

# Benchmark Report

## Furon® Q-Valve and GEMÜ® Valves Reliability in on Cabot Semi-Sperse™ 25 Slurry

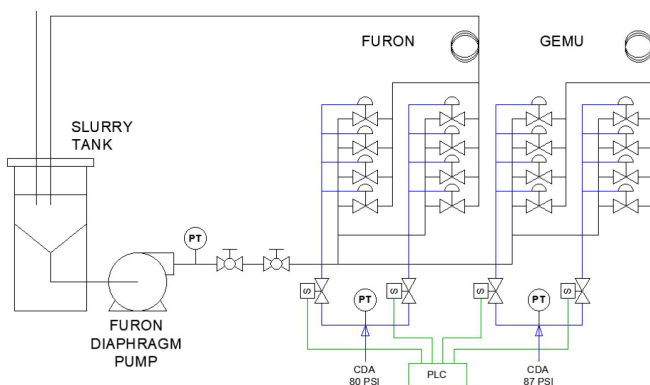
Furon® Q-Valve and GEMÜ CleanStar® valves were tested side by side to compare their reliability in a slurry application. For this test Cabot Semi-Sperse™ slurry was used. Testing was conducted by a third-party, independent lab<sup>1</sup>.

### Test Method

Eight Furon Q-Valves and Eight Gemu Cleanstar normally closed valves were assembled into four manifolds, four parallel valves (of the same model) each and installed into the slurry circulation system.

The two manifolds of each model group were plumbed to a common return line, where long tubes of a smaller diameter were used as restrictions to regulate flow. This approach drops pressure over an extended distance compared to throttle valves, reducing shear stress on the slurry. The two manifolds of each model group were cycled open and closed 180° out of phase for 3 seconds for each state to maintain constant system flow. Clean Dry Air (CDA) at 80 & 87 psi was used to actuate the Furon & Gemu valves respectively. Flow and pressure were supplied by a single Furon diaphragm pump, model A2SY3F16. Peak pump outlet pressure was kept at 30 psi during testing. Flow was initially set to achieve approximately 0.5 ft/sec through each open valve, however the flow dropped slightly during the test due to increased slurry viscosity. The system was kept at approximately room temperature for the duration of the test. A detailed schematic of the test system can be found in Figure 1 below.

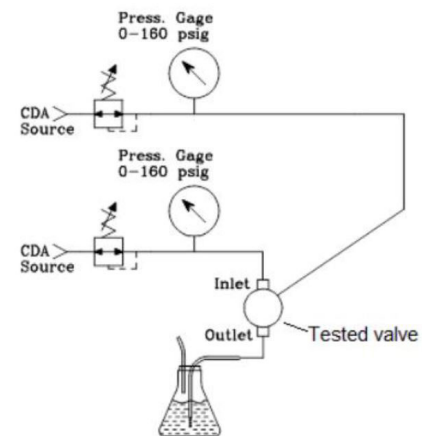
Figure 1 - Slurry Reliability System



At every 100,000 actuation cycle, the valve manifolds were removed from the slurry supply system and connected to a water supply system for rinsing. The slurry system was diverted back to tank for continuous circulation during valve rinsing and

leak testing. The water system was drained and replenished until turbidity measurements stayed below 0.1 NTU. Both ports of each valve were tested for leakage. CDA was applied to the tested port, while the opposing port was plumbed to a bubbler bottle to identify and measure leaks across the seat. Figure 2 details the setup for this leak testing.

Figure 2 - Bubble Bottle Leak Testing Apparatus



To measure external leaks, the bubbler bottle was connected to the leak detection port, while the outlet port was pressurized. 80 and 87 psi were used to test the Furon and Gemu valves respectively.

After 200,000 cycles, the GEMU valves were tested for leaks across the actuator piston seal. To conduct this testing, actuation pressure was applied to the valve while the opposing pneumatic port was submerged in water to generate bubbles. After 300,000 cycles, this testing was conducted on both the GEMU and Furon valves.

Except weekends, slurry samples were taken daily during testing and analyzed for particle distribution information and viscosity. Particle size distribution was measured with Particle Sizing System Nicomp® ZW 388. Mean and 99th percentile particle size were recorded. Slurry viscosity was measured using a glass capillary viscometer.

## Results

Tables 1 and 2 detail the results from the leak testing. Results are in the form of steady-state bubbles per minute.

**Table 1 - Furon QV2-F1216-NC Leak Testing Results (bubbles/min)**

Furon QV2-F1216-NC					
Test Port	Valve ID	Actuation Cycles			
		0	100K	200K	300K
Inlet	1	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
	4	-	-	-	-
	5	-	-	-	-
	6	-	-	-	-
	7	-	-	-	-
	8	-	-	-	1
Outlet	1	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
	4	-	-	-	-
	5	-	-	-	-
	6	-	-	-	-
	7	-	-	-	-
	8	-	-	2	-
External	1	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
	4	-	-	-	-
	5	-	-	-	-
	6	-	-	-	-
	7	-	-	-	-
	8	-	-	-	-
Actuator	1	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
	4	-	-	-	-
	5	-	-	-	-
	6	-	-	-	-
	7	-	-	-	-
	8	-	-	-	-

Notes: ( ) Not measured  
 (-) Leak rate below bubble measurement detection  
 (GL) Gross leak exceeding bubble measurement

## Summary

A total of sixteen 1" air operated valves were cycled 300,000 times in Cabot Semi-Sperse slurry at 30 psi and room temperature. The sample group consisted of eight Furon model QV2-F1216-NC and eight GEMU model C60 16D77305A1 3 HPW valves. The valves were measured at 0 cycles, and every 100,000 cycles thereafter for internal "port-to-port" leakage and external leakage. Slurry viscosity and particle size distribution measurements were made daily, except weekends to monitor slurry health.

No repeatable port-to-port leaks were exhibited by Furon valves. All GEMU valves exhibited port-to-port leakage after 300,000 cycles, most of which were repeatable. No external leaks were measured.

**Table 2 - Gemu C60 16D77305A1 3 HPW Leak Testing Results (bubbles/min)**

GEMU C60 16D77305A1 3 HPW					
Test Port	Valve ID	Actuation Cycles			
		0	100K	200K	300K
Inlet	1	-	-	9	140
	2	-	14	10	200
	3	-	2	20	36
	4	-	-	-	14
	5	-	-	55	80
	6	-	2	18	112
	7	-	-	-	4
	8	-	-	-	8
Outlet	1	-	-	15	140
	2	-	14	20	200
	3	-	1	4	80
	4	-	-	6	68
	5	-	-	60	180
	6	-	2	15	180
	7	-	-	5	12
	8	-	-	-	65
External	1	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
	4	-	-	-	-
	5	-	-	-	-
	6	-	-	-	-
	7	-	-	-	-
	8	-	-	-	-
Actuator	1	-	-	-	GL
	2	-	-	150	GL
	3	-	-	GL	GL
	4	-	-	120	GL
	5	-	-	GL	GL
	6	-	-	200	GL
	7	-	-	45	GL
	8	-	-	60	GL

Notes: ( ) Not measured  
 (-) Leak rate below bubble measurement detection  
 (GL) Gross leak exceeding bubble measurement

## References

1CT Associates, Inc., 1721 Shady Oak Road, Eden Prairie, MN 55344. (Report No. SGB 1725 3842.1)



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