

УДК 621.313

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METHODS OF DIAGNOSING DAMAGE TO ASYNCHRONOUS MOTOR WINDINGS

Asynchronous motors (AM) often work at elevated temperatures, humidity, dustiness and gassiness of the working environment, commutation overvoltages and technological overloads, which reduces the resource of their work. In the vast majority of cases, AM failures occur due to damage to the stator and rotor windings. Therefore, timely identification of the location and degree of damage will prevent their development, reduce recovery time, reduce maintenance costs, avoid equipment downtime, and increase the efficiency of engines and production mechanisms.

To date, the following methods of diagnosing AM are known:

- 1 The method of continuous monitoring of the state of the stator and rotor windings of AM based on the data of measurements of phase currents and voltage. Symmetrical components of stator currents and voltages, as well as the consumed active power and the angle of inclination of the mechanical characteristics of the electric motor in the area of working slips are used to assess the technical condition of the AM. The method allows you to avoid diagnostic errors in the presence of pulsations and harmonic components in the supply voltage. Disadvantage: the measurement results are evaluated according to a complex diagnostic criterion, which does not allow localization of the damage.

2. The method involves measuring the phase values of current and voltage stator winding, and by the magnitude of the pulsations of the third harmonic is made conclusion about the degree of damage to the windings. To implement the method, it is necessary to measure the values of zero-sequence currents and voltages, which is possible only when the windings are connected in a "star" scheme, which is not used in powerful AMs.

3. The method is based on the analysis of the starting current in the stator in one of engine phases. In the process of diagnosis, everyone is compared of the previous amplitude value of the phase current with a subsequent one, and the resulting difference can be used to judge the presence of winding defects. Disadvantages: implemented only in startup mode.

4. The method of measuring instantaneous values of two phase currents in constant mode of operation under load. Presence of damage is determined by the appearance of the phase instantaneous values, which determines the dependence between the instantaneous values of the phase currents AM. Disadvantage: diagnosis is performed under load, clear criteria for determination are not specified damage to the rotor windings.

5. The method based on the analysis of the external magnetic field (EMF) consists in the analysis of the change in the magnetic induction (ZMI) of the ZMI AM, which is a the total magnetic field created by the different frequencies of the magnetic field of the motor and the screen. The presence of damage to the rotor winding causes the appearance of spatial harmonics in the ZMI, the order of which is lower than the order of the fundamental one, and which largely determines the level of the ZMI AM. Disadvantage: complexity of research and low accuracy of research results.

6. According to the method, an alternating current electromagnet with a magnetizing winding and a measuring winding is connected to the test rod. The value of MRS at a constant supply voltage is a diagnostic sign of the condition of the rod. Disadvantage: the need to derive AM from the technological process and disassemble it to install measuring equipment.

7. The method based on the thermal action of the electric current and the supply to the rotor rings of a voltage at which the value of the current in the rods exceeds the nominal value. A thermal imager is used as an observer of the thermal state of the rotor rods. The condition of the rotor rods is judged by the heating temperature during current flow through them: undamaged rods heat up more than broken ones. Disadvantages: the need to supply large currents, the need to disassemble the engine.

8. A method based on the analysis of the electromagnetic moment spectrum. The method involves measuring the phase currents of the stator in the idling mode of the AD, determining the electromagnetic torque and comparing a significant number of harmonics of the spectrum, which change for a certain frequency range.

Disadvantage: the need to take into account losses in the engine steel for calculations, which causes the complexity of calculating the electromagnetic moment.

The analysis of methods for diagnosing damage to AM windings showed that each of the methods has both advantages and disadvantages. Methods that require the installation of special equipment, removal of the diagnostic object from the technological process, disassembly of the engine, and repeated checking of the diagnostic results using several diagnostic signal processing methods can be considered ineffective.