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ANALYSIS OF THE EFFICIENCY OF VOLTAGE STABILIZERS

A significant increase in the use of stabilized energy sources over the last year requires an analysis of their efficiency for successful use in conditions of unstable operation of electrical networks. The voltage stabilizer is electrical equipment, which designed to normalize the voltage in the network when loaded in a narrow range. The main purpose is ensuring voltage supply to all consumers within $220\text{ V} \pm 10\%$, that is, in the range of 198...242 V [1].

The following main types of voltage stabilizers are distinguished: relay, electronic, electromechanical, ferroresonant, inverter [2].

Relay stabilizers are electronic devices, which the principle of operation is built on the basis of stepwise regulation of electricity with using the control unit. Regulation is provided by a series of relays that automatically connect the necessary winding of the autotransformer. The output voltage is measured and compared with the reference voltage of the control unit. If there is a deviation, the control processor gives a command to turn on the corresponding relay, adjusting the additional voltage so that the output voltage acquires the reference value. The value of the additional voltage, depending on the oscillation of the input, is either added or subtracted from the distorted voltage.

Advantages of relay stabilizers: satisfactory voltage regulation voltage – 40 ms on average; resistance to voltage drops; protection against overvoltage and short circuit; stability to minus temperatures – can work in free-standing unheated rooms; do not require additional cooling.

Relay voltage stabilizers have several significant disadvantages: lack of power reserve – it is not recommended to use them for powerful motor equipment, it is worth using a device with a significant power reserve (30...40%); relays wear out over time, which reduces stabilization accuracy and increases the probability of repair operations; the stepped control system does not provide high accuracy at the voltage output, which is necessary for the operation of modern electronics; errors can reach up to 20 V [2].

The basic principle of operation of electronic stabilizers is similar to that of relay stabilizers. They consist of the following elements: automatic transformer, control circuit, measuring sensors, frequency filters.

Advantages of electronic stabilizers: stabilization of the input current over a wide voltage range; high accuracy and response; compact dimensions

due to the absence of mechanical parts; functioning at low temperatures (some models).

Disadvantages of electronic stabilizers: increased reaction time with a large number of steps; high sensitivity to interference in the network; the complexity of the construction; step voltage equalization; under heavy loads, the simistors and thyristors may burn out [3].

Electromechanical voltage stabilizers function thanks to the movement of the carbon electrode along the windings of the autotransformer with the help of an electric drive. As a positive moment are low cost, smooth voltage regulation and small dimensions.

Such devices also have small disadvantages – high noise during operation, low trigger speed, do not like the cold.

Inverter voltage stabilizers are considered the best. The scheme of this device is based on an inverter in double voltage conversion. First, the alternating voltage becomes constant, and then it is converted back into an alternating output voltage. As a result, we have perfectly uniform and accurate voltage: without drops and almost without deviations. The main advantage is accuracy and speed of operation. Another positive point is that it works without a transformer. It also has compact dimensions, does not make noise during operation and has additional functionality. As for the latter, inverter-type voltage stabilizers can protect household appliances from overvoltage and other external interference in the electrical network. The scheme of such a model is stepless, so voltage surges and overloads are not important for it. As for the minuses, only their cost can be attributed [4].

Thus, inverter voltage stabilizers are the most effective and promising type in terms of performance characteristics of all existing ones.

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