



Mechanical and Fluid Systems

Conical Seat Shut-Off Valve

A novel approach to low maintenance actuator-less valves

NASA's John C. Stennis Space Center is soliciting partners interested in the commercial application of a moveable valve for controlling flow of a pressurized working fluid. This valve consists of a hollow, moveable floating piston pressed against a stationary solid seat, and can use the working fluid or an external pressure source to seal the valve. This open/closed valve has a novel balanced piston so it can be designed to always seat with the same amount of force allowing the use of metal-to-metal seats as well as soft seats. Additionally, this valve design, even when used with large, high-pressure applications, does not require large conventional valve actuators, and the valve stem itself is eliminated. Actuation is achieved with the use of small, simple solenoid or hand valves. This design also eliminates the need for many seals used with existing ball valve and globe valve designs, which also commonly cause failure. Coupled with the elimination of the valve stem and conventional valve actuator, this valve design reduces downtime and maintenance costs, while increasing valve reliability and seat life.

BENEFITS

- **Wide Range of Design Parameters:** A: Allows for pressures from ambient to 15,000 psi, size from less than 1" to greater than 10", can be manufactured from a variety of metals and operated on cryogenic gas lines
- **Improved Performance and Reliability:** Constructed using only five major parts without stem seals or packing glands that can leak; does not require an external large pneumatic, hydraulic or motor actuator; stationary metal to metal seat improves valve reliability
- **Low Maintenance:** Single design with fewer parts and seals
- **Broad Applications:** Use in open/close operations such as relief or safety valves on pressured tanks and shut-off or isolation valves, and locations of severe duty, extremely high pressures or temperatures or very fast actuation applications
- **Reduced size and cost:** The combination of features eliminates the actuator, and physical size and cost of the valve are reduced

technology solution



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THE TECHNOLOGY

This technology is applicable for all pressures (15-15,000+ psi), with a floating piston design, used for controlling a flow of a pressurized working fluid. The prototype valve is an open/closed, non-positionable piston capable of using metal to metal seats without requiring seat sliding action. The valve is designed to use mechanical actuators and be positionable, if desired. This design eliminates issues associated with large high pressure ball valves and globe valves, as well as stem wear, stem leakage, and seat wear; the need for conventional large and/or motor driven/actuators is also eliminated. A hollow, moveable piston is pressed against a solid stationary seat by allowing the working fluid pressure or an external pressure source to act on a specific working area of the piston while venting an equal area, thus pushing the piston against the seat. Reversing the pressurized area and vented area allows the piston to move off of the seat and thus open the valve. The working fluid then flows around the stationary seat and is channeled through multiple passages back into the flow pipe path. To reseal the valve, the pressurization and venting are reversed again moving the piston back on to the seat. This allows the moveable seat to be pressed against the stationary seat again, and is reseated. Because the balanced piston does not require large forces to move, and the pressure change across the valve does not impose force on the piston, significantly less energy is required to operate the valve. This may allow remotely located valves to be operated for many cycles using internal pressure or a small accumulator instead of having to run tubing from an external source. Wireless technology can then be applied to make the valves true plug and play hardware.

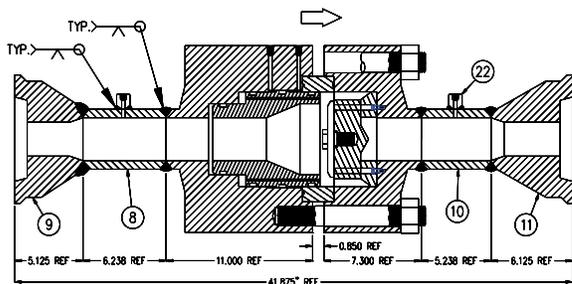


FIGURE 1 – Conical Seat Valve Concept

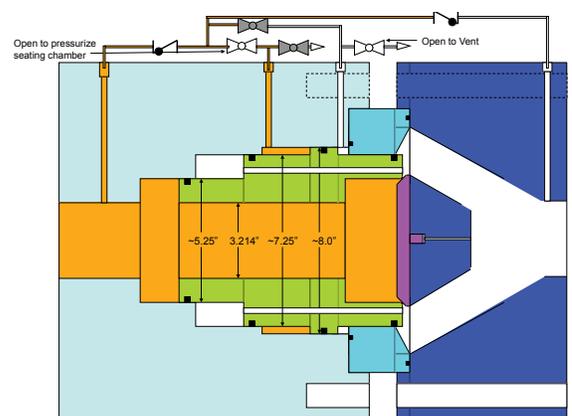


FIGURE 2 – Full Delta Pressure, Flow Over Seat

APPLICATIONS

The technology has several potential applications:

- Power plants
- Petrochemical plants-piping systems
- Chemical industry-piping systems
- Refineries
- Pressurized storage tanks
- Cryogenic fluid systems, fluid industry
- Pharmaceutical manufacturing industry
- Severe duty, extremely high pressure or temperature, and/or very fast actuation applications

PUBLICATIONS

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NASA John C. Stennis Space Center

AA01/Office of the Center Chief Technologist
Stennis Space Center, MS 39529
228.688.1929
ssc-technology@nasa.gov

<http://technology.nasa.gov/>

www.nasa.gov

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