

Pump Down and Vent Rate Tolerances of Moxtek Windows

Applications Note

Moxtek makes ultra-thin polymer X-ray windows that are often used in SEM and TEM microanalysis detectors. Moxtek windows are an excellent gas barrier and allow detector electronics to stay in vacuum while the sample chamber varies between vacuum and atmospheric pressure for sample loading and unloading. It is important to understand pump down and vent rate tolerances of Moxtek's X-ray windows for proper equipment use design.

Moxtek windows are tested in a pressure chamber that delivers pressure to the front side of the window then returns to atmosphere. This simulates the stress seen by an in situ X-ray window by cycling windows between 0.19 atm and 1.2 atm of differential pressure.

Moxtek windows are tested to be able to withstand a minimum of 10,000 cycles and still maintain their hermetic properties. Figure 1 shows an example of the differential pressure delivered during 10 of these cycles. The hermetic seal is tested after the 10,000 cycles with a helium leak detector.

The differential pressure profile during those 10,000 cycles show the known tolerances for pump down and vent rates. The graph in Figure 2 shows one typical complete cycle. The portion in red mimics chamber venting while the portion in black mimics pumping down a sample chamber.

The first part of both the vent and pump down portions of the pressure profile show the greatest rate of change and are assumed to cause the greatest mechanical strain on the window. The vent and pump down rates can be calculated by finding the average slope of both the vent and pump down portions.



Moxtek X-ray Window Pressure Cycler

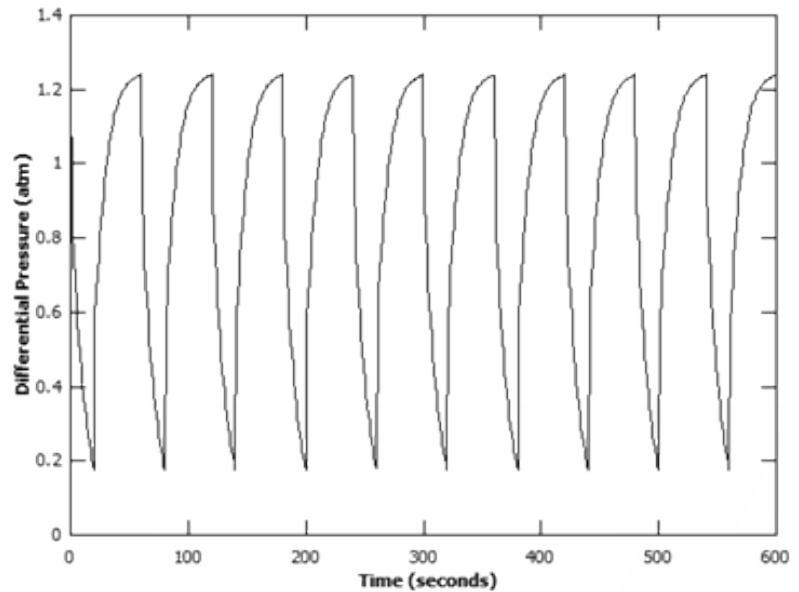


Figure 1

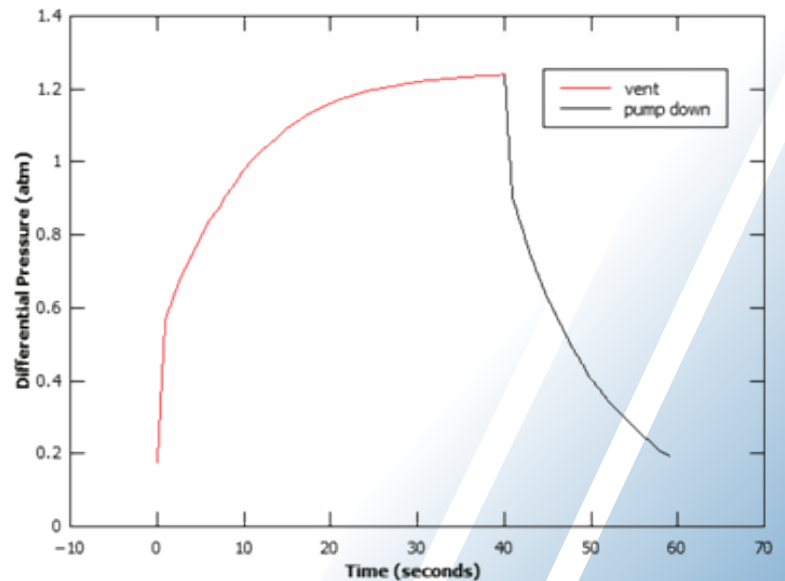


Figure 2

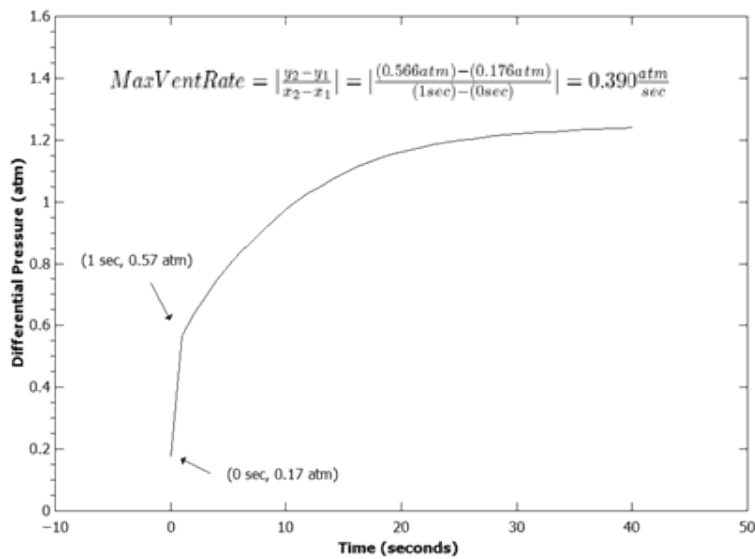


Figure 3

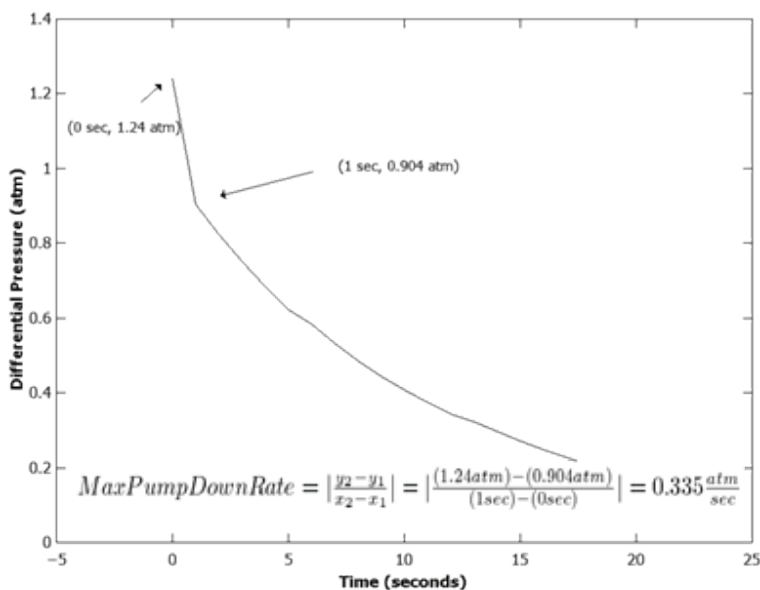


Figure 4

Figures 3 and 4 show calculations for a vent rate and a pump down rate respectively. The average slope of these sections yields 0.390 atm/sec for venting and 0.335 atm/sec for pump down.

Figures 3 and 4 show calculations for just one pressure cycle. The same calculation was done for 500 cycles. Table 1 shows the mean and standard deviation of 500 cycles for both pump down and vent rates.

Moxtek ensures that its X-ray windows can tolerate a minimum of 10,000 cycles from 0.19 atm and 1.2 atm differential pressures. The average maximum vent rate for 500 cycles was 0.404 atm/sec and the average maximum vent rate for 500 cycles was 0.330 atm/sec. Moxtek recommends designing equipment with Moxtek windows to pump down no faster than 0.330 atm/sec and vent chambers no faster than 0.404 atm/sec.

Table 1

	Ave Max Rate	Std Dev
Pump Down	0.330 atm/sec	0.00837
Vent	0.404 atm/sec	0.00732