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 $1 \times 10^{-9}$ 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.
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"