



DE Series Springless Diaphragm Valves (1.125 in.) Technical Report

Scope

This technical report provides data on Swagelok® DE series diaphragm valves (1.125 in.). The report covers:

- surface finish
- inboard helium leak testing
- particle counting
- lab cycle testing
- hydrostatic burst testing.

Particle counting show test results from valves cleaned with deionized (DI) water according to the techniques described in Swagelok *Ultrahigh-Purity Process Specification (SC-01)*, MS-06-61.

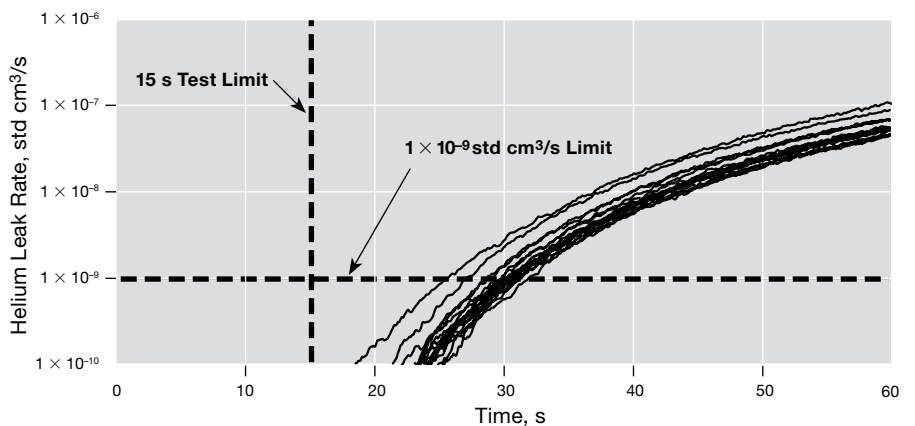
Surface Finish

Statistical process control (SPC) allows Swagelok to provide consistent surface finishes, as described in Swagelok *Ultrahigh-Purity Process Specification (SC-01)*, MS-06-61. The roughness average (R_a) specification we have established for the wetted surfaces of Swagelok P or P1 finish is 5 $\mu\text{in.}$ (0.13 μm) R_a on average.

Inboard Helium Leak Testing

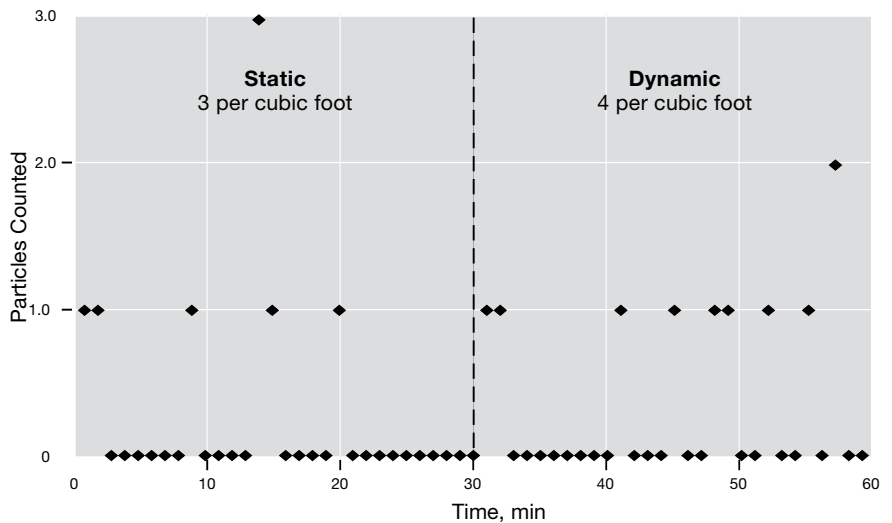
Swagelok DE series diaphragm valves (1.125 in.) processed to meet Swagelok *Ultrahigh-Purity Process Specification (SC-01)*, MS-06-61, were evaluated for inboard helium leak integrity of the valve seat in accordance with SEMI-F1.

The 16 valves exhibited a helium permeation response that was significantly better than the 1×10^{-9} std cm^3/s leak rate at the 15 s test limit.



Particle Counting

Testing was performed in accordance with ASTM F1394, measuring particles greater than 0.02 μm in size. Static particle emissions from a Swagelok DE series diaphragm valve (1.125 in.) meet the recommended performance of fewer than 20 particles per cubic foot, in accordance with SEMI E49.8.



Lab Cycle Testing

The Swagelok DE series diaphragm valve (1.125 in.) was evaluated for cycle life under controlled laboratory conditions. All valves were electronically monitored during testing for envelope seal integrity. At regular intervals the valves were removed and evaluated for seat seal integrity, envelope seal integrity, flow performance, and actuator seal performance.

These tests are not a guarantee of a minimum number of cycles in service. Laboratory tests cannot duplicate the variety of actual operating conditions and cannot promise that the same results will be realized in service.

Normally Closed Pneumatically Actuated Valves

Model	DE series diaphragm valve (1.125 in.)		
Mode of Actuation	Normally closed pneumatically actuated		
Quantity	16	16	16
Gas	Dry, filtered nitrogen		
Temperature, °F (°C)	70 (20)	14 (-10)	150 (65)
Inlet and Outlet Pressure psig (bar)	125 (8.6)	Vacuum	Vacuum
Actuator Pressure psig (bar)	75 (5.1)	75 (5.1)	75 (5.1)
Cycle Rate, cpm	300	120	120
Number of Cycles	1 million (suspended)	1 million (suspended)	1 million (suspended)
Final Seat Seal Leakage std cm ³ /s He	< 1 × 10 ⁻⁹	< 1 × 10 ⁻⁹	< 1 × 10 ⁻⁹
Final Envelope Leakage std cm ³ /s He	< 1 × 10 ⁻⁹	< 1 × 10 ⁻⁹	< 1 × 10 ⁻⁹

Hydrostatic Burst Pressure Test

The Swagelok DE series diaphragm valve (1.125 in.), in the normally closed pneumatically actuated mode, the normally open pneumatically actuated mode, and the manually actuated mode were evaluated for burst performance under controlled laboratory conditions.

These tests were conducted beyond the product's recommended operating parameters and do not modify the published product ratings.

Model	DE series diaphragm valve (1.125 in.)		
Mode of Actuation	Normally closed	Normally open	Manual
Quantity	8	8	4
Temperature, °F (°C)	70 (20)		
Working Pressure psig (bar)	125 (8.6)		
Burst Pressure Requirement psig (bar)	4500 (310)		
Samples Attaining Burst Pressure Requirement	8/8	8/8	4/4

Referenced Documents

ASTM Standards^①

F1394 Standard Test Method for
Determination of Particle
Contribution from Gas Distribution
System Valves

SEMI Standards^③

F1 Specification for Leak Integrity of
High-Purity Gas Piping Systems
and Components

E49.8 Guide for High-Purity and
Ultrapure Gas Distribution
Systems in Semiconductor
Manufacturing Equipment

Swagelok Specification

*Ultrapure Process Specification
(SC-01), MS-06-61*

① American Society for Testing and Materials,
100 Barr Harbor Dr., West Conshohocken, PA
19428, U.S.A.

② Semiconductor Equipment and Materials
International, 3081 Zanker Road, San Jose, CA
95134, U.S.A.

These tests do not simulate any specific application and are not a guarantee of performance in actual service. Laboratory tests cannot duplicate the variety of actual operating conditions. The results are not offered as statistically significant. See the product catalog for technical data.

Safe Product Selection

When selecting products, the total system design must be considered to ensure safe, trouble-free performance. Function, material compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibilities of the system designer and user.