ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 6 | Issue: 5 | May 2020 || Journal DOI: 10.36713/epra2013 || SJIF Impact Factor: 7.032||ISI Value: 1.188

ELECTRICAL ENERGY QUALITY AND ITS STABILIZATION MEASURES

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ANNOTATION

When it is said that "quality indicators of electricity", it is understood that the basic parameters of electricity production in mining, transmission and distribution correspond to the established norms.

KEY WORDS. ***Frequency deviation, frequency vibration, voltage deviation, Network nosinusoidality, voltage vibration, adjustment in power station and nimstantsiya tires)***

DISCUSSION

The quantitative characteristic of the quality of electrical energy is determined by the coefficient of the form of the curve and the coefficient of symmetry of the voltage, with the deviation of voltage and frequency, with the vibration of the voltage and frequency.

Frequency deviation this is an average value that indicates the difference in the real value of the frequency in the range of 10 minutes from the nominal value. In the normal case, the deviation of the frequency is allowed from the nominal value of ±0,1 GHz. in a short time, it can be changed to ±0,2 GHz.

Frequency vibration - this is the difference between the load of the main frequency and the smallest wear in the rapid elongation of the mode parameters, when the frequency elongation speed is not less than 0.2 GHz per second.

The oscillation of the frequency is not allowed to deviate from ±0,2 GHz, the increase from ±0,1 GHz can be given.

$$\delta f = f_{нб} - f_{нм} \quad \delta f\% = \frac{f_{нб} - f_{нм}}{f_{ном}} 100\%$$

The deviation of the voltage is this - in the slow change of the operating mode, that is, when the rate of change of voltage does not exceed 1% per second, it is said that the actual value of the voltage differs from its nominal value.

$$\Delta U = U - U_{н} \quad \text{or} \quad \Delta U\% = \frac{U - U_H}{U_H} 100\%$$

In normal working cases, the deviation of the voltage is allowed at the following values:

- Up to 5÷+10% electric blanket when wearing and Managing on clamps of apparatus;
- Up to 2,5÷+5% the performance of the sleeves;
- ±5% in the remaining electric consumers clasp.

In cases after an accident, a decrease in tension is allowed by another 5%.

Voltage fluctuations. The voltage is determined by the indicators on the oscillation tone:

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1. Vibration of the voltage δU - this is the difference between the maximum and minimum values of the voltage acting ethically when the operating mode changes fast enough, that is, the voltage change speed is not less than 1% per second.

2. Frequency of change in voltage (1/s, 1/min, 1/hours)

F=m/T in this m- the number of changes in the voltage t time interval, when the voltage change rate is not less than 1% per second.

3. The range of consecutive changes in voltage Δt_{kj}.

The picture below shows a graph of the change in voltage by time, in which during 12 seconds the voltage spreads 5 time knots.

In picture $\delta U_1, \delta U_2, \ldots, \delta U_5$, - voltage chang;

Δt_{12}, Δt_{23}, …, Δt_{m5} – time interval between successive extremities; T is the interval time from which the measurement was taken.

The net nosinusoidality is characterized by the nosinusoidality coefficient of tension curvature and can be found from the following formula:

$$K_{нс} = \frac{\sqrt{\sum_{\nu=2}^{\infty} U_{\nu}^{2}}}{U_1} 100\% \approx \frac{\sqrt{\sum_{\nu=2}^{\infty} U_{\nu}^{2}}}{U_{ном}} 100\%$$

In this U_ν- ν-chi the effect value of the voltage in the harmonic, U_1- is the effect value of the first most basic harmonic.

The coefficient of nosinusoidality should not exceed 5% in any consumer.

When we say the voltage symmetry, it is understood that the amplitude or phase angle of the phase or linear voltages is not equal to the surface of the silences.

Normalized indicator of nosimmetry this is a reverse bias voltage U_2, and it is thus indicated:

$$\varepsilon_2 = \frac{U_2}{U_{ном}} 100\%$$

The allowable value of this coefficient is 2%.

The change from the norm of the quality indicators of electrical energy leads to the waste of electrical energy in the power supply system, a decrease in the level of reliable operation of electrical devices, a violation of technology processes and a decrease in the production of products.

Voltage deviation.

What kind of electricity is built to match the rated value of the voltage of the consumer, thereby changing the voltage to the norm does not affect its normal operation. When changing from the specified norm, the working condition of consumers may be impaired (changes in the character of electrothermic devices, changes in the degree of illumination of light bulbs, changes in the electric conductor valide FIK, etc.).

The main reason for the voltage deviation in the power supply system is a change in the mode of electricity consumption, a change in the state of the supply power system, a change in the sufficient resistance of the line 10-6kv.

The change in the specified norms of voltage affects both the technical and economic indicators of consumers.

The deviation of the voltage is tied to a number of frequent alternating currents. The consequences of the voltage deviation will be not only in its value, but also in the dependence on the duration of the voltage deviation and the volume of consumers affected by the voltage deviation. For example: for some specific consumers who have experienced a short period of time, the consequence of the voltage deviation can be reduced from the outgoing expenditure to the expensive, eliminating this deviation.

The reduction in voltage worsens the quality. The time increases by 10% when the voltage decrease is 20%.

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If a 2220 PCs sewing machine (AT-120-5) is running in the sewing sex, a 5% reduction in the rated value of the voltage will lead to the production of 131m fabric for 1 hour.

The picture shows the power constants of the levels of voltage of the light flux and the time of operation of the lamp.

1-light flux F

2-light reversing circuit η

3-Power P

4-average working life T (on the percent)

A 1% nominal value increase in voltage for incandescent lamps leads to an increase in consumption by approximately 1,5% and an increase in the luminous flux by 3,7%, a decrease in the working life by 14%. An increase in the voltage by 3% leads to a decrease in the working life of the incandescent lamps by 30%. An increase in voltage by 5% will reduce the working time of the lamps by 2 March. When the voltage of fluorescent lamps increases by 10%, their working life is reduced by 20-30%.

Understanding the damage caused by voltage deviation

The characteristics of the consumer of electricity can be divided into technical and economic components by voltage.

Technical characteristics these are understood as the frequency of rotation of the conductors, the time of melting in the electropeches, the flux of light in the lighting fixtures and the dependence of the voltage on the active power consumed by the electric conductors.

The economic damage to the voltage deviation can be determined in the presence of voltage indicators that affect the technical description.

$$Y=3(U) - 3(U_{ном}) \qquad (2.1)$$

3(U) – well, the costs that he went for the production of products in the voltage

3(Uном) – $U_{ном}$ in nominal voltage, the expenditure that went for the production of products.

Costs that are with electrical consumers with the effect of voltage deviation are called economic description.

Y= f(U)

With the help of the economic description, it is possible to determine the optimal modes of voltage and effective methods of its maintenance.

The final conclusion of the economic description includes the cost of the product produced, the costs incurred for electricity and the costs incurred during the life of the consumer. When working in asynchronous conductor voltage deviation, the following sum of the output voltage will come out of the cost.

$Y=Y_1+Y_2+Y_3+Y_4$ (2.2)

Here Y1-the costs associated with productivity change. $Y_1=(П_{ном} - П)\alpha t$ (2.3)

Here is the productivity of the $П_{ном}$ and П controller in one hour when working with rated and deviation voltage.

α- the number of products produced using the same.

t- time of spending specification.

The founders of the sum of the active Y_2 and reactive Y_3 power while working with the harm of the asynchronous conductor are the same:

$$Y_2(P-P_{ном})C_0t; \quad Y_3=(Q-Q_{ном})C_0tk_{ип} \quad (2.4)$$

$P_{НОМ}$ P – power consumption in nominal and voltage deviation of the conductor;

Q, $Q_{ном}$ – for a similar reactive power;

Co – cost of spent 1kvt-hour electricity,

$K_{нп}$ – the coefficient of change in wastage is kWt/kWr.

The change in the operating life of the controller from the voltage deviation is as follows:

$$Y_4 = \frac{C_{äâ}}{\hat{A}}(\psi - \psi_{îî})t$$

Here is the price of the Su-conductor,

B-the working life of the controller with rated voltage.

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Relative irradiation of insulation is as follows.

$$\psi = \begin{cases} (47U^2 - 7.55U + 1)K_з^2, агар -0,2 \le U \le 0 \\ K_з^2, агарда 0 \le U \le 2.0 \end{cases}$$

Here is the loading coefficient of the $K_з$ – conductor.

Methods of adjusting the voltage in the power supply system can be described as follows:

a) Adjust the power station and substation tires.

Voltage can be adjusted when changing the start current of generators at maximum hours of loading and at minimum hours of loading on the power station tires.

Reducer 6-20 kv substations can be adjusted using Transformers, static capacitors, synchronous compensators, autotransfor - motors to adjust the voltage in the tires.

b) Adjust the transmission lines.

Individual adjustment in the transmission tires of the substation is an effective method. In these cases, transformers with adjustment under load are used, capacitors that are connected in series to the transformer and lines that can provide additional voltage.

v) Joint adjustment – the first (a) and second (b) methods are used together.

g) Adjust the voltage additionally. This method is additionally used when the desired level is not achieved when using other methods.

D) Adjust the power supply system by changing

In power supply schemes, the amount of reactive power, orientation and resistance of the network in some places are changed, that is, dressing the possibility of adjusting the voltage at some points of the network.

To keep the voltage level in the required amount, two different methods are used. The first - this is the use of special rectifier devices, the second-this is the application of various arrangements without the use of special rectifier devices.

The second group of events for adjusting the voltage includes:

1. For head reducer substation transformers can be adjusted under load (RPN) using transformers with which.
2. Application of compensation structures.
3. Application of special voltage adjusting devices.

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