

IAF SPACE PROPULSION SYMPOSIUM (C4)
Electric Propulsion (2) (6)

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DEVELOPMENT OF MINIATURE LATCH VALVE FOR ELECTRIC PROPULSION SYSTEM
APPLICATION

Abstract

The Electric Propulsion system has emerged as a future propulsion system which can be used for deep space missions and station keeping of communication satellites. A latch valve is used for supply and isolation of Xenon propellant to the EPS thruster. In this paper, design and realization of a miniature latch valve is discussed. Major challenge in the design of this valve is to optimize the tradeoff between mass, envelope and power. The operating pressure of the valve is 5 bar absolute. This is a solenoid operated electro-mechanical type of valve, configured with pleated disc filter for contamination control, a soft-on-hard seat sealing configuration for leak-tightness and uses rare-earth permanent magnets. These magnets keep the valve stable in the last commanded position. A helical compression spring is used to provide the required squeeze stress and flexures are used for guiding the moving element. Epotherm-130 is used for thermal conduction and electrical insulation of the coil assembly. A reed switch assembly is used for the position indication of the valve. An electromagnetic analysis is carried out for finalizing the magnetic circuit and mass optimization of the valve. Two separate coils are used for opening/closing of the valve; however, the valve is developed with coil redundancy. The valve port is designed to give the required flow rate with minimum differential pressure across the valve. A pulse width of 100 ms is required to change the status of the valve. The minimum actuation voltage of the valve for opening and closing is 15V and 5V respectively. The valve can operate from 28 VDC to 42VDC. The power consumption of the valve is 32W @ 28VDC supply voltage. The valve is realized with a mass of 180 grams and an envelope of 36 mm x 50 mm.