PROBLEMY MECHATRONIKI
UZBROJENIE, LOTNICTWO, INŻYNIERIA BEZPIECZEŃSTWA

ISSN 2081-5891

10, 3 (37), 2019, 103-112

PROBLEMS OF MECHATRONICS
ARMAMENT, AVIATION, SAFETY ENGINEERING

The Development and Implementation of Modified Machine Guns of the UKM 2000 Family (Calibre: 7.62 mm)

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Received by the editorial staff on 24 November 2018
The reviewed and verified version was received on 22 August 2019

DOI 10.5604/01.3001.0013.4808

Abstract. Zakłady Mechaniczne TARNÓW S.A. (ZMT, Tarnów, Poland), the manufacturer of the UKM 2000 family of 7.62 mm machine guns, has extensive experience producing and factory-repairing those guns, and collect the comments and observations of the weapon's users. Taking them into consideration, ZMT has decided to modify the UKM 2000 family. The decision coincided with the stance of the MoD's Armament Inspectorate, which suggested implementing such a modification, providing a detailed determination of its range ("Modification Guidelines"). First, the changes were introduced in the infantry version (UKM 2000P), then in the onboard version (UKM 2000C). The core aims of the modification were: increasing the weapon's reliability and durability, improving the technology and ergonomics, and minimising the number of parts and groups that require individual fitting.

This work has been compiled from the paper presented during the 12th International Armament Conference on Scientific Aspects of Armament & Safety Technology, Jachranka, Poland, September 17-20, 2018.

Initially, the changes were supposed to encompass only a modest number of parts and groups; however, during the design works, the necessity to introduce deep modifications to the most important rifle elements, i.e. the bolt, the slide, the pin, the gas regulator and the feeding mechanism, appeared. During the research on the 7.62 mm modified UKM 2000P machine guns, properties such as the weapon's operation in low temperatures, as well as its resistance to dynamic interaction with dust and sand, salt fog, and elevated humidity were investigated. ZMT placed the first batch of the machine guns under monitored operation, and the observations made during use so far clearly confirm the soundness and range of the changes introduced. It should be kept in mind, however, that it is not possible to develop a single, universal weapon configuration that would meet the needs of all users. Direct exchange of feedback between the User and the Manufacturer allows the structure to be optimised and guarantees development in the field in question.
Keywords: modified 7.62 mm UKM 2000P, modification, experience exchange, monitored operation, weapon family development

1. ORIGIN OF THE MODIFICATION

As the manufacturer of the 7.62 mm UKM 2000 machine gun family, ZMT S.A. possesses experience producing, accepting and factory-repairing its rifles. At the same time, user feedback pertaining to the structure, based on observations made during combat operations and training, is collected. In association therewith, the Board of ZMT S.A. has decided to modify the UKM machine gun family with the use of its own financial means.

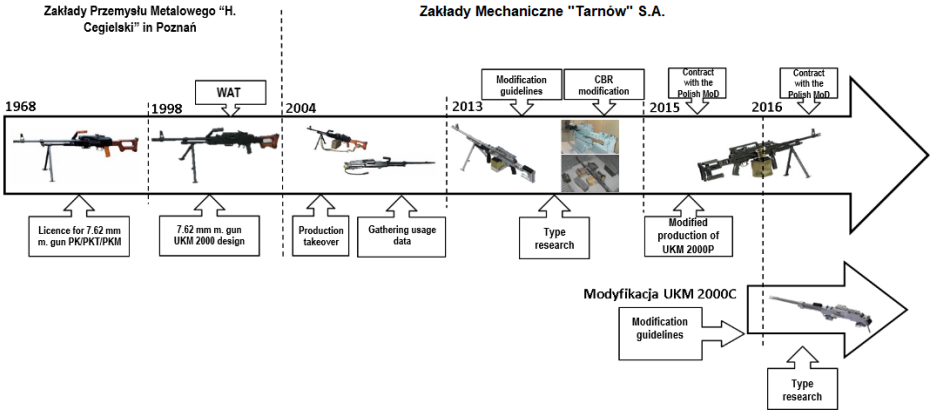

Fig. 1. Development of the 7.62 mm UKM 2000 machine gun family

The decision coincided with the stance of the MoD's Armament Inspectorate, which suggested implementing such a modification, providing a detailed determination of its range ("Modification Guidelines"). The changes were first introduced in the infantry version (UKM 2000P), then in the onboard version (UKM 2000C).

2. SCOPE OF MODIFICATION

The main objectives of the modification were:

- To raise the weapon's reliability and durability;
- To improve the ergonomics;
- To improve the technology;
- To minimise the number of individually-fitted parts and groups.

Initially, the changes were supposed to encompass only a modest number of parts and groups; however, during the design works, the necessity to introduce deep modifications to the most important rifle elements, i.e. the bolt, the slide, the firing pin, the gas regulator and the feeding mechanism, appeared.

Introducing a modern protective coating and consumables allowed for meeting the general climate conditions work requirements (N.14-O-II-A – infantry version, N.11-O-II-A – on-board version).

The changes were first introduced in the infantry version (UKM 2000P), then in the on-board version (UKM 2000C). Modifying actions performed (infantry version):

1. Adapting the gun for work with the standardised 7.62 mm ammunition compliant with STANAG 2310, as well as the M13 belt compliant with STANAG 2329.
2. Developing a new, highly-serviceable gas regulator ensuring reliable operation of the weapon's automatics, the proper rate of fire, and high service compliance.
3. Introducing changes that allow for closing the receiver's cover when the slide is both in the front and in the rear positions.
4. Developing a new solution for the firing pine.
5. Developing a new mechanism for UKM – a recoil buffer.
6. Developing and introducing a mounting rail compliant with STANAG 4694, integrated with the receiver's cover, allowing for the use of mechanical sight in settings up to 500 m.
7. Introducing a compact cradle with integrated mounting rails, protecting the gas cylinder, into the weapon's structure.
8. Developing a locking mechanism allowing the receiver to be kept open steadily.
9. Changes in the feed try structure in order to improve reliability. Introducing easements regarding the gun loading process by using additional hands in the feeder that support the ammunition belt during loading, as well as an ammunition bell "puller" that enables loading the gun without opening the cover (Figure 2c).
10. Developing a flash suppressor capable of eliminating the muzzle flash more effectively (Figure 2b).
11. Introducing an additional external safety selector lever (on the right side of the receiver), facilitating the use of UKM by left-handed shooters.

12. Developing and introducing an improved, ergonomic barrel handle, facilitating the barrel replacement process and allowing for moving the weapon more conveniently (Figure 2a).
13. Developing a new, ergonomic pistol grip and front grip mounted on the lower mounting rail, with the possibility to adjust the mounting point.
14. Developing a telescopic butt stock, folded to the left, with an adjustable cheek pad (Figure 2d, e, f).
15. Developing "soft" ammunition box for keeping 100 rounds.
16. Developing an ergonomic carrying sling allowing for more convenient weapon transportation and facilitating firing in so-called unstable positions.
17. Introducing changes to the ammunition belt feeding mechanism, developing a cartridge guide improving the reliability of the functioning of the feeding mechanism.
18. Stiffening the receiver (Figure 2g).
19. Developing a new ejector.
20. Changes to the extractor set.

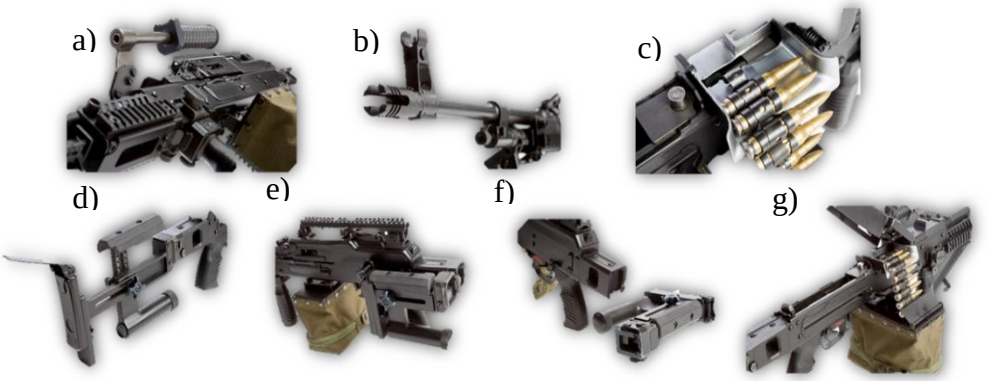

Fig. 2. Modification scope – mod. UKM 2000P

After serialising the production and delivering the first modified UKM 2000P units to the Polish Armed Forces, ZMT began the process of modifying the onboard version, concluded in 2017.

3. TYPE TESTING

In the course of examining the modified 7.62 mm UKM 2000 machine gun family, the scope of tests meant for qualifying new weapons has been effectively executed, with the testing going beyond the scope of the required lifespan, the weapon's functioning (among others) has been tested in temperatures as low as -50°C (Figure 3), along to the resistance to dynamic interaction with dust and sand, as well as to salt fog and elevated humidity.

Fig. 3. Modified UKM 2000P – low-temperature testing

Simultaneously (within the framework of the infantry version tests), a machine gun modified past its service life (25,000 shots), tested in the scope of its full lifespan as well, proving the possibility to modify UKM 2000P units from earlier production.

All of the solutions pertaining to ergonomics, i.e. the stocks, belts, ammunition boxes, and handles, have been designed in various variants that have been tested and evaluated by the users' representatives. The ergonomics testing was divided into three stages:

- service activities, i.e. replacing the barrel, the ammunition belt, performing operation and regulation activities;
- aiming and firing (Figure 4a), i.e. shooting short and long series, changing the shooting direction and distance, passing from marching to firing;
- transporting the weapon (Figure 4b), i.e. crossing terrain with various methods, transporting the weapon while marching.

During these tests, the weapon's final configuration, along with its equipment, have been determined. After producing the first batch of the machine guns, part and group interchangeability was tested.

a) b)

Fig. 4. Type testing – ergonomics tests

In 2015, during the International Exhibition of Defence Industry (Kielce, Poland), ZMT S.A. received the prestigious “Defender” award for modifying the 7.62 mm UKM 2000P.

For the on-board (vehicle) version, the testing programme was expanded with testing of the convenience of operation-related activities, mounting and adjusting the weapon on shooting positions (BRDM-2, BWP-1, PT-91, KTO ROSOMAK).

Fig. 5. Modified UKM 2000C mounted in the tower of a PT-91 tank

4. EXPERIMENTS WITH THE USE OF THE MODIFIED UKM 2000P

ZMT S.A., being the manufacturer of the best, most reliable weapons, has presented to the Custodian a request to monitor the usage of the first batch of the modified UKM 2000P machine guns, with permission being granted. One of the elements of monitored usage was checking the weapon's basic parameters, such as, for example, the firing rate. The firing rate testing (Figure 6) has been conducted in all regulator settings, firing series of 30 rounds using an acceleration sensor.

Fig. 6. Monitored usage: firing rate testing

Another element of the controlled operation was to conduct a review together with the users along with technical support after one year of use.

Fig. 7**.** Presentation of the modified UKM 2000P for the users

Considering the smooth introduction of a fairly significantly modified weapon to use, as well as the increasing of the users' knowledge about the use and service of this piece of military equipment, conducting training/presentation in units where the first batch of the modified UKM 2000P are going to arrive was proposed.

During the training, the scope of modifications and elements of usage of the modified UKM 2000P were presented, with emphasis on the aspects of technical servicing, as reliably maintaining the weapon's technical condition while using it safely and economically relies on proper execution of this servicing.

The last element of the monitored usage programme was the technical workshop on repairs for users and maintenance personnel of the Polish Armed Forces.

Fig.8. Technical workshop

5. CONCLUSION

Thanks to the modifications conducted, the 7.62 mm UKM 2000 family has become a durable and reliable weapon, meeting the needs of modern users. The observations made so far while monitoring the usage of the modified UKM 2000P clearly demonstrate the validity and the scope of the introduced changes. Thanks to the direct cooperation of the manufacturer and the users, the need has been noted to expand the 7.62 mm UKM family with specialised weapon types, meeting the particular needs of users such as airborne, aeromobile and special forces. ZMT S.A. has advanced conceptual designs of such weapons, which have been evaluated very positively by their potential users.

They may be undertaken as projects and produced in a relatively short timeframe, yet, in order for this to transpire, two elements are necessary – a decisive stance of the Polish MoD as the main recipient, and financial means (own or external).

During the experience exchange between the user and the manufacturer, the need has been noted to develop interactive user manuals, and to use them during training too, and to develop online access to the user documentation (or an abridged version thereof). The training process is more effective if it is interactive and contains visual elements. The trained user, going through a simulated procedure of use in an interactive environment, can be assessed precisely based on a series of skill tests.

FUNDING

The authors received no financial support for the research, authorship, and/or publication of this article.

Rozwój i wdrożenie zmodyfikowanych karabinów maszynowych rodziny UKM 2000 kalibru 7,62 mm

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Streszczenie. Zakłady Mechaniczne TARNÓW S.A. (ZMT), producent rodziny 7,62 mm karabinów maszynowych UKM 2000, posiadają bogate doświadczenie z zakresu produkcji i napraw zakładowych tych karabinów oraz gromadzą uwagi i spostrzeżenia z użytkowania tej broni. Uwzględniając je, ZMT podjęły decyzję o przeprowadzeniu modyfikacji rodziny UKM 2000. Decyzja ta zbiegła się ze stanowiskiem Inspektoratu Uzbrojenia MON, sugerującym przeprowadzenie takiej modyfikacji ze szczegółowym określeniem jej zakresu („Wytyczne do modyfikacji"). W pierwszej kolejności zmiany wprowadzono w odmianie piechotnej (UKM 2000P), a następnie w wersji pokładowej (UKM 2000C). Zasadniczymi celami modyfikacji były: zwiększenie niezawodności i trwałości broni, poprawienie ergonomii i technologiczności oraz zminimalizowanie ilości części i zespołów podlegających indywidualnemu pasowaniu. Początkowo zmiany miały objąć tylko kilka części i zespołów, jednak w trakcie prac projektowych zaistniała potrzeba dokonania głębokiej modyfikacji najważniejszych elementów karabinu, tj. zamka, suwadła, iglicy, regulatora gazowego oraz mechanizmu dosyłania. Podczas badań typu 7,62 mm zmodyfikowanych karabinów maszynowych UKM 2000P sprawdzono m.in. działanie broni w niskich temperaturach oraz odporność broni na dynamiczne działanie pyłu i piasku, na mgłę solną i podwyższoną wilgotność. ZMT objęły pierwszą partię karabinów maszynowych nadzorowaną eksploatacją, a dotychczasowe obserwacje z użytkowania jednoznacznie potwierdzają zasadność i zakres wprowadzonych zmian. Należy jednak pamiętać, że nie ma możliwości opracowania jednej uniwersalnej konfiguracji broni, zaspokajającej wymagania wszystkich użytkowników. Bezpośrednia wymiana uwag między Użytkownikiem a Producentem pozwala optymalizować konstrukcję i jest gwarantem rozwoju w przedmiotowym obszarze.

Słowa kluczowe: zmodyfikowany 7,62 mm UKM 2000P, modyfikacja, wymiana doświadczeń, nadzorowana eksploatacja, rozwój rodziny broni