

Small Multi-Cycling Cryogenic Fluid Flow Valve

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Mission Research Corporation (MRC) in partnership with Jet Propulsion Laboratory (JPL) has developed a new small remote controlled fluid valve. The motivation for developing this valve came from the requirements of a future International Space Station experiment called MISTE (Microgravity Scaling Theory Experiment). This experiment requires an *in-situ*, low temperature operated, fluid valve that can be open/closed over 50 times during a 4.5 month flight. The successful operation of MISTE and other space-based and ground-based laboratory experiments now in development will require reliable cryogenic fluid valves that are remotely operated, helium leak tight, non-magnetic, very low power, and which have a small dead volume. The new valve (Model 12023B) is normally closed and requires fluid actuation to open. The heart of the valve design is found in the configuration of the valve seat and sealing poppet. The design of these two surfaces was derived from work performed previously during the five year development program for the larger MRC remote-controlled, cryogenic fluid flow control valve of which more than 50 have been produced and delivered for space flight applications. The new small valve has only three moving parts, which move less than 0.025 cm when the valve fully opens or closes. The bearing surfaces in the valve operating mechanism are all flexure (except for the valve poppet) and subsequently the valve should have a lifetime of thousands of open/close cycles. Initial tests of this valve have demonstrated leak rates of less than 10^{-9} scc/sec (helium) after repeated low temperature open/close cycling. The valve is actuated using approximately 600 kPa of fluid pressure. The materials and processes used to fabricate the new valve have been flight certified. The unique valve design and detailed test results on the valve performance will be presented. The application to the future MISTE flight experiment will also be discussed.

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