**ANNEX 1**

# FORREST BORE CLEANING FOAM

Information file

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*MILFOAM Ltd*
**Kauppakartanonkatu 7 A 73**
**FIN-00930 Helsinki**
**FINLAND**

**The FORREST non-toxic bore cleaning foam**

Inventor:

MJP Production Ltd. Oy / competing shooter Mr. Markku Paananen

Background:

Mr. Markku Paananen, who fires approx. 20,000 shots annually, was of the opinion that there should be an easier rifle cleaning method than the existing barrel-wearing and time-consuming methods. In this way, the developing work of the new cleaning agent started. The objectives were as follows:

1) The agent must not be toxic.
2) The agent must not contain evaporative gases.
3) It must be more powerful than the other agents.
4) The application method must be fast and clean.
5) It must eliminate the need of mechanical cleaning (bronze brush).
6) The agent must be anti-freezing.
7) The agent must be economically competitive.
8) The agent must protect the barrel metal from corrosion.

Technical properties:

Non-toxic.
pH 12.
Operating temperature -30 - +50°C.
Adsorbs copper compounds by means of oxidation efficiently.
Removes the residues of gunpowder and carbon deposits efficiently.
Leaves a protective film in the barrel (the anti-corrosion properties are shown in the annex).

Function:

The agent oxidises intensively in contact with copper, brass and bronze compounds. In some extent, also aluminium oxidation takes place. During the oxidation process the foam turns to blue.

The agent attaches evenly to the internal barrel surfaces as it is sprayed in foam form. The reaction time in a barrel containing a normal amount of jacket metal is approx. 15 min. A barrel containing heavy jacket deposits must be cleaned anew. The propellant pressure controls the tightness of the foam.

The agent can be efficiently used for cleaning the outer rifle surfaces; it removes gunpowder residues and carbon.

VTT, MANUFACTURING TECHNOLOGY STUDY REPORT

No. VAL 40202

Client

Mr. Markku Paananen
Peltolantie 30-32 G 29
04400 Järvenpää

Order

Mr. Markku Paananen by mail 20.4.1994.

Samples

A clear liquid, so-called jacket-removing chemical, supplied by the client by mail 20.4.1994.

Information provided

According to the information provided by the client, the chemical is used for removing copper from gun barrels. pH-value of the agent is 12.

Assignment

A study of the agent by means of immersion test using carbon steel and stainless steel samples. The samples were selected from the laboratory steel samples according to the client's instructions.

Studies conducted

The steel samples, the analysis on which is shown in table below, were polished, cleaned with acetone and spirit in an ultrasound canister and immersed in the chemical for 7 days. The weight change of the samples were determined.

Results and assessment of the study

The analyses of the steel samples are follows:

| Sample | C % | Si % | Mn % | S % | W % |
|---|---|---|---|---|---|
| Carbon steel | 0.65 | 0.97 | 0.50 | 0.006 | 0.022 |

| | | | | | |
|---|---|---|---|---|---|
| Stainless steel | 0.23 | 0.30 | 0.48 | +.023 | 0.028 |
| | Cr % | Ni % | Mo % | Cu % | |
| Carbon steel | 1.05 | 0.07 | 0.50 | 0.03 | |
| Stainless steel | 12.3 | 0.07 | - | 0.09 | |

The weight changes of the samples were as follows:

| Sample | Initial weight | Final weight | Change mg | Change $g/m^2$ |
|---|---|---|---|---|
| Carbon steel | 10.06698 | 18.06736 | -0.38 | -0.3 |
| Stainless | 15.91854 | 15.91862 | -0.08 | -0.06 |

After the test, no pitting or other corrosion spots were found on the samples. The carbon steel surface was turned to yellowish. Already during the manufacture of the sample, it was found out that the surface colour of the carbon steel had been changed owing to oxidation.

The weight changes indicate that the sample surface has oxidized in the solution, as it normally occurs in a solution containing water. On both samples, surface oxidation was insignificant. Assessed on the basis of the weight change recorded, the corrosion rate during a one year-long immersion test would be under 1 ym/a for stainless steel and under 1 ym/a for carbon steel.

Opinion

On the basis of the information provided and the studies conducted, the corrosive effect of the jacket-removing chemical on the tested carbon steel and stainless steel samples was relatively insignificant. After one week's immersion test, no pitting or spot corrosion were found on the steel samples.

Espoo, Finland 11.5.1994

VTT VALMISTUSTEKNIIKKA (MANUFACTURING TECHNOLOGY)

PANSSARIPRIKAATI OPINION
Panssarikoulu

Parolannummi 13.12.1995

Opinion on the copper removing foam marketed by Mr. Markku Paananen

The product has been used in the Tank Brigade in the maintenance of .50 and .338 calibre guns with the following experiences.

The copper removing foam has proven to be easy to use. The agent has been injected directly into the barrel in such a way that the injection nozzle has been sealed against the muzzle and the other barrel end has been left open. The injection has been carried on until foam has gushed out of the open end. The reaction time applied has been 1-2 hours, after which the barrel has been cleaned by means of a rather tight cleaning wad.

Normally, with calibre .338, good cleaning results have been obtained by cleaning one or two times. For calibre .50, three to five cleanings have been necessary to obtain a good result. On this calibre, copper build-up has been relatively heavy.

As regards its copper removing properties, the copper removing foam has proven to be equal to the best corresponding agents on the market.

However, being odourless and easy to use, this product stands out from the earlier corresponding agents.

Markku Vehmas
Warrant Officer

TANK BRIGADE
Service Department
Maintenance Activities
Parolannummi

OPINION

24.5.1996

CRUST AND COPPER REMOVING AGENT TEST

The new crust and copper-removing agent was tested by the Tank Brigade during the maintenance operation of the guns of an assault tank, a combat tank and a tracked howitzer.

Trade name of the product is FORREST Professional Super BORE CLEANING FOAM. The agent is packed in a spray bottle and the product is supplied by MJP Corporation Ltd, Markku J. Paananen, Peltolantie 30-32, 00440 JÄRVENPÄÄ

Guns used for the test:

30 mm automatic gun
Initial condition: About 2000 shots had been fired with the gun; crust build-up was considerable in the rear part and copper build-up quite heavy throughout the barrel. After two treatments the obtained result was remarkably good. Crust and copper were removed so that the barrel was sufficiently clean.

122 mm gun
Initial condition: About 200 shots had been fired with the gun, light crust build-up in the rear part of the barrel and in the shell chamber, and light copper build-up throughout the barrel.

After one treatment it could be seen that the barrel was in good condition and almost completely cleaned from impurities.

125 mm gun
Initial condition: About 100 shots had been fired with the gun, light crust build-up in the rear part of the barrel and in the shell chamber, and light copper build-up throughout the barrel.
After one treatment it could be seen that the barrel was almost completely cleaned from impurities.

On the test situation the agent was injected into the gun barrel through shell chamber, in such a manner that the injection nozzle was sealed at its rear end with a shell, and the barrel front end was left open.
The injection was carried on until foam gushed out of the open end. The barrel was filled with the foam and the agent was left there to act.

On the 30 mm gun the agent was injected through the gas port into the barrel. The foam expanded to both directions, thus filling the barrel, and the agent was left there to act.

Tested action time was 1-3 hours.

3 spray bottles were required for a 122 mm barrel.
6 spray bottles were required for a 125 mm barrel.
For 30 mm barrels, 1 bottle is sufficient for five treatments.

It became evident during the test that considerably better result is obtained if the agent is ”laid” into the barrel wall with a clean oil brush, once during the action time. Applying more foam during the action time was not necessary.

Use of the crust and copper removing foam turned out to be very easy, because it is non-toxic, odourless and also clean to use. The agent is very environment-friendly and no harmful waste was produced.

The performed test proved that considerable amount of time can be saved by using this product, compared with the present copper removing method. For example, removing copper from a 122 mm barrel with the present method takes about 1,5 hours. With this new method the actual cleaning time was about 10 minutes.

Taking safety matters into consideration, compared with the present method with ammonia vapours, need for skin protection, and extremely dirty working conditions; this new foam method is clearly more practical and user-friendly.

Note also that ammonia has harmful effects to the strength of steel.

The most important fact is, however, that the agent is extremely efficient in removing crust and copper from the gun barrel.

Based on the test results, I recommend more comprehensive use of the agent, so that this product should be used for removing crust and copper during cleaning operations after every shooting.

This procedure will give the benefit that crust and copper build-up into the barrels during their service life will be almost completely avoided.

I recommend this product to be taken into test use in the Tank Brigade and PvMatLE.

Tank Brigade Ordnance Maintenance Officer
TCMatti Peltola

Finnish Air Force
Aircraft and electronics services unit
Tampere 16.02.1996

MJP Corporation Ltd
Peltolantie 30-32
04400 Järvenpää

Statement on bore cleaning foam

The bore cleaning foam, which was provided for us by Markku Paananen, was tested in our aircraft service unit during the week 607.

The product was packed in two 500 ml. spray units that had different nozzles, a small one and a 4.8 mm. one.

The product was tested on cal .357, 23 mm. and 30 mm. weapons.

The bore cleaning foam was easy to use without any specific preparations.

One cleaning produced a good/excellent result on cal .357 weapons.

As a result of two to five treatments, both 23 mm (barrel length 1700 mm.) and 30 mm. (barrel length 1080 mm.) weapons were cleaned to meet our standards. The number of treatments was related to the length and rather excessive copper residue in these barrels.

Our experience is that this copper cleaning foam is among the best products available, it is easy to use and it cleans barrels effectively.

For the future, we would like to have the product safety information sheet of this product.

Captain, technician Martti Kallio

**SAKO OY** 7.3.1994

OPINION

The jacket removing chemical for barrels, supplied by Mr. Markku Paananen in an unmarked spray-bottle, was tested by Sako Oy in February 1994. The study was relatively brief, but showed very positive results of the power of the agent.

In the test, a barrel made of normal barrel steel, containing heavy copper build-up, was cleaned with this foam. As a result, a practically completely clean barrel was obtained. The other corresponding agents tested by us have not given so good results.

However, it should be noted that the test was quite brief and the agent was not studied as regards its possible barrel material corroding properties.

Erkki Kauppi

Sako Oy
Product Development Manager

OPINION ON TESTED JACKET METAL REMOVING AGENT

During the spring and summer of 1995, the jacket metal removing agent developed and patented by Mr. Markku Paananen were tested by the 300 m rifle shooters of the project team "Atlanta -96" selected by the Finnish Shooters' Association in the area of Central Finland.

All in all, the shooters were satisfied with the agent.

How to use the agent

The agent is foamed from the pressure bottle directly into the rifle when the barrel is at most "skin-warm". The barrel temperature must not be too high, because the cleaning agent is water-soluble. At too high barrel temperatures, the cleaning process will not succeed as intended owing to moisture evaporation.

While firing a great number of shots, e.g. at a standard rifle event, the foam was left to act in the barrel for approx. 10 - 15 minutes after the shooting was finished. After that, the foam was removed by means of a clean cloth wad or felt wad. In this way, it was possible to remove most of the gunpowder residue accumulated in the barrel and a part of the jacket metal from the barrel. The treatment was renewed allowing the agent to act in the barrel for a longer period of time. At that time, the duration of the treatment was from a few to 24 hours, even a couple of days. After that the jacket metal was already oxidised so thoroughly that after cleaning with two or three wads the barrel could be oiled for the next shooting time.

During a long shooting event, e.g. free rifle with 3 x 40 shots, it was possible to clean the rifle without any difficulty while changing shooting positions, giving extra time for making ready for the next position. As a result, the barrel became sufficiently clean; in other words, there was not too much accumulation of jacket metal or gunpowder residue, which would weaken the accuracy of the rifle appreciably during shooting, even while changing to the demanding kneeling position. It has also been possible to do the same during long shooting exercises.

The method compared with other methods and agents

The methods used earlier, and partly as a comparison during this test, were conducted using either abrasive agents or strong toxic solvents. When abrasive agents were used, excessive barrel wear, among other things, could not be avoided, which reduced the time of use of the barrel. The use of strong solvents and agents for removal of jacket metal also caused evaporation of gases injurious

to health. In addition, the agents used for removal of jacket metal have been corrosive and could not be left in the barrel for a longer period of time in the same way as the foam in question. This has also made the need of extremely good acid neutralization and oiling of the metal surfaces more important.

The tested foam differs from the agents used earlier by its oxidation capability, preventing corrosion of the barrel and minimizing the need of removing the contaminants by mechanical scouring. The foam has also been easy to use (from a pressure bottle directly into the barrel) and not injurious to health because it is non-toxic.

The great advantages of the foam are its water-solubility in the event of accidents. Although the agent is supplied in pressure bottles, the propellant and the detergent itself are non-polluting. The above-mentioned advantages have also been reported to us by the shooters selected to the test group. The most of us also have our little "rascals", whose fussing around makes safety precautions everyday life.

Economy and bottle size

The tested, co-called "small pressure bottle", contains detergent for 35 - 45 cleanings of .308 calibre rifles. It can be estimated that one bottle of this size lasts well for one year for a common amateur shooter. A competing shooter consumes 3 - 4 bottles of this size depending naturally on the number of shots fired and the number of cleaning times required.

In our opinion, the bottle size has been sufficient, because large packages take up too much space and add weight to the bags, which are heavy in any case. During trips to competitions abroad one does not need extra weight or "packages" which take up too much space. For amateurs and occupational use the bottle could a little bit larger.

Shooters of the test group

The project team consisted of the following shooters: 1994 standard rifle world champion Jukka Salonen, the team of KeuSA (Central Finland Shooters) (Jukka Salonen, Aarne Markko, Timo Ahlgren, Tapio Saarinen) winning all Finnish championships at 300 m free rifle events in 1994, and Kimmo Tulonen and Keijo Minkinen. The shooters have been successful as Finnish representatives both in international matches and world championships.

On behalf of the project team,

Aarne Markko
Leader of rifle sports