PERFORMANCE VERIFICATION
Data Sheet

Metal Extraction From HPV Valves

Furon® HPV valves are designed for use with ultrapure media in semiconductor manufacturing, chemical processing and biomedical industries. HPV valves have been tested by an independent lab to verify that they do not release significant amounts of metals into the process chemicals. Metal extraction from HPV valves is within the specifications set by a major chemical distribution system manufacturer[1].

Test Method

The DyconE$^{X\,SM}$ dynamic extraction procedure[2] was used to measure the surface contamination and the rate of metal extraction from HPV valves. The valves were exposed to a continuous flow of 35% hydrochloric acid (HCl).

A dynamic extraction system was filled with 1.1 liters of high-purity HCl, and a sample was withdrawn for analysis for trace metals. Ten valves (HPV2-144NC) were installed in the circulation loop. These valves had been previously cleaned using a proprietary process and tested for particle shedding[3]. HCl was circulated through the system at 400 ml/min for one day, after which the flow rate was reduced to 250 ml/min.

An acid sample was taken after 40 minutes to measure metal contaminants removed from the surface of the valves. Additional samples, taken at 2 hrs, 8 hrs, 2 days, and 12 days, were used to determine the masses and rates of metal extraction from the valves over time. All samples were analyzed for twenty metals by either inductively coupled plasma-mass spectroscopy (ICP-MS) or graphite furnace atomic absorption (GFAA) spectroscopy.

Results

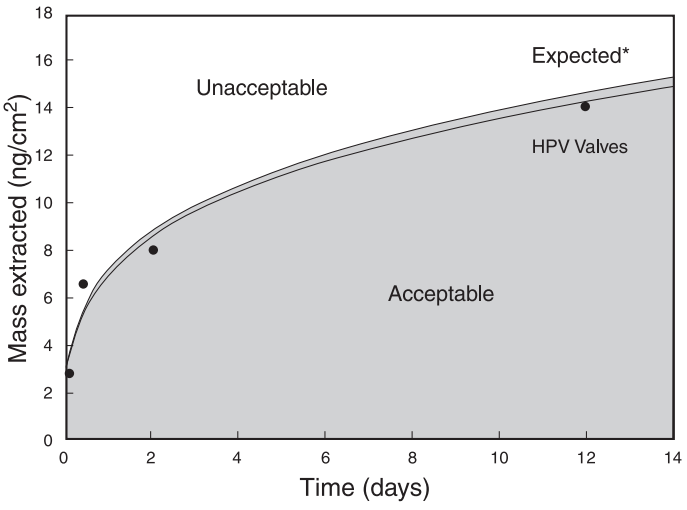
Mass extraction data were normalized to the wetted surface area of a single valve. Table 1 shows the masses that were extracted from the valve in 12 days. Only two metals, iron and calcium, had more than 0.02 µg extracted per valve.

Table 1: Masses of individual metals extracted per valve by 35% HCl in 12 days

ELEMENT	MASS EXTRACTED (µg/fitting)
Fe	0.18
Ca	0.08
Al, Au, B, Ba, Be, Cd, Cr, Cu, K, Li, Mg, Mn, Na, Ni, Pb, Sn, Ti, ZN	≤0.02

Figure 1 shows the total mass of all 20 metals extracted over time. The extraction rate at 7 days calculated from these data was 0.49 ng/cm^2-day. This extraction rate was within the 0.5 ng/cm^2-day specification set by a major chemical distribution system manufacturer for extraction for delivery system components.

Figure 1: Cumulative total metal extraction during a 12-day dynamic extraction test



* for a component meeting semiconductior OEM specifications

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Summary

Ten HPV valves (HPV2-144NC) were tested for extraction of 20 metals by 35% HCl using the DyconE$^{X\,SM}$ dynamic extraction procedure. During 12 days of exposure to HCl, only calcium and iron had more than 0.02 µg extracted from the wetted surface of the valves. The extraction rate at 7 days calculated from these data was 0.49 ng/cm^2-day. The mass removed from the surface of the valves and the extraction rate into 35% HCl were within the specifications set by a major manufacturer of chemical delivery systems.

References

1. Grant DC, T Lemke and D Carrieri, "Specification and verification of metallic extractables in fluid handling components by dynamic extraction," in *Proceedings of the Semicon West Workshop on Contamination in Liquid Chemical Distribution Systems*, July, 1997.
2. 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.
3. Valves were cleaned with a proprietary, patent-pending process by CT Associates, Inc., Bloomington, MN.

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 Company makes no specific claims about the performance of the valves in other chemicals or systems.

The DyconE$^{X\,SM}$ procedure is patented by BOC Edwards Chemical Management Division
(US patent No. 5,641,895).

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