

## СЕКЦІЯ «ТЕХНОЛОГІЯ АВІАЦІЙНИХ ДВИГУНІВ»

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### **METHODOLOGY OF RESEARCHING THE TECHNOLOGY OF INCREASING THE ELECTRICAL CONDUCTIVITY OF COMPOSITE CABINETS OF AIRCRAFT**

According to the requirements of the aviation rules AP-29, one of the most important criteria for ensuring flight safety is the ability of an aircraft to operate in lightning conditions. Lightning can cause critical damage to the fuselage, as well as malfunctions of electrical equipment, radio navigation and power plants. Therefore, an important component in the design is such a criterion as lightning protection. The most important influence on lightning protection is the electrical conductivity of the aircraft cabin. To meet these conditions, an electrically conductive layer is introduced into the structure. Structurally, this is achieved by using conductive materials (carbon nanotubes or metal particles), using layers with conductive properties (grids, foil sheets) and reinforcing conductive elements (conductive inserts, cabin reinforcement). Technologically, this is achieved by depositing and sputtering metals onto the composite, using conductive pastes, bonds and coatings.

The object of the study was the development of a composite cabin for a helicopter with a low take-off weight (3 t) MSB-2. The main problem during the design and manufacture of the cabin was to ensure proper lightning protection in accordance with AP-29, that is, the ability to withstand high voltages of a lightning discharge, without destroying and protecting the equipment. Attempts were made to increase the electrical conductivity of the cabin by introducing a metal power frame of copper and aluminum buses and plates inside the cabin in the locations of the main electronics. This partially solved the problem of providing the equipment with energy, but did not solve the problem of lightning protection and shielding. It is proposed to consider and test various technologies for manufacturing composite cabins based on tests of full-scale samples manufactured with different design and technological approaches. It is planned to present several technologies for composite samples, namely: with a polyester binder and a filler in the form of carbon nanotubes; with polymer binder and inner layers of aluminum or copper foil; with polymer binder and inner layers of copper or aluminum wire mesh; polymer binder with sprayed coating; composites of cellular conductive plates cast in polymer binder. Tests of samples 100 mm wide and 500 mm long will be carried out for each type of sample separately.

The test by passing a high-voltage discharge of 30...50 kV for 5...10 seconds will simulate the impact of an aircraft on a lightning discharge. The criterion for evaluating the test samples will be the degree of material destruction (charring, melting), as well as the possibility of further passing an electric current with the required specific resistance (electrical conductivity).

The load test of the sample with the on-board network voltage of 27 V DC and 115 V AC will simulate normal operation. The current strength at 27 V will be 300 A, at 115 V – 100 A. The test time is 30 minutes. The evaluation criteria are similar to the high-voltage discharge. These loads will be carried out for the samples both before and after the high-voltage tests. The high-voltage generation unit will be a Marx-type lightning pulse generator (Lightning Technologies 120 x XNUMX), the 115 V source will be a single-phase voltage converter, and the 27 V power source will be an autonomous airfield power source of the AIP-800-T type. Measurement of the electrical resistance of the samples before and after the tests will be carried out using the Megger TPT 320 complex. The results obtained after the tests will further determine the advantages and disadvantages of design and technological methods for improving the quality of composite cabins in general and will form the optimal approach to their manufacture.