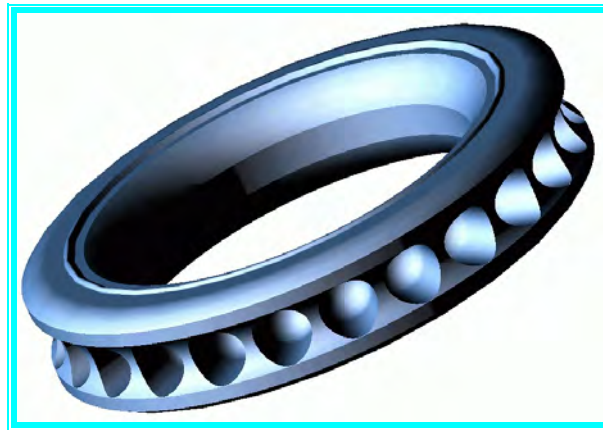


MicroSeal™

Product Selection Guide





The MicroSeal™ family is a complete line of high purity, high integrity seals for industrial and semiconductor applications including low flow, high flow, high pressure and low pressure drop. We also offer orifice seals and blind seals to cap off spare ports. Other key benefits include high cleanliness and passive, chrome rich, low Ra surface finishes. MicroSeals retrofit to standard "C" seal systems. Our seals meet SEMI Standard PR 3.1, 3.5 and new high-flow standards.

The MicroSeal design has a softer, more compliant interface that molds itself to the mating surface ensuring leak tightness, and eliminating virtual leaks without sacrificing rebound characteristics. This is the only high compliance seal on the market with high rebound. MicroSeals rebound rate exceeds competing seal designs by as much as ten times and they are particularly forgiving of cavity tolerance. This ensures that the sealing surfaces stay in intimate contact during pressure, temperature and vibration extremes. All these characteristics are achieved with low compression rates, ensuring high first pass yield.

Key MicroSeal Benefits:

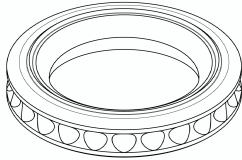
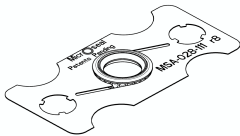
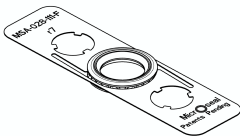
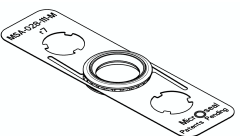
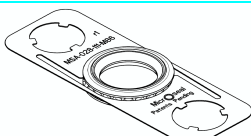
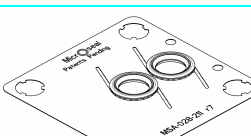
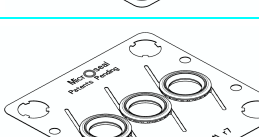
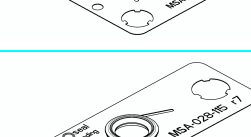
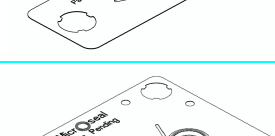
- ✓ Lowest Pressure Drop Design
- ✓ Optimized I.D. Bore for Lowest Pressure Drop In Medium Flow, High Flow, Vapor and Liquid Delivery Systems
- ✓ Lowest Compression to Ensure Highest Reliability of Gas / Liquid Delivery Systems
- ✓ 10x's Seal Rebound vs. Traditional designs to achieve Leak Integrity under Shock and Vibration (Patented)
- ✓ SEMI PR 3.1 and 3.5 Compliant
- ✓ Ultra High Purity Double Melt 316 Stainless Steel
- ✓ Ultraclean Passive Chrome Rich Surface
- ✓ 5 Ra wetted surface finish
- ✓ Compressor Ring Design Eliminates Virtual Leaks (Patented)
- ✓ Exceptional First Pass Yield on Seal Makeup - Virtually Eliminates High Cost Rework and Scrap
- ✓ Rapid Delivery

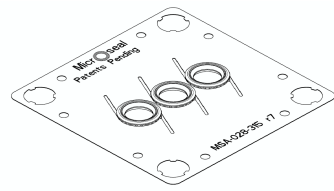
MICROSEAL™ MODULAR SURFACE MOUNT SEAL TEST SUMMARY

Tests were conducted according to section 5.9 of SEMI Guide to Performance Specifications and Test Methods for Sealing Systems, which address the mechanical aspects of the sealing system for 1.125 and 1.5 inch gas distribution system components.

Performance Test	Acceptance Criteria	Performance
Material Cr/Fe Ratio Oxide Thickness (less carbon) Surface Roughness / Defects	316L VIM VAR Cr/Fe ratio > 2.0 CrO Thickness > 20 angstroms 10 micro inch / less than 25 defects per location	>0.004% Sulfur content Cr/Fe ratio 2.5 CrO thickness (less Carbon) 35 angst. Less than 1micro inch / less than 1 defect per location
Leak Tests , Design Pressure (5000 psig)	Outboard leakage: $<1 \times 10^{-9}$ atm-cc/sec He	Outboard leakage: $<7 \times 10^{-11}$ atm-cc/sec He at 100 psig after exposure to 5000 psig
Pressure Tests-Proof at 7500psig Burst Test (hydrostatic)	No hydrostatic test fluid shall be visible. Inboard leakage: $<7 \times 10^{-11}$ atm-cc/sec He	No hydrostatic test fluid visible. Proof parts leak tight $<7 \times 10^{-11}$ Burst at > 20,000 psig
Vibration -MILSPEC 810E Sec 1 Category 1 Shock – Drop test in 25G increments	Inboard leakage: $<1 \times 10^{-9}$ atm-cc/sec He after testing No Spec on Shock	Inboard leakage: $<7 \times 10^{-11}$ atm-cc/sec He after MIL-SPEC 810E Sec 1-3 category 1test. Shock exceeding >294G's – No leaks
Pre-load Safety Factor	Inboard leakage: $<1 \times 10^{-9}$ atm-cc/sec He at 80% and 120% of manufacturers' specified torque setting.	Inboard leakage: $<7 \times 10^{-11}$ atm-cc/sec He at 10, 15, 24, 30, 36, and 48 in/lbs torque.
Repeatability -Make and remake substrate with 20 sets of new seals.	Inboard leakage: $<1 \times 10^{-9}$ atm-cc/sec He after 20 re-make cycles.	Passed Inboard leak: $<7 \times 10^{-11}$ atm-cc/sec He at each make and remake and after 20 re-make cycles. Tested at 10, 24, and 48 in/lbs torque
Torsion	Inboard leakage: $<1 \times 10^{-9}$ atm-cc/sec He after testing at 50,75,and 100 ft/lbs.	Inboard leakage: $<5 \times 10^{-11}$ atm-cc/sec He after torque test.
Temperature Cycling	Inboard leakage: $<1 \times 10^{-9}$ atm-cc/sec He after temperature testing. Three sets of two port seals room temperature, 100°C, room temperature, -10°C; five cycles	Inboard leakage: Passed leak test $<7 \times 10^{-11}$ atm-cc/sec He at each temperature.
Temperature Shock Test	Shock 200°C to -196°C	Shock test +200°C to -196°C (direct insertion into Liquid N2) No Leaks at $<7 \times 10^{-11}$ atm-cc/sec He
Compression Load Test	Compress from .062 to .050 inch Measure Load	Standard Seal - 685 lbs Low Load Seal - 618 lbs

Low Flow Sealing Systems

Type	Part Number	Description
	MS-028-062	MicroSeal for SEMI PR3.1 Compliant Designed for seal port counter bore 0.29"dia. x 0.024" depth, 0.18"dia. flow path
	MSA-028-111	MicroSeal assy., SEMI PR3.1 Compliant Used on Mass Flow Controller, 1-1/8" Surface Mount
	MSA-028-111-F	MicroSeal assy., SEMI PR3.1 Compliant Used on Flange Connector, Celerity K1S modular systems
	MSA-028-111-M	MicroSeal assy., SEMI PR3.1 Compliant Used on Manifold Connector, Celerity K1S modular systems
	MSA-028-111-M86	MicroSeal assy., SEMI PR3.1 Compliant Used on Manifold Connector, Celerity K1S modular systems (0.86" L.)
	MSA-028-211	MicroSeal assy., SEMI PR3.1 Compliant Used on Component, 2 Port Surface Mount 1-1/8" Interface
	MSA-028-311	MicroSeal assy., SEMI PR3.1 Compliant Used on Component, 3 Port Surface Mount 1-1/8" Interface
	MSA-028-115	MicroSeal assy., SEMI PR3.1 Compliant Used on Mass Flow Controller, 1-1/2" Surface Mount
	MSA-028-215	MicroSeal assy., SEMI PR3.1 Compliant Used on Component, 2 Port Surface Mount 1-1/2" Interface



MSA-028-315

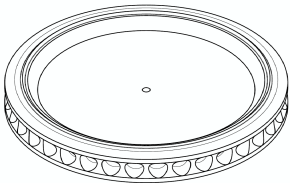
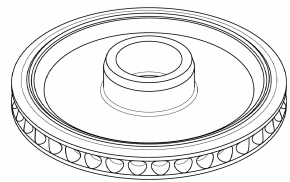
MicroSeal assy., SEMI PR3.1 Compliant
Used on Component, 3 Port
Surface Mount 1-1/2" Interface

High Flow Sealing Systems

Type	Part Number	Description
	MS-043-062	MicroSeal for High Flow Designed for seal port counter bore 0.44"dia. x 0.024" depth, 0.30"dia. flow path
	MSA-043-115	MicroSeal assy., High Flow Used on Mass Flow Controller, 1-1/2" Surface Mount
	MSA-043-115-F	MicroSeal assy., High Flow Used on Flange Connector, Celerity K1H modular systems
	MSA-043-215	MicroSeal assy., High Flow Used on Component, 2 Port Surface Mount 1-1/2" Interface
	MSA-043-315	MicroSeal assy., High Flow Used on Component, 3 Port Surface Mount 1-1/2" Interface

Custom Microseal Assembly

	MSA-028-111-U	MicroSeal assy., Single seal port Surface Mount 1-1/8" Interface
	MS-028-062-XXX	MicroSeal for SEMI PR3.1 Compliant Designed to replace MS-028-062 when a flow restrictor is required. Suffix -XXX is orifice size in 1/1000". Suffix -000 means plug seal

	MS-043-062-XXX	MicroSeal for High Flow Designed to replace MS-043-062 when a flow restrictor is required. Suffix -XXX is orifice size in 1/1000". Suffix -000 means plug seal
	MS-043-062-XXX-PV	MicroSeal Custom Design

Other sizes and designs are available upon request.

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