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USE OF VALVE-INDUCTOR ELECTRIC ACTUATOR TO DRIVE SUBMERSIBLE PUMPS

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Currently, asynchronous motors (AM) with high-frequency converters and direct current (DC) motors are used as drives for deep submersible pumps. These have a number of disadvantages – for deep wells, casing pipes with a diameter of 3-4" are used, and to achieve the required pump capacity, there is a need for larger axial dimensions of the electric motor. However, the presence of a rotor winding leads to unacceptably high heat generation, which prevents the use of AM in deep submersible pumps. The presence of a brush unit in DC motors reduces the drive's reliability, and the use of hard magnetic materials increases the drive's cost.

The solution to this situation is the use of switched reluctance motors (SRMs), which compare favorably with traditionally used motors in terms of technical characteristics and design simplicity. SRMs are distinguished by their manufacturability; they lack scarce hard magnetic materials and additional excitation windings; also, SRMs are characterized by high reliability due to the absence of brush units [1, 2].

In combination with high-frequency semiconductor commutators, SRMs are used in high-speed electric drives that have high control properties close to those of direct current motors.

There are no windings of any kind on the SRM rotor, which greatly eases the thermal load on the rotor, and the absence of permanent magnets expands the range of operating temperatures. Therefore, in operating mode, the SRM does not require rotor cooling. To cool the electric motor, it is sufficient to use the stator's outer surface.

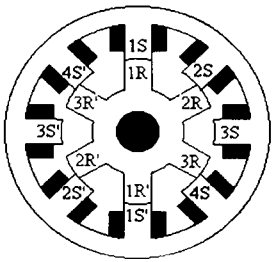


Figure 1.2 – Arrangement of windings.

The simplicity of the SRM design reduces the labor intensity of its manufacture. For mass production of SRMs, conventional mechanical equipment is required – dies for manufacturing laminated stator and rotor cores, lathes, and milling machines for processing shafts and housing parts. Labor-intensive, technologically complex operations, such as the manufacture of a commutator and its brushes for a commutator electric motor or the casting of the rotor cage for an induction motor, are absent here.

According to preliminary estimates [3], the labor intensity of manufacturing an SRM is 70% lower than that of a commutator motor and 40% lower than that of an asynchronous electric motor. The simplicity of the design provides the SRM with higher reliability than the reliability of other types of electrical machines. In generator mode, the SRM remains operational even if one or two phases fail.

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