

# INFLUENCE OF INSULATION IMPREGNATION ON THE OPERATION OF TRACTION ELECTRIC MACHINES

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**Abstract.** To determine the damage, the most appropriate and effective method will be to extend the insulation resource by encapsulating local damage using impregnating materials and thermal radiation. Over the past ten years, the UE “O’ztemiryo’lmashta’mir” has maintained a stable tendency to breakdown of insulation and inter-turn short circuit (BTC) of the armature of the NB-514 type. In this connection, a hypothesis was put forward that breakdowns of insulation and inter-turn closures of the armature winding most often occur as a result of intense heat and mass transfer processes in the insulation of the frontal parts of their windings with open section heads.

**Keywords:** Traction motors, anchor, main coil, additional coil, compensation coil, collector.

The results of studies of TSTU employees in which SB Nuriddinov took part were analyzed [1,2]. The change in the reliability of regularly impregnated insulating structures of traction motors from 2000 to 2012 was studied, for all types of repairs, including current repairs of the third volume (TR-3). The results of the study are shown in the form of graphs in (Figure 1).

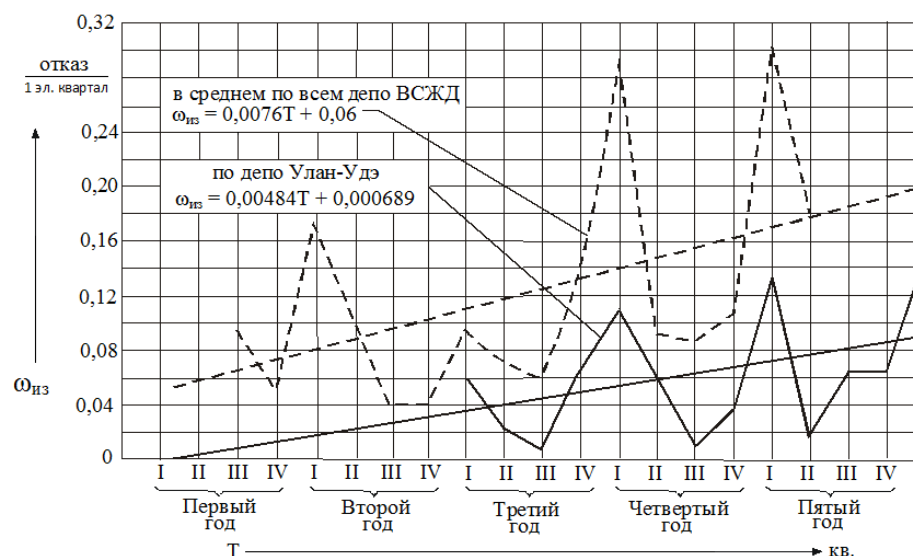


Figure 1 - Reliability of TEM insulation of electric locomotives of UZBZD, regularly impregnated during current repairs of the third volume.

The reliability of the TEM operation depends on the materials used and the design for the repair of electric motors (Figure 1.), as well as on the factors affecting the TEM during repair and operation [1, 2]. The performance indicators of TED in the work mean the electrical strength of its insulating structures.

Conventionally, the factors affecting the reliability of TEM insulation in operation can be divided into two components: negative (decrease in reliability) and positive (increase in reliability). In the process of manufacturing insulating structures, it becomes necessary to act on them with loads - mechanical, thermal and electrical [114, 115]. A significant reduction in the electrical properties of insulating materials occurs in the presence of impacts. The amount of impregnation affects the strength properties of the TED insulation. Reducing the number of impregnations leads to an increase in the number of breakdowns of their body insulation by 4.5 times. Accordingly, we will present organizational and technical measures that contribute to improving the reliability of the insulation of TED of electric locomotives.a

From the consideration of the graphs of the parameters of the failure flows of the TEM of the entire road and the locomotive depot Uzbekistan (where the VL80 electric locomotives recently received from the NEVZ manufacturer's plant were operated). It can be noted that there is an increase in the parameter of the flow of TEM insulation failures over time, both for a long time in operation and for those recently received from the plant. There is an increase in the flow of insulation failures in the first (winter) quarters of operation and a minimum number in the third (summer) quarters. In the analysis, we used the dependences of the failure flow parameters of anchors of TEMs of electric locomotives VL80 of the Uzbekistan locomotive depot on the average monthly air temperature in the operating areas in 2018 and 2020, presented in (Figures 2 and 3).

It should be noted that upon receipt of TEM NB-514 with heat resistance class F, the leadership of the department of locomotive facilities of Uzbekistan Temir

Yullari JSC recommended that the Nizhneudinsk locomotive depot not impregnate the TEM insulation during current repairs of TR-3. From the consideration (Figure 2) it can be seen that due to the exclusion of the impregnation of the anchor windings of TEDs, an increase in failures in the summer period is observed, which is not typical for impregnated TEMs, see (Figure 2) on which a significant decrease in failures was observed in the summer period of operation [2].

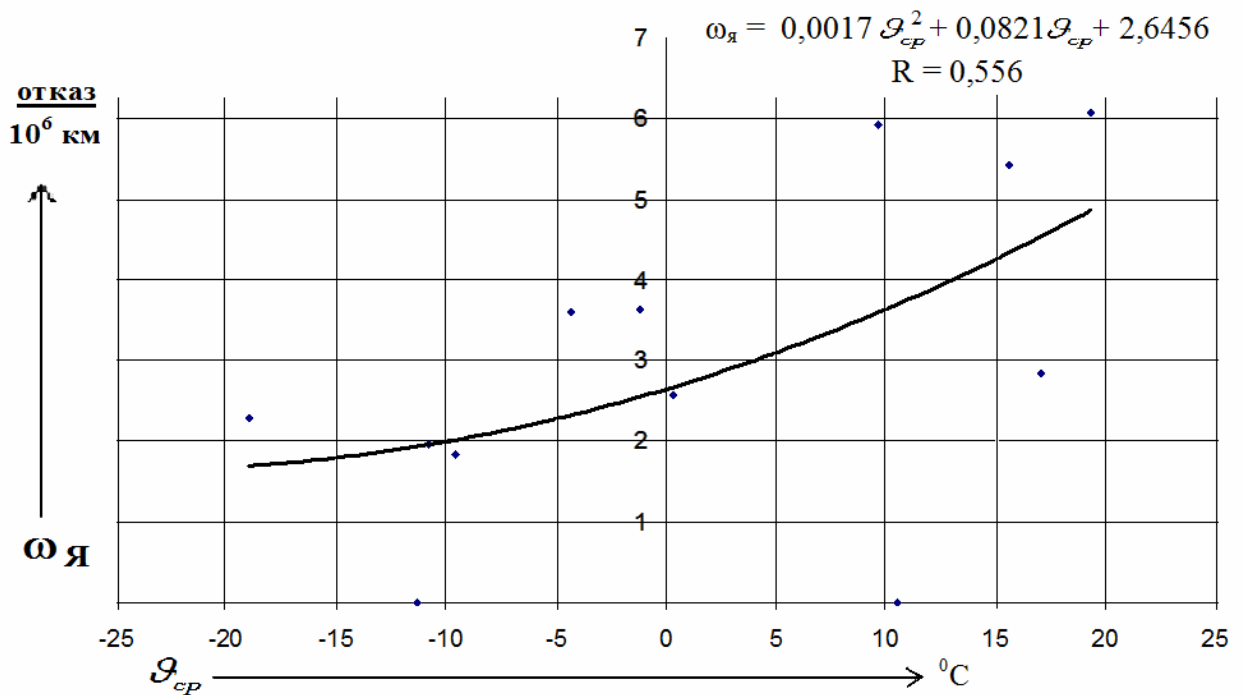


Figure 2. - Change in the parameters of the flow of failures of the anchor winding of the TEM during the period of TR-3 without insulation impregnation

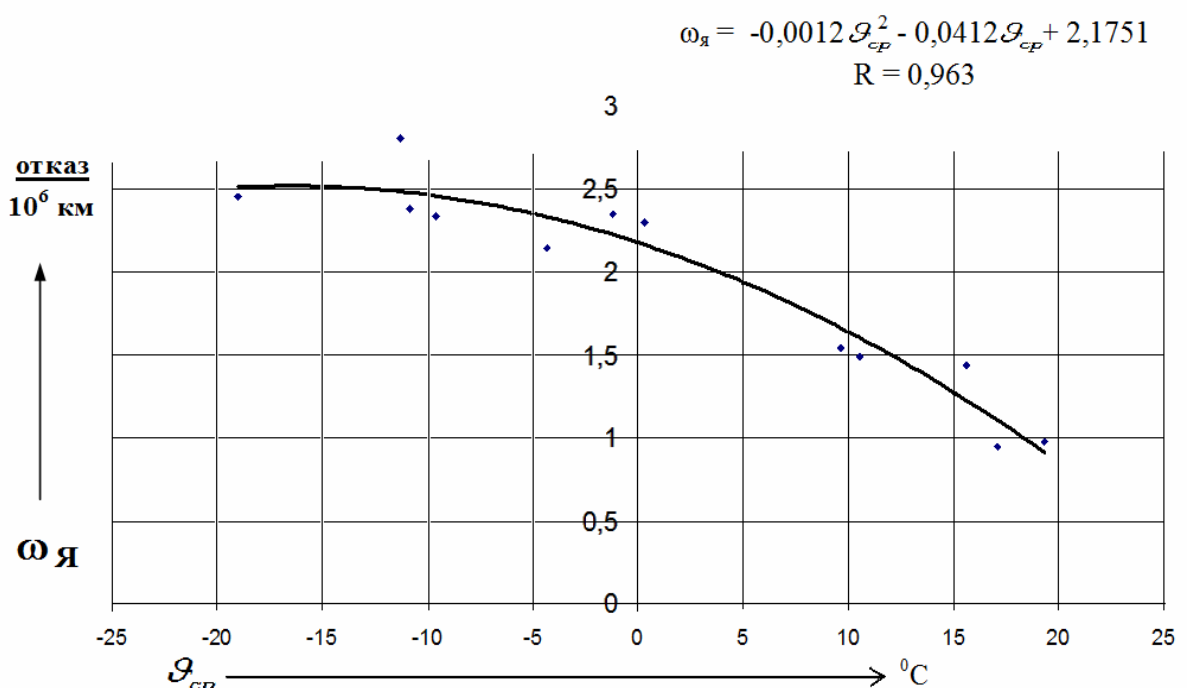


Figure 3. - Dynamics of change in the failure rate parameter of the TEM armature winding after the introduction of insulation impregnation at TR-3.

The emergency measures taken by the management of the Uzbekistan depot in 2020 made it possible to impregnate the anchors of the TEM NB-514 of the VL80 electric locomotives. Due to this, to reduce the number of anchor failures by 1.6 - 2.0 times (Figure 3) compared to the previous year. At the same time, the dependence of the change in the parameters of the flow of anchor failures on the air temperature has a character similar to the dependence corresponding to the impregnated TEM anchors shown in (Figure 1).

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