



Pre-Test Assessment of Freeland 3000



Capt Patrik Blomander SWEDEC

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Mailing Address	Visiting Address	Telephone	Fax	E-mail, Internet
Box 1003		+46 381 180 00	+46 381 184 14	exp-swedec@mil.se
SE-575 28 EKSJÖ				www.swedec.mil.se
SWEDEN				

Executive Summary

This report details the result of a Pre-trial Assessment (PTA) of Freeland 3000 ground-clearing flail. The PTA is an important part of the testing of a piece of equipment, allowing testing organisations such as those represented by ITEP (International Test and Evaluation Program for Humanitarian Demining) to gather and verify basic data quickly and cost effectively before committing significant time and effort for a full test of the equipment. Although a PTA will not be able to give accurate information on the performance, it has been designed to highlight trends and characteristics of the equipment that can be explored further at a later stage. The machine is still under development, which means that not all have been tested on the field.

Positive

- Flails the ground very effectively to a depth of 30 cm.
- Good engine power for the flail
- The cruise control keeps an even velocity.

Negative

- Limitations in terrain pass ability. It must be possible to raise the flail more than today's 50 cm. At least 100 cm is necessary.
- There is no ground level system.
- No blast tests performed to show what kind of protection the driver has against blast and fragments.
- Has no tracking system today, which means that the machine has a 1 metre overlap.
- There is no remote control for the machine.
- The machine can't do a maximum turn, that because of protecting plate's ion the waistline.

Freeland 3000 has a very good engine capacity for the flail, the machine can penetrate the ground to a depth of 40 cm (Swedish agricultural soil). The machine does not have a ground levelling system, which means that the operator has got difficulties maintaining the clearance depth when the ground isn't completely in level. The machine possibility when driving on ground with low load-bearing is good, the possibility is limited when there is a height difference though. This is due to the fact that in the current configuration the flail unit can't be raised more than 50 cm. This was shown when the machine passed a ditch with a 75 cm depth, the machine didn't make it across.

The clearance speed of the machine is very stable. The machine has a very even speed with stable engine revolutions.

The machine today has a limitation when starting on an upward slope. When tested on a 20 degree upward slope the machine failed, the manufacturer should test this in the future to gain improved capacity.

The Freeland 3000 has the potential to become a valuable tool for the demining community and it is recommended that a prospective user consider it for further testing and/or field trials.

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1 Introduction

1:1 Background

The International Test and Evaluation Program (ITEP) of which Sweden, through Swedec is a member, has agreed that testing of mechanical equipment for humanitarian demining should be based on agreed standards wherever practicable. The European Committee for Standardisation (CEN) Workshop Agreement CWA 15044 provides the basis for this type of testing that has been adopted by ITEP.

Following the inspection of data from the manufacturer, the recommended first step in CWA 15044 is a Pre-Trial Assessment (PTA). Normally conducted at/or near the manufacturer facilities, this stage is used as a filter to ensure that the machine in question is sufficiently capable, and the design sufficiently mature, that it is worth proceeding too the next step in CWA 15044, which are more expensive in terms of time, labour and other resources.

1:2 Aim

The aim of the trial was to evaluate the performance and mobility of Freeland 3000 under defined threat and terrain conditions.

1:3 Trial Objectives

The key objective of this Pre-Trial Assessment is to perform tests and use best engineering judgement in order to present basic evidence to the customer about the maturity and applicability of the equipment in relations to current technology and methods used in Humanitarian Demining.

In doing so it will be necessary to:

- assess the mobility of the equipment using the facilities available.
- make an assessment of performance of the equipment under prescribed conditions and estimate clearance rates of both mined and vegetated areas.

2 Equipment under Test

Complete Demining AB has developed Freeland 3000. Freeland 3000 is classified as a medium (5-20 ton) machine with flail. The machine is operated from the cabin on the machine.

The general specifications of the machine, as provided in the manufacturer's literature, are as follows:

Engine

- Engine basic vehicle: Rotne 9-6, 140 hp
- Engine demining unit: Deutz BF 12 513 L, 480 hp, air-cooled
- Fuel capacity, basic vehicle: 140 litres
- Fuel capacity, demining unit: 420 litres
- Transmission: Mechanical

Chassis

- Rotne 9-6

2:1 Location and personnel

The trial took place between 18 and 19 August 2008 at SWEDEC Norra Kulla Sweden.

Capt Patrik Blomander, Test leader, SWEDEC
Anders Bredelius, SWEDEC

2:2 Test Procedure

Test procedure sheets were issued for each test, a summary of the tests is shown in table below. A description, a summary of results and comments/observations of each test are detailed on the following pages.

Day		Activity
Monday 18 August		<ul style="list-style-type: none"> • Arrive, set up, familiarisation of equipment and surroundings. • Driving speed • Operating speed and clearance depth in varying terrain. • Clearing over fibreboards
Tuesday 19 August		<ul style="list-style-type: none"> • Start and stop in slope • Side inclination • Capacity in vegetation • Vehicle data

3 Results

3:1 Speed

- The machine was penetrating the ground to a depth to 20 cm with a speed of 507 m/h, (driving 50 m on 5.55 min).
- The machine was driven on soft ground, 50 m on 46 s, (3613 m/h)
- The machine was driven on hard road, 50 m on 25 s, (7200 m/h)

For the speeds above, the machine was fitted with band tracks; according to the manufacturer the machine has a speed of about 25 km/h without band tracks.

3:2 Slopes and Gradients

- The machine was tested on 10 degrees upwards /downwards slope, which was no problem for the machine.
- The machine was tested on a 20 degrees upwards /downwards slope. When driving downwards, the machine had no problems stopping and standing still for a minute. The machine was not able to drive upwards.



The terrain used on this occasion did not permit the opportunity to test the machine on a 15 degrees upward slope.

- The machine performed clearance with a 10 degrees sideward inclination, and the machine performed well. With a higher inclination the operator had a hard time to maintain the right course though. The machine should not perform clearance when the sideward inclination exceeds 10 degrees.



3:3 Obstacles and rough terrain

The machine has a hard time to advance when the terrain is uneven. This is due to the fact that the machine can not lift the flail unit high enough. These variations in height can often occur when the machine has to move from a road to a field.



3:4 Vegetation clearance

The machine was tested on two different vegetation areas; thick and thin brushwood. The machine had no problems to manage vegetation with a coarseness up to 10 cm, it should however be observed that the clearance result with coarser vegetation has not been tested.



3:5 Logistics

With the trial only spanning two days very little could be gained from recording fuel consumption. The image below shows that the flail engine is easy to access for maintenance thanks to the ability to fold the engine bonnet to the sides. During the test, Freeland 3000 had problems with the brake locking up, due to some kind of computer error. The machine manufacturer Rotne had to rectify the problem.



3:6 Ground Flailing

The machine cleared over two witness plates, consisting of two fibreboards placed 10 m apart. The test was performed in gravel, at one of the test tracks at Norra Kulla. From the pictures it can be seen that the machine has a tendency to incline; the clearance depth is about 20 cm at the right edge and 10-15 cm at the left edge. The condition during the test was a level area on the test area used.



Fibreboard no 1



Fibreboard no 2

5 Freeland 3000 Specifications

These specifications of Freeland 3000 are from the machine manufacturer Complete Demining AB.

1 Performance

- 1.2 Road speed: 25 km/h (max)
- 1.3 Operation speed: 0.1-1.5 km/h
(Depending on ground conditions)
- 1.4 Clearance rates : 1,000-3,000 m²/h
(Depending on ground conditions)
- 1.5 Flail clearance width: 3000 mm
(30-50 cm overlap recommended)
- 1.6 Slopes Operational: +/- 15 degrees
- 1.7 Ditch: width 1.0 m (future 2.0 m)
- 1.8 Turning space: 13 m
- 1.9 Wade ability: 1.0 m
- 1.10 8 wheel drive

2 Dimensions

- 2.1 Widths:
 - Overall: 3,800 mm (flail)
 - Prime Mover: 2,600 mm
 - Width of tracks: 600 mm
- 2.2 Lengths:
 - Fully operational : 10,500 mm
 - Prime Mover: 8,000 mm
- 2.3 Heights:
 - Fully operational : 3,300 mm
- 2.4 Weights:
 - Gross operational: 18,700 kg (future 18,000 kg)
 - Prime Mover: 15,000 kg
 - Flail Unit: 3,700 kg (future 3,000 kg)
- 2.5 Ground bearing pressure: 0.25-0.30 kg/cm² (estimate)
- 2.6 Ground clearance: 600 mm

3 Flail Unit

3.1 Capacity

Flail diameter: 1,500 mm
Chain length: 750 mm
Weight of tool with chain: 9.7 kg
Weight of tool: 6.0 kg
Number of chains: 42
Rotor revolutions: 370-420 rpm
Flailing depth max: 450 mm
Flailing depth normal: 150-300 mm
(Depending on speed and ground conditions)
Hp pr. Meter flail: 160

4 Engines

4.1 Prime Mover:

Type: John Deere, 4045 HF275
Power rating: 104 kw (140 hp)

4.2 Flail engine:

Type: Duetz Double Turbo, BF 12-513
Power rating. 353 kw (480 hp / 19 liter)
Air cooled

5 Hydraulic System

5.1 Prime Mover:

Hydrostatic drive system

5.2 Flail System (independent from prime mover)

Mechanical drive system
Trippel "lamell" Clutch

6 Electrical System

24 volt

7 Fuel capacity

620 liters
Consumption: 50-60 liter (depending on ground conditions)

8 Protection

Armoured cabin: 20 mm, armox 500