

MOBILE DIAGNOSTIC LABORATORY FOR POWER TRANSFORMERS AND SWITCHGEARS

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LABORATORY FOR DIAGNOSTICS
OF POWER TRANSFORMERS «AURORA-7»



Laboratory is intended to perform the complex of works on testing and diagnostics of power transformers and high-voltage inputs in accordance with requirements of «Volume and standards of electric equipment tests».

- measurement of insulation parameters of windings and inputs;
- measurement of winding resistance by direct current;
- measurement of standby losses;
- measurement of short-circuit resistance;
- verification of transformation ratio;
- verification of windings connection group;
- insulation testing by increased voltage of industrial frequency.

Data of measurements and tests are recorded automatically in tables and test report. Transformer state is evaluated by operator.

Diagnostics of the transformer technical state allows the following:

- To prevent in timely manner occurrence of emergency situations related with faults of transformers and switchgears; to improve reliability of equipment operation;
- To reduce significantly expenditures for repairs with improved efficiency of their performance;
- To evaluate actual state of electric equipment and to determine its stamina (reserve time of operability), which is of special importance for transformers that have worked out 15 years and more;
- To prepare for commissioning of the continuous diagnostics (monitoring) systems and determination of remaining service life of equipment in composition of automatic process control systems within power facilities.



Developed laboratory is based on the measurement control module executed under SCADA (Supervisory Control And Data Acquisition) technology, which makes it possible to integrate measurement methods and instruments applied within laboratory for diagnostics of transformers into single combined unit. Application of SCADA-technology allows high level of system control automation to be achieved, as well as data acquisition, processing, transmission, storing and displaying.

- measurements are controlled from operator's compartment by means of industrial computer with a touch screen;
- friendly HMI (Human Machine Interface) interface provided by the control module demonstrates completely and pictorially the state of measuring system and ensures interactive dialogue with it;
- built-in reference library of normative and technical documentation provides operator with possibility to use "prompts", improves efficiency of interaction with measuring system and reduces to minimum critical errors of operator during control and measurements;
- specially developed software in conjunction with measuring system provides memorization, processing and recalculation, storing and analysis of measurement results;
- engineering data for preparation and modification of measurement protocols are processed in pre-programmed way;
- integration of measurement methods and instruments by means of control module makes it possible to use single cable for electromagnetic tests of all types for transformers and two cables for tests of all types for insulation of transformer windings and inputs;
- measurements diagrams required under methodology are selected by operator from the laboratory control compartment; selected diagram is displayed on the computer screen and can be corrected by operator;
- minimization of the number of climbs up and down to and from the lid of tested transformer required for measurements to be performed, which, of course, reduces probability of the personnel injuries;
- measuring circuits are switched by special relays providing sufficient values of measuring currents and voltages, as well as reliability of connections.

Within the laboratory, measuring instruments are used and the series of know-how solutions are applied that provide unique technical capabilities:

- quick automatic demagnetization of the transformer's magnetic core, including one of transformers of VI size;
- measurement of ohmic resistance of transformer's windings and units with inductivity of up to 1,500 H;
- as an insulation medium in high-voltage transformer and voltage divider of laboratory, electronegative gas (SF6) is used. Charging with electronegative gas is designed for the whole service life of articles; no maintenance is envisaged, except ordinary cleaning of outer insulating surfaces; besides, due to application of electronegative gas insulation, exceptionally small overall dimensions and weight of high-voltage equipment are achieved.
- mains power and electric safety module provides power supply for laboratory from both 220 V single-phase and 3x380 V/3x220 V three-phase mains;
- voltages and currents required for performance of measurements are supplied and adjusted with no additional equipment (regulating autotransformer, batteries, etc.);
- laboratory earthing and appearance of electric potential on the laboratory chassis is monitored.

Should any danger of electric shock for personnel occurs, power supply of laboratory is shut down automatically without violation of measuring circuits switching. All measuring instruments are provided with conformity certificates for the type of measuring means.



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