

# Statement of Performance

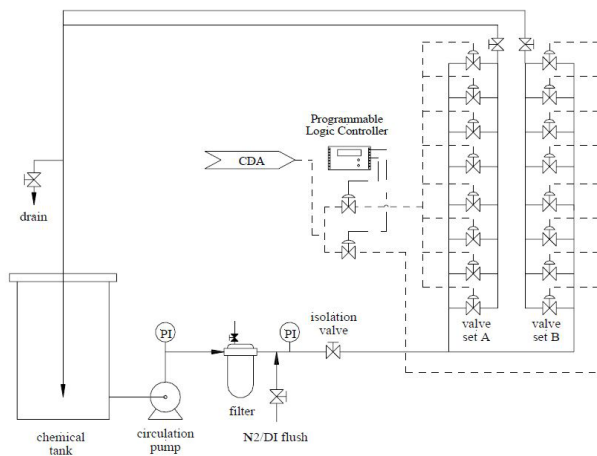
## Furon<sup>®</sup> HPVM Reliability in 49%wt Hydrofluoric Acid (HF)

Furon HPVM valves, normally closed, have been tested for reliability in 49 wt% hydrofluoric acid (HF) by an independent test lab<sup>1</sup> using the protocol of a major US OEM manufacturer.

### Accelerated Life Test Method

Eight Furon HPVM valves were assembled in a manifold (valve set A in Figure 1) allowing two parallel flow paths through each set of 8 valves. Each set was cycled 3 seconds open and 3 seconds closed at room temperature with an actuator pressure of 80 psig. One set was opened as the other set was closed to maintain a constant flow of acid through the system at 76-80 psig. Flow was provided by a double diaphragm pump. Valves were inspected every workday for leaks.

Figure 1 - Accelerated Life Test Schematic



The accelerated life test was performed on a set of eight valves in 49% HF. Cleanroom grade HF was used. The acid was replaced halfway through the test to ensure that full chemical strength was maintained.

Valves were tested for cracking pressure internal leakage and external leakage port-to-port leakage throughout the test. Internal leak testing was conducted by positioning the valve in a vertical orientation with the test port down. Degassed ultrapure water then flowed upward through the valve. The valve was opened and closed several times and agitated to evacuate air bubbles. The valve was then left closed. The downward facing test port was drained of water and pressurized with 80 psi Clean Dry Air (CDA). The upward facing port was plumbed to a scale attached to logging software. Any air leaks past the seat would displace water from the upward facing port to the scale for measurement. This procedure was repeated for both the inlet and outlet ports of each valve.

External leak testing was conducted by opening the valve, capping one port, and pressurizing the valve with the other port using 80 psi CDA. The same degassed ultrapure water system and scale were plumbed to the weep port of the test valve to measure any leakage past the diaphragm. Crack pressure testing was conducted by plumbing a variable pressure CDA supply to the test port of a closed valve, and a pressure gage to the other port. CDA pressure was slowly increased to a maximum of 125 psi, or until the pressure gage at the other port increased, indicating bypass. The CDA pressure required to cause bypass was then recorded.

### Results

Table 1 - Accelerated Life Test Results in HF

Valve ID	As Received			300,000 Cycles			600,000 Cycles			900,000 Cycles		
	Cracking Pressure (psig)		10 min ΔP	Cracking Pressure (psig)		10 min ΔP	Cracking Pressure (psig)		10 min ΔP	Cracking Pressure (psig)		10 min ΔP
	IN>>OUT	OUT>>IN	OUT>>IN @ 80 psig (ΔP ≤ 2.2 psi)	IN>>OUT	OUT>>IN	OUT>>IN @ 80 psig (ΔP ≤ 2.2 psi)	IN>>OUT	OUT>>IN	OUT>>IN @ 80 psig (ΔP ≤ 2.2 psi)	IN>>OUT	OUT>>IN	OUT>>IN @ 80 psig (ΔP ≤ 2.2 psi)
5112046	>125	>125	0.3	>125	>125	0.2	>125	>125	0.3	>125	>125	0.1
5112049	>125	>125	0.4	>125	>125	0.2	>125	>125	0.3	>125	>125	0.2
5112050	>125	>125	0.3	>125	>125	0.3	>125	>125	0.3	>125	>125	0.4
5112051	>125	>125	0.3	>125	>125	0.3	>125	>125	0.3	>125	>125	0.2
5112052	>125	>125	0.3	>125	>125	0.3	>125	>125	0.3	>125	>125	0.2
5112053	>125	>125	0.3	>125	>125	0.3	>125	>125	0.3	>125	>125	0.2
5112054	>125	>125	0.3	>125	>125	0.3	>125	>125	0.2	>125	>125	0.4
5112057	>125	>125	0.3	>125	>125	0.2	>125	>125	0.3	>125	>125	0.3

**Table 2 – Accelerated Life Test Results in HF**

Valve ID	1,200,000 Cycles			1,500,000 Cycles			1,800,000 Cycles			2,100,000 Cycles		
	Cracking Pressure (psig)		10 min ΔP OUT>>IN @ 80 psig (ΔP ≤ 2.2 psi)	Cracking Pressure (psig)		10 min ΔP OUT>>IN @ 80 psig (ΔP ≤ 2.2 psi)	Cracking Pressure (psig)		10 min ΔP OUT>>IN @ 80 psig (ΔP ≤ 2.2 psi)	Cracking Pressure (psig)		10 min ΔP OUT>>IN @ 80 psig (ΔP ≤ 2.2 psi)
	IN>>OUT	OUT>>IN		IN>>OUT	OUT>>IN		IN>>OUT	OUT>>IN		IN>>OUT	OUT>>IN	
5112046	>125	>125	0.3	>125	>125	0.2	>125	>125	0.2	>125	>125	0.3
5112049	>125	>125	0.2	>125	>125	0.3	>125	>125	0.2	>125	>125	0.3
5112050	>125	>125	0.2	>125	>125	0.3	>125	>125	0.3	>125	>125	0.3
5112051	>125	>125	0.2	>125	>125	0.2	>125	>125	0.4	>125	>125	0.4
5112052	>125	>125	0.3	>125	>125	0.4	>125	>125	0.3	>125	>125	0.2
5112053	>125	>125	0.3	>125	>125	0.3	>125	>125	0.4	>125	>125	0.3
5112054	>125	>125	0.3	>125	>125	0.3	>125	>125	0.3	>125	>125	0.2
5112057	>125	>125	0.3	>125	>125	0.3	>125	>125	0.3	>125	>125	0.3

**Summary**

Eight Furon HPVM valves were successfully exposed to 2,100,000 cycles accelerated life cycle test in 49 wt% HF without suffering any major performance loss and all tested parameters completed at fixed intervals were acceptable.

**References**

<sup>1</sup>CT Associates, Inc., 1721 Shady Oak Road, Eden Prairie, MN 55344.

The data provided here were obtained under defined test conditions. The tests were designed to mimic use or worst case conditions. However, Saint-Gobain Performance Plastics makes no specific claims about the performance of the components in other chemicals or systems.



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