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## CAUSES OF ROLLING STOCK BRAKE EQUIPMENT FAILURES

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**CAUSES OF ROLLING STOCK BRAKE EQUIPMENT FAILURES****O. T. Kasimov<sup>1\*</sup>, Sh. I. Mamaev<sup>1</sup>, A. V. Grishenko<sup>2</sup>**<sup>1</sup> Tashkent State Transport University, 100167, Tashkent, Uzbekistan<sup>2</sup> St. Petersburg State University of Railway Transport of the Emperor Alexander I, 190031, Saint-Petersburg, Russia

**Abstract:** *Reliable operation of the rolling stock and devices of railway transport is the basis for ensuring the throughput and transport capacity of railways, as well as safety.*

*The article is dedicated to the current day of the topical topic: increasing the reliability and analyzing the causes of brake equipment failures in locomotives in the conditions of JSC "Uzbekistan Temir Yollari".*

*On the rolling stock of railways of JSC "Uzbekiston Temir Yullari" five types of brakes are used: parking (manual), pneumatic, electro-pneumatic, electric (dynamic and reversible), magnetic-rail and are used as additional to EPT.*

*The article presents an analysis of the causes of failures in the brake equipment of the rolling stock of the railways of Uzbekistan. It was shown that the main reasons for the withdrawal from operation of brake pads is their wear, including scuffing of the friction surfaces, malfunction of the air distributor, brake line, brake cylinders and linkage. Premature removal of the wells occurs due to loss in the process of exploitation of their geometric parameters; "Sliding" from the rolling surface of the bandage and wedge-shaped wear.*

**Keywords:** *safety, brake systems, Hope, malfunction, pads, rolling stock.*

**INTRODUCTION.** Today, great attention is paid to ensuring a high level of safety of the movement of trains [1,2,3] and transport lead to greater technical and material losses. As a result of transport accidents, there is a loss of goods and equipment, destruction of tracks and a contact network, cessation of the movement of trains on the site, which leads to greater economic and human losses.

Reliable operation of the rolling stock and devices of railway transport is the basis for ensuring the throughput and passing capacity of railways, as well as safety. This is the main task of all directorates, services and divisions of the Russian railways. Evaluation of their quality of work directly depends on the number of crashes, events, failures of technical means. A special role in ensuring the safety of movement lies in the reliability of the brake equipment of the mobile unit.

The brakes of the rolling stock are designed to regulate the speed of movement from the maximum possible to full stop, as well as to keep the train in place.

The appearance of thermal cracks and fractures of the wells is associated with the low quality of the material of the wells, as well as violations in the operation of the lever transmission. Brakes are one of the main means of ensuring the safety of the movement of trains. The classification of brakes and their basic properties are presented.

**Classification of brakes and their basic properties.**

Brakes are classified according to the methods of creating the braking force and the properties of the control part. Frictional and dynamic brakes are distinguished by the methods of creating brake force. By the properties of the control part, they distinguish between automatic and non-automatic brakes. Five types of brakes are used on the rolling stock of railways of JSC "Uzbekiston Temir Yullari" [3-6]:

- Parking (manual) - they are equipped with locomotives, electric and self-propelled rolling stock, passenger and freight cars.

- Pneumatic - they are equipped with the entire rolling train with the use of compressed air.
- Electro-pneumatic - they are equipped with passenger cars and locomotives, electric rolling stock and diesel trains.
- Electric (dynamic and reversible) - they are equipped with separate series of locomotives and electric trains.
- Magnetic-rail - they are equipped with high-speed trains.

They are used in addition to EPT and electrical.

Parking hand brakes consist of a gearbox and a system of levers and (or) chains. They are manually operated and provide holding in place of the mobile unit during long periods of standing.

Device for pneumatic brakes.

Pneumatic brakes have:

- one-wire line for supplying compressed air and remote control of the operating brake equipment;
- brake control devices;
- braking devices.

### **Analysis of the causes of failures in the brake equipment of the mobile train**

The main reasons for the withdrawal from service of brake pads is their wear (40%), including seizure of the friction surfaces (7%). Premature removal of wells occurs due to loss in the process of exploitation of their geometrical parameters; "Sliding" from the rolling surface of the tire (27%) and wedge-shaped wear (10%). The appearance of thermal cracks (6%) and fractures (7%) of the wells is associated with the low quality of the material of the wells, as well as violations in the operation of the lever transmission. Damage to locomotive bands by thermal fatigue cracks can lead to their destruction along the route of the train, which threatens the safety of movement. Each case of the appearance of cracks on the ridges of the rim requires rolling out and replacement of the wheel chest with a motor-traction unit [4-8].

One of the directions of combating thermal fatigue cracks is the further improvement of profile locomotive brake pads and the use of frictional complex modified phosphoric cast iron, which has a joint As practice has shown, technological difficulties arise in obtaining a high-quality casting of such a box. In addition, in operation, there are cases of breakaway of the hook of the shoe. The cost of such a box with a deep hook in comparison with a box of serial production increases by 30-40%.

Jamming of bandages by shoes, causing short-term intermittent skid, damages the rolling surface with small sliders "skid heels" in the form of light spots with a hardness of 575-715 H<sub>μ</sub>. Metallographic and chemical analyzes show that these layered formations on the shoe and the rolling surface of the rim have an uneven hardness, which fluctuates within a wide range of 585-1117 N<sub>μ</sub>. In terms of chemical composition, they are close to the bandage steel.

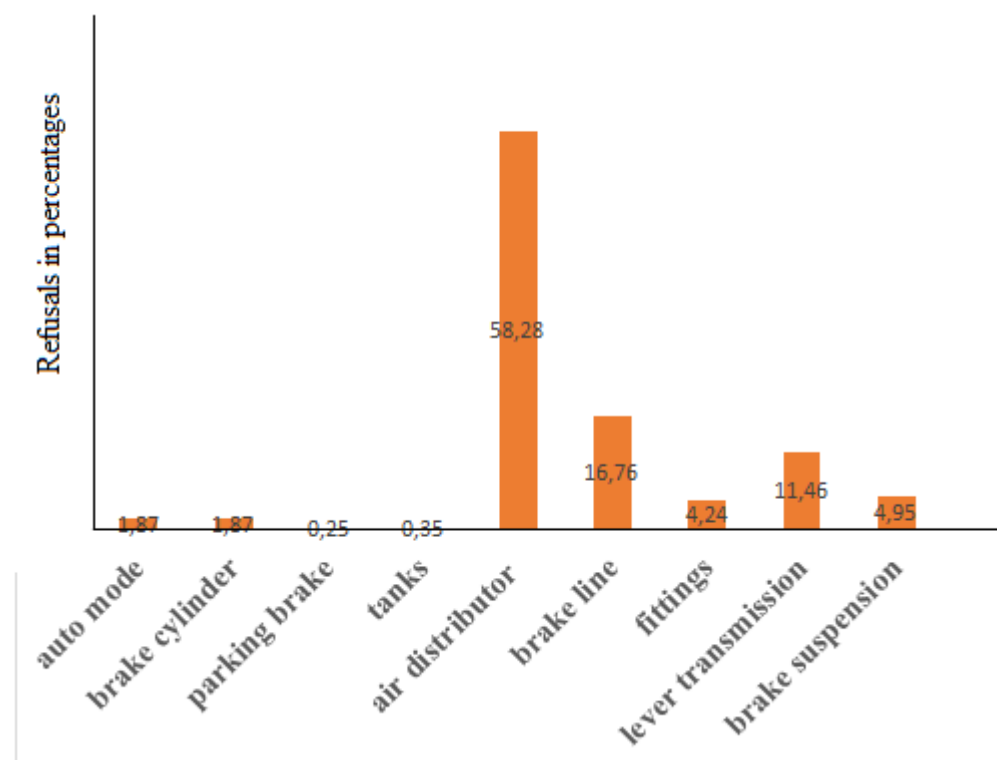
Small paving areas at the initial stage remain on the rolling surface and are rolled up, large formations are detached or transferred to the skate. To increase the reliability of the brake equipment, it is necessary to identify the underlying causes of the failure of the brake equipment [1-4].

On the basis of the analysis of the reasons for the failure of the brake equipment, the need to diagnose the system for diagnosing the brake equipment and the system for diagnosing the operating network [2,5].

Over the past three years, 30,432 cases of mobile train failures have been recorded on the railroad network of JSC "YTY", which were allowed to operate due to malfunctions of the auto-brake equipment, which is 3-6.7% of the total [3-6]. The largest number of failures associated with malfunctions of brake equipment was registered at RZhU-Karshi-Termiz - 4064 cases (13.35%) out of the total number of failures of brake equipment, registered on the roads of JSC "KTY", on the RZhU-Bukhoro - 3,248 cases (10.67%), on the RZHU-Tashkent - 2,928 cases (9.62%).

The diagram shown in Fig. 1., shows the distribution of brake equipment failures with

division into separate nodes for 2016-2020 [4].



**Fig. 1. Failures of components of brake equipment of rolling stock in 2016-2020**

The largest number of cases of brake equipment failures in 2016-2020 falls on the malfunction of the air distributor - 18 464 cases of failures, which is 58.25% of the total number of failures of the brake equipment units of the mobile train.

A large number of failures is caused by the complexity of the design of the air distributor and the presence of numerous structural elements, which reduces their reliability, namely:

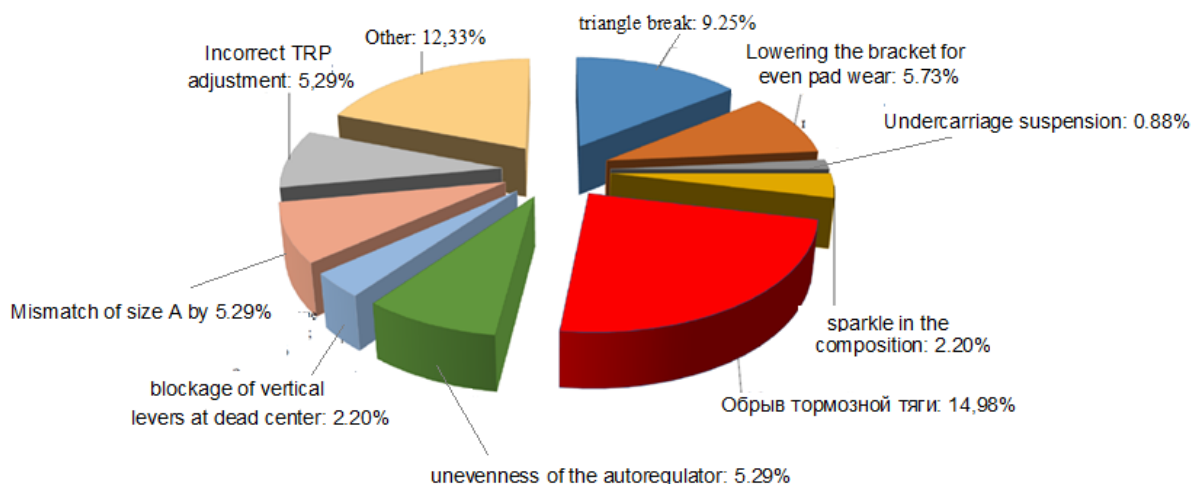
- air distributor conv. No. 292 - 32 elements;
- air distributor conv. No. 483 - 39 elements;
- air distributor conv. No. 305 - 29 elements.

The main reason for the failure of the air distributors is [5,6] leakage in the diaphragm of the main part, 6,240 cases (33.80%) were detected, a large number of unsettled causes of malfunction - 6,080 cases (32.93%), incorrect activation of the distributor mode - 5,55 %.

In second place in terms of the largest number of failures is a violation of the integrity of the brake line.

The failure of the brake line served as the reason for 1328 cases of failure of brake equipment on the roads of JSC "YTY" over the past four years. The largest number of cases registered at RZhU-Tashkent - 200 cases (15.06% of the total number of failures due to brake line faults) and at RZhU-Karshi - 160 cases (12,05 %). The main reasons for the brake line failure are: breakage of the supply tube to the air distributor - 2224 cases (41,87 % from the total number of brake line faults); air leakage due to low tightness of threaded connections - 528 cases (9,94 %) [3,4,6,7].

Linkage failure is a common cause of brake equipment failure. At JSC "YTY" due to this malfunction, 592 cases of brake equipment failure occurred. The distribution of brake equipment failures due to linkage failure is shown in the diagram in fig. 2.



**Fig. 2 Reasons for linkage failures for 2016-2020.**

Between the performance, reliability, performance and other operational indicators of the operation of the brake equipment of the mobile train and safety devices, there are certain connections, the identification of the operation of the system. Nevertheless, the prevention of accidents and ensuring the safety of movement on the way of the train is carried out by the locomotive crew, therefore, despite the complex of measures and the automatization of the processes of the control of the actions of the crew, the crew has a reliable [8-16].

### CONCLUSIONS

Analysis of the breakdown of the brake pads in operation shows that a significant number of locomotive pads are prematurely withdrawn from service due to defects associated with violations of the braking modes by the state of these systems and technical specifications. To ensure the safety of movement and reliable operation of the braking devices, continuous monitoring from the side of the locomotive brigade is required for the state of the entire braking line: from the driver's crane to the carriage of the carriage.

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