

УДК 621.3.014.12

Andrii Tretiakov¹, Olena Syvachuk²

¹ PhD student, EE Dpt., NU “Zaporizhzhia Polytechnic”

² senior teacher NU “Zaporizhzhia Polytechnic”

**MULTILEVEL DIAGNOSTICS AND AUTOMATION ANALYSIS OF
THE CURRENT CONDITION OF THE TRANSFORMERS FOR
SPECIFIC PURPOSE**

The ASSOCIATION AGREEMENT between Ukraine, on the one hand, and the European Union, the European Atomic Energy Community

and their member states, on the other hand, predicts gradual adaptation of Ukrainian legislation to EU norms, including in the field of energy.

These changes provide for control over the quality of electricity, the introduction of norms for the restoration of electricity supply to consumers, and so on. This, in turn, requires the transition of the energy system to digital standards, remote control of equipment, etc.

In this article, we will separately consider the situation with monitoring the condition of a transformer filled with power oil. Life cycle of the transformers is about 25-30 years. According to accepted practice, the first overhaul of power transformers should be carried out no later than 12 years after the transformer is put into operation. However, transformer producers in their "struggle" for tenders, by reducing the cost of the goods, optimize the cost of the materials used, which leads to the fact that there is sometimes a small margin of safety in modern transformers. Statistics for SERGI Transformer Protector (France) show that the largest percentage of safety system activation occurs in the first 3 years of a new transformer operation.

That is why control of transformer parameters is very important, both new and those that have been in operation for a long time. The evaluation of these data offers the possibility of detecting oncoming faults early. For this purpose, off- and online diagnostic methods and systems for power transformers have been developed in recent years [1].

Equipping the transformer with an online condition monitoring system will allow switching to the transformer maintenance program based on their current condition.

KEMA ((Keuring van Elektrotechnische Materialen te Arnhem) NV, established in 1927, is a global energy consultancy company headquartered in Arnhem, Netherlands) studies have shown that the implementation of post-condition maintenance programs for the existing power infrastructure in North America and Europe during the first 10 years will save more than 3 billion USD through maintenance costs and capital investment postponement. This statement is based on the fact that several power supply companies around the world have implemented, for the purpose of testing, condition-based maintenance, and maintenance costs have decreased by 14-18%. In support of this claim several utilities around the world that have used condition-based maintenance programs are achieving as much as 14-18% reduction in maintenance costs [2].

Such issues are particularly actual in the networks that feed electro-metallurgical industries, including arc steel furnaces, rolling mill drives, gas and oil refining industry, electrolysis, inverting and rectifying devices of direct current power transmission lines, modules for converting energy from 50Hz to 60Hz, etc. [3-4]. This is explained by the fact that such technologies lead to a deterioration of the quality indicators of electrical energy, as a re-

sult of which the equipment operates in modes whose indicators exceed those set by state standards and other regulatory and technical documentation. Such regimes are called "variable" [4-5].

REFERENCES

1. Tenbohlen S., Coenen S., Djamali M., Müller A., Samimi M.H., Siegel M. (2016) Diagnostic Measurements for Power Transformers. [Текст] / Energies (open access journal), pp. 1-2. Retrieved from: <https://www.mdpi.com/1996-1073/9/5/347> (accessed 04 March 2023).
2. [Electronic resource]. – Retrieved from: https://cdn2.hubspot.net/hubfs/227797/Neoptix_Brochures/Iris_Powers_Brochures/CM-S32-01L-01E_SMARTSUB.pdf (accessed 04 March 2023)
3. Shidlovsky A.K. (2004) Palyvno-enerhetychnyy kompleks Ukrayiny v konteksti hlobalnykh enerhetychnykh peretvoren [Текст] / [Fuel and energy complex of Ukraine in the context of global energy transformations]. Kyiv: Ukrainian encyclopedic knowledge. (in Ukrainian)
4. Arrillaga J., Watson N.R. (2003) Power systems harmonics [Текст] / Second Edition. Chichester: John Wiley & Sons Ltd.
5. Feshchenko P.P., Zinovkin V.V., Sergienko S.L. (1993) Analiz pov-rezhdayemosti silovykh transformatorov pri rezkoperemennoy nagruzke [Текст] / [Analysis of the accident rate of power transformers under rapidly variable load]. Kyiv: Energy and electrification. – no. 4. – p.24-27. (in Ukrainian)