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Analysis of Malfunctions in the Wheel-Motor Unit of Locomotives

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Abstract:

This article examines the analysis of the malfunction of the wheel-motor unit of diesel locomotives of the UzTE116M series. The main causes of failures of the wheel-motor units are considered; statistical data on the causes of malfunctions of locomotive units after major repairs, as well as the causes of damage to the ED-118B(A) electric traction motors, taking into account real operating conditions.

Keywords: failure, wheel sets, locomotive, destruction of parts, asymmetrical, traction mode, slipping.

Introduction

The wheel-motor unit of a locomotive is the most critical element of the mechanical part of the rolling stock. The wheel-motor unit includes a wheel pair, axle box unit, gearbox, elastic coupling and traction electric motor.

The block of the UzTE16M diesel locomotive (Figure 1.1) is made with a support-axial suspension of the traction electric motor ED118B(A) and a one-way gear drive. From gear wheels, power is

realized in the form of traction forces during the interaction of wheel pairs with rails. The traction electric motor ED118B(A) on one side rests rigidly on the axis of the wheel pair through motor-axle bearings, and on the other side - with a support lug elastically through a spring suspension on the bogie frame [1 -3].

The wheel-motor unit of locomotives is significantly influenced by shock impulses from collisions of the wheel with the rail, as well as from bearing units. An increase in the level of shock impulses in the general case can be caused [4, 5]:

- any contamination of the bearing lubricant;
- water getting into the lubricant;
- deterioration of the performance properties of the lubricant;
- increasing the operating temperature of the lubricant;
- drying, squeezing, freezing, etc. grease;
- inconsistency of the lubricant used with the operating conditions of the bearing;
- increased load on the bearing;
- vibration of the mechanism, creating an increased load on the bearing;
- excessive deviation of the geometry of bearing parts from an ideal round shape;
- unsatisfactory installation of the bearing (misalignment, overtension);
- weakening of the bearing fit;
- interference, i.e. rubbing or impacting parts;
- malfunctions of electromagnetic nature;
- unsatisfactory alignment of the unit shafts;
- gear noise (in this case, shock pulses from all nearby shaft bearings of a given gear grow simultaneously);
- increased clearance in the bearing;
- bearing damage.

Figure 1.1 shows a photo of the UzTE16M mainline diesel locomotive.

Figure 1.1. – External view of the UzTE16M diesel locomotive.

Most failures of wheel-motor units of locomotives are associated with the occurrence of slipping and skidding of wheel pairs, unacceptable static or periodically changing dynamic loads, leading to fatigue failure of the components of the wheel assembly.

KMB malfunctions are:

1. Failure to take measures in case of wheel pairs slipping. The violation lies in the fact that during boxing of the wheel pairs the driver does not take the necessary actions: he does not lower the position of the driver's controller and does not supply sand (if the automatic feed is turned off). This violation is typical for all series of locomotives. Mechanical destruction of parts of the wheelbase due to an unacceptable increase in the speed of rotation of the wheelset (anchor) in the absence of adhesion to the rail (striking). Impaired fit of the gear on the TED shaft (also, a break in the TED shaft, gear teeth or large gear - BZK) is a consequence of a sharp restoration of adhesion between the wheel pair and the rail.

The negative impact of the presence of a faulty unit (unit) on the other components of the locomotive associated with it (if unfavorable development of boxing occurs):

- failure of the wheel-motor unit;
- asymmetrical redistribution (increase) of current loads between serviceable (not boxed) power banks;
- failure (decrease) in the traction force of the locomotive as a whole;
- transfers along the TED collector due to current surges during boxing.

The use of an auxiliary crane in the draft to prevent slippage. The violation is that the driver uses the driver's auxiliary crane in the traction mode, instead of reducing the traction position. This violation of operating conditions is typical for all series of locomotives.

Weakening of the tire of the wheel pair, increased wear of the commutator-brush assembly.

The negative impact of the presence of a faulty unit (unit) on the other components of the locomotive associated with it: rotation of the wheelset tire and transfer of the electric arc through the collector.

2. Skidding of wheelsets. The violation is that the driver allows increased pressure in the brake cylinders, which leads to skidding of the wheel pairs. This violation is typical for all series of locomotives, especially freight ones, which is associated with the driving of heavy trains and the tendency of their wheel pairs to skid when the braking force from the block to the tire is exceeded.

Formation of sliders on the rolling surface of wheelsets. The negative impact of the presence of a faulty unit (unit) on the other components of the locomotive associated with it (if unfavorable development of wheelset skidding occurs):

- forced reduction in locomotive speed due to the formation of sliders on the rolling surface of the wheelsets;
- failure of the wheel-motor unit;
- asymmetrical redistribution (increase) of current loads between serviceable SMBs;
- failure (decrease) in the traction force of the locomotive as a whole.

3. Disabling automatic sand adding when the system is working properly. The violation is that while the locomotive is moving, the automatic sand supply system is turned off. This violation is typical

for all series of locomotives and can lead to a breakdown in the adhesion of the wheel to the rail with the subsequent transition of the wheel pairs to slipping mode.

Conclusion

Negative impact of the presence of a faulty unit (unit) on other components of the locomotive associated with it (in case of unfavorable development of boxing):

- failure of the wheel-motor unit;
- asymmetrical redistribution (increase) of current loads between serviceable (not boxed) power banks;
- failure (decrease) in the traction force of the locomotive as a whole;
- transfers along the TED collector due to current surges during boxing.

Among other things, this violation is an aggravating circumstance when wheelsets are allowed to slip.

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