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RESEARCH AND IMPROVEMENT OF TECHNICAL CONDITION ONLINE MONITORING FOR 110 KV TRANSFORMER EQUIPMENT UNDER OPERATIONAL VOLTAGE

The creation of smart power grids is a global trend. New requirements for "smart" equipment affect all scientific branches including designing of electrical machines, apparatus, switchgears, substations and electrical power plants. Further improvement of the operational reliability of electric power grids in the conditions of trend to "non-maintained" electrical objects is impossible without online monitoring system (OMS) of high-voltage electrical equipment.

The technical condition, the actual electric power system design in Ukraine, modern trends to modernization and intellectualization of the electric power industry also arise a number of new tasks for operational diagnostics:

reduction of operational costs and improvement of the technical stability of the energy system;

estimation of the current state and forecasting of the remaining life of equipment for planning the distribution of financial assets in conditions of aging of the equipment, especially during the war period and enemy missile attacks on the energy infrastructure of Ukraine;

automation of diagnostics for the creation of substations without permanent maintenance personnel and the creation of so called smart-grids in Ukraine.

The specified provisions determine the relevance of the scientific and practical task and define the following tasks:

creation of theoretical base and practical implementation for a set of equipment for creating a OMS based on the monitoring unit (MU) with a fixed list of parameters (hereinafter MUFP).

development and improvement of mathematical models, expert assessments, methods of determining and analyzing diagnostic parameters of the condition transformer equipment (TE) under operatinal voltage to extend its service life, as well as to reduce the level of maintenance costs.

development of a structure with improved technical and economic indicators and maximal usage of Ukrainian equipment.

In work [1], the authors performed an analysis of systems for monitoring the concentrations of gases dissolved in transformer oil for the purpose of use in OMS during the operation of power TE, possible reasons for discrepancies in the results of the analysis of the concentrations of gases dissolved in oil, performed by stationary gas analyzers and laboratory chromatographs, were investigated. It was found that all gas analyzers are able to record a trend in equipment deterioration, which is the main task of online monitoring. Extended interpretation of the equipment condition should be carried out in the presence of readings from the device for monitoring the amount of combustible gases by taking samples and analyzing them with the help of a portable analyzer, which allows to estimate concentration of each diagnostic gas. Therefore, taking into account the positive operational experience of monitors that control the sum of the concentrations of combustible gases (TCGC) and the moisture saturation of TE oil in Ukraine, USA and the countries of the European Union, it is possible to make the conclusion, that the most economically and technically justified solution for dissolved gases monitoring in110 kV TE is TCGC-monitors. TCGC-monitors are the best way to upgrade the level of diagnostics of TE and reducing the costs of OMS for this class of the equipment.

The values of diagnostic parameters are determined based on the statistical data about damages of high-voltage equipment, which makes it possible to estimate parameters with a high "specific weight" that are used for frequently occurring defects. These include: moisture content in oil, concentration of gases, insulation power loss factor (tan-delta), and the fourth parameter can be either the acid number, or the content of mechanical impurities, or the breakdown voltage.

An analysis of mathematical models was carried out for the purpose of their application in OMS, as a result of which a list of input signals of MUFP, distribution of MUFP signals was formed, for correct and effective diagnosis of the state of TE, which ensures a reduction in the emergency of the monitored equipment, accounting and forecasting of the residual life, optimization of the operational modes of high-voltage equipment, on this basis, increasing the reliability, decreasing of pre-emergency and emergency modes of transformers, autotransformers and reactors during operation, as well as minimizing the

influence of the human factor on the processes diagnostic parameters measuring, processing, transmission and storage.

The scheme and design of the MUFP have been developed. The efficiency of the development is ensured by reducing the cost of production of monitoring systems, due to the use of a fixed list of parameters and models that ensure maximum diagnostic efficiency

LIST OF REFERENCES

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