Performance Verification
Data Sheet

1/4" UPM 1000 Diaphragm Valve Metal Extraction and Reliability

Furon's UPM 1000 diaphragm valve has been designed primarily for use in the semiconductor industry for transfer of highly aggressive ultrapure chemicals and deionized water. The UPM 1000 valves were evaluated by an independent test lab to verify that they meet the industry's rigorous standards for reliability and extraction of metal ions.

Metal Ion Extraction

All wetted parts of UPM valves are made of virgin PTFE and high purity molded PFA. The DyconE$^{X\ SM}$ dynamic extraction procedure was used to evaluate the extraction of metallic elements from the valves into one of the most aggressive chemicals used by the semiconductor industry, 37% HCl.

Test method: Six valves were connected in series and exposed to a constant flow of 37% HCl for eleven days at a flow rate of 250 ml / min. The initial system HCl volume was 1.0 liter. Four HCl samples were withdrawn over 11 days. The samples were submitted for ICP-MS and GFAA analysis for 20 metals.

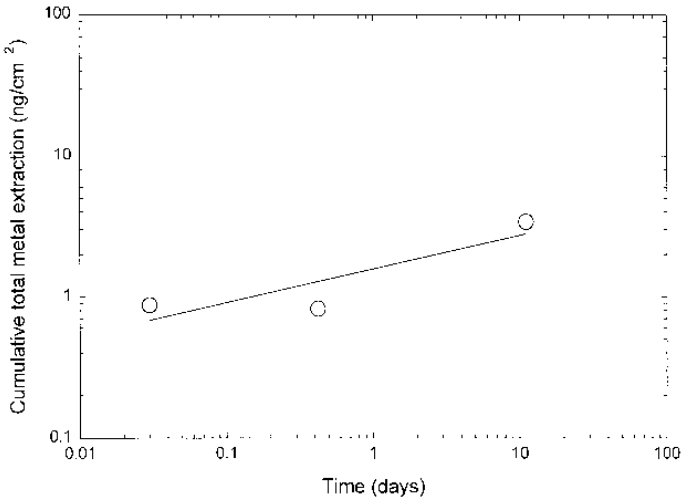
Results: Table 1 shows the amounts of individual metals extracted during the test. Only five metals had more than 0.02 µg extracted / valve: Fe, Ca, Ni, Zn, and Cr.

The masses of all 20 elements extracted over time were totaled and normalized for valve internal wetted area. The total mass extracted as a function of time is shown in Figure 1. The extraction rate at 7 days calculated from these data was 0.11 ng /cm^2-day.

Table 1: Masses of individual metals extracted by 37% HCl in 11 days

Element	*Mass Extracted (µg/valve)*
Fe	*0.12*
Ca	*0.09*
Ni	*0.03*
Zn	*0.02*
Cr	*0.02*
Al, Au, B, Ba, Be, Cd, Cu, K, Li, Mg, Mn, Na, Pb, Sn, Ti	*0.02*

Figure 1: Cumulative total metal extraction during an 11-day dynamic extraction test



Reliability

UPM valves have been tested for reliability in harsh chemical environments. The valves were cycled more than 1,000,000 times in 37% HCl and tested regularly for leaks through the valve seats.

Cycling test method: Ten valves were installed in a continuous circulation loop containing 37% HCl at 40 ± 5 psig. The flow into the common port of each valve was 1.0 ± 0.3 L/min. The valves were cycled from the normally open to the normally closed position at one second intervals. The actuation pressure was 70 or 90 psig. Valves were inspected periodically for leakage from the valve body.

Seat integrity test method: Each valve was tested for seat integrity upon installation and after every 200,000 cycles until 1,000,000 cycles. Integrity was tested by measuring the rate at which nitrogen leaked through the valve seat. The differential pressure across the seat was 100 psig. Four flow paths were tested: common to normally open, common to normally closed, normally closed to common, and normally open to common. Water leak rates of 0.0001 ml/min could be detected.

Results: The UPM valves were cycled 1,003,451 times. No leaks were detected.

Summary

Furon's 1/4 inch UPM valves have been tested for extraction of metal ions and reliability by an independent test lab. Only five metals were extracted from valves by 37% HCl at more than 0.02 µg in 11 days: Fe, Ca, Ni, Zn, and Cr. The extraction rate at 7 days for a total of 20 metals was 0.11 ng/cm^2-day. No leaks were detected from the UPM valves after 1,003,451 cycles.

References

Grant DC, T Lemke and D Carrieri, "Specification and Verification of Metallic Extractables in Fluid Handling Components," Semicon West Workshop on Contamination in Liquid Chemical Distribution Systems, July, 1997.

Grant DC, T Lemke, G Duepner, D Wilkes, and N Powell, "Measurement of Inorganic Contaminant Extraction from Fluid Handling Components by Dynamic Extraction," *J of the IES*, 39(2): 29-37, 1996.

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

DyconE$^{X\,SM}$ is a procedure patented by FSI International (US patent No. 5,641,895).

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