

**RESEARCH ON THE EXTERNAL TEMPERATURE DEPENDENCE  
OF THE TRDN-32000/110\*KVA TRANSFORMER**

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**Abstract**

Power transformers are the most expensive and important components of any power system. The modern system is mainly focused on monitoring the start-up and overhaul of the transformer, which cannot fully guarantee the reliability of the work and the safety of their operation. By analyzing the influence of external factors on the temperature of power oil transformers in industrial enterprises and power networks, the reasons for the increase in the temperature of transformers and the expected problems are highlighted. As a result of the general analysis, measures to extend the working time of transformers were noted.

**Keywords.** Temperature, transformer, load, outdoor temperature, load increase, oil temperature, cooling system, efficiency.

The reliable and efficient operation of high-voltage oil transformers depends on their level of maintenance and operation. It is known that high-voltage oil transformers consist of the following structural elements: magnetic system, winding, winding wires, insulation, tank, cooling device, voltage control mechanism, and various protection and measuring devices. Each of these elements is involved in the operational process of the transformer and affects its technical performance to a different degree. However, the service life of high-voltage oil transformers mainly depends on the condition of the insulating paper oil insulation [1].

Analysis of the reasons for the failure of high-voltage oil transformers shows that the lack of special preventive measures leads to the failure of electrical devices to reach their nominal operating resources. The main reasons leading to the failure of transformers are considered to be the decrease in electrical strength of insulation due to contamination of oil with various impurities and increased humidity [2].

According to GOST 11677-85 [3], the service life of power oil transformers is set at 25 years. However, the number of power oil transformers that have exceeded their service life is constantly increasing. A study of foreign literature shows that

the "obsolescence" of power oil transformers is observed in all developed countries. For example, in Russia, more than 40% of high-voltage power oil transformers have a service life of more than 25 years [4]. More than 24% of total power oil transformers in Japan have been in operation for more than 30 years [5]. In Ukraine and Belarus, this indicator reaches 40% [6] and 60% [4], respectively. The state of "obsolescence" of the complex of power oil transformers in the USA was also observed. According to the US Electric Power Institute (EPRI), 65% of power oil transformers in the US electric grid have been in operation for more than 25 years [6]. The current economic situation does not allow a complete renewal of the transformer complex. Therefore, maintaining the level of reliable operation of outdated electrical equipment is one of the most important tasks of the electric power industry at the current stage [3-4].

To increase the service life of power oil transformers, it is necessary to use new and modern methods of timely servicing of these electrical devices and early detection of possible failures. The method of research and comparison of oil temperature and external environment temperature of power oil transformers in long-term operation was used.

As a result of the study, the influence of external ambient temperature on transformer oil in the long-term operation of a TRDN type transformer with a capacity of 32 MVA in June for two times of the day: 8:00-9:00 in the morning, when there is a relatively small effect of external ambient temperature on the transformer. The condition parameters between 17:00-18:00, which can be more affected by indoor and outdoor temperature, were studied.

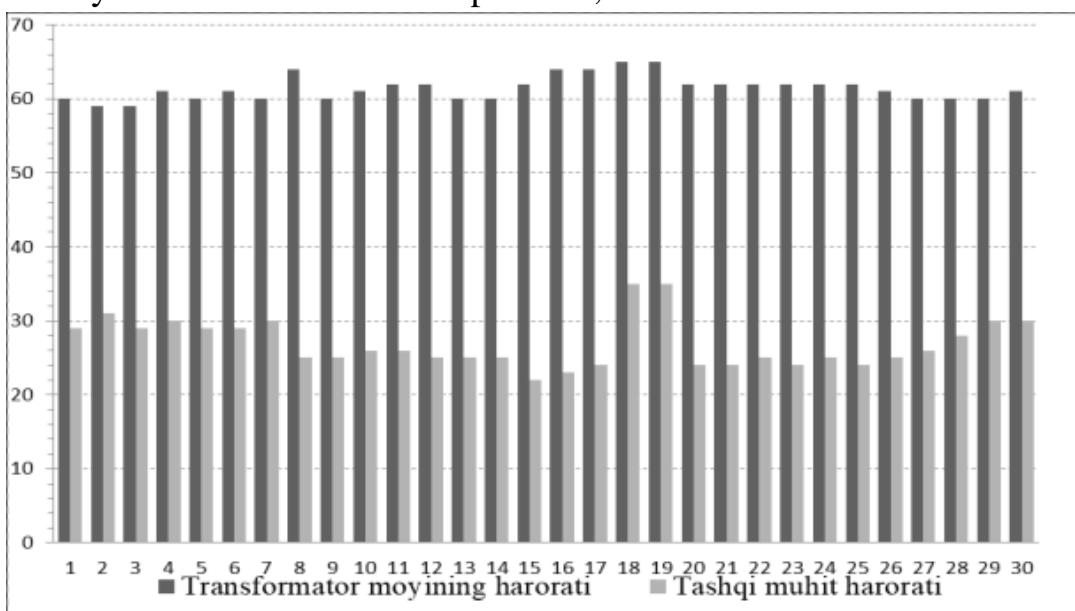


Figure 1. Effect of ambient temperature on oil temperature of transformer TRDN-32000/110\* kVA between 8:00 and 9:00.

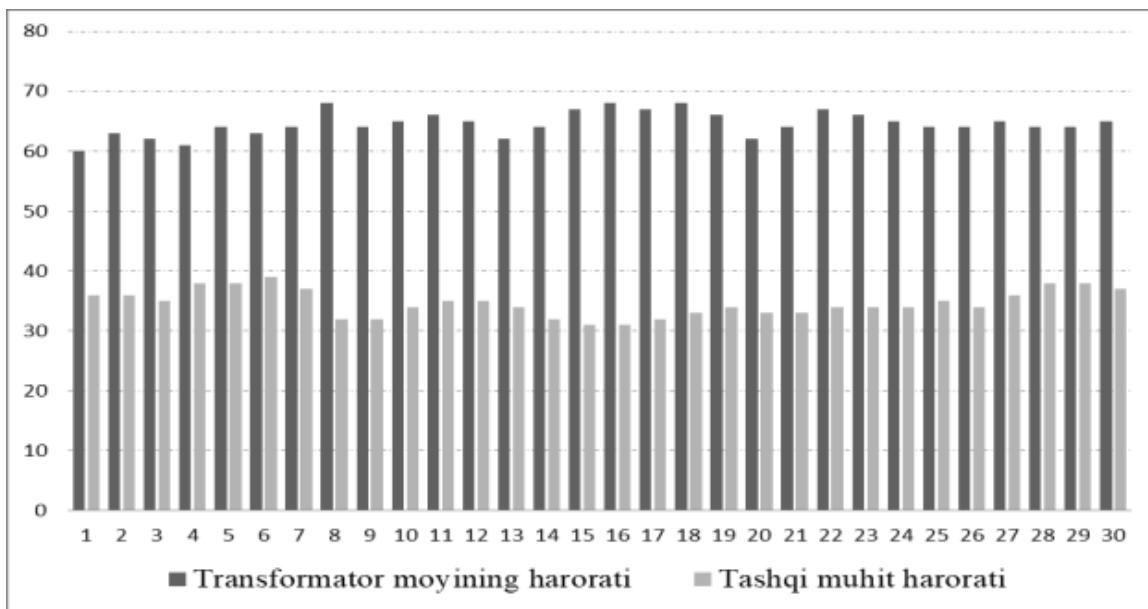


Figure 2. Effect of outdoor temperature on transformer oil temperature of TRDN-32000/110\* kVA between 17:00-18:00.

The result of the study shows that TRDN-32000/110\* kVA For the first power oil transformer, the smallest temperature difference between the external environment and the transformer oil temperature is 28°C for the period of 8:00-9:00, 23°C for the period of 17:00-18:00 and the largest difference 41 °C for 8:00-9:00, 37 °C for 17:00-18:00.

In conclusion, as a result of the analysis of the values determined by the results of the research, the excess increase of the transformer oil changes depending on the temperature of the external environment. In order not to affect the production process, it is necessary to reduce the effect of the external temperature on the transformer. For this purpose, it is recommended to use special air-coolers. Transformers are recommended to use a simple perfect and effective transformer oil cooling system, which is equipped with special blowers that blow air and pumps for forced oil circulation. The forced circulation of oil allows obtaining the same temperature distribution along the height of the transformer and increases the efficiency of cooling the transformer.

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