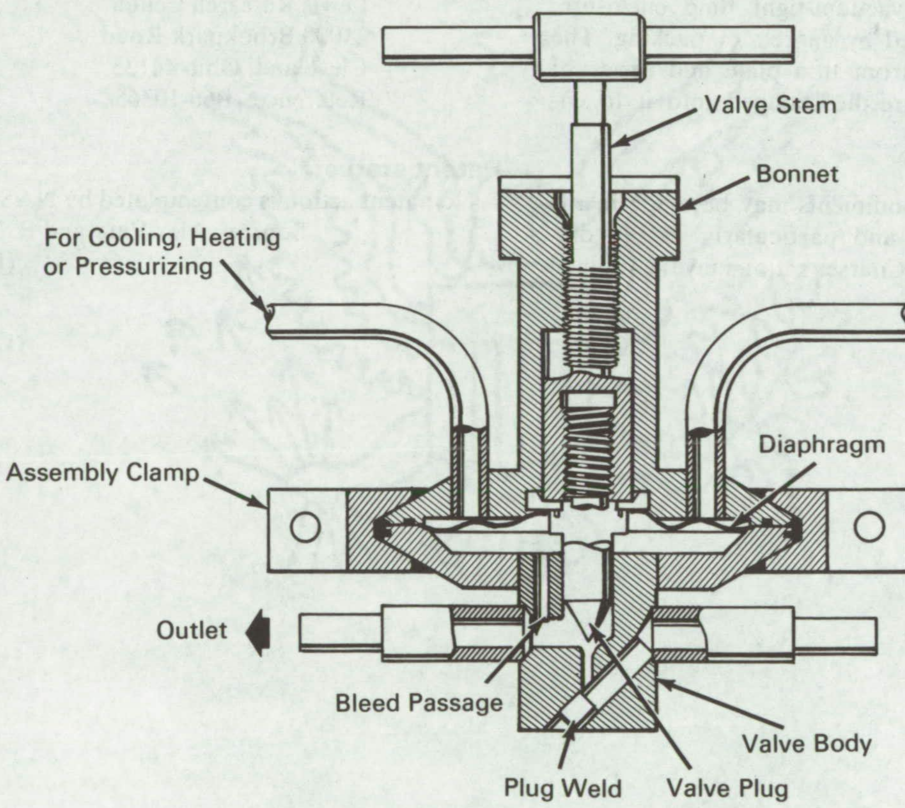
NASA TECH BRIEF

Diaphragm Valve for Corrosive and High Temperature Fluid Flow Control Has Unique Features



The problem:

Metallic, weld-sealed valves (usually of the bellows-seal construction) used for corrosive and high temperature fluid flow control, are costly to fabricate and are often large and cumbersome, and may not provide reliable pressure and vacuum-tight fluid enclosures.

The solution:

A monometallic diaphragm valve in which the body, diaphragm, and plug are welded together to form an integral leakproof unit for containing the fluid as it passes through the valve from inlet to outlet.

(continued overleaf)

How it's done:

Flow control is achieved by varying the position of the conical end of the plug with respect to its cylindrical inlet passage seat. The movement of the plug with respect to the valve body is achieved by means of a differential thread action provided by the two threaded portions of the stem. A finer thread engages the bonnet and a coarser thread engages the plug, resulting in a fine adjustment for throttling and flow control. A bleed passage in the valve body connects the cavity between the diaphragm and body with the outlet or low pressure side of the valve. The cavity between the diaphragm and the bonnet is tapped for venting, or for pressurizing to counter the internal pressure if necessary. In addition, the bonnet side of the diaphragm can be heated or cooled by means of these inlet and outlet passages provided in the bonnet. The body, plug, and diaphragm are welded together to form a pressure- and vacuum-tight fluid enclosure, and the bonnet is sealed by gaskets or packing. The diaphragm is formed from thin plate and series of annular convolutions are die stamped into it to ensure ease of flexure.

Notes:

1. Many alternate embodiments may be made in the basic valve design and particularly in the diaphragm movement. Coarser action may be attained by reversing the threads on the stem. The shape of the plug and seat may be altered for different fluids and flow rates. An alternate valve design incorporating a pneumatic positioner that imparts an axial motion to the stem is preferable in cases where galling or seizing of the differential threads in the bonnet and plug are likely.
2. Monometallic diaphragm valves of 321 stainless and HS25 (L605) have been fabricated and successfully tested at temperatures up to 1000°F in a two-phase mercury system. A version of this valve will be used in a two-phase potassium system at temperatures of about 1300°F.
3. The body, diaphragm, and plug may all be monometallic to prevent differential cell corrosion.
4. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B66-10365

Patent status:

No patent action is contemplated by NASA.

Source: Alex Vary and B. T. Ebihara
(Lewis-304)