

# ENSURING THE MAXIMUM SPECIFIC POWER OF THE POWER TRANSFORMER OF THE CONTACTLESS BATTERY CHARGING SYSTEM OF AN AUTONOMOUS UNDERWATER VEHICLE

V.A. Gerasimov, A.V. Komlev, A.Yu. Filozhenko

The object of the study is a special high-frequency power transformer, which is a functionally necessary element of the contactless battery charging system of an autonomous underwater vehicle. Separable primary and secondary parts of the transformer cause a non-magnetic gap between the windings and an axial displacement, thus reducing the magnetic coupling coefficient. An increase in the specific power of the transformer helps to reduce the system mass when transmitting a given value of the active charge power. The paper proposes a system of relative units with a base value of the core outer diameter. The technique makes use of the magnetic coupling coefficient between the windings and the relative inductance of the winding coil. These parameters fully determine the transformer electromagnetic properties as functions of the relative values of the gap and the axial displacement between the windings. Calculations are performed using mathematical modeling in the Ansys Maxwell and Solidworks software packages. Their purpose is the transformer design parameters, ensuring its maximum specific power and determined by the maximum value of ampere-turns with permissible heating of the wire and full use of the core window. The calculation result is the number of turns and the cross-section of the winding wire, as well as the inverter frequency at a given supply voltage and the accepted core size in the form of a cup-type ferrite magnetic core. The calculated parameters of the transformer provide the maximum specific power at the permissible overheating of the windings and the set values of the non-magnetic gap and axial displacement. The use of a transformer made according to the proposed method as part of a contactless power transmission system makes it possible to increase the overall efficiency of using an autonomous underwater vehicle.

**Keywords:** contactless charging system, underwater vehicle, high-frequency transformer, specific power, non-magnetic gap, ampere-turns, permissible overheating, design parameters.

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