

Scientific Objective and Infrastructure of Space Exploration (1)
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Author: Mr. Jialong Zhu

Beijing Research Institute, Sichuan Academy of Aerospace Technology, China Aerospace Science and
Technology Corporation (CASC), China, nortium@163.com

EXPERIMENTAL STUDY ON THE AQUA PURA PRESSURE REDUCING VALVE FOR THE WATER SUBLIMATOR

Abstract

The exploration of outer space has become more and more frequently, water sublimation device, which is an ideal thermal control device for space probe and space suits, has been used widely in various space exploration tasks. In order to make the water sublimator work continuously and efficiently, it is necessary to accurately control the pressure applied to the water sublimator's working medium so as to rapidly establish the sublimation mode. Meanwhile, increasing the tank pressure to maintain water supply to the water sublimator is also required. As one of the key components of the sublimation thermal control system, the aqua pura pressure reducing valve is responsible for regulating the working medium's pressure. The pressure of the tank applied to the aqua pura pressure reducing valve varies a lot (50kPa to 350kpa), however, the output pressure of the aqua pura pressure reducing valve has to be maintained in a small range (14kPa to 17kpa). The ultra-low pressure high-precision pressure control technology is very challenging. This paper mainly focuses on the design of diaphragm amplifier, a novel diaphragm shape with low additional stiffness is proposed. The related experiment about the influence of the thermal and mechanical conditions on the performance of the diaphragm was also conducted. The results show that the aqua pura pressure reducing valve can control the throttling effect of the variable throttle through the negative feedback mechanism. The output stress is stabilized between 14kPa and 17kpa when the input pressure is 50kPa to 350kpa. After thermal cycle test, vacuum test, random vibration test and shock test, its normal performance is still maintained.