Normally-closed (NC) Zero Leak Valve

Utilizes a magnetorestrictive alloy for well-timed, near instant actuation

NASA Goddard Space Flight Center has developed a hermetically sealed normally-closed (NC) zero leak valve. Prior to actuation, the valve isolates upstream working fluid from the downstream volume with a parent metal seal. The valve utilizes the magnetorestrictive alloy Terfenol-D for near instant actuation. Terfenol-D undergoes magnetostriction, or gross elongation, when exposed to a magnetic field. This fractures the seal and opens the valve permanently to establish fluid flow.

**BENEFITS**

- Non-pyrotechnic and nonexplosive, and thus safer than current pyrovalves
- Serviceable and repairable in-situ
- Can be electrically tested end to end
- Survivable temperature range of -100 to 200 degrees Fahrenheit
- Offers well timed, near instant actuation
THE TECHNOLOGY
The valve consists of two major sub-assemblies: the actuator and the flow cavity. The actuator is preloaded to 1,250 N by adjusting the preload bolt, pressing the Terfenol-D against the now-deflected belleville springs. When actuation is needed, either solenoid coil is charged in a pulsed mode, causing magnetostriction or elongation in the Terfenol-D which deflects the belleville spring stack, supplying an increasing load to the stem until the parent metal seal is fractured. Once fractured, the spring inside the bellows drives the bellows base downward, onto a raised boss at the top of the fracture plate. When fracture has occurred, the stem and its spring stack is left, separated from the actuator column. The Terfenol-D is unloaded and returns to its original length. The valve remains open due to the spring inside the bellows.

APPLICATIONS
The technology has several potential applications:
- Fluid Isolation Applications
- Launch Vehicle Propulsion Systems
- Wherever Normally-Closed valves are used

PUBLICATIONS
Patent No: 9657858