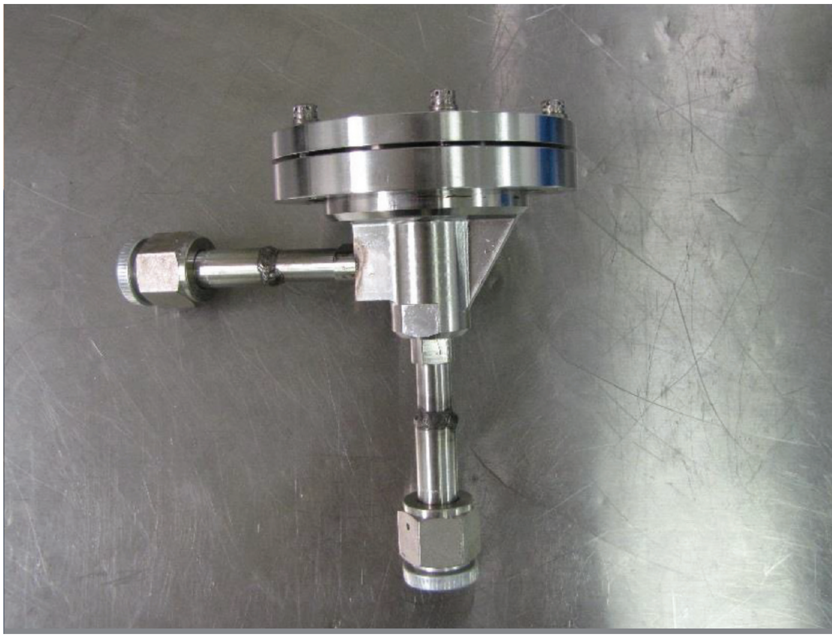

National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Mechanical and Fluid Systems

# Pilot Assisted Check Valve for Low Pressure Applications

Maintains sealing load at low pressure differentials, resulting in lower leakage rates

Inventors at NASA have developed an advanced check valve with a pressure sensing design that allows the valve to crack open at low pressure differentials while still providing the required sealing stress on the valve seat at all pressures below cracking pressure. The design of the valve also allows it to maintain sealing stress on the seat regardless of downstream pressure. In low pressure conditions of 100 psi or less, sealing issues often occur when a low cracking pressure is desired. Alternative check valves are unable to provide the required sealing stress on the valve seat. This results in seat damage and eventual leak issues due to the rotation of internal parts relative to the seat. This valve provides a solution to low pressure applications with stringent leak requirements.

## BENEFITS

- Improved internal leakage
- Prevents seat damage
- Has a low cracking pressure
- Maintains sealing stress on the seat regardless of downstream pressure

## APPLICATIONS

The technology has several potential applications:

- Cryogenic propulsion applications
- Cryogenic manufacturing
- Liquid Natural Gas (LNG) storage and transport
- Nuclear Safety Systems
- Vacuum Jacketed Systems
- Any low-pressure environment that has strict requirements against chemistry mixing or venting

## THE TECHNOLOGY

Check valves are traditionally designed as a simple poppet/spring system where the spring is designed to equal the force created from the sealing area of the valve seat multiplied by the cracking pressure. Since the valve seat diameter in these types of valves are relatively small, less than 0.5 inches diameter, a low cracking pressure required for back pressure relief devices results in a low spring preload. When sealing in the reverse direction, the typical 20 psid storage pressure of the cryogenic fluid is not enough pressure force to provide adequate sealing stress. To better control the cracking pressure and sealing force, a bellows mechanism was added to a poppet check valve (see Figure 2). The bellows serves as a reference pressure gauge; once the targeted pressure differential is reached, the bellows compresses and snaps the valve open. Prior to reaching the desired crack pressure differential, the bellows diaphragm is fully expanded, providing sufficient seal forces to prevent valve flow (including reverse flow) and undesired internal leakage. Room temperature testing of cracking pressure, full flow pressure, and flow capacity all showed improvements. The overall results of the test proved to be 10-20 times greater than conventional check valves with no internal leakage at three different pressure differentials.

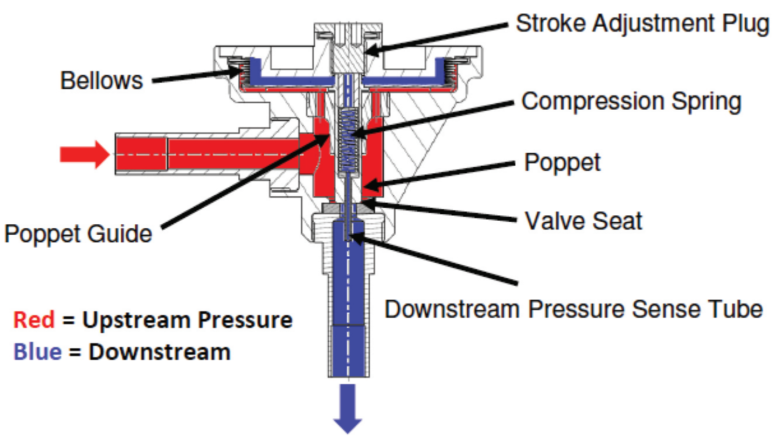


FIGURE 1 Cross-sectional view of the NASA-designed check valve

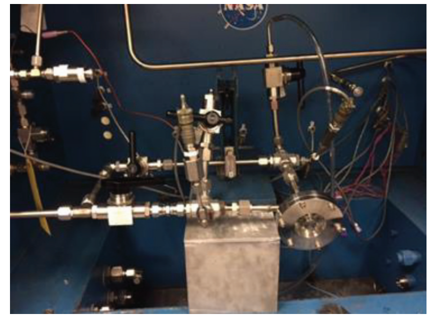

FIGURE 2 Crack/Reseat Pressure and Leakage Test

## PUBLICATIONS

Patent No: 10,268,213

**More Information**

National Aeronautics and Space Administration

**Agency Licensing Concierge**

**Marshall Space Flight Center**

Huntsville, AL 35812
202-358-7432
Agency-Patent-Licensing@mail.nasa.gov

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