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DEFECTIVE UTITS DETERMINATION OF ASYNCHRONOUS MOTOR DURING PERIODIC DIAGNOSIS

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Abstract: Research is dedicated the complex determination method to find out a current condition of asynchronous motor units, which are damaged during operation. The method is implemented using coefficients of the functional state of the motor units.

Keywords: asynchronous motor, diagnosis, units damage, power loss, functional state coefficients.

The most common power unit used in agriculture is an induction (asynchronous) motor. Their number is about 95% of the total number of electric drives and consume more than half of the industry's electricity. Asynchronous motors have become widespread due to their high structural reliability, but in the operation process at the Ukrainian agro-industrial enterprises annually refuses 20-25% of the existing electric motors quantity. This leads to unplanned material costs associated with the sudden stoppage of production lines, as well as the repair of induction motors [1, p. 128]. Thus, the economic problem of increasing the asynchronous motors operational reliability remains unresolved. The reason is the insufficient level of exploitation of these electric motors at agro-industrial enterprises, in particular – the lack of sufficient information about their condition. Therefore, one way to solve this problem is operation level increasing of asynchronous motors through timely complete diagnostic. This will control the motors condition and increase the probability of their trouble-free operation during the scheduled service.

Existing methods of functional analysis are based on the sequential determination of performance indicators of the main units of the asynchronous motor (stator and rotor windings, magnetic circuit and bearings). A faulty motor unit is determined by deviating the current values of the selected indicators from their acceptable values. Most often, the control starts with the stator winding as the most damaging motor assembly and ends with a magnetic circuit. Therefore, before detecting a malfunction in the magnetic system, it is necessary to perform a large number control operations of other electric motor components, which leads to the irrational use of equipment and time allocated for diagnosis [2, p. 11].

In order to identify damaged units, it is necessary to develop a comprehensive methodology for evaluation the asynchronous motor condition.

We introduce the functional state coefficients of asynchronous motor units, which specify losses in the control mode (mode of operation of the motor with a rated power at a nominal voltage at the clamps $U_1 = U_{1n}$; $P = P_n$):

$$\left.\begin{aligned} \delta_B &= \frac{P_{3.B}}{P_{3.B.B}};\ \delta_M = \frac{P_{3.M}}{P_{3.M.B}}; \\ \delta_{E1} &= \frac{P_1}{P_{1B}};\ \delta_{R1} = \frac{r_1}{r_{1B}}; \\ \delta_{E2} &= \frac{P_2}{P_{2B}};\qquad \delta_{R2} = \frac{r_2}{r_{2B}}, \end{aligned}\right\} \quad (1)$$

where δ_B – bearings functional state coefficient; $P_{3.B}$, $P_{3.B.B}$ – current and basic value of mechanical losses during electric motor operation in the control mode, *W*; δ_M – magnetic core functional state coefficient; $P_{3.M}$, $P_{3.M.B}$ – current and basic losses value in the magnetic circuit during electric motor operation in the control mode, *W*; δ_{E1} –functional state coefficient of stator winding; P_1, P_{1B} – current and basic value of electrical losses during electric motor operation in the control mode, *W*; δ_{R1} – coefficient of active resistance change of the stator winding due to a damage; r_1, r_{1B} – current and basic actives resistance value of the stator winding reduced to operating temperature, *Ohm*; δ_{E2} – functional state coefficient of rotor winding; P_2, P_{2B} – current and basic value of electrical losses of the rotor winding in the control mode, *W*; δ_{R2} – coefficient of active resistance change of the rotor winding due to a damage; r_2, r_{2B} – current and basic actives resistance value of the rotor winding reduced to operating temperature, *Ohm*.

On relationship between the determined coefficients and induction motor functional state, a scheme of troubleshooting of the motor is drawn up. It allows to determine the causes of failure of the motor and to identify faulty units (Fig. 1).

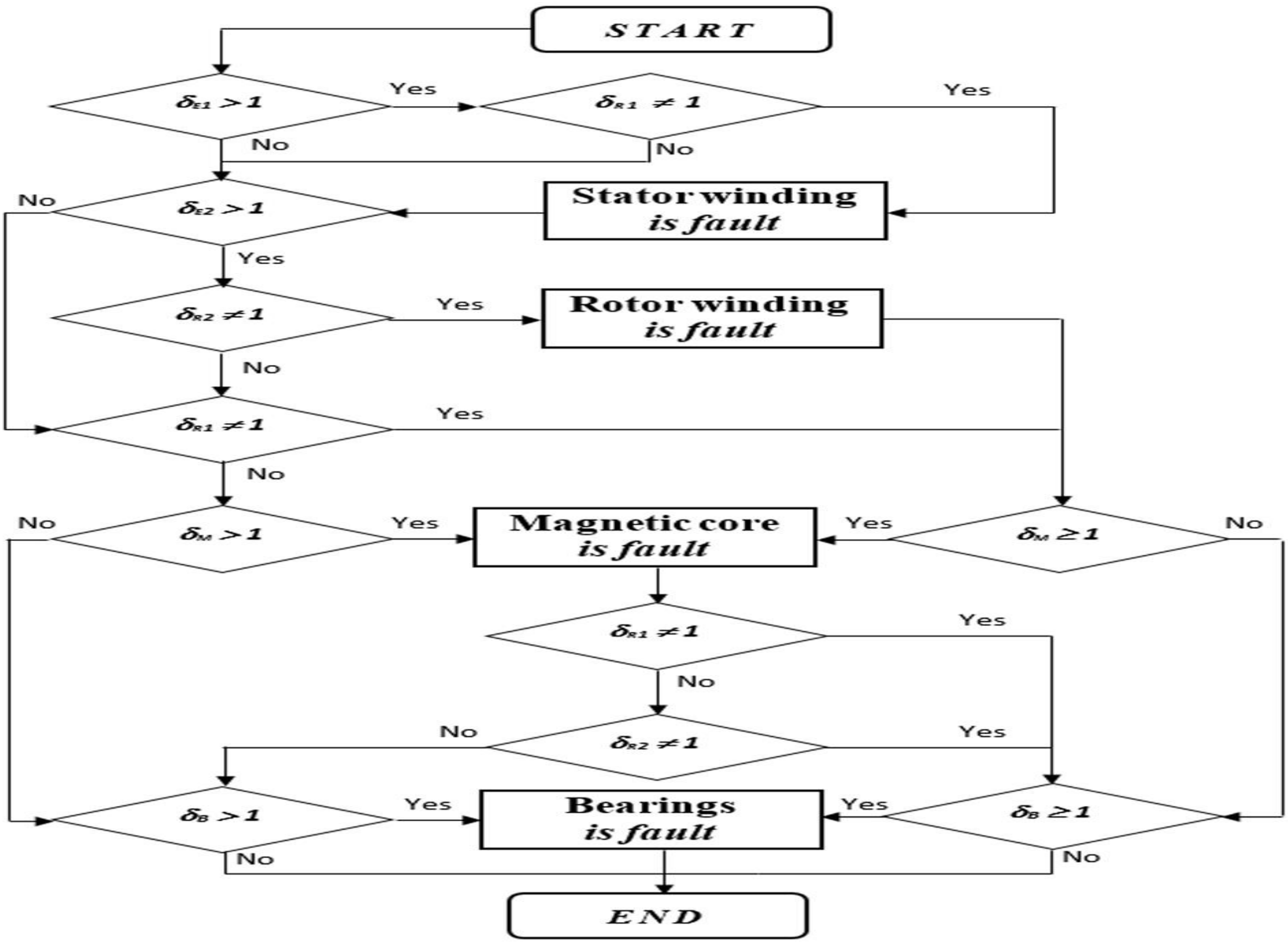

Fig.1. Diagram of troubleshooting in asynchronous motor

Thus, it is necessary to determine the active power and active resistances losses of the motor windings for its current functional state control. It is suggested to use a circle diagram as well as measuring the ohmic resistance of the stator winding. The circle diagram is a graphical model of the converting energy process into an electric induction motor. The loss of active power should be determined by a condition of the rated voltage at the terminals ($U_1 = U_{1n}$) and the rated power ($P = P_n$) of the motor.

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