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COOLING SYSTEM FOR HIGH ENERGY POTENTIAL SPACE VEHICLE

Abstract

Future space programs for the study and development of outer space are impossible without increasing the energy potential of space complexes. It is related as with the service systems of the spacecraft, as well as with the scientific equipment.The tasks covered by these spacecrafts, may be both applied and fundamental. It could be remote sensing devices, communications and intelligence spacecrafts, space vehicles for Moon and outer space exploration. In this regard, there is a problem to release a large amount of heat to the surroundings. The only type of heat transfer in space is radiation, so it is advisable to raise the temperature of the emitting surface and to translate low potential heat in to high. Such transformation is possible by the refrigerating machine. The paper will consider the possibility of cooling the spacecraft equipment module. This will require compensate for the 200 kW of heat from devices, the work of most of which is not possible at temperatures above 40-50. The most responsible moment is the choice of the refrigeration cycle and the working fluid. The paper examines three different cycle: normal vapor-compression, vapor-compression with recuperator and vapor-compression with a flow separation and economizer. It is proposed to use as a working fluid of the refrigerant R134a. Result of calculation will be main parameters that characterize the cycle, namely, the specific work of compression, the specific cooling capacity, refrigerating factor, the compression ratio, the specific heat of condensation. As heat leaks of different instruments are not the same, and the heat flow in the instrument board is uneven, it is advisable to use an intermediate heat carrier and heat pipes to transfer heat from the plate to the working fluid. Optimal working fluid at this heat level is ammonia. Ends of heat pipes where the ammonia condensation occurs, washed by working fluid R134a. Thus, the evaporator of refrigeration unit is essentially an evaporator-condenser, where R134a evaporates on the one hand, and the ammonia is condensed inside heat pipes on the other. Plates with instruments are fixed in the relevant frame. Specific heat release of modern electronic devices is about 1W/cm2, the most powerful devices till 3-4W/cm2. That is at the heat capacity of instruments is 200kW, the area occupied by them is about 20m2. The main advantage of the refrigeration unit over the cooler-radiator is its weight and size.