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INCREASING THE EFFICIENCY OF AIR PURIFICATION BY THE ENGINE AIR PARTICLE SEPARATOR OF THE HELICOPTER

The helicopter is a type of aircraft in which lift and thrust are supplied by horizontally spinning rotors. This allows the helicopter to take off and land vertically on unprepared sites outside airfields and also hovering over the ground.

These operating conditions are characterized by a high degree of dust content in the air. Such conditions are formed due to the action of a jet of air thrown by the rotor blades towards the ground. In certain areas of operation, the dry and dusty conditions are found at high altitudes, where the air is less dense and sometime hotter.

Dust, sand and small stones are composed of silicon dioxide, which has high hardness and strength. Getting into the helicopter engine at high speed, these particles cause abrasive wear of the compressor blades. In the process of wear, the geometry of the blade feather changes. This phenomenon causes a decrease in the gas-dynamic stability of the engine, which leads to power loss, stall and surge. In addition, the blade can collapse and cause engine failure.

Currently, in order to reduce the influence of the above conditions and increase the life of the engine, engine air particle separators (EAPS) are used on helicopters. In the global helicopter industry, the following types of EAPS have found the widest application: vortex tube separators (VTS), integrated inlet particle separators (IPS) and inlet barrier filters (IBF).

All EAPS have a common drawback - the loss of engine power due to the air pressure drop on the separator, and the complication of servicing the helicopter on the ground. Until recently, the most common separators were IPS, that rely on rapid change in curvature of the inlet geometry. Such separators have small dimensions, simple design and low weight, but they have a low efficiency of air purification.

Today, VTS separators are very promising. That rely on centrifugal forces created by large amount of small cyclone-like systems. Compared to other types, they are larger, heavier and take up more space on a helicopter. The use of composite materials made it possible to reduce the weight of the device.

Such separators have a higher degree of air purification and a lower pressure drop. The study of how the materials, design and geometric parameters of the cyclone system affect the efficiency of air purification will further optimize the design of the EAPS and improve its performance.