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Operation of electric machines. Installation of electric machines and transformers

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A B S T R A C T

In this article, opinions were expressed about electrical wiring and transformer assembly

A R T I C L E I N F O

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Devices designed to convert mechanical energy into electrical energy and vice versa are called electrical machines. A machine that converts mechanical energy into electrical energy is called a generator. If a machine converts electrical energy into mechanical energy, it is called an electric motor.
The same machine can work as both a generator and an electric motor. This feature of current machines is widely used. But when a single machine acts as both a generator and an engine, its performance deteriorates. For example, the coefficient of useful work decreases.
An asynchronous machine is an alternating current machine, its principle of operation is based on the phenomenon of rotating magnetic material. Asynchronous machines, like all electric machines, consist of two main parts: a stationary stator and a rotating rotor
The stator plate is long and consists of three-phase coils placed in the stator slots. The frame is made of cast iron or aluminum in the form of a cylinder, and the stator coil is fastened to it. The statin also serves to protect the car from external mechanical influences. The stator has a "terminal box" where the ends of the stator windings are removed to connect them to the power source. In order to better cool AD when it is working, it is made of statin carpet.
The rotor is made of 3 circular plates and has the shape of a cylinder. The current in it occurs as a result of arcing from the rotating field during the rotation of the rotor. These current values are determined by the rotation speed of the magnetic field. Electric motors are designed to generate mechanical energy at the expense of electrical energy. Electric motors are designed for rotary motion, the stationary part is called the stator, and the rotating part is called the rotor. is installed, and from a mechanical point of view, electric motors consist of a rotor rotating inside a single body - a stator. The electric power transmitted to the electric motor is expressed by UI multiplier for direct currents. In the motor, as in ordinary conductors, Joule heat is released (I2R), and magnetic forces do useful mechanical work:The energy balance is expressed as follows:
UI = I2R + (1)
or: Pum=Pis + Pm (2)

Here, Pum is the total power input, Pis is the joule heat, and PM is the useful mechanical power exerted by the magnetic forces.

The meaning of the energy balance for alternating currents is more complicated.

In single-phase alternating current motors, a single-conductor coil is mounted on its stator (fixed outer part), and as a result of single-phase current being connected to them, a rotating magnetic field is created in the internal area of the motor, where the rotor is located. The rotation speed of the field corresponds to the industrial frequency v=50 Hz (3000 revolutions per minute).

Alternating current motors are divided into synchronous and asynchronous motors. If the rotation speed of the motor rotor is equal to the rotation speed of the magnetic field, it is called a synchronous motor, otherwise it is called an asynchronous motor. The principle of operation of asynchronous motors is based on the law of electromagnetic induction and Lenz's rule. The principle of operation of a synchronous motor laming is explained by the effect of torque on a closed circuit with current in a magnetic field.

The principle of operation of an asynchronous motor is particularly simple. First, let's say that the rotor of the connection consists of a metal conductor mounted on the axis of rotation. The rotating magnetic field creates Foucault currents in it due to the phenomenon of induction, and the magnetic field interacts with the external rotating field and tries to stop the mutual movement according to Stokes' law. .

The torque acting on the rotor is proportional to the rate of change of the magnetic field current. The torque is greatest when the rotor is at rest, and decreases as the speed of the rotor increases and approaches the rotation speed of the magnetic field. If the rotor rotates at the same speed as the external field (it is stationary relative to the field), induction currents are not generated in the rotor, and the torque is zero. In order to work against external forces, the engine must have a torque, and in order to have a torque, the rotor must rotate slower than the external field. In this sense, these engines are called asynchronous, not synchronous. if there is no friction, its angular velocity increases to the angular velocity of the field.

If the rotor is rotated faster than the magnetic field due to external forces, the interaction of the induction currents with the rotating field will try to make the rotor equal to the field, the rotor will be braked, and its kinetic energy will be converted into electrical energy. The same happens when the rotation of the magnetic field is opposite to that of the rotor: the rotor is braked, its kinetic energy is converted into electrical energy. So, if a machine performs the function of an electric motor under certain conditions, it becomes a generator under other conditions.After understanding the principle of operation of an asynchronous motor, you can move on to the question of what to do to increase its power. The torque generated in the motor is proportional to the magnetic field current. To increase the magnetic field, the cores of the current coil are made of ferromagnet, steel. In order for the field in the size of the rotor to be strong, its body should also be made of PoMat. In order to solve this conflict, closed copper coils are made inside the rotor cup. This structure of the rotor allows to strengthen the magnetic field due to ferromagnetic steel, and to generate strong induction currents in copper rings with low resistance. For the magnetic field to be strong, a ferromagnetic stator and the rotor spacing is tried to be smaller.

The alternating current strength in the induction motor's inductor depends on the rotation of the rotor. When the rotor is at rest or when the rotation speed is low, the current in the inductor can be very large. This current can heat up and melt the motor. Therefore, it is recommended to connect a current-limiting rheostat to the motor circuit, and the rheostat should be set to a large resistance when the motor is started. As the motor speed increases, the rheostat resistance can be reduced to zero. When an inverter is installed on an asynchronous motor (see the end of this section), such a problem won't stay.

The design of asynchronous electric motors was perfected in the works of M. O. Dolivo-Dobrovolsky, and since then it has changed very little in more than a century.

An asynchronous motor is a motor whose rotational speed lags behind the rotation of the magnetic flux in the stator. The asynchronous motor consists of two structural parts, the moving part is the rotor and the stationary part is the stator. Its mechanical characteristics depend on the speed of rotation of the rotor and the mechanical torque. is said to be

A static electromagnetic device that changes the value of alternating current voltage is called a transformer.

In electrical networks, transformers are widely used for the transmission of electrical energy over a certain distance (to increase the voltage) and for its distribution among consumers (to reduce the high voltage).The transformer, which is considered an important device of the electric network, was invented by the Russian electrical engineer P. N. Yablochkov in 1876. The Russian inventor I.F. Usagin also conducted a lot of research on the further improvement of the transformer.

A transformer works only when connected to an AC network, it does not work when connected to a DC network, because when the primary winding is connected to a DC network, the DC current passing through it is in the ferromagnetic core. creates a constant magnetic flux. Due to the fact that the magnetic flux does not change per unit of time, EMF (Electroconductive Force) is not generated in the coils. But any change in the electric current in the circuit causes the formation of ЕЙУК in the chulgams. The generation of UEK in the windings of a transformer connected to a constant current network is well felt when the transformer is connected to the network or disconnected, because when the transformer is connected to the network, the current in its winding increases from zero to a certain value, or when it is disconnected from the network, the current increases from a certain value decreases to zero. The transformer is mainly made of a ferromagnetic core and wrapped around its wires. consists of two or more chulgam. Ferromagnetic core

it is the magnetic system of the transformer, that is, the magnetic conductor. The ferromagnetic core reduces the magnetic resistance of the circuit through which the magnetic current passes and strengthens the electromagnetic coupling of the coils.

The magnetic system of low-power transformers can be armored (a), star-shaped (b) and toroidal (v). In practice, magnetic conductors made of tape made of thin electrotechnical steel are widely used. The steel core of transformers is made of steel.

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