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Monitoring the parameters of the operating mode of high voltage electrical networks

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ABSTRACT: The authors consider the importance and improvement of control over the operation of high voltage electrical networks. The function of monitoring the operating mode of high voltage electrical networks: monitoring the operating modes of electrical equipment, individual loads, voltage and frequency at control points of electrical networks, the value and direction of flows of active and reactive power, the amount of supplied energy.

KEY WORDS: panel instrumentation, accuracy class, electrical installation elements.

I.INTRODUCTION

The main tasks of monitoring the parameters of the operating mode of high voltage electrical networks include: detection of interference and their assessment; registration of measured numerical characteristics for the purpose of processing and displaying results; assessment of the measured values of power quality indicators for compliance with the established requirements; identification of the source of interference; conducting commercial settlements between the supplier and the consumer of electricity.

To organize measurements, it is necessary to determine the type of control, the point of measurement and the types of controlled indicators of power quality. Depending on the duration of observation, two types of control organization can be distinguished: periodic and constant.

II. METHODOLOGY

Control over compliance with the parameters and other technical indicators of the operation of electrical networks is carried out mainly with the help of panel control and measuring instruments, and in some cases, if necessary, portable measuring instruments are used.

Electrical panel meters used at substations have an accuracy class of 2.5-4.0. At the control points of the power system, panel voltmeters of accuracy class 1.0 are used. Accuracy class means the largest reduced error of the device as a percentage of the maximum reading α max allowed by the scale of the device, i.e.

$$\beta = \frac{\alpha_{measured} - \alpha_{true}}{\alpha_{maximum}} \cdot 100\ \%$$

where $\alpha_{measured}$ - the measured value α_{true} - the true value, determined by the exemplary device; α_{max} - maximum readings on the instrument scale.

Electrical measuring devices of various types are used to control the operating modes of electrical equipment of substations: magneto electric, electromagnetic, electrodynamic, induction, digital and self-recording, as well as automatic oscilloscopes.

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To control the nominal value of the measured value, a red line is drawn on the instrument scales, which makes it easier for the duty personnel to monitor the operating mode of electrical equipment and helps to prevent unauthorized overloads.
The load is monitored using ammeters connected in series to the measuring circuit. Devices for high currents are difficult to perform, therefore, when measuring on direct current, ammeters are connected through shunts (Fig. 1, a), and on alternating current - through current transformers (Fig. 1, b, c).

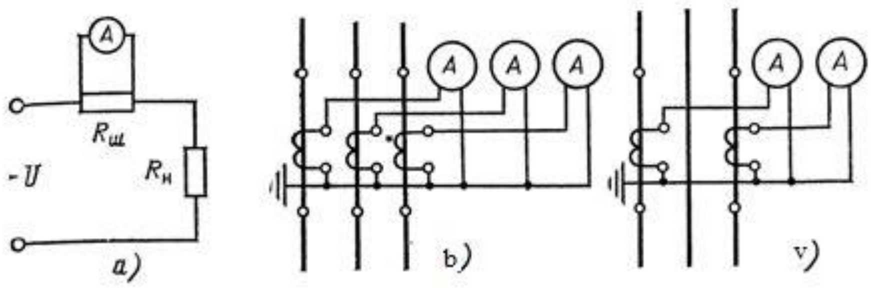

Figure: 1. Circuits for switching ammeters for measuring DC and AC current

DC ammeters are installed in rectifier circuits, in excitation circuits of synchronous compensators, in battery circuits.
The voltage level is monitored using voltmeters on all sections of the bus bars of all voltages, both direct and alternating current, which can operate separately (installation of one voltmeter with a switch for several measurement points is allowed). To measure voltage, voltmeters are connected in parallel in the measuring circuit. If it is necessary to expand the measurement limits, additional resistors are connected in series with the instruments.

III. EXPERIMENTAL RESULTS

The question is even more acute when it comes to industrial plants and high voltages. Damage from improper electrical equipment and lines can be significant. These are real, usually significant, financial costs due to the failure of electrical elements, burnt cables and similar troubles.
There is no need to talk about fatalities at work. Therefore, electrical measurements have been and remain relevant for the energy sector of any, even a small, company.
It is clear that electrical measurements and their composition will differ for different objects. Here it should be noted only the most important and demanded services of this plan, namely:
testing of lightning protection systems;
determination of the insulation resistance of the electrical installation cable and the quality of grounding;
diagnostics of power transformers and residual current circuit breakers;
determination of breaks and places of short circuit on power supply lines;
testing devices and networks using high voltage of various current forms and others.
In order to obtain a sufficient amount of statistical data on all measured parameters, control and measuring devices are connected at the entrance to the building (room) and continuously take readings in a weekly (or more) cycle. If there are more than one active inputs, the measurement cycle is repeated for each of them:
1.Voltage deviation;
2. Frequency deviation;
3. Coefficient of non-symmetry of voltages in reverse sequence;
4. The coefficient of non-symmetry of voltages in zero sequence;
5.Total coefficients of harmonic components of phase voltages;
6. Short-term dose of flicker;
7.Long dose of flicker;
8. Coefficients of harmonic components of phase voltages of the order of n (Phase A (AB));
9. Coefficients of harmonic components of phase voltages of the order of n (Phase B (VC));
10. Coefficients of harmonic components of phase voltages of the order of n (Phase C (CA));
11. Coefficients of interharmonic voltage components of the order of n1;
12. The number of over voltages by maximum voltage and duration;
13. The number of dips in residual voltage and duration;

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14.Number of voltage interruptions by residual voltage and duration.

IV. CONCLUSION

Electricity is the cheapest and most convenient form of energy to operate. The widespread use of electrical energy is due to the relative ease of its receipt, transformation and the possibility of its transmission over long distances.
A huge role in power supply systems is played by power lines and electrical substations - electrical installations designed to convert and distribute electricity.
Grid organizations are obliged to take measures to connect consumer facilities to power grids. If there is no technical possibility, it should be created. An important part of substation design is circuit selection.
The substation scheme is closely linked with the purpose and method of connecting the substation to the supply network and must: 1) ensure the reliability of power supply to the substation consumers and power flows through intersystem or trunk connections in normal and post-emergency modes; 2) take into account the development perspective; 3) allow the possibility of gradual expansion of switchgears of all voltages; 4) take into account the requirements of emergency automation.

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