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TRACTION ELECTRIC DRIVE OF LOCOMOTIVES WITH A GROUP DRIVE OF WHEEL PAIRS

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Abstract. Choice of the drive of wheel pairs type was analyzed and it was established that the use of a group drive of wheel pairs provides the possibility of realizing high traction forces without additional devices, while the drive itself has a lower cost. This determines the expediency of using a group drive of wheel pairs when modernizing diesel locomotives with hydraulic power transmission.

Keywords: traction electric drive, energy efficiency, rolling stock, modernization, locomotive

Introduction.

Topicality. Industrial enterprises use shunting diesel locomotives with hydraulic power transmission. These locomotives are technically obsolete, which causes increased costs for fuel and lubricants and maintenance. As a result of long periods of operation, low-quality maintenance and repair, key aggregates and components break down more and more often, the restoration or replacement of which is impossible. Therefore, updating such diesel locomotives is urgent.

The object of research is industrial transport locomotives.

The subject of the study is an electric traction drive for locomotives with a group drive of wheel pairs.

The purpose of the work is to study the features of the application of traction electric drives for the modernization of diesel locomotives with a group drive of wheel pairs.

The objectives of the research are the analysis of the designs of locomotives with a group drive of wheel pairs, the advantages and disadvantages of a group drive of wheel pairs, the analysis of the results of the development of the traction electric drive for the modernization of the TGM6 diesel locomotive.

The novelty lies in the fact that a prototype electric traction drive was developed, manufactured and researched for the modernization of the TGM6 diesel locomotive with a group drive of wheel pairs.

Presentation of the main research material.

Railway transport is widely used in the technological processes of industrial enterprises in the mining and metallurgical industries, at enterprises for the production of building materials, chemical enterprises, etc. Diesel locomotives with hydraulic power transmission type TTM3, TTM4, TTM6, TTM40, TTM23, TTK2 and others are widely used for moving wagons.

Re-motorization, in which a modern diesel engine is installed, is mostly used to update diesel locomotives with hydraulic power transmission. This type of modernization is used by domestic locomotive repair plants. Modernizations are carried out abroad using modern hydraulic transmission [1].

An alternative option is the use of a traction electric drive while preserving the original crew part with a group drive of wheel pairs. Projects of such modernizations are being developed (and, according to reports on Internet resources, already implemented) in the CIS and Baltic countries. In Ukraine, the modernization of the TGM6 diesel locomotive with the use of an electric traction drive was carried out by Mykolaiv Locomotive Repair Plant LLC.

Summarizing the materials devoted to the analysis and comparison of individual and group traction drive of wheel pairs [2, 3], allows to highlight the following advantages of group drive of wheel pairs:

- requires fewer units;
- has a lower cost;
- has less labor-intensive maintenance and repairs;
- the crew part of the locomotive with a group drive of wheel pairs has a smaller mass, moments of inertia and dimensions;
- increased coupling coefficient;
- less prone to boxing and yuzu in conditions of instability of twheel-rail grip.

Disadvantages of the group drive of wheel pairs include:

- a lower efficiency ratio;
- increased motor resistance;

- reducing the static deflection of the spring suspension;
- increased requirements for maintenance;
- significant dynamic loads in non-stationary operating modes.

As you can see, the group drive of wheel pairs has contradictory properties. However, the indicated advantages in the form of a lower cost of the drive and the possibility of realizing high traction forces without additional devices are significant. And therefore, the preservation of the group drive of wheel pairs during the modernization of diesel locomotives with hydraulic power transmission and its application in the creation of new locomotives is considered expedient.

Taking into account the above, Mykolaiv Locomotive Repair Plant LLC developed a project for the modernization of outdated diesel locomotives with hydraulic power transmission and executed according to this project the modernization of diesel locomotives of the TGM6 type [4]. The conditions of operation of the modernized diesel locomotive provide for its use for performing "medium" and "heavy" shunting work. To ensure the traction properties of the diesel locomotive and realize advantages of group drive of wheel pairs, a traction electric drive based on an asynchronous electric motor is used on the diesel locomotive.

A feature of the developed traction electric drive is the possibility of long-term operation of the locomotive with maximum traction power at reduced power: the traction electric drive ensures long-term operation of the locomotive with maximum traction power at a speed of 3 km/h.

The use of a frequency-controlled electric drive of motor-fans of the cooling device and cooling of the traction asynchronous electric motor ensure their operation with optimal load, which helps to reduce energy consumption.

The calculated coefficient of useful operation of the diesel locomotive and the coefficient of useful use of diesel power at nominal power and the calculated speed of long-term mode, equal to 6 km/h, are 0.312 h.o. and 0.69 h.o. in accordance. These values meet the requirements of standards for shunting diesel locomotives, although they are at the limit of the permissible range. Currently, the diesel locomotive is undergoing operational tests at ArcelorMittal Kryvyi Rih PJSC.

Conclusions. A rational way to update outdated shunting diesel locomotives with hydraulic power transmission is to use an electric traction drive while maintaining a group drive of wheel pairs. The technical parameters and characteristics of the experimental model of the TGM6 diesel locomotive, which was modernized at Mykolaiv Diesel Locomotive Repair Plant LLC with the use of an electric traction drive, correspond to modern models of shunting locomotives. This confirms the expediency of using the specified technical solution for this diesel locomotive and the possibility of its application on similar diesel locomotives.

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INFLUENCE OF REQUIREMENTS FOR EXPLOSION-PROOF EQUIPMENT ON ITS DESIGN PROCESSES

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Abstract. The necessity of analysis the influence of requirements for explosion-proof equipment on the design processes of such equipment caused by the lack of a clear sequence of actions when ensuring explosion protection of equipment. General design tasks (for example, ensuring reliability indicators, product performance characteristics, etc.) and design stages do not take into account the requirements for explosion safety and conformity assessment, which makes it necessary to formulate and research these connections in order to improve the design process of explosion-proof equipment, with subsequent successful passing the assessment of compliance with technical regulations No. 1055.

Keywords: explosion protection, explosion-proof equipment design, improvement of the design process structure, conformity assessment of explosion-proof equipment, explosion protection standards.

Introduction. In Ukraine, in the area of explosion protection of equipment, there is a big number of standards identical to European ones,