DEVELOPMENT OF A POLE-SWITCHING WINDING ONPOLE RATIO 8:4.

Authors of the publication

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Annotation: The article discusses the process of development and research of a new pole-switching winding with a pole ratio of 8:4 for two-speed motors driving twin-shaft mixers.

Keywords:electric drive, adjustable electric drive, two-speed motor, pole-switching winding, harmonic components, magnetomotive force, winding coefficient, differential dissipation coefficient.

1.Relevance

The world places particular importance on the problems of starting and accurately stopping engines in the mining, metallurgical, paint and varnish and chemical industries, as well as in the production of building materials. Currently, in developed countries, research work is being carried out to study issues of increasing production efficiency and automation of the technological process, as well as the introduction of new technologies into production.

In this regard, special attention is paid to the creation of new electrical circuits, energy saving and resource saving, which will increase the service life of the active parts of the device by facilitating the process of starting these high-inertia mechanisms, as well as ensuring their precise stop.

Recently, along with thyristor frequency converters, much attention has been paid to adjustable electric drives based on multi-speed electric motors with pole-switching windings (PSW). They are practically the only electric drives in which electrical energy is not subject to additional conversion and is not consumed in the form of additional losses in converters or sliding, as a result of which their efficiency can be the highest compared to other types of electric drives.

2. Development of a PPO scheme.

The development of a new circuit of a pole-switching winding with a pole ratio of 8/4 with 48 stator slots was carried out by applying the method of "Discrete-specified spatial functions"; when analyzing the electromagnetic properties of the resulting winding, the graphic-analytical method of Fourier series expansion, methods of vector and harmonic analysis were used.

The construction of a PPO for a pole ratio of 8:4 can be carried out on the basis of the basic circuit (BS) “Δ/YY”, but if it is necessary to improve electromagnetic properties, match inductions in the air gap, baluning, etc. It is advisable to use the BS “Δ/YY with additional branches.”

The number of coils in additional branches can be 17-50% of the total number of winding coils. The additional branches usually contain those coils that are not efficient enough in creating the total phase EMF on the side of the smaller polarity. The coils of additional branches are distributed with the condition of mutual compensation, because when connecting a power source from the polarity side, where there are no additional branches, EMFs are induced in them, which contribute to the appearance of equalizing currents.

The minimum number of coils in the common part of the BS (base) is equal to the largest number of rays of three-phase stars. For example, in the BS “Δ/YY” and “Δ/YY with additional branches”, consisting of three three-phase stars, the base is 9.

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The number of series-connected coils in the branches of the common part of the BS, on the basis of which the software is designed, must be an integer and is calculated according to (3). A new three-phase pole-switching two-layer winding with a number of stator slots equal to 48 per pole number ratio 2p1/2p2=8/4, consisting of equal-turn coils distributed in 24 coil groups, is made according to the Δ/YY circuit.

The winding coefficients of the pole-switching winding from the 2p1 and 2p2 pole sides are respectively equal to kob1 = 0.876 and kob2 = 0.691.

Table 2 - Winding data at step-6 from the 2p side$_1$=8

	Branches of BS Δ/YY with additional branches					
	A2	B2	C2	A3	B3	C3
A	8,293	8,293	8,293	8,293	8,293	8,293
kexchange	0.691	0.691	0.691	0.691	0.691	0.691
φ	thirty	90	150	thirty	90	150

Table 3 - Winding data at step-6 from the side 2p1=4

	A	B	C
A	28.07	28.07	28.07
kexchange	0.877	0.877	0.877
φ	37.09	82.91	157.09

CONCLUSION.

From a technological point of view, the developed pole-switching winding is a conventional two-layer winding consisting of equal-turn coils of the same pitch evenly distributed along the slots, which allows for the industrial applicability of the proposed winding, since two-speed motors with such a winding can be used on numerous twin-shaft mixers, centrifugal pumps and fans where it is necessary to adjust the rotation speed according to the technological process or for energy saving purposes.

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