mine detector.

Assessment of clearance result is done as below:

-destroyed (only the plate found or separated mine object with <50% of the explosive remaining.



-unaffected (the mine object still in working condition after clearing)



-separated (>50% explosive remaining, igniter detached)



-damaged (reduced functioning of mine or igniter)



6. Evaluation whether the machine is affected by the soil condition.
7. Preparation as well as repacking of respective tracks up to degree of compaction as given above.

Time required for each execution for 100 nos. AP as well as 10 AT is approx. 1 day

The procedure requires 300 AP-mines and 30 AT-mines in each soil type. The machine clears up laid mining at one time (single passage).

Equipment used during the test, peripheral equipment:

Test objects AT/AP
Mine igniter m/49B
Mine igniter m/47
Break trigger m/49 with pressure star
Metal detector/mine detector (Vallon/Schiebel)
Earth borer/spade
Aggregate exposure equipment
Equipment to destroy unexploded ammunition.
Personal protective gear

In order to restore the tracks, following are required in addition:

- Wheel-mounted loader
- Tow-roller with vibro function with tow-carriage
- Isotope meter for determination of degree of compaction
- Test was carried out with three teeth plough designed to find mines below detectable depth.

Date:

The test was carried out between 06-08-2001 and 17-08-2001.

ID number of the machine:

Hydrema 910 MCV

Summary (for the full clearance probability test)

Clearance probability test was carried out with 900 AP-mine objects as well as 90 AT-mine objects.

The results were as given below (based on 3.4). The machine:

- left **8.2 %** of the laid **AP-mines unaffected**. (74//900)
- left **1.1 %** of the laid **AT-mines unaffected**. (1/90)
- destroyed, damaged or separated **91.8 %** of the laid **AP-mines** if the missing mine objects are considered as destroyed.
- destroyed, damaged or separated **98.9 %** of the laid **AT-mines**

	AP	%	AT	%
Number laid:	900		90	
Destroyed:	767	85.2	89	98.9
Unaffected:	74	8.2	1	1.1
Separated:	37	4.1	0	
Damaged:	22	2.4	0	
Sum:	900		90	
Detonations	639		86	

Clearance probability test

Testing persons:

Mj G Danielsson DAN	from Testing dept. Ing 2
Lt L Ribbefors RIB	from Testing dept. Ing 2
Kn Peter Djerf DJE	from Testing dept. Ing 2
Lt Tommy Karlsson KAR	from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts for restoration as well as preparation of tracks from Testing dept. Ing 2

Drivers of deep-mine clearing vehicle:

Jan Andersen	from Hydrema
Mikael Larsen	from Hydrema

Clearance test 1:1

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV	Manufacturer Hydrema
-------------------------	-------------------------

Date 07-08-2001	Weather conditions Cloudy with rainy intervals	Temperature 20 deg
--------------------	---------------------------------------------------	-----------------------

Test number/description/laid depth 1:1 Probability	0 cm
-------------------------------------------------------	------

Structure Top soil	Degree of compaction 84.60	Water content 11.57
-----------------------	-------------------------------	------------------------

Clearance depth 20 cm	Clearance time/50m 13:28:34	⇒	Clearance speed 223 m/h
--------------------------	--------------------------------	---	----------------------------

	AP	AT	
Number laid:	<input type="text" value="100"/>	<input type="text" value="10"/>	
Destroyed:	<input type="text" value="95"/>	<input type="text" value="10"/>	90 plates found
Unaffected:	<input type="text" value="3"/>	<input type="text"/>	
Separated:	<input type="text" value="1"/>	<input type="text"/>	
Damaged:	<input type="text" value="1"/>	<input type="text"/>	
Sum:	<input type="text" value="100"/>	<input type="text" value="10"/>	
Detonations	<input type="text" value="69"/>	<input type="text" value="10"/>	audible

Remark:

Loose igniters: 26 nos. of which 2 nos. damaged

Missing igniters. AP: 99 % of igniters found (number of detonations + number unaffected + number damaged + number of loose igniters)

Missing 1 no. was considered as destroyed.

Clearance test 1:2

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV	Manufacturer Hydrema
-------------------------	-------------------------

Date 2001-08-13	Weather conditions Sunny	Temperature 18 Deg
--------------------	-----------------------------	-----------------------

Test number/description/laid depth 1:2 Probability	10 cm
-------------------------------------------------------	-------

Structure Arable ground	Degree of compaction 84.05	Water content 15.23
----------------------------	-------------------------------	------------------------

Clearance depth 25 cm	Clearance time/50m 20.34.67	⇒	Clearance speed 146	m/h
--------------------------	--------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	100	10	
Destroyed:	87	10	72 plates found
Unaffected:	2		
Separated:	7		
Damaged:	4		
Sum:	100		
Detonations	79	9	Audible

Remark:

Loose igniters: 10 nos. of which 9 damaged

Missing igniters. AP 95% of igniters found (number of detonations + number unaffected + number damaged + number of loose igniters)

Missing 5 nos. were considered as destroyed.

Clearance test 1:3

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV

Manufacturer Hydrema

Date 2001-08-16	Weather conditions Sunny	Temperature 26 Deg
--------------------	-----------------------------	-----------------------

Test number/description/laid depth 1.3 Probability	20 cm
-------------------------------------------------------	-------

Structure Arable ground	Degree of compaction 84,53	Water content 14,69
----------------------------	-------------------------------	------------------------

Clearance depth 20 cm	Clearance time/50m 19.21.81	⇒	Clearance speed 155	m/h
--------------------------	--------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	100	10	
Destroyed:	85	10	70 plates found
Unaffected:	8		
Separated:	3		
Damaged:	4		
Sum:	100	10	
Detonations	65	10	Audible

Remark:

Loose igniters: 19 nos. of which 12 nos. damaged. 9 nos. found 1-10 m from cleared track
 2 nos. unaffected of which 1 no. 8 m side (behind), right side of cleared track. 1 no. 1 m side ,
 left of cleared track

1 no. damaged 1 m side, left of cleared track

Missing igniters. 96 % of igniters found (number of detonations + number unaffected +
 number damaged + number of loose igniters)

Missing 4 nos. were considered as destroyed.

Clearance test 2:1

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV	Manufacturer Hydrema
-------------------------	-------------------------

Date 2001-08-08	Weather conditions Showers of rain	Temperature 18 Deg
--------------------	---------------------------------------	-----------------------

Test number/description/laid depth 2.1 Probability	0 cm
-------------------------------------------------------	------

Structure Sand	Degree of compaction 89,70	Water content 7,15
-------------------	-------------------------------	-----------------------

Clearance depth 40 cm	Clearance time/50m 21.06.62	⇒	Clearance speed 142	m/h
--------------------------	--------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	100	10	
Destroyed:	98	9	76 plates found
Unaffected:	2	1	*
Separated:			
Damaged:			
Sum:	100	10	
Detonations	73	9	Audible

Remark:

* the casing buckled, yet was fully functional

Loose igniters: 24 nos.

Missing igniters. AP: 99% of igniters found (number of detonations + number unaffected + number damaged + number of loose igniters)

Missing 1 no. was considered as destroyed.

Clearance test 2:2

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV	Manufacturer Hydrema
-------------------------	-------------------------

Date 2001-08-10	Weather conditions Sunny	Temperature 17 Deg
--------------------	-----------------------------	-----------------------

Test number/description/laid depth 2.2 Probability	10 cm
-------------------------------------------------------	-------

Structure Sand	Degree of compaction 91,15	Water content 6,72
-------------------	-------------------------------	-----------------------

Clearance depth 40 cm	Clearance time/50m 15.16.71	⇒	Clearance speed 196	m/h
--------------------------	--------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	100	10	
Destroyed:	91	10	77 plates found
Unaffected:	6		
Separated:	2		
Damaged:	1		
Sum:	100	10	
Detonations	83	10	Audible

Remark:

Loose igniters: 10 nos.

No missing igniters. 100 % of igniters found (number of detonations + number unaffected + number damaged + number of loose igniters)

Clearance test 2:3

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV	Manufacturer Hydrema
-------------------------	-------------------------

Date 2001-08-15	Weather conditions Cloudy with sunny intervals	Temperature 20 Deg
--------------------	---------------------------------------------------	-----------------------

Test number/description/laid depth 2.3 Probability	20 cm
-------------------------------------------------------	-------

Structure Sand	Degree of compaction 93,52	Water content 5,56
-------------------	-------------------------------	-----------------------

Clearance depth 30 cm	Clearance time/50m 11.45.66	⇒	Clearance speed 255	m/h
--------------------------	--------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	100	10	
Destroyed:	75	10	75 plates found
Unaffected:	17		
Separated:	5		
Damaged:	3		
Sum:	100	10	
Detonations	69	10	Audible

Remark:

Loose igniters: 8 nos. of which 5 nos. damaged
 1 no. unaffected found 1 m to the right of cleared track
 Missing igniters. 97% of igniters found (number of detonations + number unaffected +
 number damaged + number of loose igniters)
 Missing 3 nos. were considered as destroyed.

Clearance test 3:1

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV	Manufacturer Hydrema
-------------------------	-------------------------

Date 2001-08-09	Weather conditions Rain	Temperature 17 Deg
--------------------	----------------------------	-----------------------

Test number/description/laid depth 3.1 Probability	0 cm
-------------------------------------------------------	------

Structure Pit Run	Degree of compaction 94,05	Water content 3,50
----------------------	-------------------------------	-----------------------

Clearance depth 30 cm	Clearance time/50m 14.01.20	→	Clearance speed 214	m/h
--------------------------	--------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	100	10	
Destroyed:	83	10	71 plates found
Unaffected:	9		
Separated:	8		
Damaged:			
Sum:	100	10	

Detonations Audible

Remark:

Loose igniters: 20 nos.

1 no. unaffected approx. 1 m to the right of cleared track

Missing igniters. Result: 99% of igniters found (number of detonations + number unaffected + number damaged + number of loose igniters)

Missing 1 no. was considered as destroyed.

Clearance test3:2

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV	Manufacturer Hydrema
-------------------------	-------------------------

Date 2001-08-14	Weather conditions Rain	Temperature 19 Deg
--------------------	----------------------------	-----------------------

Test number/description/laid depth 3.2 Probability	10 cm
-------------------------------------------------------	-------

Structure Pit Run	Degree of compaction 95,90	Water content 5,35
----------------------	-------------------------------	-----------------------

Clearance depth 30 cm	Clearance time/50m 13.13.55	⇒	Clearance speed 227	m/h
--------------------------	--------------------------------	---	------------------------	-----

	AP	AT
Number laid:	<input type="text" value="100"/>	<input type="text" value="10"/>
Destroyed:	<input type="text" value="94"/>	<input type="text" value="10"/>
Unaffected:	<input type="text" value="1"/>	<input type="text"/>
Separated:	<input type="text" value="4"/>	<input type="text"/>
Damaged:	<input type="text" value="1"/>	<input type="text"/>
Sum:	<input type="text" value="100"/>	<input type="text" value="10"/>
Detonations	<input type="text" value="86"/>	<input type="text" value="9"/> Audible

Remark:

Loose igniters: 9 nos. of which 3 nos. damaged
 1 no. separated found 6 m to the right of cleared track
 Missing igniters. 97 % of igniters found (number of detonations + number unaffected +
 number damaged + number of loose igniters)
 Missing 3 nos. were considered as destroyed.

Clearance test3:3

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV	Manufacturer Hydrema
-------------------------	-------------------------

Date 2001-08-17	Weather conditions Sunny	Temperature 20 Deg
--------------------	-----------------------------	-----------------------

Test number/description/laid depth 3.3 Probability	20 cm
-------------------------------------------------------	-------

Structure Pit Run	Degree of compaction 94,77	Water content 5,02
----------------------	-------------------------------	-----------------------

Clearance depth 20 cm	Clearance time/50m 19.46.22	⇒	Clearance speed 152	m/h
--------------------------	--------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	100	10	
Destroyed:	59	10	57 plates found
Unaffected:	26		
Separated:	7		
Damaged:	8		
Sum:	100	10	
Detonations	45	9	Audible

Remark:

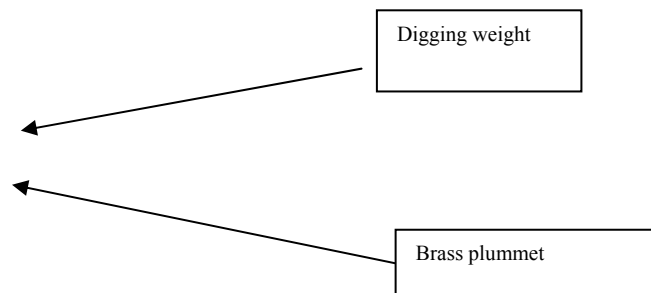
Loose igniters: 13 nos. of which 4 nos. damaged
4 nos. unaffected, AP found in original position. (the flails have not ploughed through the ground)
3 nos. unaffected, 2-5 m to the left of cleared track
1 no. unaffected, 10 m to the right of cleared track
5 nos. unaffected, 0-1 m around cleared track
Missing igniters. 92% of igniters found (number of detonations + number unaffected + number damaged + number of loose igniters)
Missing 8 nos. were considered as destroyed.

Operation

No operational problems to report. The machine was completely functional at the time of the required operations.

Action on the machine

Before the probability test 36 was performed with the machine, brass plummets were changed into digging weights. Total number of digging weights 72 .



The machine did not show any abnormal wear nor was adversely affected by the preparation of the soil in the structural tracks.

Discussion of results

Analysis was carried out with a view to identify possible relationship between, e.g.:

- Clearance speed and clearance result
- Placement of mine object at different depths and the clearance result
- Structure of the tracks and the clearance result
- Side spread and deep placement of mines
- Damaged/separated mines and deep placement of mines

The machine shows a distinct tendency not to clear up the test objects which are placed at a depth of 20 cm. The control measurement of clearance depth shows that the machine ploughed through the ground in all the cases in test 3.3 (see report) down to placement depth. Reason for the objects being left unaffected can be discussed. A theory (DAN) is that the energy from brass plummets or digging weights decreases gradually up to the ground surface, so that it has energy at the bottom only to strike against the ground. The plummet is decelerated by the friction of the ground. Based on this reasoning it is advisable not to increase the installed engine power on the diesel engine without increasing the kinetic energy on the plummet (peripheral speed and weight). An alternative to this can be to lower the clearance speed of the machine further.

If 20 cm clearance depth is considered as not included in the Synthesis (for the full clearance probability test), the result overall would have been 96.2 %.

The side spread tends to increase with increased placement depth. This is strengthened by the above-mentioned theory i.e. the machine can only move or throw off the test objects as the energy in the clearing tool is used up when it reaches 20 cm.

The clearance speed is low. The clearance speed varied between 142 and 255 m/h. (Compare RUTTEM)

There is no clear relationship between clearance speed and clearance probability.

Conclusions

The machine clears up properly down to 10 cm depth.

The testing person's observations

The machine is very flexible and easily handled. It allows fast and flexible regroupings between different ranges thanks to its capability to fold together and put the clearing unit in transporting position. Shifting on the way is done simply and surely as the width in transporting position is only 2.80 m. Maximum speed approx. 35 km/h.

While working with the flails, the rpm of the flail motor sometimes drops. The drive system which lifts the flail arms for high load does not seem to work sufficiently fast.

The machine whips up much dust. This puts great demands on planning of clearing as well as consideration of wind direction, etc. The driver's ability to clear up as per a definite pattern is

questionable with respect to visibility. Overlapping while clearing of surfaces can become problematic.

Only preventive maintenance was necessary. No breakdown maintenance was necessary. The machine was available whenever it was required.

Hydrema 910 MCV carried out the test (with the exception of dynamic clearance test) with two persons in the cabin. The reason was either it was used for training or the second driver helped the first driver to navigate properly.

Compilation of results of clearance probability test

The compilation shows complete results of respective track structure. Each one of the three performances of track structure at a depth of 0-20 cm is indicated in a test report.

In the paragraph 1.8.4, all the performances are presented in a report (900 AP as well as 90 AT).

Synthesis Pit Run track 3

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV	Manufacturer Hydrema
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Date	Weather conditions	Temperature
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Test number/description/laid depth Probability Pit Run track	0-20 cm
-----------------------------------------------------------------	---------

Structure Pit Run	Degree of compaction Average 95%	Water content Average 4,6%
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Clearance depth 20-30 cm	Clearance time/50m	⇒	Clearance speed Average 175 m/h
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	AP	AT
Number laid:	300	30
Destroyed:	236	30
Unaffected:	36	0
Separated:	19	0
Damaged:	9	0
Sum:	300	30
Detonations	201	28

Remark:

With the addition of number of detonations, number unaffected, number damaged as well as number of loose igniters, an overall result for found igniters: 96% AP and 100% AT was found. Consequently 12 nos. of AP igniters were missing after the test was carried out on the gravel track. It is unlikely that these will be located in an unaffected mine object. Therefore they are considered as destroyed.

Synthesis Sand track 2

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV	Manufacturer Hydrema
-------------------------	-------------------------

Date	Weather conditions	Temperature
------	--------------------	-------------

Test number/description/laid depth Probability Sand track	0-20 cm
--------------------------------------------------------------	---------

Structure Sand	Degree of compaction Average 91%	Water content Average 6,5%
-------------------	-------------------------------------	-------------------------------

Clearance depth 30-40 cm	Clearance time/50m	⇒	Clearance speed Average 198 m/h
-----------------------------	--------------------	---	------------------------------------

	AP	AT
Number laid:	300	30
Destroyed:	264	29
Unaffected:	25	*1
Separated:	7	0
Damaged:	4	0
Sum:	300	30
Detonations	225	29

Remark:

*Casing buckled, yet fully functional.

With the addition of number of detonations, number unaffected, number damaged as well as number of loose igniters, an overall result for found igniters: 98.6% AP and 100% AT was found. Consequently 4 nos. of AP igniters were missing after the test was carried out on the gravel track. It is unlikely that these will be located in an unaffected mine object. Therefore they are considered as destroyed

Synthesis Arable ground track 1

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV	Manufacturer Hydrema
-------------------------	-------------------------

Date	Weather conditions	Temperature
------	--------------------	-------------

Test number/description/laid depth Probability Arable ground	0-20 cm
-----------------------------------------------------------------	---------

Structure Arable ground	Degree of compaction Average 84 %	Water content Average ca 13,8%
----------------------------	--------------------------------------	-----------------------------------

Clearance depth 30 cm	Clearance time/50m	⇒	Clearance speed Average 175 m/h
--------------------------	--------------------	---	------------------------------------

	AP	AT
Number laid:	300	30
Destroyed:	267	30
Unaffected:	13	0
Separated:	11	0
Damaged:	9	0
Sum:	300	30

Detonations 213 29

Remark:

With the addition of number of detonations, number unaffected, number damaged as well as number of loose igniters, an overall result for found igniters: 96.7 % AP and 100% AT was found. Consequently 10 nos. of AP igniters were missing after the test was carried out on the gravel track. It is unlikely that these will be located in an unaffected mine object. Therefore they are considered as destroyed

Overall compilation of clearance probability track 1-3

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV	Manufacturer Hydrema
--------------------------------	--------------------------------

Date	Weather conditions	Temperature
------	--------------------	-------------

Test number/description/laid depth Probability TOTAL	0-20 cm
----------------------------------------------------------------	----------------

Structure	Degree of compaction	Water content
-----------	----------------------	---------------

Clearance depth 30 cm	Clearance time/50m	⇒	Clearance speed Average 183 m/h
---------------------------------	--------------------	---	-------------------------------------------

	AP	AT
Number laid:	900	90
Destroyed:	767	89
Unaffected:	74	1
Separated:	37	0
Damaged:	22	0
Sum:	900	90
Detonations	639	86

Remark:

Clearing performance in vegetation

General info

The test was carried out with live fuse material only in the AT-mines.

Equipment used during the test, peripheral equipment.

Test objects AT/AP
Mine igniter m/47
Break trigger m/49 with pressure star
Earth borer/spade
Metal detector/mine detector (Vallon/Schiebel)
Aggregate exposure equipment
Equipment to destroy unexploded ammunition.
Personal protective gear
IST detectors as well as ID-chips

Testing persons:

Mj G Danielsson	from Testing dept. Ing 2
Lt L Ribbefors	from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts from Testing dept. Ing 2

Drivers of deep-mine clearing vehicle:

Jan Andersen	from Hydrema
Mikael Larsen	from Hydrema

Time taken:

The test lasted two days

Any modifications/changes on the deep-mine clearing machine from the starting date of the test:

The flails work with 36 digging weights and 36 brass plummets

Description of the testing range

The ground and terrain conditions, sketch/photo.



Pictures show the testing locations for vegetation clearing

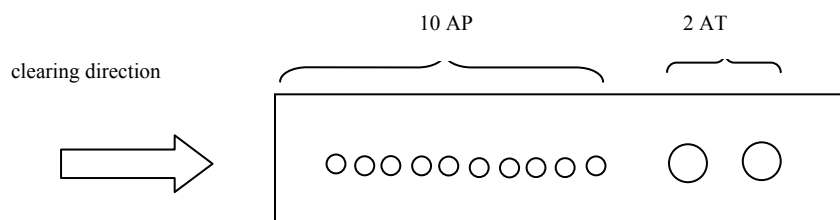
The test section was 20 m long and contained impenetrable vegetation < 10 cm.
Three trees >10 cm were cut before the test

The test was carried out without live igniters in the AP-mines. Instead a plate was glued additionally on the outside of the mine. This was for facilitating search later on with mine detector.



The picture shows AP-mine with glued-on plate

The sketch of the mine



Summary



The picture shows cleared range after an action

The machine ploughed through the ground properly. No uncleared sections could be noticed after the test.

Results of clearing performance in vegetation

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV	Manufacturer Hydrema
-------------------------	-------------------------

Date 2001-08-21	Weather conditions Cloudy with sunny intervals	Temperature 18 Deg
--------------------	---------------------------------------------------	-----------------------

Test number/description/laid depth Clearing in vegetation	10 cm
--------------------------------------------------------------	-------

Structure Pit Run with vegetation <10 cm	Degree of compaction	Water content
---------------------------------------------	----------------------	---------------

Clearance depth 20 cm	Röjtid/25m 12.45.20	⇒	Clearance speed 118 m/h
--------------------------	------------------------	---	----------------------------

	AP	AT	
Number laid:	10	2	
Destroyed:		2	
Unaffected:			
Separated:			
Damaged:			
Sum:	7	2	
Detonations	0	0	Audible

Remark:

- Only seven nos. of AP mines noticed after clearing
- Ground tracking without any problem

Operation

No operational problems to report. The machine was completely functional at the time we wished to undertake the activity

Effect on the machine

The machine did not show any abnormal wear nor was affected adversely by the preparation of the soil in any other manner, apart from normal wear.

Discussion of results



The pictures show cleared track in vegetation according to Hydrema

Conclusions

The machine manages to clear up in vegetation <10 cm. Laid AT-mines were detonated and destroyed. The ground tracking system functioned well, because of which no uncleared sections were found after the clearing.

The testing person's observations

The machine ploughs through the ground properly. Trunks, etc. severed along with the roots. Left behind branches and knots were loose after the test. The vegetation test is carried out without live igniters in the AP-mines. This is in view of the risk that igniter may be thrown off, as the test is carried out beyond the fenced range. The AT-mines were provided with live fuse material during the test occasion.

Clearing performance at different sloping conditions

General

The test was carried out with live igniters in the AT-mines. Live igniter was employed in AP only for 10% side slope test.

The test was carried out beyond the test track in unprepared terrain. The 10% or 20% sloping condition is determined with measuring tape, pegs and sight rods. The above slope is > 20%.

The test was carried out on 20-08-2001 and 22-08-2001

Clearing in 10% side slope

General info

Equipment used during the test, peripheral equipment.

Test objects AT/AP
Mine igniter m/49B
Mine igniter m/47
Break trigger m/49 with pressure star
Earth borer/spade
Metal detector/mine detector
Aggregate exposure equipment
Equipment to destroy unexploded ammunition.
Personal protective gear
IST detector as well as ID-chips

Testing persons:

Mj G Danielsson from Testing dept. Ing 2
Lt L Ribbefors from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts from Testing dept. Ing 2 for restoration as well as preparation of tracks

Drivers of deep-mine clearing vehicle:

Jan Andersen from Hydrema
Mikael Larsen from Hydrema

Time taken for each activity e.g. preparation of track, clearing, searching:

The test lasts 2 days with upward slope

Description of the testing range

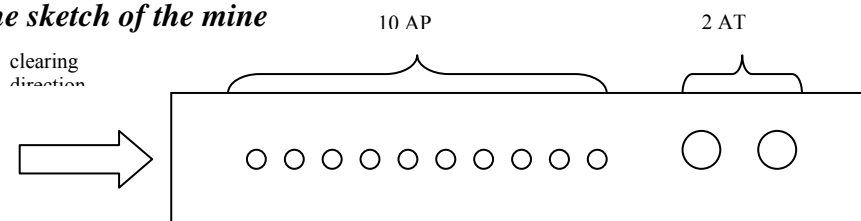
The ground and terrain conditions, sketch/photo.

- 10 % sloping condition
- Grassy grazing ground



The picture shows clearing in 10% side slope

The sketch of the mine



The mine objects provided with ID-chips



The picture shows laid AP mine



The picture shows laid AT mine

Results for the 10% side slope case

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV	Manufacturer Hydrema
-------------------------	-------------------------

Date 2001-08-21	Weather conditions Vxl	Temperature 23 Deg
--------------------	---------------------------	-----------------------

Test number/description/laid depth 10 % side sloping field	10 cm
---------------------------------------------------------------	-------

Structure Running wild field	Degree of compaction	Water content
---------------------------------	----------------------	---------------

Clearance depth 20 cm	Röjtid/25m	⇒	Clearance speed m/h
--------------------------	------------	---	------------------------

	AP	AT	
Number laid:	<input type="text" value="10"/>	<input type="text" value="2"/>	
Destroyed:	<input type="text" value="9"/>	<input type="text" value="2"/>	
Unaffected:	<input type="text" value="0"/>	<input type="text"/>	
Separated:	<input type="text" value="1"/>	<input type="text"/>	
Damaged:	<input type="text" value="0"/>	<input type="text"/>	
Sum:	<input type="text" value="10"/>	<input type="text"/>	
Detonations	<input type="text" value="8"/>	<input type="text" value="2"/>	Audible

Remark:
 Ground tracking of clearing unit without any problem
 Loose igniters: 2 nos. of which 1 was damaged.
 1 no. igniter found, 4 m to the right of cleared track
 1 no. damaged igniter found at the edge of cleared track.

Operation

No operational problems to report. The machine was completely functional at the time we wished to undertake the activity

Effect on the machine

The machine did not show any abnormal wear nor was affected adversely by the preparation of the soil in any other manner.

Conclusions

10 % side slope does not limit the clearing performance of the machine.

Clearing in 20% downward slope

General info

Equipment used during the test, peripheral equipment.

Test objects AT/AP
Mine igniter m/47
Break trigger m/49 with pressure star
Earth borer/spade
Metal detector/mine detector
Aggregate exposure equipment
Equipment to destroy unexploded ammunition.
Personal protective gear
IST detector as well as ID-chips

Testing persons:

Mj G Danielsson	from Testing dept. Ing 2
Lt L Ribbefors	from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts for restoration	from Testing dept. Ing 2
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Drivers for deep-mine clearing vehicle:

Jan Andersen	from Hydrema
Mikael Larsen	from Hydrema

Time taken for each activity e.g. preparation of track, clearing, searching:

The test lasts 2 days with upward slope

Description of the testing range

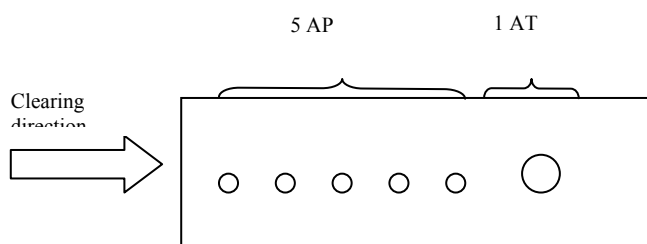
The ground and terrain conditions, sketch/photo.

- Sloping conditions: 20 %.(above slope >20%).
- Bigger stones, etc. were found in the terrain where the machine was supposed to clear up.



The pictures show clearing with 20% downward slope

The sketch of the mine:



Results in the case of 20% downward slope

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV

Manufacturer Hydrema

Date 2001-08-22	Weather conditions Sunny	Temperature 18 Deg
--------------------	-----------------------------	-----------------------

Test number/description/laid depth Downward slope 20%	10 cm
----------------------------------------------------------	-------

Structure Gravel with vegetation	Degree of compaction	Water content
-------------------------------------	----------------------	---------------

Clearance depth 20 cm	Clearance time/50m	⇒	Clearance speed m/h
--------------------------	--------------------	---	------------------------

	AP	AT
Number laid:	5	1
Destroyed:	3	1
Unaffected:		
Separated:		
Damaged:		
Sum:	3	1
Detonations	0	1

Remark:

Ground tracking without any problem.

Only three AP-objects were found. They were not yet provided with live igniters.

Operation

No operational problems to report. The machine was completely functional at the time we wished to undertake the activity

Discussion of the results

The AT mine detonated. Only three AP-mines were found (not provided with igniter)

Conclusions

20 % downward slope definitely limits the performance of the machine. If slopes with sloping condition corresponding to 20% are required, then the other conditions must be favourable. The ground at the location of testing consists of unsorted masses of gravel with both big and small earth-bound stones.

The testing person's observations on 20% downward slope

Clearing in the sloping condition corresponding to 20% is risky. The machine may start to slide (ball bearing effect). The driver can no longer control the machine and this could endanger life.

The machine cleared up the full path down the slope. At the start the slope was more than 20%. The driver subsequently tried to drive uphill on cleared track. The machine stalled i.e., the wheels did not move even with full throttle. The movement stopped and the machine instead drove down the slope.

Clearing in 20% upward slope

General info

Equipment used during the test, peripheral equipment.

Test objects AT/AP
Mine igniter m/47
Break trigger m/49 with pressure star
Earth borer/spade
Metal detector/mine detector (Vallon/Schiebel)
Aggregate exposure equipment
Equipment to destroy unexploded ammunition
Personal protective gear
IST detector as well as ID-chips

Testing persons:

Mj G Danielsson	from Testing dept. Ing 2
Lt L Ribbefors	from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts for restoration	from Testing dept. Ing 2
--------------------------------	--------------------------

Drivers of deep-mine clearing vehicle:

Jan Andersen	from Hydrema
Mikael Larsen	from Hydrema

Time taken for each activity e.g. preparation of track, clearing, searching:

The test lasts 2 days with upward slope.

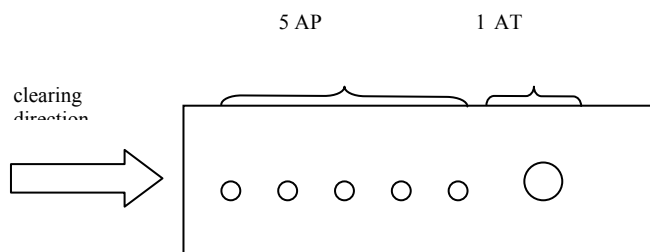
The ground and terrain conditions, sketch/photo.

- Sloping conditions: 20% (above slope is >20%).
- Bigger stones, etc. were found in the terrain where the machine was supposed to clear up.



The pictures show clearing in 20% upward slope

The sketch of the mine:



Results in the case of 20% upward slope

TEST REPORT OF MINE CLEARANCE

Machine type 910 MCV

Manufacturer Hydrema

Date 2001-08-22	Weather conditions Sunny	Temperature 18 Deg
--------------------	-----------------------------	-----------------------

Test number/description/laid depth 20% upward slope	10 cm
--------------------------------------------------------	-------

Structure Gravel with vegetation	Degree of compaction	Water content
-------------------------------------	----------------------	---------------

Clearance depth 20 cm	Röjtid/20m	⇒	Clearance speed m/h
--------------------------	------------	---	------------------------

	AP	AT
Number laid:	5	1
Destroyed:	2	1
Unaffected:		
Separated:		
Damaged:		
Sum:	2	1
Detonations		1

Remark:

The test was stopped as the machine could not move forward on the slope
 The AT mine was detonated
 Only two nos. of AP mines were found
 The AP-mines were not provided with live igniters

Operation

No operational problems to report. The machine was completely functional at the time we wished to undertake the activity

Discussion of results



The picture shows cleared surface after upward slope test. Observe wave pattern after compacting actions

Conclusions

The machine shows obvious limitations on the occasion of the test. The test was discontinued as the machine jammed and could not move on the laid track.

The testing person's observations in the case of 20% upward slope

Clearing in the sloping condition corresponding to 20% is risky. The machine may begin to slide (ball bearing effect) .The driver can no longer control the machine and this could endanger life.

Manoeuvrability/navigability

General info

Equipment used during the test, peripheral equipment.

Chronograph
Measuring tape
Iron tipped oak beam 30x30 cm
Trench 1.5mx0.5m

Testing persons

Mj G Danielsson	from Testing dept. Ing 2
Lt L Ribbefors	from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts for restoration as well as preparation of tracks	from Testing dept. Ing 2
-----------------------------------------------------------------	--------------------------

Drivers of deep-mine clearing vehicle:

Jan Andersen	from Hydrema
Mikael Larsen	from Hydrema

Summary

See remarks of respective tests

Description of the testing range

The ground and terrain conditions, sketch/photo.



The picture shows 30x30 cm obstacle



The picture shows trench 1.5x 0.5 m



The picture shows minimum turning radius test



The picture shows reversing on cleared track



The picture shows turning on cleared track

Results of Manoeuvrability/navigability during clearing

Minimum Turning Radius

How large a minimum turning radius does the machine have during clearing with safety guarantee for tyre/wheel, in m?

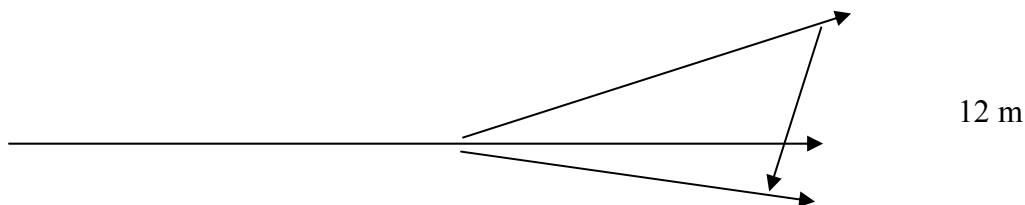
The minimum turning radius was measured up to 14.5 m.

The clearance depth was 15-20 cm on during the test. A stone slab of approx. 2 m² was found in the clearing area of the machine. The slab was ploughed through without additional efforts with the machine. No abnormal damages/wear resulted for the machine.

The machine has its inherent limitations to turn beyond cleared track (max 16°).

Turning of the machine on cleared track

The extent of range required in order to turn the machine on cleared track, m², m, sketch/photo.



Arrows describe the methodology for the machine to turn

10 m

Time taken for turning on cleared track:

25 min including 25 m of clearing straight on.

Clearance depth:

15-20 cm

Remark:

The machine has an inbuilt system to prevent driving beyond cleared track. During the test the machine did not end up with the wheels beyond cleared track.

The rpm of the flail motor dropped on three occasions during the test. This may be due to the number of clogged air filter.

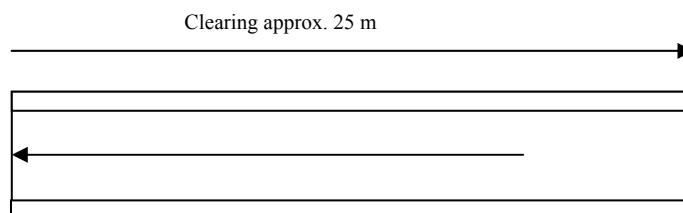
Results of Manoeuvrability/navigability during the execution of sub-series 1

Capability to reverse on cleared track

Maximum speed with safety guarantee, km/h.

The machine cleared up a 25 m long track. Thereafter the machine was reversed 20 m. Time for the reversing manoeuvre:

- 16 seconds →4.5 km/h



Sketch/photo: deviations from cleared track.

The machine has no problems in reversing on cleared track.

Trench

Number of successful/unsuccessful tests to cross the trench, nos..

The machine cleared the obstacle in the first attempt both forward as well as backward

Sketch/photo: description of the trench.



The picture shows the trench at the front

Obstacle

Number of successful/unsuccessful tests to overcome the obstacle, nos.

The machine managed the obstacle in the first attempt both forward as well as backward.

Sketch/photo: description of the obstacle.



The picture shows obstacle at the back

Operation

No operational problems to report. The machine was completely functional at the time we wished to undertake the activity

Effect on the machine

The machine did not show any abnormal wear nor was affected adversely by the test in any other manner.

Conclusions

The only limitation of the machine relating to manoeuvrability during clearing is the visibility as the flails ploughs. The machine rakes up too much dust.

The inbuilt limiting system functions well. During the test the machine has not run beyond the cleared track under any circumstances.

The testing person's opinions-Manoeuvrability during clearing (the full test)

The machine is easily handled and proved to be flexible. The power for the forward movement of the machine has been considered to be insufficient in some cases. (20% slope)

The ground and terrain conditions, the nature of the tracks.

A roadbed with length 20 m, width 6 m and height 50 cm is constructed at 45° angle from the common shelter. This is so that the driver will be able to drive the machine from the shelter and at the same time be able to determine the speed and direction. The roadbed is made from sorted natural gravel of 0-18 mm. Compaction with 4 ton tow-roller was carried out after each 20 cm layer of piled material.



The picture shows the machine arranged for dynamic clearance test

The roadbed was damp during the test.

Weather conditions

Rainy, temp. approx. 16°

Any modifications/changes made on the deep-mine clearing machine from the starting date of the test.

No reported or known modifications.

Time taken for each activity e.g. preparation of track, clearing, searching.

The test lasts 1 day excluding preparations for construction of roadbeds.

Results of blasting test 5.5 kg

Course of events

The test was carried out completely according to the description in 5.2

Measured forces

See FMV/FFK report

Damages to the machine

What damages were caused to the machine? Sketch/photo



The picture shows the clearing unit after the test



The picture shows worn out weight



The picture shows splinter damages to the flail pipe



The picture shows splinter damages to chains

- 5 nos. of striking tools have to be changed
- An electrical outlet at the back side of the shield has split.

Discussion of results of the 5.5 kg blasting test

The damages to the clearing unit are judged to be less after the 10 kg mine than the 5.5 kg one. The flails showed insignificant splinter damages after the 10 kg detonation whereas 5.5 kg

caused significantly more. The probable cause is that antitank mine 5 does not have a casing whereas antitank mine m/47 has sheet-metal casing.

Conclusions

The machine is judged to be operative again after change of 5 nos. of chains including brass plummets. Assessed tearing time: approx. 0.5 hours. This is not yet checked.

The testing person's observations on 5.5 kg blasting test

The machine appears to be very robust. The damages after both the 5.5 kg and 10 kg mines are marginal in this case.



The picture shows strvmina 5 after an interrupted test

Roadbed, etc. was restored before new test. The mine was reinforced with a 12 mm nylon sheet in order to induce a detonation.



The picture shows strvmina 5 reinforced with nylon sheet compacted with fabric tape

New test as above was carried out. This time the mine was detonated

The ground and terrain conditions, nature of the tracks.

A roadbed with length 20 m, width 6 m and height 50 cm is constructed at 45° angle to the common shelter. This is so that the driver is able to drive the machine from the shelter and at

the same time determine the speed and direction. The roadbed is built with sorted natural gravel 0-18 mm. Compaction with 4 ton tow-roller was done after each 20 cm layer of piled material.

The roadbed was soaked in water during the test.

Weather conditions

Rainy, temp. approx. 8°

Any modifications/changes made on the deep-mine clearing machine from the starting date of the test.

36 digging weights were changed to brass plummets before the test. The aim was to minimise the risk so that the mine is destroyed before the detonated ones (the purpose was to induce a detonation).

Time taken for each activity e.g. preparation of track, clearing, searching.

The test lasts 1 day excluding preparations for construction of path object.

Results of 10 kg blasting test

Course of events

The test was carried out completely according to the description above

Measured forces

See FMV/FFK report

Damages to the machine

What damages were caused to the machine? Sketch/photo



The pictures show the clearing unit after carrying out test



The picture shows worn out grip

- 1 no. brass plummet is missing
- 1 no. grip is missing, as shown in the picture

Discussion of results of the 10 kg blasting test

The damages to the clearing unit is judged to be less after the 10 kg mine than the 5.5 kg one. The flail pipe showed insignificant splinter damages after the 10 kg detonation whereas 5.5 kg caused significantly more. The probable reason is that antitank mine 5 does not have a casing whereas antitank mine m/47 has sheet-metal casing.

Conclusions

The machine is considered to be operative again after the lost and damaged chains are replaced. Estimated tearing time: approx. 10 minutes.

The testing person's opinion on 10 kg

The machine appears to be very robust. The damages after both the 5.5 kg as well as 10 kg mines are marginal in this case.

SCANJACK 3500

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Clearance probability test

General

Description of test method

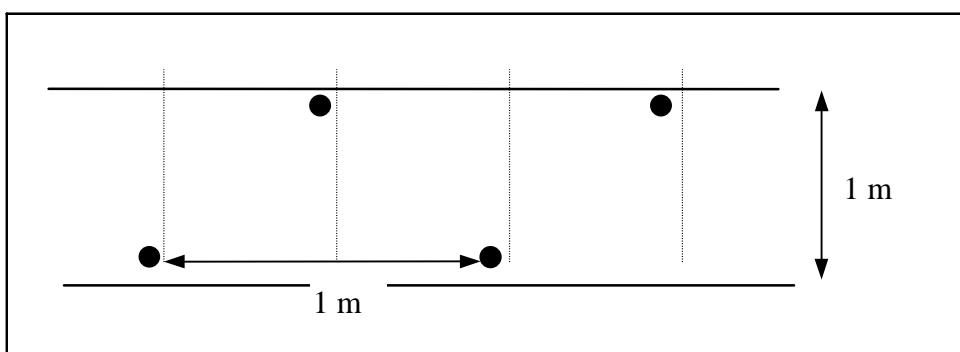
During the probability test, test objects similar to antipersonnel mine (PMA 2) and antitank mine (TMM 1) are used. The test objects are provided with live mine igniters.

The test is carried out on the following soil types:

- Arable ground track 1 degree of compaction: approx. 85% of max.
- Sand track 2 degree of compaction: approx. 90% of max.
- Pit run track 3 degree of compaction: approx. 94% of max.

Test mines with live igniters from antipersonnel mine m/49B or mine igniter m/47 are used to indicate whether the mine is active or detonates. The test objects are provided with a metal plate so as to verify the status of the mine after the clearing.

1. Present track is cleared with regard to electrically conducting material (no deflection on the mine detector).
2. The mines are laid out at 1 m distance and with varying depths of 0 cm, 10 cm and 20 cm and they are also armoured. See sketch/photo.





3. The machine clears up laid mines. The manufacturer himself operates the machine and selects the speed, clearance depth etc. so as to achieve the best results. Testing person/clearing person observes and records the number of detonations as well as the time for 50 m clearing.
4. Testing person/clearing person locates the remains of cleared mine objects and defuses the unexploded ammunition.
5. Evaluation according to the following aspects:
 - destroyed, separated and damaged are considered as cleared.
 - missing mine/mine object is considered as cleared as it is unlikely that an entire mine object is left behind after locating using mine detector.

Assessment of clearance result is done as below:

-destroyed (only the plate found or separated mine object with <50% of the Explosive remaining.



Example of destroyed mine

-unaffected (the mine object still in working condition after clearing)



Example of unaffected mine

-separated (>50% explosive remaining, igniters detached)



Example of separated mine

-damaged (reduced functioning of mine or igniters)



Example of damaged mines

6. Evaluation whether the machine is affected by the soil condition.
7. Preparation as well as repacking of respective tracks up to degree of compaction as given above.

Time required for each execution for 100 nos. AP as well as 10 AT is approx. 1 day.

The procedure requires 300 AP-mines and 30 AT-mines in each soil type. The machine clears up laid mining at one time (single passage).

Equipment used during the test, peripheral equipment:

Test objects AT/AP
Mine igniter's m/49B
Mine igniter's m/47
Break triggers m/49 with pressure star
Metal detector/mine detector (Vallon/Schiebel)
Earth borer/spade
Aggregate exposure equipment
Equipment to destroy unexploded ammunition.
Personal protective gear

In order to restore the tracks, following are required in addition:

- Wheel-mounted loader
- Tow-roller with vibro function with tow-carriage
- Isotope meter for determination of degree of compaction
- Test was carried out with three teeth plough designed to find mines below detectable depth.

Date:

The test was carried out between 03-09-2001 and 14-09-2001.

ID number of the machine:

ScaScanjack 3500

Summary (for the full clearance probability test)

Clearance probability test was carried out with 900 AP-mine objects as well as 90 AT-mine objects.

Test 1:3 not carried out due to the weather conditions. Rain and bad weather have made the water level in the ground to exceed top level (>19% water contents).

The results were as given below (based on 3.4). The machine:

- left **1,9 %** of the laid **AP-mines unaffected** (15/800).
- left **0 %** of the laid **AT-mines unaffected** (0/80).
- Destroyed, damaged or separated **98,1%** of the laid **AP-mines** if the missing mine objects are considered as destroyed.
- destroyed, damaged or separated **100%** of the laid **AT-minorna**

	AP	%	AT	%
Number laid:	800		80	
Destroyed:	729	91,1	80	100
Unaffected:	15	1,9	0	0
Separated:	37	4,6	0	
Damaged:	19	2,4	0	
Sum:	800		80	
Detonations	559		79	

Clearance probability test

Testing persons:

Mj G Danielsson DAN	from Testing dept. Ing 2
Lt L Ribbefors RIB	from Testing dept. Ing 2
Kn Peter Djerf DJE	from Testing dept. Ing 2
Lt Tommy Karlsson KAR	from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts for restoration as well as preparation of tracks from Testing dept. Ing 2

Drivers of mine clearing vehicle:

Sören Andersson	from Scanjack
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Clearance test 1:1

TEST REPORT OF MINE CLEARANCE

Engine type 3500	Manufacturer Scanjack
---------------------	--------------------------

Date 04-08-2001	Wether conditions Rain	Temperature 12 deg
--------------------	---------------------------	-----------------------

Test number/description/laid depth 1.1 Probability	0 cm
-------------------------------------------------------	------

Structure Arable ground	Degree of compaction 86,35	Water ratio average 17,70
----------------------------	-------------------------------	------------------------------

Clearance depth 20-30 cm	Clearance time/50m 9.08.53	⇒	Clearance speed 328	m/h
-----------------------------	-------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	100	10	
Destroyed:	89	10	(83 plates found)
Unaffected:	2		
Separated:	8		
Damaged:	1		
Sum:	100	10	
Detonations	77	10	audible

Remark:

Loose igniters: 20 nos. Of which 2 nos. damaged

No missing igniters. AP:100 % of igniters found (number of detonations + number unaffected + number damaged + number of loose igniters)

Result AT:100 %

Clearance test 1:2

TEST REPORT OF MINE CLEARANCE

Engine type
 3500

Manufacturer
 Scanjack

Date 07-08-2001	Wether condition Partly cloudy	Temperatur 15 deg
--------------------	-----------------------------------	----------------------

Test number/description/laid depth 1.2 Probability	10 cm
-------------------------------------------------------	-------

Structure Arable ground	Degree of compaction 86,55	Water ratio average 16,91
----------------------------	-------------------------------	------------------------------

Clearance depth 30 cm	Clearance time/50m 5.50.92	→	Clearance speed 513	m/h
--------------------------	-------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	100	10	
Destroyed:	80	10	(76 plates found)
Unaffected:	4		
Separated:	10		
Damaged:	6		
Sum:	100	10	
Detonations	49	10	audible

Remark:

Loose igniters: 37 nos. of which 20 nos. damaged

Missing igniters. AP:96 % of igniters found (number of detonations + number of loose igniters + unaffected + damaged)

Missing 4 no. considered as destroyed

Result AT:100 %

5 nos. of loose igniters found 1-8 m to the right of cleared track.

1 no. of loose igniter found 3 m to the left of cleared track.

Clearance test 1:3

Not carried out due to the weather conditions

Clearance test 2:1

TEST REPORT OF MINE CLEARANCE

Engine type 3500	Manufacturer Scanjack
---------------------	--------------------------

Date 05-09-2001	Väderlek Partly cloudy	Temperatur 18 gr
--------------------	---------------------------	---------------------

Test number/description/laid depth 2.1 Probability	0 cm
-------------------------------------------------------	------

Structure Sand	Degree of compaction 91,93	Water ratio average 6,40
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Clearance depth 30 cm	Clearance time/50m 6.48.59	⇒	Clearance speed 440	m/h
--------------------------	-------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	<input type="text" value="100"/>	<input type="text" value="10"/>	
Destroyed:	<input type="text" value="100"/>	<input type="text" value="10"/>	(79 plates found)
Unaffected:	<input type="text" value="0"/>	<input type="text"/>	
Separated:	<input type="text" value="0"/>	<input type="text"/>	
Damaged:	<input type="text" value="0"/>	<input type="text"/>	
Sum:	<input type="text" value="100"/>	<input type="text" value="10"/>	
Detonations	<input type="text" value="84"/>	<input type="text" value="10"/>	audible

Remark:

Loose igniters: 16 nos. of which 13 nos. damaged

No missing igniters. AP:100 % of igniters found (number of detonations + number of loose igniters + unaffected + damaged)

Result AT:100 %

Clearance test 2:2

TEST REPORT OF MINE CLEARANCE

Engine type 3500	Manufacturer Scanjack
---------------------	--------------------------

Date 06-09-2001	Weather contitions Clear, partly cloudy	Temperature 17 deg
--------------------	--------------------------------------------	-----------------------

Test number/description/laid depth 2.2 Probability	10 cm
-------------------------------------------------------	-------

Structure Sand	Degree of compaction 94,12	Water ratio average 5,43
-------------------	-------------------------------	-----------------------------

Clearance depth 30 cm	Clearance time/50m 6.32.62	⇒	Clearance speed 458	m/h
--------------------------	-------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	100	10	
Destroyed:	100	10	(97 plates found)
Unaffected:	0		
Separated:	0		
Damaged:	0		
Sum:	100	10	
Detonations	84	10	audible

Remark:

Loose igniters: 16 nos. of which 16 nos. damaged

No missing igniters. AP:100 % of igniters found (number of detonations + number of loose igniters + unaffected + damaged)

Result AT:100 %

Clearance test 2:3

TEST REPORT OF MINE CLEARANCE

Engine type 3500

Manufacturer Scanjack

Date 11-09-2001	Weather condition Partly cloudy	Temperature 12 deg
--------------------	------------------------------------	-----------------------

Test number/description/laid depth 2.3 Probability	20 cm
-------------------------------------------------------	-------

Structure Sand	Degree of compaction 94,47	Water ratio average 6,38
-------------------	-------------------------------	-----------------------------

Clearance depth 30 cm	Clearance time/50m 7.02.52	⇒	Clearance speed 426	m/h
--------------------------	-------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	100	10	
Destroyed:	96	10	(91 plates found)
Unaffected:	1		
Separated:	2		
Damaged:	1		
Sum:	100	10	
Detonations	70	10	audible

Remark:

Loose igniters: 28 nos. of which 27 nos. damaged

Missing igniters AP:98 % of igniters found (number of detonations + number of loose igniters + unaffected + damaged)

Missing 2 nos. considered as destroyed

Result AT:100 %

Clearance test 3:1

TEST REPORT OF MINE CLEARANCE

Engine type 3500	Manufacturer Scanjack
---------------------	--------------------------

Date 05-09-2001	Weather conditions Partly cloudy	Temperature 18 deg
--------------------	-------------------------------------	-----------------------

Testnumber/description/laid depth 3.1 Probability	0 cm
------------------------------------------------------	------

Structure Pit run	Degree of compaction 96,45	Water ratio average 5,09
----------------------	-------------------------------	-----------------------------

Clearance depth 30 cm	Clearance time/50m 5.58.00	⇒	Clearance speed 502	m/h
--------------------------	-------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	100	10	
Destroyed:	92	10	(74 plates found)
Unaffected:	2		
Separated:	5		
Damaged:	1		
Sum:	100	10	
Detonations	70	10	audible

Remark:

Loose igniters: 26 nos. of which 4 nos. damaged

Missing igniters AP:99 % of igniters found (number of detonations + number of loose igniters + unaffected + damaged)

Missing 1 no. considered as destroyed

Result AT:100 %

Clearance test 3:2

TEST REPORT OF MINE CLEARANCE

Engine type 3500

Manufacturer Scanjack

Date 10-09-2001	Weather conditions Partly cloudy	Temperature 12 deg
--------------------	-------------------------------------	-----------------------

Testnumber/description/laid depth 3.2 Probability	10 cm
------------------------------------------------------	-------

Structure Pit run	Degree of compaction 96,75	Water ratio average 4,29
----------------------	-------------------------------	-----------------------------

Clearance depth 25 cm	Clearance time/50m 5.28.66	→	Clearance speed 547	m/h
--------------------------	-------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	100	10	
Destroyed:	98	10	(104 plates found)
Unaffected:	0		
Separated:	1		
Damaged:	1		
Sum:	100	10	
Detonations	82	10	audible

Remark:

Loose igniters: 15 nos. of which 14 nos. damaged

Missing igniters AP:98 % of igniters found (number of detonations + number of loose igniters + unaffected + damaged)

Missing 2 no. considered as destroyed

Result AT:100 %

Clearance test 3:3

TEST REPORT OF MINE CLEARANCE

Engine type 3500	Manufacturer Scanjack
---------------------	--------------------------

Date 12-09-2001	Weather conditions Rain	Temperature 10 deg
--------------------	----------------------------	-----------------------

Testnumber/description/laid depth 3.3 Probability	20 cm
------------------------------------------------------	-------

Structure Pit run	Degree of compaction 97,13	Water ratio average 6,82
----------------------	-------------------------------	-----------------------------

Clearance depth 30 cm	Clearance time /50m 7.02.00	→	Clearance speed 426	m/h
--------------------------	-----------------------------------	---	------------------------	-----

	AP	AT	
Number laid:	100	10	
Destroyed:	74	10	(70 plates found)
Unaffected:	6		
Separated:	11		
Damaged:	9		
Sum:	100	10	
Detonations	43	9	audible

Remark:

Loose igniters: 35 nos. of which 33 nos. damaged

Missing igniters AP:96 % of igniters found (number of plates + separated + unaffected + damaged)

Missing 4 nos. considered as destroyed

Result AT:100 %

Operation

No operational disturbance to report. The machine was completely functional at the time of the required operations.

Action on the machine

The machine was provided with anti-skid device after about one week. This was based on the fact that the anti-skid device was still to be delivered. According to reports, the machine works always with the belt on. The machine showed no adverse effects even if it was driven without anti-skid device.

The machine have not show any abnormal wear nor was adversely affected by the preparation of the soil in the structural tracks. None of the 2x73 tools (73 tools/flail axel) have to be changed during ground working in the structure track. None of the 2x73 tools (73 tools/flail axel) have to be changed during the test period. (until the dynamical test)

Discussion of results

Analysis was carried out with a view to identify possible relationship between, e.g.:

- Clearance speed and clearance result
- Placement of mine object at different depths and the clearance result
- Structure of the tracks and the clearance result
- Side spread and deep placement of mines
- Damaged/separated mines and deep placement of mines

The machine shows a slight tendency not to clear up the test objects which are placed at a depth of 20 cm. One theory is that the energy from the tool decreases gradually when hitting the ground and in the bottom only has the power to scratch the ground.

The plummet is decelerated by the friction of the ground. Based on this reasoning it is advisable not to increase the installed engine power on the diesel engine without increasing

the kinetic energy on the plummet (peripheral speed and weight). An alternative to this can be to lower the clearance speed of the machine further.

Clearance speed varied between 328-547 m/h. There is no clear relationship between clearance speed and clearance probability.

The test result from the sand track shows the best result.

The machine only spread mine and mine parts during the test in the Pit run track.

Conclusions

The machine clears with a good result down to 20 cm depth.

The testing person's observations

The Scanjack 3500 are well experienced and easily handled. The engine power for as well as advance and flaildevice seems to be completely enough. One indicator similar to the indicator that indicate the flailarms horizontal position (flailarms shall work parallell to the ground) should be implemented.

The machine whipe up dust. Still dous Scanjacks mudguard helps to bring down the dustcloud. Consideration must be taken to the wind direction etc.

Only normal maintenace was necessary. No breakdown maintenance was necessary. The machine was available whenever it was required.

Compilation of results of clearance probability test

The compilation shows complete results of respective track structure. Each one of the three performances of track structure at a depth of 0-20 cm is indicated in a test report.

In the paragraph 1.8.4, all the performances are presented in a report (800 AP samt 80 AT).

Synthesis pit run track, track 3

TEST REPORT OF MINE CLEARANCE

Engine type 3500	Manufacturer Scanjack
---------------------	--------------------------

Date	Weather conditions	Temperature Gr
------	--------------------	-------------------

Testnumber/description/laid depth Probabilitytest pit run	0-20 cm
--------------------------------------------------------------	---------

Structure Pit run	Degree of compaction Average approx 97%	Water ratio average Average approx 4,7 %
----------------------	--------------------------------------------	---------------------------------------------

Clearance depth 20-30 cm	Clearance time/50m	⇒	Clearance speed Average approx 492 m/h
-----------------------------	--------------------	---	-------------------------------------------

	AP	AT	
Number laid:	300	30	
Destroyed:	264	30	
Unaffected:	8	0	
Separated:	17	0	
Damaged:	11	0	
Sum:	300	30	
Detonations	195	29	Audible

Remark:

After adding the number of detonations, the number of unaffected, damaged as well as loose igniters an overall result of 98% AP and 100% AT is obtained. Thus 7 nos. of AP igniters were found missing after the test was carried out on the gravel track. It is unlikely that this is present in an unaffected mine object. Therefore it is considered as destroyed.

Synthesis Sandtrack, track 2

TEST REPORT OF MINE CLEARANCE

Engine type 3500	Manufacturer Scanjack
---------------------	--------------------------

Date	Weather conditions	Temperature gr
------	--------------------	-------------------

Testnumber/description/laid depth Probability Sand track	0-20 cm
-------------------------------------------------------------	---------

Structure Sand	Degree of compaction Approx. 93 %	Water ratio average Average approx. 6,1 %
-------------------	--------------------------------------	----------------------------------------------

Clearance depth 30-40 cm	Clearance time/50m	⇒	Clearance speed Average approx. 441 m/h
-----------------------------	-----------------------	---	--------------------------------------------

	AP	AT
Number laid:	<input type="text" value="300"/>	<input type="text" value="30"/>
Destroyed:	<input type="text" value="296"/>	<input type="text" value="30"/>
Unaffected:	<input type="text" value="1"/>	<input type="text" value="0"/>
Separated:	<input type="text" value="2"/>	<input type="text" value="0"/>
Damaged:	<input type="text" value="1"/>	<input type="text" value="0"/>
Sum:	<input type="text" value="300"/>	<input type="text" value="30"/>
Detonations	<input type="text" value="238"/>	<input type="text" value="30"/>

Remark:

While adding the number of detonations, the number of unaffected, damaged as well as loose igniters an overall result of 100% AP and 100% AT is obtained. All the laid mine objects and igniters are retrieved.

Synthesis Arable ground track, track 1

TEST REPORT OF MINE CLEARANCE

Engine type 3500	Manufacturer Scanjack
---------------------	--------------------------

Date	Weather conditions	Temperature gr
------	--------------------	-------------------

Testnumber/description/laid depth Probability Arable ground track	0-20 cm
----------------------------------------------------------------------	---------

Structure Arable ground	Degree of compaction Approx. 86 %	Water ratio average Average approx. 17,3%
----------------------------	--------------------------------------	----------------------------------------------

Clearance depth 30 cm	Clearance time/50m	⇒	Clearance speed Average approx. 584 m/h
--------------------------	--------------------	---	--------------------------------------------

	AP	AT
Number laid:	200	20
Destroyed:	169	20
Unaffected:	6	0
Separated:	18	0
Damaged:	7	0
Sum:	200	20
Detonations	126	20

Remark:

Note: Only two tests carried out (0 cm and 10 cm depth)

After adding the number of detonations, the number of unaffected, damaged as well as loose igniters an overall result of 98 % AP and 100% AT is obtained. Thus 4 nos. of AP igniters were found missing after the action. It is unlikely that these are present in an unaffected mine object. Therefore these are considered as destroyed

Overall compilation of clearance probability track 1-3

TEST REPORT OF MINE CLEARANCE

Engine type 3500	Manufacturer Scanjack
---------------------	--------------------------

Date	Weather conditions	Temperature gr
------	--------------------	-------------------

Testnumber/description/laid depth Probability TOTAL	0-20 cm
--------------------------------------------------------	---------

Structure	Degree of compaction	Water ratio average
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Clearance depth 30 cm	Clearance time/50m	⇒	Clearance speed Average approx. 506 m/h
--------------------------	--------------------	---	--------------------------------------------

	AP	AT
Number laid:	800	80
Destroyed:	729	80
Unaffected:	15	0
Separated:	37	0
Damaged:	19	0
Sum:	800	80
Detonations	559	79

Remark:

Clearing performance in vegetation

General info

The test was carried out with live fuse material only in the AT-mines. This is in view of the risk that igniter may be thrown off, as the test is carried out beyond the fenced range.

Equipment used during the test, peripheral equipment.

Test objects AT/AP
Mine igniter m/47
Break trigger m/49 with pressure star
Earth borer/spade
Metal detector/mine detector (Vallon/Schiebel)
Aggregate exposure equipment
Equipment to destroy unexploded ammunition.
Personal protective gear

Testing persons:

Mj G Danielsson from Testing dept. Ing 2
Lt L Ribbefors from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts from Testing dept. Ing 2

Drivers of mine clearing vehicle:

Sören Andersson from Scanjack

Time taken:

The test lasted two days

Description of the testing range

The ground and terrain conditions, sketch/photo.

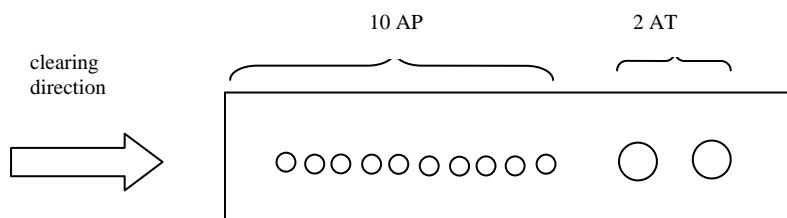


The picture shows the test location for vegetation clearing

The test section was 25 m long and contained impenetrable vegetation < 10 cm.

The test was carried out without live igniters in the AP-mines. This is in view of the risk that igniter may be thrown off, as the test is carried out beyond the fenced range.

The sketch of the mine



Summary

The machine ploughed the ground efficiently. No unclear parts could be retrieved after the test. Depth: approx. 20 cm



The picture shows cleared area after an action

The machine missed the last mine while clearing in the vegetation. This is because the driver tried to avoid a bigger obstacle later on. The DAN testing person had not provided adequate information about how long the machine would take to clear up.



The picture shows mine left behind outside the cleared track

Results of clearing performance in vegetation

TEST REPORT OF MINE CLEARANCE

Engine type 3500	Manufacturer Scanjack
---------------------	--------------------------

Date 20-09-2001	Weather condition Vxl,regn	Temperature 12 deg
--------------------	-------------------------------	-----------------------

Testnumber/description/laid depth Vegetation clearance	10 cm
-----------------------------------------------------------	-------

Structure Naturgrus med sly <10 cm	Degree of compaction	Water ratio average
---------------------------------------	----------------------	---------------------

Clearance depth 20 cm	Clearance time/25m 6.28.18	⇒	Clearance speed 232 m/h
--------------------------	-------------------------------	---	----------------------------

	AP	AT
Number laid:	10	2
Destroyed:	8	*1
Unaffected:	0	
Separated:	0	
Damaged:		
Sum:	8	2
Detonations	0	1 Audible

Remark:

- Only 8 AP mine objects, from which 4 loose plates were retrieved after clearing
- *Only one AT mine affected. See para. 2.3
- Ground tracking without any problem

Operation

No operational problems to report. The machine was completely functional at the time we wished to undertake the activity.

Effect on the machine

The machine did not show any abnormal wear nor was affected adversely by the preparation of the soil in any other manner, apart from normal wear.

Discussion of results

Conclusions

The machine manages to clear up in vegetation <10 cm. Laid AT-mines were detonated and destroyed. No unclear sections were found after the clearing.

The testing person's observations

The test driver begun the test with the cleaningarms in a non horizontal position to the ground. The front flailshaft went into the ground. The driver discovers this and corrected the position on the cleaning arms after approx. 3 m driving.

The machine ploughs through the ground properly. Trunks, etc. severed along with the roots. Left behind branches and knots were loose after the test.

The vegetation test is carried out without live igniters in the AP-mines. This is in view of the risk that igniter may be thrown off, as the test is carried out beyond the fenced range. The AT-mines were provided with live fuse material during the test occasion.

Clearing performance at different sloping conditions

General

The test was carried out with live igniters in the AT-mines. Live igniter was employed in AP (only 5 pcs) during side slope test.

The test was carried out beyond the test track in unprepared terrain. The 10% or 20% sloping condition is determined with measuring tape, pegs and sight rods.

The test was carried out on 17-09-2001 and 19-09-2001.

Clearing in 10% side slope

General info

Equipment used during the test, peripheral equipment.

Test objects AT/AP
Mine igniter m/49B
Mine igniter m/47
Break trigger m/49 with pressure star
Earth borer/spade
Metal detector/mine detector
Aggregate exposure equipment
Equipment to destroy unexploded ammunition.
Personal protective gear

Testing persons:

Mj G Danielsson from Testing dept. Ing 2
Lt L Ribbefors from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts for restoration as well as preparation of tracks, from Testing dept. Ing 2

Drivers of mine clearing vehicle:

Sören Andersson from Scanjack

Time taken for each activity e.g. preparation of track, clearing, searching:

The test lasts 2 days with upward slope

Description of the testing range

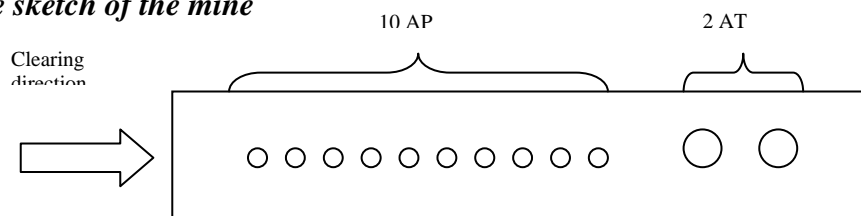
The ground and terrain conditions, sketch/photo.

- 10 % sloping condition
- Grassy grazing ground



The picture shows clearing on 10% side slope

The sketch of the mine





The picture shows laid AP mine

The picture shows laid AT mine

Results for the 10% side slope case

TEST REPORT OF MINE CLEARANCE

Machine type 3500

Manufacturer Scanjack

Date 17-09-2001	Weather conditions Partly cloudy	Temperature 13 deg
--------------------	-------------------------------------	-----------------------

Test number/description/laid depth 10 % side slope arableground	10 cm
--------------------------------------------------------------------	-------

Structure Arable ground, Grassy grazing ground	Degree of compaction	Water ratio average
---------------------------------------------------	----------------------	---------------------

Clearance depth 20 cm	Clearance time /25m 3.24.00	→	Clearance speed 442 m/h
--------------------------	--------------------------------	---	----------------------------

	AP	AT	
Number laid:	5 + 5	2	5 pcs AP with igniter and 5 pcs without
Destroyed:	8	2	
Unaffected:	0		
Separated:	0		
Damaged:	0		
Sum:	8		
Detonations	3	2	Audible

Remark:

Ground tracking of clearing unit without any problem

1 no. of loose igniter found 5 m to the left of cleared track.

1 no. of igniter is missing after the clearance test (presumably detonated)

2 nos. of mine objects without igniters missing

Operation

No operational problems to report. The machine was completely functional at the time we wished to undertake the activity.

Effect on the machine

The machine did not show any abnormal wear nor was affected adversely by the preparation of the soil in any other manner.

Discussion result

The ground contain a lot of stone and it was very hard to hear possible detonations.

Conclusions

10 % side slope does not limit the clearing performance of the machine.

Opinions of the testing person on 10% side slope

The benefit of AP-mines to be retrieved, during the test, outside the test track is questionable. While assessing the machines outside the test track it is important that AT-mines are laid so as to find out whether they are destroyed at the first instant. These can otherwise seriously harm both the operator and the machine during the next clearing.

Clearing in 20% downward slope

General info

Equipment used during the test, peripheral equipment.

Test objects AT/AP
Mine igniter m/47
Break trigger m/49 with pressure star
Earth borer/spade
Metal detector/mine detector
Aggregate exposure equipment
Equipment to destroy unexploded ammunition.
Personal protective gear

Testing persons:

Mj G Danielsson	from Testing dept. Ing 2
Lt L Ribbefors	from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts for restoration	from Testing dept. Ing 2
--------------------------------	--------------------------

Drivers for mine clearing vehicle:

Sören Andersson	from Scanjack
-----------------	---------------

Time taken for each activity e.g. preparation of track, clearing, searching:

The test lasts 2 days with upward slope

Description of the testing range

The ground and terrain conditions, sketch/photo.

- Sloping conditions: 20 %.(above slope >20%).
- Bigger stones, etc. were found in the terrain where the machine was supposed to clear up.
- In the above slope the inclination is >20%. No mine objects placed on the above slope.

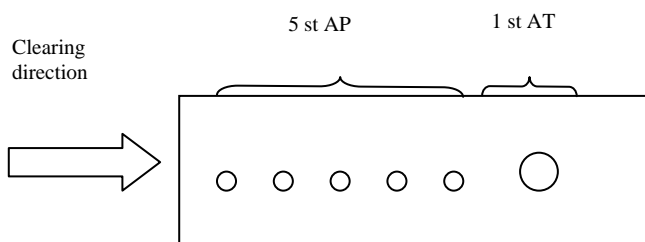


The picture shows clearing in 20% downward slope



The picture shows clearing in 20 % upward slope

The sketch of the mine:



Results of 20% downward slope

TEST REPORT OF MINE CLEARANCE

Machine type 3500	Manufacturer Scanjack
----------------------	--------------------------

Date 19-09-2001	Weather conditions Cloudy with rainy intervals	Temperature 13 deg
--------------------	---------------------------------------------------	-----------------------

Test number/description/laid depth Downward slope 20%	10 cm
----------------------------------------------------------	-------

Structure Gravel esker with vegetation	Degree of compaction	Water ratio average
-------------------------------------------	----------------------	---------------------

Clearance depth 20 cm	Clearance time /50m	⇒	Clearance speed m/h
--------------------------	------------------------	---	------------------------

	AP	AT
Number laid:	<input type="text" value="5"/>	<input type="text" value="1"/>
Destroyed:	<input type="text" value="4"/>	<input type="text" value="1"/>
Unaffected:	<input type="text"/>	<input type="text"/>
Separated:	<input type="text"/>	<input type="text"/>
Damaged:	<input type="text"/>	<input type="text"/>
Sum:	<input type="text" value="4"/>	<input type="text" value="1"/>
Detonations	<input type="text" value="0"/>	<input type="text" value="1"/>

Remark:

Ground tracking without any problem.

Only four AP-objects were retrieved. They had not yet been provided with live igniters.

Operation

No operational problems to report. The machine was completely functional at the time we wished to undertake the activity.

Discussion of the results

The AT mine detonated. Only four AP-mines were found (not provided with igniter)

Conclusions

20 % downward slope definitely limits the performance of the machine. The machine increased in speed downward the slope. The driver did not use the brakes. The ground at the location of testing consists of unsorted masses of gravel with both big and small earth-bound stones.

Opinions of the testing person on 20% downward slope

Clearing in sloping conditions corresponding to 20% or more can be risky. The machine can start to slide (ball bearing effect). In that case the driver cannot control the machine any longer and this can endanger life.

Scanjack is still capable of properly handling sloping conditions as in the given test conditions.

The machine cleared the entire path down the slope. In these slopes, the inclination is more than 20%.



FÖRSVARSMAKTEN

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OCH MINRÖJNINGSCENTRUM

SUBREPORT

Date

19-09-2002

Appendix 3

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*The picture shows Scanjack clearing downwards
in the upper slope*

*The picture shows cleared surface after testing
downwards*

Clearing in 20% upward slope

General info

Equipment used during the test, peripheral equipment.

Test objects AT/AP
Mine igniter m/47
Break trigger m/49 with pressure star
Earth borer/spade
Metal detector/mine detector (Vallon/Schiebel)
Aggregate exposure equipment
Equipment to destroy unexploded ammunition
Personal protective gear

Testing persons:

Mj G Danielsson from Testing dept. Ing 2
Lt L Ribbefors from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts for restoration from Testing dept. Ing 2

Drivers of mine clearing vehicle:

Sören Andersson from Scanjack

Time taken for each activity e.g. preparation of track, clearing, searching:

The test lasts 2 days with upward slope.

Description of the testing range

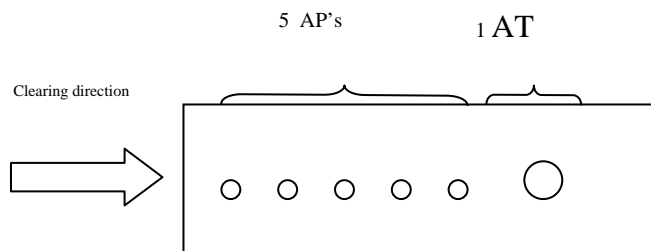
The ground and terrain conditions, sketch/photo.

- Slope conditions: 20 %
- Bigger stones/trunks, etc.



The picture shows clearing on 20% upward slope

The sketch of the mine:



Results in the case of 20% upward slope

TEST REPORT OF MINE CLEARANCE

Machine type 3500	Manufacturer Scanjack
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Date 19-09-2001	Weather conditions Cloudy with rainy intervals	Temperature 13 deg
--------------------	---------------------------------------------------	-----------------------

Test number/description/laid depth Upward slope 20%	10 cm
--------------------------------------------------------	-------

Structure Gravel esker with vegetation	Degree of compaction	Water ratio average
-------------------------------------------	----------------------	---------------------

Clearance depth 20 cm	Clearance time /20m	⇒	Clearance speed m/h
--------------------------	------------------------	---	------------------------

	AP	AT
Number laid:	5	1
Destroyed:	4	1
Unaffected:		
Separated:		
Damaged:		
Sum:	4	1
Detonations		1

Remark:

The AT mine was detonated.
 Only four nos. of AP mines were retrieved.

Operation

No operational problems to report. The machine was completely functional at the time we wished to undertake the activity

Discussion of results

The picture shows cleared surface after the upward slope test

Conclusions

The machine shows no limitations on the occasion of the test.

The testing person's observations in the case of 20% upward slope

Clearing in the sloping condition corresponding to 20% is risky. The machine may begin to slide (ball bearing effect) .The driver can no longer control the machine and this could endanger life. The judgement is that Scanjack 3500 can work in this slope condition.

It's important that the machine clear all the AT-mines in the first passage, when they in a later passage, if they don't clear, can seriously damage the operator and the machine (general point of view).

Manoeuvrability/navigability

General info

Equipment used during the test, peripheral equipment.

Chronograph
Measuring tape
Iron tipped oak beam 30x30 cm
Trench 1.5mx0.5m

Testing persons

Mj G Danielsson from Testing dept. Ing 2
Lt L Ribbefors from Testing dept. Ing 2

Other employees: names, responsibilities:

2-3 conscripts for restoration as well as preparation of tracks from Testing dept. Ing 2

Drivers of mine clearing vehicle:

Sören Andersson from Scanjack

Summary

See remarks of respective tests

Description of the testing range

The ground and terrain conditions, sketch/photo.



The picture shows 30x30 cm obstacle



The picture shows 1.5x 0.5 m trench



The picture shows minimum turning radius test



The picture shows reversing on the cleared track



The picture shows turning on the cleared track

Results of Manoeuvrability/navigability during clearing

Minimum Turning Radius

How large a minimum turning radius does the machine have during clearing with safety guarantee for tyre/wheel, in m? Turning radius was measured up to 35 m. Turning time (180°) 11,25 min

The clearance depth was 15-20 cm on during the test. No abnormal damages/wear resulted for the machine.

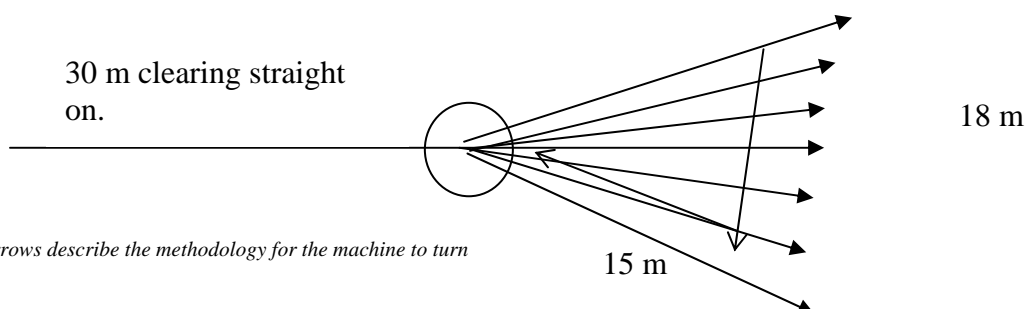
The test had to be made ones again after the first test. The machine was turning to much On the inside wheel, on the front axis, went on unclear ground. Turning radius was then 26 m.



The picture shows front pair of wheels on the uncleared track

Turning of the machine on cleared track

The extent of range required in order to turn the machine on cleared track, m², m, sketch/photo.



Arrows describe the methodology for the machine to turn

Time taken for turning on cleared track:

32 min

Clearance depth:

15-20 cm

Remark:

Timewasting and dangerous manoeuvre because of the machine's small overlap between clearance width and wheel base (only 10 cm/side). The machine was climbing on the edge to the uncleared area at several occasion with rear goggie (encircled area)



The picture shows rear bogey wheel while turning on the cleared track

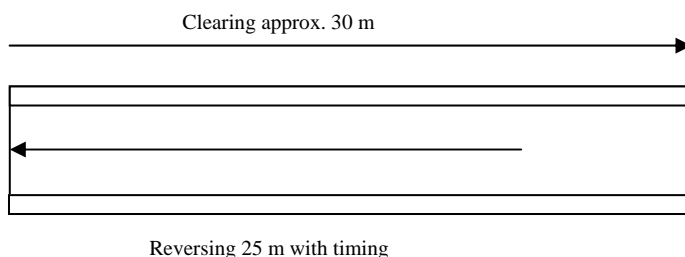
Results of Manoeuvrability/navigability during the execution of sub-series 1

Capability to reverse on cleared track

Maximum speed with safety guarantee, km/h.

The machine cleared up a 30 m long track. Thereafter the machine was reversed 25 m. Time for the reversing manoeuvre:

- 1 min 12 seconds? 1,25 km/h



Sketch/photo: deviations from cleared track.

The machine has no problems in reversing on cleared track. The driver has good visibility.

Trench

Number of successful/unsuccessful tests to cross the trench, nos..

The machine cleared the obstacle in the first attempt both forward as well as backward

Sketch/photo: description of the trench.



The picture shows forward trench stay

Obstacle

Number of successful/unsuccessful tests to overcome the obstacle, nos.

The machine managed the obstacle in the first attempt both forward as well as backward.

Sketch/photo: description of the obstacle.



The picture shows backwards obstacle test

Operation

No operational problems to report. The machine was completely functional at the time we wished to undertake the activity

Effect on the machine

The machine did not show any abnormal wear nor was affected adversely by the test in any other manner.

Conclusions

The only limitation of the machine is the small overlap between clearance width and wheel base (only 10 cm/side). The manufacturer are going to modify this as soon as possible after the test.

There is no inherent limitation system to turn beyond cleared track.

Trench and obstacle make no limitations for Scanjack 3500.

The testing person's observations

The machine are transported with the flail first. According to the overhang behind the machine. This procedure in combination with anti-skid devices means that the machine moves far beyond the maximum (top) speed for the vehicle (maximum (top) speed for Timberjack approx. 20-25 km/h).

**The testing person's opinions-Manoeuvrability during clearing (the full test)**

Manoeuvrability during clearing ar limitid because only small steering correction are possible. The reason to this is the limited overlap between clearance width and wheel base (only 10 cm/side). The driver have no teknical support that help him to not do large steering movments and then be beyond cleared track.



The picture shows the laid antitank mine m/47

The ground and terrain conditions, the nature of the tracks.

A roadbed with length 20 m, width 6 m and height 50 cm is constructed at 45° angle from the common shelter. This is so that the driver will be able to drive the machine from the shelter and at the same time be able to determine the speed and direction. The roadbed is made from sorted natural gravel of 0-18 mm. Compaction with 4 ton tow-roller was carried out after each 20 cm layer of piled material.



The picture shows the machine arranged for dynamic clearance test

The roadbed was damp during the test.

Väderleksförhållanden

Rainy, temp. approx. 12°

Any modifications/changes made on the mine clearing machine from the starting date of the test.

No reported or known modifications.

Time taken for each activity e.g. preparation of track, clearing, searching.

The test lasts 1 day excluding preparations for construction of roadbeds.

Results of blasting test 5.5 kg

Course of events

The test was carried out completely according to the description in 5.2. The Detonation was in the front flail.

Measured forces

See FMV/FFK report

Damages to the machine

What damages were caused to the machine? Sketch/photo



The picture shows splinter damages on the flail pipe



The picture shows worn out plummets

- 2 nos was missing and a part of the chain
- 2 nos was damage
- Various superficial splinterdamages on the cylinder and some damages on screw joint reinforcement

Discussion of results of the 5.5 kg blasting test

The damages to the clearing unit are judged to be less after the 10 kg mine than the 5.5 kg one. The flails showed insignificant splinter damages after the 10 kg detonation whereas 5.5 kg caused significantly more. The probable cause is that antitank mine 5 does not have a casing whereas antitank mine m/47 has sheet-metal casing.

Conclusions

The machine is judged to be operative again after change of 2-4 pcs of chain including plummets. Assessed tearing time: approx. 0.5 hours. This is not yet checked.

The testing person's observations on 5.5 kg blasting test

The machine appears to be very robust. The damages after both the 5.5 kg and 10 kg mines are marginal in this case.

The picture antitank mine 5

The ground and terrain conditions, nature of the tracks.

A roadbed with length 20 m, width 6 m and height 50 cm is constructed at 45° angle to the common shelter. This is so that the driver is able to drive the machine from the shelter and at the same time determining the speed and direction. The roadbed is built with sorted natural gravel 0-18 mm. Compaction with 4 ton tow-roller was done after each 20 cm layer of piled material.

The roadbed was soaked in water during the test.

Weather conditions

Rainy, temp. approx. 10°C

Time taken for each activity e.g. preparation of track, clearing, searching.

The test lasts 1 day excluding preparations for construction of path object.

Results of 10 kg blasting test

Course of events

The test was carried out completely according to 5.8.

Measured forces

See FMV/FFK report

Damages to the machine

What damages were caused to the machine? Sketch/photo



The pictures show damages to the clearing tool after carrying out the test

- 1 no. plummet is missing
- 2 no. plummet damaged / deformed

Discussion of results of the 10 kg blasting test

The damages to the clearing unit is judged to be less after the 10 kg mine than the 5.5 kg one. The flail pipe showed insignificant splinter damages after the 10 kg detonation whereas 5.5 kg caused significantly more. The probable reason is that antitank mine 5 does not have a casing whereas antitank mine m/47 has sheet-metal casing.

Conclusions

The machine estimated to be operativ after changes of missing plummets and chain. Estimated repair time approx. 15 minutes.

The testing person's opinion on 10 kg

The machine appears to be very robust. The damages after both the 5.5 kg as well as 10 kg mines are marginal in this case.

The machines protection sheilds reduces at the detonation by 2 pcs accumulator on the tiltcylinder plusside. Beside damper there is 2 pcs saftywent that drain possible overpressue strait out in the air. No movments in the tiltcylinter could be found after the test. No oil waste from the saftywent could be found.