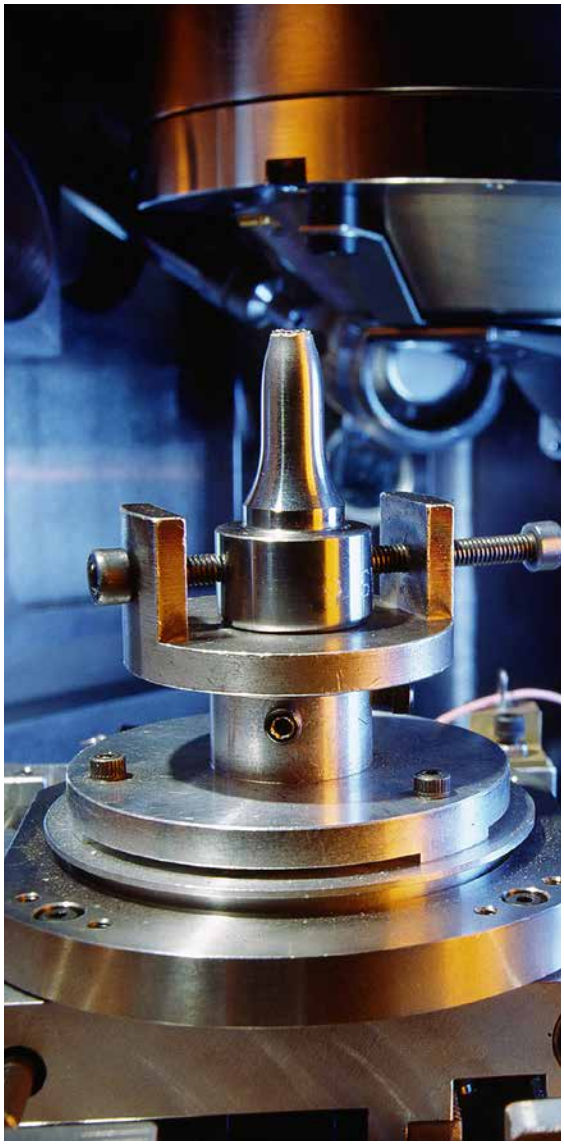
DEVELOPMENT OF A VACUUM SEAL-OFF VALVE FOR AN ULTRA HIGH VACUUM ENVIRONMENT

For Cryogenic Electron Microscopy to work, Cryogenic techniques must preserve sample integrity by maintaining the samples in their natural condition and state. Snap-freezing the cells allows the immune molecules to be viewed in a state and environment that is as close to natural living cells as possible, while achieving magnification of several billion times. To achieve this level of sensitivity, the electrons must have a clear path to travel with near zero resistance. This requires a near perfect vacuum environment from the optical regime down to the nanometer length scale.



THE CHALLENGE

Develop a vacuum seal-off valve that will support an Ultra High Vacuum environment for vacuum chambers used on Cryogenic Electron Microscopes without using the vacuum greases or lubricants typically used on sub-atmospheric vacuum sealing elastomer components on standard commercial vacuum seal-off valves. These vacuum seal-off valves must be capable of sealing off vacuum pressures with minimum vacuum leak rates of 1x10E-9 scc/sec. helium gas - and lower, and near zero Torr vacuum pressures - lubricant free.

THE SOLUTION

Using our standard 1" inch, SV7 Series spring loaded poppet vacuum seal-off valve, we redesigned the O-ring groove to partially encapsulate the elastomer O-ring seal, while providing a highly polished valve body groove design. This allowed the O-ring to sit between the body and the spring loaded poppet, where vacuum-tight shutoff is required. Vacuum-tight shutoff was achieved by developing a special grooving tool to adjust the feeds and speeds on precision tolerance spindles on a high-speed CNC turning lathe. To finish the process we used a proprietary final polishing step while the piece was still in the lathe spindle. This step created the single-digit Ra highly-polished sealing surface required for the elastomer and mating poppet assembly to seal without use of grease or high vacuum pressure lubricants.

THE RESULTS

A vacuum seal-off valve capable of evacuating and sealing off at the required ultra-high vacuum levels, without risk of vacuum contamination or decay from foreign lubricants and greases.

CIRCOR | CPC-Cryolab

CRYOGENICS

12501 Telecom Drive, Tampa, Florida 33637-0906
Phone +1 (813) 978-1000 | Fax +1 (813) 978-0984
Email: cryogenics@circor.com | www.circor.com

SV7 SERIES 2 - 6 PSIG

VACUUM SEAL-OFF VALVES AND VALVE OPERATORS

FEATURES

- Vacuum Tight Seal-Off
- Easy Access to Vacuum
- High Capacity Flow
- Low Profile

APPLICATIONS

- High Vacuum Tanks
- High Vacuum Dewars
- Low Pressure Gas Systems
- Vacuum Insulated Cryogenic Piping Systems
- Cold Box Vacuum Systems

OPERATING RANGES

Temperature	-20˚F to +150˚F -29˚C to +66˚C
Relief Pressure	2 to 6 PSIG

MATERIALS OF CONSTRUCTION

Body	300 Series S/S or 6061 Aluminum
Spring	300 Series S/S
Retainer	300 Series S/S
O-Ring	Viton®
Cap	Plastic PVC
Poppet	300 Series Stainless Steel

TESTS

Seat Leakage	Mass spec. less than $1x10^{-9}$ scc GHe/sec (Exclusive of O-ring Permeability) at Ambient Temp.

CONNECTION

Valve	Butt Weld
Operator	ISO Flange or Tube

VALVE SIZE

1” to 3”

CRYOGENICS

CIRCOR | CPC-Cryolab

12501 Telecom Drive, Tampa, Florida 33637-0906
Phone +1 (813) 978-1000 | Fax +1 (813) 978-0984
Email: cryogenics@circor.com | www.circor.com