

Metal Extraction From Mini Check Valves

Furon® mini check valves are ideally suited for unidirectional flow of high-purity liquids and gases in harsh chemical environments. Mini check valves have been tested by an independent lab to verify that the check valves do not release significant amounts of metals into the process chemicals. Metal extraction from the valves is well within the specification set by a major chemical distribution system manufacturer¹.

Test Method

The DyconESM dynamic extraction procedure² was used to measure the mass and the rate of metal extraction from check valves. The valves were exposed to a continuous flow of 35% hydrochloric acid (HCl).

A dynamic extraction system was filled with 1.0 liters of high-purity HCl, and a sample was withdrawn for trace metals analysis. Ten valves (PN MCVM-F44) were installed in the circulation loop. 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.

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

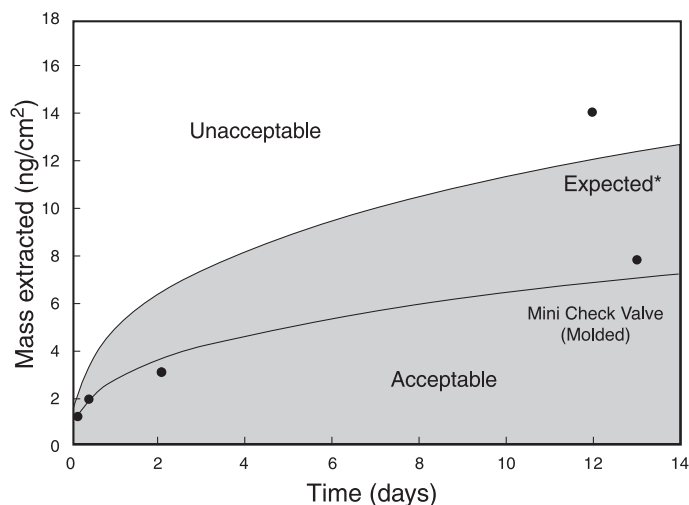
ELEMENT	MASS EXTRACTED (µg/fitting)
Fe	0.25
Na	0.13
Ca	0.12
Zn	0.09
Cu	0.06
K	0.05
Al	0.03
Au, B, Ba, Be, Cd, Cr, Li, Mg, Mn, Ni, Pb, Sn, Ti	≤0.02

Results

Mass extraction data were normalized to the wetted internal surface area of a single valve. Table 1 shows the total masses of individual metals extracted from the valves in 12 days. Only seven metals, iron, sodium, calcium, zinc, copper, potassium, and aluminum, had more than 0.02 µg extracted per fitting.

Figure 1 shows the total mass of all 20 metals extracted over time. The extraction rate at 7 days calculated from these data was 0.35 ng/cm²-day. This extraction rate was well below the 0.5 ng/cm²-day specification set by a major chemical distribution system manufacturer for extraction from delivery system components.

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



* for a component meeting semiconductor OEM specifications

Summary

Ten check valves (PN MCVM-F44) were tested for extraction of 20 metals by 35% HCl using the DyconEXSM dynamic extraction procedure. During 12 days of exposure to HCl, only iron, sodium, calcium, zinc, copper, potassium, and aluminum had more than 0.02µg extracted from the wetted surface of the valves. The extraction rate at 7 days calculated from these data was 0.35 ng/cm²-day. The mass of metals removed from the valve surface and the extraction rate from the valve into 35% HCl were well within the specification 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.

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 DyconEXSM procedure is patented by BOC Edwards Chemical Management Division (US patent No. 5,641,895).



PERFORMANCE PLASTICS

Saint-Gobain Performance Plastics
7301 Oranewood Ave.
Garden Grove, CA 92841-1411
USA Toll Free: (800) 543-8823
www.plastics.saint-gobain.com
www.furon-asti.com

France

Tel: 33/(0) 1 55 68 59 59
Fax: 33/(0) 1 55 68 59 68

Japan

Tel: 81/(0) 2 6679 6400
Fax: 81/(0) 2 6670 1001