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# MAINTENANCE OF THE BRAKE SISTEMS IN THE COMMERCIAL VEHICLES

**Daniel LAZE, Gheorghe ACHIMAŞ, Ionatan Teodor ZELEA**

***Abstract:*** *Maintenance, according to STAS 8174 / 2-77, comprise all technical and organizational actions associated with them realized in order to maintain or restore the state of a technical equipment so it performs its' specified function [1]. Maintenance includes less than one name, the entire system of technical and organizational maintenance, technical inspections and repairs, maintenance activities that provides both the maintenance of a vehicle in a functional state and its technical restoration in case of failure. Maintenance has two classes of shares: repair and troubleshooting the faults, maintenance associates them with new modern elements, such as tracking and statistical processing of faults, diagnosis, quality assurance and computerization.*

***Keywords:*** *maintenance, repairs, servicing.*

## 1. INTRODUCTION

In our country, the term "maintenance" began to be used after 1990, being substituted by that date with "maintenance and repair". It is believed that maintenance is a higher level of servicing equipment and systems, to which should aspire and which will lead to maximum efficiency of activities.

Upgrading maintenance processes ensure the extension of the vehicle life, reducing the proportion of expenses incurred on repairs and spare parts, reducing or even eliminating unscheduled shutdowns or incidental labor reduction, cost optimization due to an overall increase in the use and savings resulting from the increased use of the motor vehicle.

Damage occurring during operation of the braking system of the vehicle in relation with the nature and their extent divide them into damages and failures. Fault is considered to be the braking system damage that is followed by the necessity of replacing the entire brake system. Failure is considered to be the braking system damage after which there must be current repairs without replacement or overhaul of the braking system. Depending on the nature of the causes damaging your vehicle's brake system, breakdowns and failures can be classified as follows:

- ✓ faults and Failures caused by improper operation of the vehicle;
- ✓ faults and malfunctions caused as a result of hidden defects in materials or phenomena of fatigue in use;
- ✓ faults and failures due to improper manufacture or repair;
- ✓ faults and failures due to major force (unforeseeable circumstances), or other causes.

The technical diagnosis is an element of the maintenance of the breaking system for commercial vehicle and it consists from the testing of the technical state with specialized equipment's following a well-defined technological process, with or without the removal of component parts. Diagnosis is made in order to discover defects early in the braking system, which could lead to poor brake performance, increased fuel consumption, rapid wear and deterioration of subassemblies, etc. Depending on the volume of work, technical diagnosis can be partial or complete, as follows:

- ✓ partial technical diagnostics is run when conducting regular technical maintenance;

- ✓ full technical diagnostics that run on regular technical maintenance while performing general operation of transition from summer to winter, during the running-after a general repair and overhaul.

Technical diagnosis of the braking system is run in the repair shop, a arranged and equipped place with equipment and devices for this purpose.

## 2. STRUCTURE OF THE MAINTENANCE SYSTEM

The structural elements of the maintenance for commercial vehicles braking system is: daily maintenance, technical inspections (regular) and repair (current and capital). Maintenance and technical revisions means a set of operations which are performed daily mandatory and regular throughout the life of the vehicle in order to prevent failures of premature wear and ensuring their operation with optimum exploitation indices[1].

Frequency of maintenance and overhaul is established for each type of braking mechanism through memmos, depending on the specific design of the braking system.

### 2.1. The maintenance activity

The concept represents all maintenance actions to maintain or restore equipment and machines fitted to an enterprise operating parameters and their specific characteristics.

The components of maintenance scheme is shown in Figure 1.

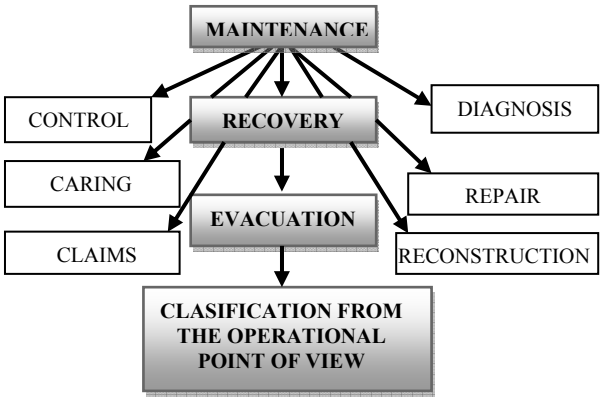


**Fig. 1. The maintenance components chart**

Modernizing maintenance requires computerization and application of effective management, tracking and optimization. In the design of an appropriate program of maintenance; particularly important is the design of an efficient informational system that provides information on the efficiency of the maintenance, to estimate the lifetime of the brake system and determine the components that are critical condition and need to be contained in maintenance program.

Given the complexity of the maintenance activities, a possible variant is shown in Figure 2, where it is proposed a diagram of the relationships between the components of maintenance, the interdependence between them, and how that affects their management.

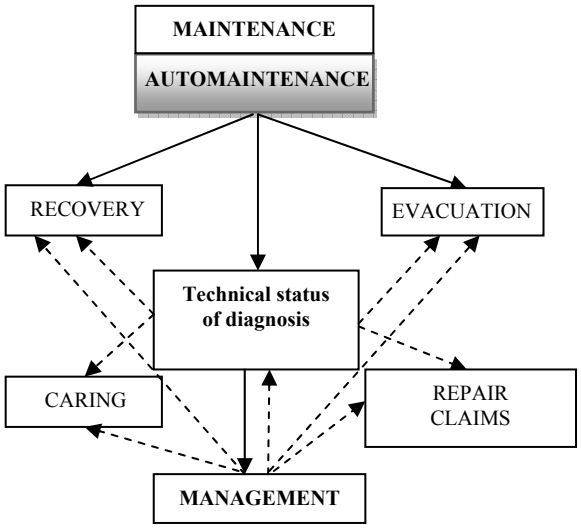


**Fig. 2. Diagram of maintenance management relations** [3]

Particular attention should be given to the maintenance of equipment, all elements that contribute directly to reducing consumption and losses of the materials used, in compliance with the operating parameters.

### 2.2. Concepts and systems for the maintenance

In order to determine the place of the organizational form of maintenance within a classification, the existent maintenance systems will be presented (fig. 3).

Preventive maintenance is the maintenance activity which is meant to reduce the probability of failure of the braking system. Types of preventive maintenance include: systematic and conditional forecasting.

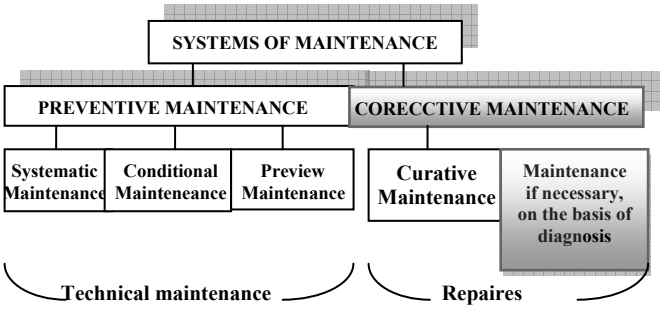


**Fig. 3. Maintenance systems**

Corrective Maintenance means all activities carried out after an unexpected failure of the braking system. It consists of: maintenance curative and palliative maintenance. The required maintenance system based on proper diagnosis is an integrated part of the palliative maintenance which at its turn belongs to the corrective maintenance.

It can be concluded that preventive maintenance will apply only to technical maintenance (reduced maintenance level) and repair, corrective maintenance or maintenance, on diagnosis, as can required be seen in Figure 3. Next to the term „maintenance" we can frequently turn into „reliability" and „availability".

## 3. THE NECESSITY OF BRAKE SYSTEM MAINTENANCE AND ITS OCCURING PERIODICITY

The purpose of full and on time technical maintenance work is multiple and varied, in the specific case of the breaking system also has a preventive character for failures and also of safety in traffic, materialized through:

- ✓ maintain functional performance, namely braking capacity, vehicle behavior on the road and fit the performance provided by the manufacturer;
- ✓ achieving distances without significant repairs;
- ✓ always ensure the comfort and safety for the transport driver, passengers or goods;
- ✓ prevent premature wear and failure assemblies, subassemblies and component parts, made them functional, by the correct maintaining of parts joints, respecting the torque set by the manufacturer;
- ✓ permanently ensuring optimal conditions for cleaning the intake air compressor that is a necessary agent working in this system;
- ✓ control and assurance games between the limits recommended by the manufacturer for the content parts;
- ✓ continuous functionality of all signs on board - gauges, warning and indicator lamps.

Maintenance work on the brake system is running preventive, even if their operation is flawless and is currently in diagnosing equipment for the electronic management of the system, check the brake mechanism and the pneumatic mechanism of wheels. Technical revisions include operations control and verification of connections, ensuring the collection, recovery settings, games, etc. The frequency is determined during the technical maintenance done equivalents miles or hours of engine operation.

## 4. PERFORMANCE TEST FOR WHEEL BRAKES

Statistics show that many commercial vehicles are sent to repair prematurely and sometimes delayed. For these reasons it is necessary, from a technical point of view, check and establishes technical condition, estimated by different criteria:

- ✓ operation;
- ✓ noise and vibration function;
- ✓ respectively the answer time to commands;
- ✓ energy consumption, where this can be assessed;
- ✓ changes of the pneumatic and hydraulic pressures etc.

The delay should be set as a proportion of the test vehicle weight. When determining the delay, the forces driving the

brake pressure must not be additional / complementary.

$$Z = \frac{\text{total braking forces on the wheel circumferences}}{\text{vehicle weight}} \cdot 100\ [\%] \quad (1)$$

where:

Z - represents the delay of braking.

### 4.1. Determination of delay to vehicles with compressed air braking system

If braking forces are measured on a vehicle that is partially loaded or loaded to maximum capacity allowed, the following is implemented calculation:

$$Z_{PM} = \frac{F_1 + F_2 + \cdots + F_n}{P_M} \cdot 100\ [\%] \quad (2)$$

$$Z_{PM} = \frac{\sum_{i=1}^{n} F_i}{P_M} \cdot 100\ [\%] \quad (3)$$

Definitions:

$Z_{PM}$ - late partially loaded or fully loaded vehicle;
$F_i$ - braking force to the axis 1 to n, [N];
$P_M$ - testing of vehicle weight, in [N].

Vehicles shall be tested using this method only if testing weights is known.

If the procedures set forth by equations (1), (2) and (3) may be not used to determine the minimum delay, then it will be determined according to the following relationship:

$$Z = \frac{F_1 l_1 + F_2 l_2 + \cdots + F_n l_n}{G_z} \cdot 100\ [\%] \quad (4)$$

where:

$G_Z$ - Force admitted that the total weight load on the vehicle, in [N];
$F_1$ - front axle brake force due to the pressure $p_1$, in [N];
$F_2$ - braking force on the second axis due to the pressure $p_2$, in [N];
$F_n$ - last axle braking force due to the pressure $p_n$, in [N].

$i_1$ ---- $i_n$ - calculated with equations:

$$i_1 = \frac{p_{N1} - 0{,}4}{p_1 - 0{,}4} \qquad i_n = \frac{p_{Nn} - 0{,}4}{p_n - 0{,}4} \quad (5)$$

in which:

$p_{N1...n}$ - maximum control pressure [bar] stipulated by the manufacturer of the axis;
$p_{1...n}$ - control pressure [bar] applied to the cylinder that axle brake testing.

### 4.2. Determination of delay during a road test for vehicles with trailers / semitrailers

For determining the braking performance of the trailer, road test must be carried out in combination tractor-trailer and only the trailer brakes are activated. Approximation delay the trailer is calculated by the relationship of:

$$Z_{PMA} = Z_{PM} \frac{F_M + F_{M'}}{F_{M'}} \ [\%] \quad (6)$$

Definitions:

ZPMA – trailer delay;
ZPM - delay tractor/ trailer unit using only the trailer braking system;
FM - The force of gravity on the towing vehicle in [N].

The vehicles can be tested with this method only when they are loaded and the weight of tests are known.

## 5. TRENDS IN DIAGNOSIS OF BRAKING EQUIPMENT

Productive organizations have to face structural problems caused by the rapid development of activities in different companies that are spread almost all over the world, in other words must ensure global integration of transnational organizations. It speaks, thus, increasingly more often the so called „teleservice" concept that supports the extension of the life of the equipment braking and maintaining quality. The new management system service involves fundamental methods on vehicle performance evaluation techniques. The structure will ensure auto maintenance mechatronics equipment and remote diagnostics. Future maintenance of the facilities will introduce the notion of firm or organization "digital service", with the main aim to help users and remote equipment [2].

In addition to the advantages of virtually unlimited distances that can occur due to the Internet first, another great advantage offered by such a system would remove subjectivity operators. To understand more easily the idea, the example service automotive is relevant. Sensory process is monitored and optimized with proper operation of the car constantly transmits the measured data to an interface where signals are read when debugging the main components. The signals read by the operators indicate where and how the defect repair is simple component changes completely, thus avoiding subjectivity the specific human behavior.

Maintenance practices increase efficiency by remote diagnostics using the facilities offered by mechatronics, informatics and advanced sensors.

## 6. CONCLUSIONS

Current requirements are to diversify the economy and modernize technical equipment to increase the complexity and degree of mechanization, automation and performance. In this context also increases and concern for optimizing maintenance works to rebuild the technical condition of equipment vehicles to extend and increase the efficiency of operation.

After certain time of functioning equipment's do not have the same employment indices; their technical state getting worse due to multiple causes. This raises the need for maintenance interventions that equipment is restored to working order by a well-defined period of time. Maintaining vehicle performance levels required by legislation or economic factors is conditioned by maintenance of technical limitations. Maintenance brake system is defined as an action that leads to maintain functional of this system, with maximum reliability and safety, and in case of malfunction, startup in the optimum operating conditions. Previous definition involves two types of maintenance actions, namely preventive maintenance and corrective maintenance or scheduled or unscheduled.

Efficient organization of maintenance work must be done properly correspondently to the general organizational principles. In this way it will create conditions that ensure the highest level of quality possible, increase machine availability and shorten turnaround times in repairs, raising the utilization of the machines in the workshops of maintenance, improvement and modernization of labor and specialization. Due to inattention these problems occur produce an increase of costs that can be reduced through studies and research on the role that maintenance should have.

Upgrading maintenance processes ensures extended of the life of the vehicle, reducing the proportion of expenses incurred with spare parts and repairs, reducing unscheduled shutdowns or incidental labor reduction, cost optimization due to an overall increase of vehicle use and savings that resulted from better use.

Technical diagnostics are part of system maintenance for brake system consists of testing equipment and specialized technical condition, after a well-defined process technology, with or without removal of subassemblies.

Maintenance means all technical activities - organizational associated performed in order to maintain or restore a state of technical equipment to perform specific functions. Technical equipment is any subassembly, assembly, subsystem or system that can be considered on its own and can be used or independently tried. The specific functions of vehicles are passenger′ and / or goods′ and transport equipment and operating under defined conditions of safety, environmental protection and efficiency.

As a result maintenance includes less than one name, the whole system of technical and organizational maintenance, technical inspections and repairs, maintenance activities that provide both function vehicles and restore them in case of failure.

Although maintenance is confused in most cases with the maintenance of differences between large, while maintenance has two classes of shares, repair and troubleshoot faults, maintenance associate

their new items as tracking and statistical processing of defects, diagnosis, quality insurance and computerization.

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## MENTENANȚA SISTEMULUI DE FRÂNARE LA AUTOVEHICULE COMERCIALE


***Rezumat:*** *Mentenanța, în conformitate cu STAS 8174/2-77, reprezintă ansamblul tuturor acțiunilor tehnice și organizatorice care le sunt asociate, efectuate în scopul menținerii sau restabilirii unui echipament tehnic în stare de a-și îndeplini funcția specificată [1]. Mentenanța cuprinde, sub o singură denumire, întregul sistem tehnic și organizatoric de întrețineri, revizii tehnice și reparații, activități care asigură atât menținerea în stare de funcționare a autovehiculului, cât și restabilirea stării tehnice a acestora în cazul defectării. Întreținerea cunoaște două categorii de acțiuni: reparații și depanarea defectelor, mentenanța le asociază acestora elemente noi, moderne, cum ar fi: urmărirea și prelucrarea statistică a defectelor, diagnosticarea, asigurarea calității și informatizarea.*



**Daniel LAZE,** Phd. Student Eng., Technical University of Cluj-Napoca, Department of Manufacturing Engineering, Muncii Boulevard 103-105, Cluj-Napoca, ROMANIA, e-mail: danut.laze@yahoo.com; Satu Mare 440199, Str. Dimitrie Bolintineanu no. 19/A, Județul Satu Mare, tel. 0746 120 550.

**Gheorghe ACHIMAŞ,** Prof. Dr. Eng., Technical University of Cluj-Napoca, Department of Manufacturing Engineering, Muncii Boulevard 103-105, Cluj Napoca, ROMANIA, e-mail: Gheorghe.Achimas@tcm.utcluj.ro; Cluj-Napoca 400537, Str. Clăbucet no. 1/38, Județul Cluj, tel. 0720 054 863.

**Ionatan Teodor ZELEA,** Phd. Student Eng., Technical University of Cluj-Napoca, Department of Manufacturing Engineering, Muncii Boulevard 103-105, Cluj-Napoca, ROMANIA, e-mail: ionatanzelea@yahoo.com; Vama 447350, no. 1059, Județul Satu Mare, tel. 0740 794 370.