IMPACT OF VOLTAGE ASYMMETRY ON TECHNOLOGICAL AND POWER CHARACTERISTICS OF CONVEYOR

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The asymmetry of stress adversely affects the operation and service life of induction motors. Due to reduced voltage unbalance moment induction motor and increasing loss of energy. Negative sequence currents cause additional heating of the rotor and the stator, which leads to rapid aging of insulation and reducing engine power.

Due to the asymmetry of stress changes the angular speed of the motor, which in turn causes the change process and power characteristics of working machines.

The purpose of research - to establish the impact of voltage unbalance on technology and energy characteristics of conveyors .

Materials and methods research. The analysis of the angular speed of the electric drsve of conveyor and energy loss in voltage asymmetry was performed using the theory of the electric relating to the electromechanical properties of induction motors, power transmission characteristics of working machinery, electric power and steady application of mathematical modeling.

In experimental studies in one of the phases of the stator motor resistor turned on. Voltmeters voltage measured at each phase of the engine. The voltmeter voltage unbalance factor determined by the reverse sequence.

Experimentally determined angular speed and performance conveyorTC-40C at different values of voltage and asymmetry factor determined power loss.

Results. When voltage unbalance as a result of negative sequence voltage decreases of the engine and change the stiffness of the mechanical characteristics. This causes a change in the angular velocity of the engine:

$$\omega_* = \frac{\omega_0}{\omega_н}\left(1 - \frac{1}{\beta_{днс*}}\right) + \frac{1}{\beta_{днс*}}, \qquad (1)$$

where $\omega_н$ - rated angular speed of the engine, s^{-1}; $\beta_{днс*} = \beta_{днс} / \beta_д$ - mechanical rigidity of the engine in relative units.

The dependence of the stiffness of the mechanical characteristics of the motor АИР90L4, which is used to drive conveyor ТС-40С, the coefficient of asymmetry voltage in a reverse sequence described by the equation:

$$\beta_{днс*} = 1 - 0{,}057\, K_{2u}, \tag{2}$$

where K_{2u} - voltage asymmetry coefficient in a reverse sequence.

Then the dependence of the angular velocity of the conveyor asymmetry factor stress in a reverse sequence would be as follows:

$$\omega_* = \frac{1 - 0{,}061 K_{2u}}{1 - 0{,}057\, K_{2u}} \tag{3}$$

and performance conveyor

$$Q_* = \frac{1 - 0{,}061 K_{2u}}{1 - 0{,}057 K_{2u}}. \tag{4}$$

Thus, to change the angular conveyor speed and performance is inversely proportional to the mechanical stiffness of the engine. Growth asymmetry factor stress leads to a decrease in the angular speed and performance of the conveyor.

The asymmetry causes a change in voltage power losses in the engine. This permanent loss vary slightly and variable losses

$$\Delta P_v = \frac{\Delta P_{vн}}{\beta_{днс*}}. \tag{5}$$

For scraper ТС-40С dependent loss of power asymmetry factor stress in a reverse sequence has the form (Fig. 2):

$$\Delta P == \Delta P_{vн} \left(\alpha + \frac{1}{1 - 0{,}057 K_{2u}} \right). \tag{6}$$

where α - coefficient of losses.

As follows from the dependence of growth asymmetry factor stress in a reverse sequence causes an increase in energy loss in the motor.

Conclusions

Voltage asymmetry leads to a decrease in stiffness of the mechanical characteristics of the motor, reducing the angular velocity and productivity conveyor. This increases the energy loss in the motor.