

RULES FOR THE ORGANIZATION AND FUNCTIONING OF A MAINTENANCE SUPPORT SYSTEM IN A MILITARY UNIT – SELECTED ASPECTS

Katarzyna Markowska, Łukasz Knapik

*Silesian University of Technology
Department of Organization and Management
Institute of Management and Administration
Roosevelta Street 26-28, 44-800 Zabrze, Poland
tel.: +48 32 2777417, fax: +48 32 2777361, e-mail: katarzyna.markowska@polsl.pl*

Abstract

One of the most important tasks of military logistics is to ensure proper use and technical maintenance of armaments and military equipment. Providing maintenance support services on the modern battlefield, with its saturation with complex technical solutions, poses a significant challenge for the logistics system of the Armed Forces of the Republic of Poland. It is the duty of military logistics to adjust the potential of logistical sub-units as well as the organizational scheme and procedures of logistical support in accordance with changes occurring in the field. In times of peace, maintenance support services are focused on preventing equipment malfunctions. If a given piece of equipment becomes non-operational, their task consists in restoring it to full working order, taking into account all economic considerations.

The vehicles should feature good traction characteristics in varied terrain and be adapted to operation in both cold and hot environments. The training of repair sub-unit staff remains an important element affecting the standard of maintenance support.

Keywords: *maintenance support, operation, technical maintenance, automotive vehicle utilization*

1. Introduction

The purpose of the technical subsystem is to plan, organize, and execute tasks related to the operation of armaments and military equipment. It is designed to provide maintenance and the related technical support services. Keeping the equipment in proper working order and combat-ready during wartime is of crucial importance.

The purpose of the logistical supports services of the Polish Armed Forces:

- providing combat and material assets,
- supplying the armed forces with armaments and military equipment,
- providing supplies and services necessary for operation, training and combat purposes.

The purpose of operations is to retain such organizational and technical circumstances so as to enable the use of the armaments' and military equipment's practical function:

- in specified time,
- at the assumed location,
- with a specific intensity.

In essence, operations cover the performance of tasks such as operation of armaments and military equipment for the purposes of achieving the planned combat goals, training, as well as maintenance support [6].

2. Theoretical basis and classification of maintenance support

Technical readiness is defined as the capacity of a technical item for handling in a specified time and in accordance with its intended purpose. A technical item in a state of technical readiness should fulfil specific criteria:

- no parts/components missing,
- systems completely filled with operating fluids [1],
- technically efficient,
- specified service life reserve remaining.

Technical integrity is perceived as the content of military technology in a state of technical readiness. The item in question has a fully trained crew, as well as the equipment necessary for the execution of a specific task. Discontinuation of operation with respect to an item of military technology occurs when:

- the item is deemed unfit,
- a failure is detected in the item,
- the item reaches the end of its service life.

Utilization consists in the planned and intentional use of armaments and military equipment in order to take advantage of its practical function as per its intended purpose and functional characteristics, and to perform specific activities and tasks. According to M. Brzeziński, maintenance is an intentional procedure pertaining to an operational or non-operational item of military technology aimed at enabling its operation. This includes repair, technical maintenance, storage, and organizational handling.

A repair constitutes an array of organizational and technical measures aimed at restoring the capacity of a technical item and eliminating deficiencies resulting from operation. This involves preventive action performed at a specified time and in accordance with technological requirements and technical preconditions. Technical maintenance (servicing) is the sum of all planned preventive actions that serve to retain the technical and tactical characteristics that are elementary for a given type of technological item. Storage constitutes a set of organizational and technical measures related to storing technical objects and their handling in that period, maintaining the required working order during breaks in utilization.

Organizational handling is defined as a set of procedures aimed at the preparation of a given technical item for operation, servicing, or its protection [1].

2. Operational characteristics of transport equipment in a military unit

Maintenance and repair infrastructure is defined as a complete set of technical facilities and devices existing within the framework of the national economy and military assets, which is designed for the purpose of supporting the maintenance and repair system of the armed forces. Infrastructure includes, among others, the following assets, which operate during peace and wartime: repair companies and platoons as well as logistical tactical formations, military repair facilities, regional and district technical workshops of local logistics bases, and logistics battalions.

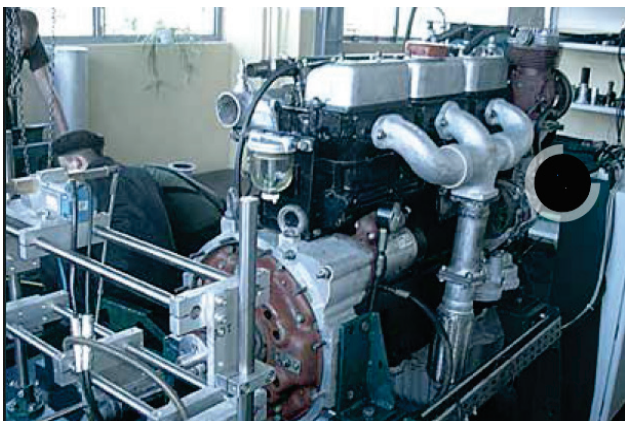


Fig. 1. Running-in of a Diesel engine and a table for injection pump adjustment [4]

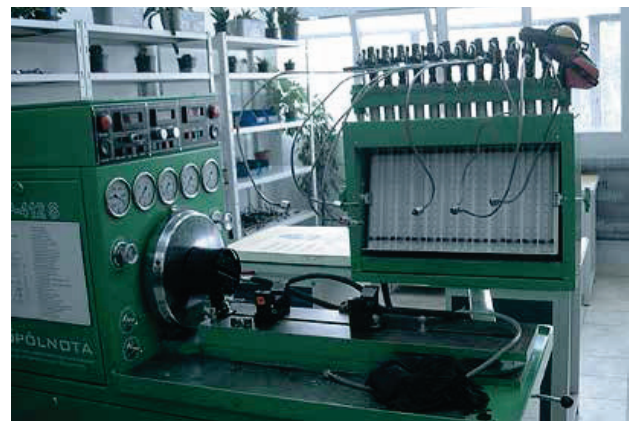


Fig. 2. Running-in of a Diesel engine and a table for injection pump adjustment [4]

The repair battalions and technical workshops feature engine shops, whose main function is running in engines. The engines for testing are fixed on a special structure and connected to cooling, supply and exhaust systems as well as other instruments that signal their operational parameters. Other equipment includes testing tables for setting and adjusting injection pumps for automotive and tank engines [5].

2.1. Operational characteristics of military technology items

Operation consists in actions that enable the proper execution of transport tasks. Operation is one of the main conditions for the efficient utilization of a given means of transport. It includes:

- all the planned organizational actions,
- technical and economic activities,
- adoption of the vehicle for use, up to the moment of its disposal.

The goal of all activities related to operation is the efficient utilization of the vehicle as per its intended purpose [2].

Operation of automotive vehicles consists in activities, which enable the proper execution of special tasks. These activities can be divided into two groups (Fig. 3).

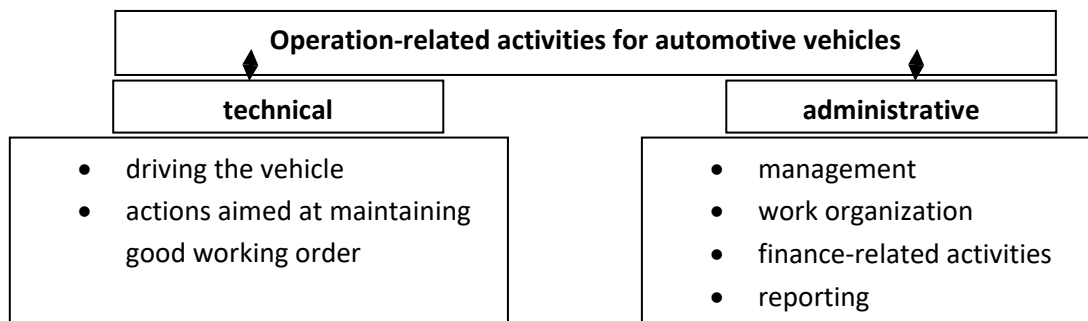


Fig. 3. The groups and characteristics of operation-related activities for automotive vehicles [2]

Figure 4 shows the factors of operation system assessment. An adequately performed assessment provides data on item wear and tear, degree confidence in its proper functioning and the system as a whole.

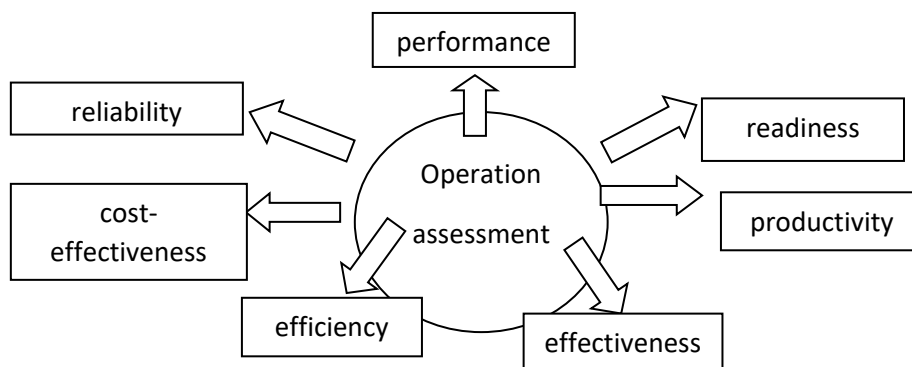


Fig. 4. Factors defining the assessment of an operation system [2]

The goal of an operation strategy is to specify the method of utilizing and servicing vehicles. Example types of strategies are presented in Fig. 5.

The operational requirements of automotive vehicles depend on their purpose. The requirements specified are different for heavy-duty trucks operating in difficult terrain, and different still for truck-tractors, automobiles and general-purpose trucks. The drivers expect their vehicles to be:

- easy to maintain,
- safe to drive,
- easy to drive [2].

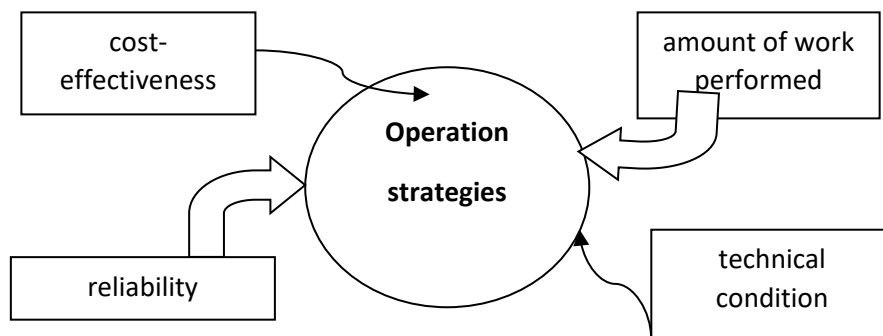


Fig. 5. Operation strategies as per various criteria [2]

2.2. Motor vehicle consumables

The assessment of the condition of a given piece of equipment depends not only on experience, but also on proper expertise in terms of the types of agents used to prevent malfunctions and the appropriate time to use them. Engine fuels and lubricants, oil and grease used in military vehicles and equipment are important for ensuring proper working order for a given operational and storage group [4].

Consumables are divided as follows:

- liquid fuels,
- lubricating oils,
- plastic lubricants,
- special products,
- maintenance consumables.

The following oil types are used in military vehicles [3]:

- SAE 75 – in arctic regions with low temperature,
- SAE 80 – used in temperate climate during winter,
- SAE 85 – used in countries with a mild climate,
- SAE 90 – in temperate climate, all seasons,
- SAE 140 – in summer,
- SAE 250 – tropical climate.

Tab. 1. Selected vehicle types [3]

Vehicle type	Standard of fuel consumption	Capacity of the fuel system	Capacity of the engine lubrication system	Kind of oil
			UHSIS capacity	
T-72	340 ON	1200	65	Superol SAE CB 50
			57	Unocal C4 Fluid
PT-91	560 ON	1200	65	Superol CB 20W/50 Dragon
			57	Unocal C4 Fluid
BWP-1	95 ON	460	58	Superol SAE CB 50
Honker	15 ON	100	6	Lotos 15W/40
Tarpan	12,5 E-94	110	7	Lotos 15W/40
WZT 2	330 ON	833	82	Superol SAE CB 50
WZT 3	330 ON	1200	65	Superol SAE CB 50
BRDM 2	39 E-94	290	9,5	Superol SC/CB 15W/40 Alanda
Leopard 2A4	450 ON	1160	90	O-236

Tab. 2. Characteristics of selected oil types [3]

Properties	PI Oil	PZ Oil	Hipl Oil					
			10	15	15F	15MF	15ZF	30
SAE viscosity grade	SAE 140	SAE 90	SAE 80	SAE 90	SAE 90	SAE 90	SAE 90	SAE 140
Quality class according to API	API GL1	API GL1	API GL4	API GL5	API GL5	API GL5	API GL5	API GL5
Kinematic viscosity at 100°C [mm ² /s]	28.4-32.4	17.9-22.0	9-12	15-20	14-24	min. 17.5	15-24	25-30
Viscosity index min.	-	-	90	90	95	95	90	90
Solidification temperature [°C] max.	-5	-15	-30	-20	-25	-18	-20	-10
Flash-point [°C] min.	180	170	190	200	200	220	200	200

3. Examination of the technical maintenance process for transport equipment

In professional armed forces, the driver of a military motor vehicle is the cornerstone of its safe operation. The tasks of the driver are as follows:

- monitoring the operation of the mechanisms and subassemblies,
- maintaining the vehicle in proper technical condition by utilizing appropriate driving techniques,
- monitoring the operation of the mechanisms and subassemblies,
- thorough preparation of the vehicle for operation through the performance of servicing tasks.

The technical maintenance process for automotive vehicles has been established based on observations made in a military unit on 03.01.2018.

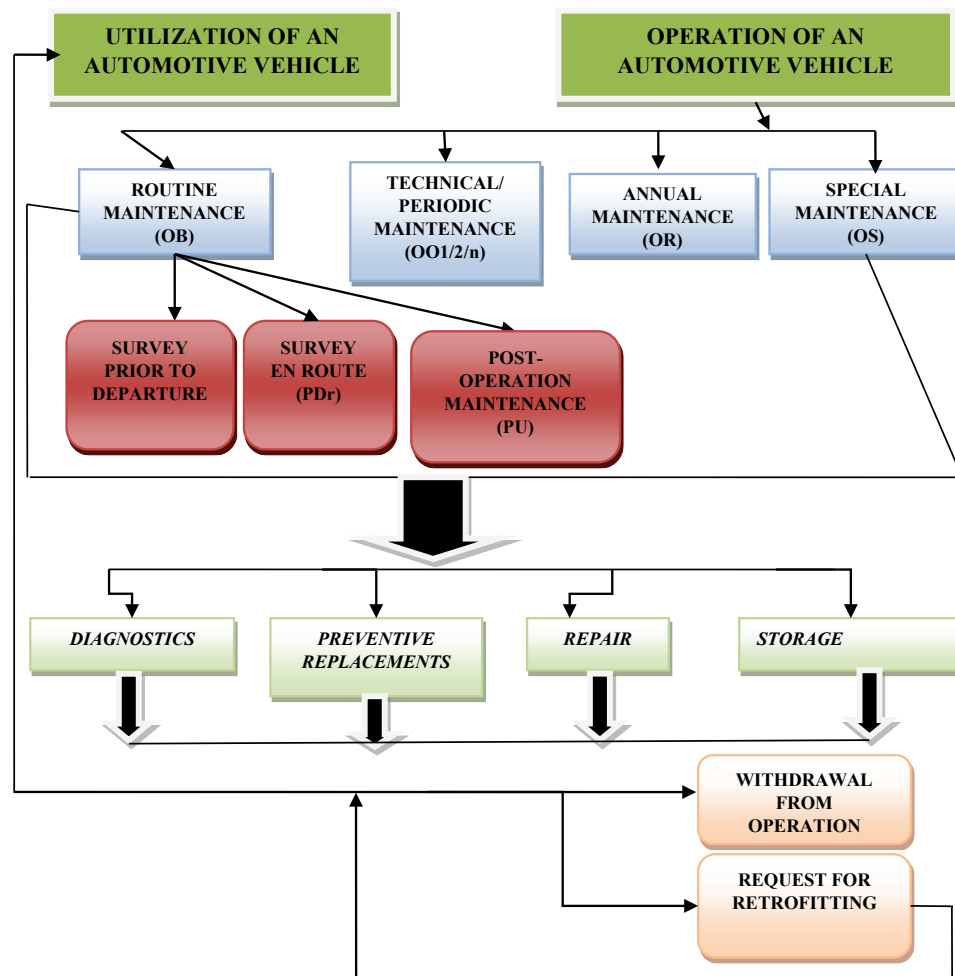


Fig. 6. Automotive vehicle technical maintenance process map

3.1. Surveys pertaining to transport equipment maintenance in a military unit

Empirical studies were performed on 9-11 January 2018. A questionnaire has been prepared for the purpose of studying transport equipment maintenance in a military unit. The aim of the surveys has mainly consisted in studying the awareness of military vehicle users regarding the impact of vehicle technical maintenance on its integrity and safety in road traffic.

The survey has been conducted with drivers of military vehicles in a military unit. The respondents received the questionnaire through electronic means.

When asked whether maintenance prior to utilization affects the vehicle's operational safety, as many as 80% have answered in the affirmative, with 20% responding the opposite.

When asked whether maintenance following utilization affects the restoration of the transport equipment's technical condition, 84% of respondents have answered in the affirmative, 12% in the negative, with 4% having no opinion.

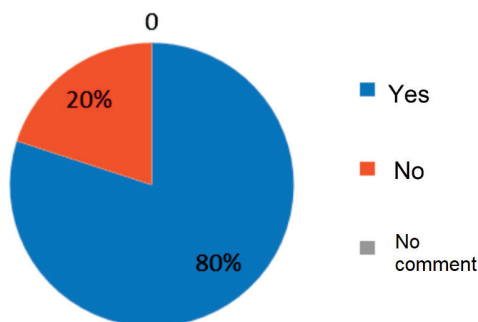


Fig. 7. Does maintenance prior to utilization affect the vehicle's operational safety?

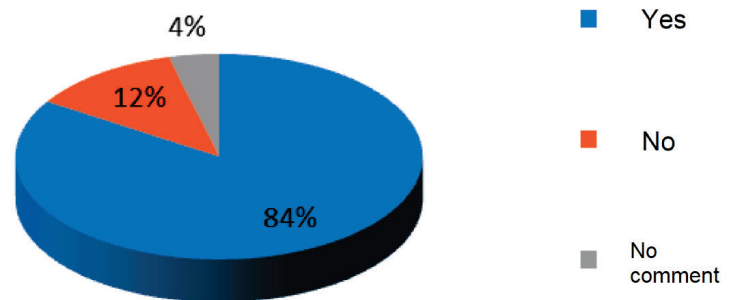


Fig. 8. Does maintenance following utilization affect the restoration of the transport equipment's technical condition?

4. Summary

A proper degree of maintenance support can be achieved by providing the repair sub-units with adequate logistical potential. Providing them with modern maintenance-repair workshops with equipment facilitating diagnostics, maintenance, and repair of military equipment should be strictly pursued. The vehicles should feature good traction characteristics in varied terrain and be adapted to operation in both cold and hot environments. The training of repair sub-unit staff remains an important element affecting the standard of maintenance support. Proper management of maintenance support services and command of allocated elements will be possible, provided that the logistical sub-units receive an adequate number of communication means with the appropriate parameters. Currently, on the tactical level of maintenance support, the availability of appropriate means of technical evacuation is insufficient with respect to the combat equipment being introduced as part of sub-unit weaponry.

References

- [1] Brzeziński, M., *Logistyka wojsk lądowych*, pp. 105-123, Warsaw 2005.
- [2] Kacperczyk, R., *Transport i Spedycja, część 1 Transport*, p. 107, Warsaw 2010.
- [3] Woźniak, D., *Materiały Eksploatacyjne do pojazdów mechanicznych*, *Przegląd Sił Zbrojnych*, No. 1, p. 97, 2015.
- [4] Woźniak, D., *Techniczna Infrastruktura obsługowo-naprawcza*, *Przegląd Sił Zbrojnych*, No. 4, 2015.
- [5] Woźniak, D., *Techniczna Infrastruktura obsługowo-naprawcza*, *Przegląd Sił Zbrojnych*, No. 4, p. 117, 2015.
- [6] *Zabezpieczenie techniczne Sił Zbrojnych RP, Zasady funkcjonowania*, DD/4.22, p. 7, Bydgoszcz 2012.

Manuscript received 18 September 2017; approved for printing 15 January 2018