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THE DESIGN AND DEMONSTRATION OF THE THERMAL CONTROL SYSTEM IN SCIENTIFIC
EXPERIMENTS RACK

Abstract

As the main carrier of the science experiment apparatus of the China space station under construction, the Scientific Experiment Rack undertakes the duty of the implement of the operation onboard and the maintenance of the operational tasks. The thermal control system is a main subsystem of experiment rack used to the complements of the temperature control and the condition monitoring of the experiment unit, The purpose of it is to ensure the safe and efficient operation of scientific experiments within a reasonable temperature rang. The main content of this paper is to describe the composition principle, the product structure and the performance of the thermal control system. The hardware consists of four parts: liquid loop drive unit, thermal control drawer unit, external air piping system, liquid-liquid heat exchange device. The first two can be separated and replaced onboard. The external air pipe system is installed on the back of the rack according to the layout design of the scientific payload. The liquid-liquid heat exchanger is the heat exchange interface between the experimental rack and the aircraft platform, Each unit is connected via external flexible pipes, assisting the operation work of thermal control system onboard. The thermal control system can meet the maximum cooling need, the peak heatload of the Rack is 1500W. Half of the heatload can be takeaway by forced air convection, two cold plate can take away 50%of the heatload. The basic functions and the requirement technology indicators are needed to consider in the design of the thermal control system. The product safety and reliability is also needed to meet the replacement and maintenance onboard. The noise control system and smoke detector are conducted the adaptive design to ensure the reliable and efficient operation of the system.