

BLAST PROTECTIVE BOOTS

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Abstract:

For mines & UXO clearance operations, there enough different technologies exist. There is very probably that new methods and technologies will be developed in near and fast future.

Group of then joint one partial dangerous procedure, deminer must walk across minefield. Similar problems have a rather large group of humanitarian workers and all who remedy former battlefield. They must walk across suspicious areas.

For all these peoples was developed protection boots. It is designed for protection of legs against explosion of small anti-personnel mines and related UXOs items.

Presented paper describes milestones in development and testing protective boots.

Technical specification and protection levels are added.

1 INTRODUCTION

Each war brings killing. For enemy killing machineguns, cannons, tanks.... and also landmines can be use. When war finish, soldiers return back to home, tanks go away, only landmines - these small hidden killers remain. They sleep in the soil and wait at own victim. They sleep in soil and wait 10, 20, 30 or 50 years. They wait on last step...

During war is killing casual. It is terrible, but killing soldiers during war is casual. Why landmines kill to civilians, children or farmers 20, 30 or 50 years after war? Why?

Because in 60 countries in the world is scattered around 100 millions landmines, we started own development of blast protective boots.

2 INDEPENDENT DEVELOPMENT

2.1 Dr. Chladek independent development

Works solving these problems concerning foot protection started in 1988 year. Firstly there were collect different materials appropriate for armour construction. In this period number of different types of flexible armour were prepared. Differences were in material, number of layers, thickness of layers, technology of layer connection etc.



Pic.1 Prototypes of armour prepared for testing

Each sample was tested by explosion. Like testing charges were used boosters made from TNT, PETN and Semtex. In accordance to results of previous steps, new test samples contain also a sole were made. After successful trials with different explosive charges, there appeared clear request: co-operation with boots producer is necessary. There was necessary to know which material and which technology can be use for resistant boots production.

2.2 ZEMAN Shoe Ltd. independent development

Zeman Shoe Ltd. started own research & development works concerning mine resistant boots during year 1998. During preliminary stages was used available information from other

abroad producer and experience from tests carried out in USA.

All leather boots reinforced by ballistic material and sole with special shape for movement of explosion gases outside the boot contains aluminium insert were base of own development

Final prototype was prepared for tests in spring 1999. These tests show that own way in R & D blast resistant boots is bad. Boots had not required protection level. During tests were obtained also some interesting finding:

- Sole design is not so important and it has minority effect on protection level
- boot construction must be without any metallic part
- it is necessary to find appropriate testing methods (there are no standards)

There were necessary to find some expert experienced in explosives and protection against explosion. Meeting with Dr. Chladek, independent expert in explosives on exhibition IDET 99 was successful. There started new era in research and development of blast protective boots.

3 JOINT RESEARCH & DEVELOPMENT

Both sides met firstly during International Exhibition of Defense Technology IDET 99 in May 1999. Already in start of co-operation there were given basic requirements for final product:

- boots will be appropriate for all-day wearing,
- must be resistant against AP mines containing around 35g TNT and/or unexploded ordnance like sub-munitions and related items,
- will be designed for all peoples who must go across dangerous areas, especially wide range of humanitarian workers as well as for de-miners.

During R & D works each material, each technology was tested by explosion of different charges. There were necessary to find new technologies and also new materials appropriate for resistant boots production. Special attention was given to main parts of future boots, like sole, toecap and heel seat.

After two years from first meeting, during two years co-operation there were made new mine resistant boots.

4 TESTING

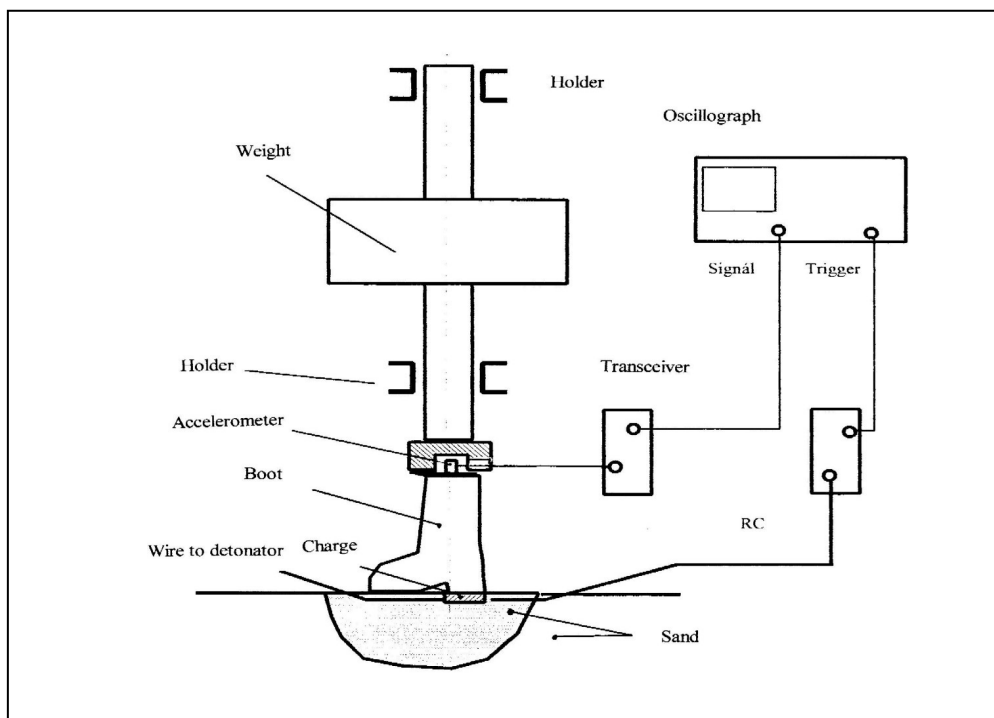
During preliminary period each sample was weighted by wooden box filled by sand and soil with the total mass around 50 kg. Later few different steel legs were used, but this tests shows that these tests do not answer to this purpose. Useful results were obtained when wooden man (block of wood) with a mass around 65 kg was used.

Trials with charges exploded in front of boots simulated situation when user kick at unexploded ordnance.

The boots were tested in state testing laboratory and it fulfills the requirements on the CSN EN 347.

Final tests in testing facility of Dept. of Theory and Technology of Explosives, University of

Pardubice were undertaken Tested boots were fitted to measuring equipment, equipped by accelerometer (see Pic.2). Weigh of person was simulated by 65 kg weight. Under hell was placed testing charges – 25, 35 or 50 g of plastic explosive Semtex. There was also tested when charge was buried 2cm in soil (*). Results of measurement were recorded by oscilograph. Results are given in text table.



Pic. 2 Measurement system - block diagram

Tab. I. Result of tests

SAMPLE	CHARGE	G force	COMMENTS
Ordinary combat boots	25g	N/A	fatal destruction, AMPUTATION !
Zeman AM	25g	550-600g	damaged part of sole (heel)
Zeman AM	35g	N/A	damaged part of sole (heel)
Zeman AM	50g	800g	heavy damaged heel, inside OK
Zeman AM	25g*	530g	minority damage of sole

5 RESULT OF CO-OPERATION



Introduced product “Blast Resistant Boots model Zeman AM” offer resistance against explosion of AP mines and unexploded ordnance with a charge of 35–50g TNT. Materials used for boots production ensure waterproofs while keeping permeability for water vapors out from the boot.

The boots are characterized by a robust and resistant design with long-term service live and they do not contain any metallic parts.

And that all with the total weight under 3 kg per pair.

Pic. 3 Zeman AM – Blast Protective Boots.

6. REFERENCES

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