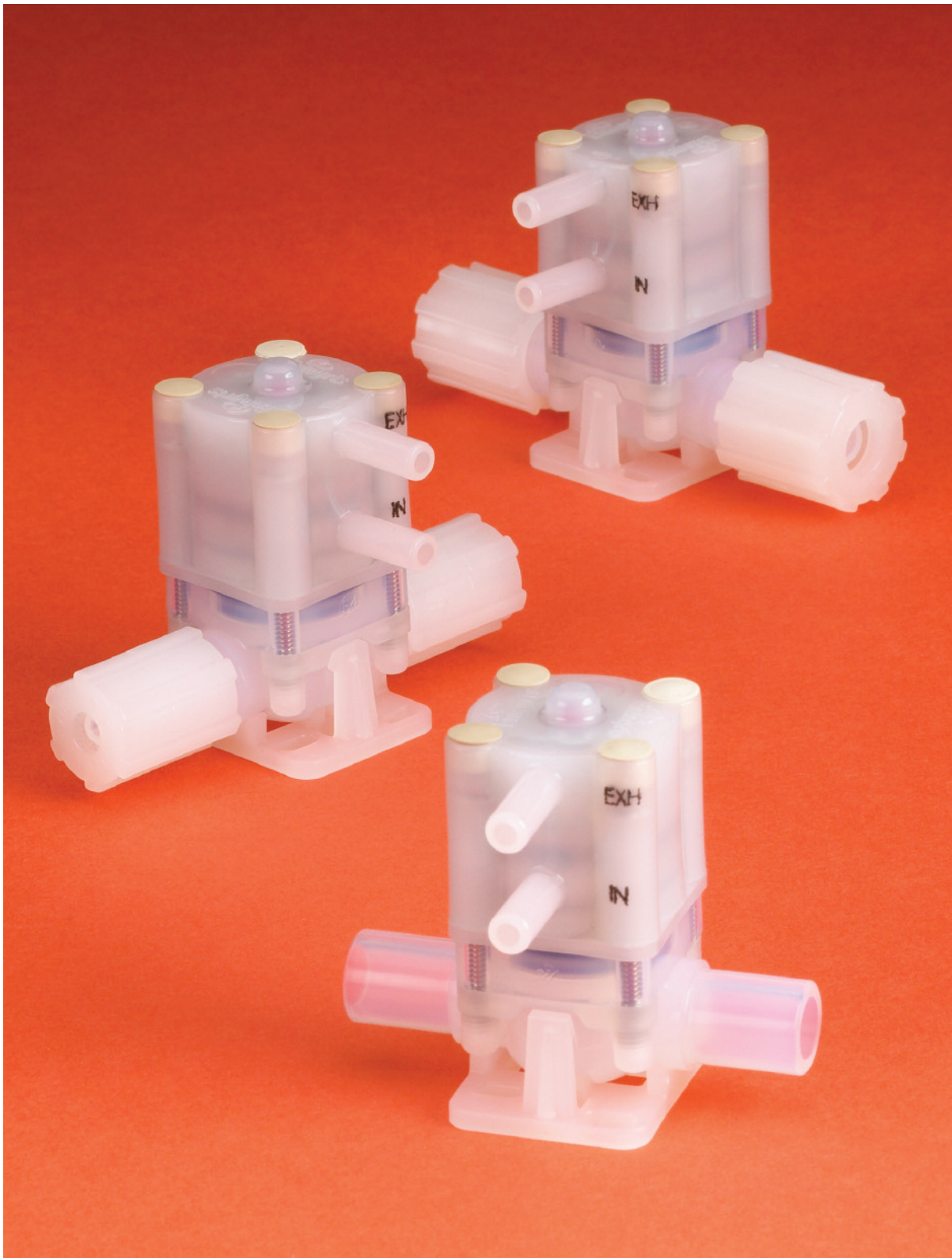
Entegris

CR4 SG SERIES VALVES

For corrosive environments in wet etch and clean applications



for corrosive environments in wet clean applications

Overview

With the CR4 valve, Entegris adds another option to its successful line of SG series valves. The CR4 can handle temperatures up to 160°C (320°F) in corrosive environments for wet etch and clean applications. At this temperature, the SG4 is rated to 276 kPa (40 PSIG) media.

With these durable valves, users will have a variety of options to add ¼˝ and ⅜˝ connections, from either Flaretek® or PureBond.® With no exposed metal hardware, the valve is completely sealed and protected from harsh chemical environments.

This new series will have the same footprint as the stand-alone and manifold Galtek® SG series and Dymension® valves, allowing for easy retrofitting or replacement.

Features and Benefits

- Smallest all-PFA wetted valve available for high- purity fluid handling applications
- High-temperature valves to withstand corrosive and harsh chemical environments
- Same footprint as the Galtek SG series stand-alone valve and Dymension surface-mount manifold valves for easy replacement
- Valves offer a variety of connection options: Flaretek, Flaretek “SpaceSaver”, PureBond, FNPT

Applications

- High-purity corrosive chemical handling
- All semiconductor wet clean process chemicals
- Transporting and protecting your high-purity chemicals
- Chemical line size in ⅜˝ or smaller

Specifications

Materials:	All wetted parts	PFA		
	Exterior actuator parts	PVDF, Viton®		
	Interior actuator parts	PVDF, SST, Viton		
	Mounting base	PVDF		
Operating conditions:	Media pressure at	21°C (70°F)	Inlet – 552 kPa (80 PSIG)	Outlet – 276 kPa (40 PSIG)*
		160°C (320°F)	Inlet – 276 kPa (40 PSIG)	Outlet – 138 kPa (20 PSIG)
	Actuation pressure	345–483 kPa (50–70 PSIG)		
	Temperature range	Ambient	23°–50°C (73°–122°F)	
		Fluid	21°–160°C (70°–320°F)	
Pneumatic supply port:	¼" tube stub; accepts one-touch (push to connect) type fittings			
Compliant:	RoHs, WEE			

**Optional high pressure outlet versions for up to 552 kPa (80 PSIG)*

Valve Reliability Test Results

Valve Qualification Testing

Test Type	Test Conditions	Acceptance Criteria	Test Results
Pressure decay	40 PSIG CDA	<0.050 cc H_2O/hour equivalent leak rate	PASS <0.0077 cc H_2O/hour equivalent leak rate
Cracking pressure	Increase test pressure CDA until valve opens. Maximum test pressure 140 PSIG	Cracking pressure must be >10% above rated pressures (88 PSIG inlet, 44 PSIG outlet). Cracking pressure defined as when downstream pressure increases by >2 PSIG, indicating valve has opened.	PASS Inlet cracking pressure >140 PSIG Outlet cracking pressure ~108 PSIG
Proof pressure	Hydraulic oil at valve proof pressure of 120 PSIG	Valve must maintain pressure decay and cracking pressure requirements after exposure to 120 PSIG	PASS <0.0077 cc H_2O/hour equivalent leak rate Inlet cracking pressure >140 PSIG Outlet cracking pressure ~108 PSIG
Burst pressure	Hydraulic oil pressure increased until leakage detected	Burst pressure must be >2X rated pressure	PASS Burst pressure average of 357 PSIG
Accelerated life testing	49% HF acid at 22°C @ 80 PSIG for 2.1 M cycles	Minimum acceptable B_{10} Weibull life* of 2 million cycles. Inspected every 300k cycles for cracking pressure (≥88 PSIG) and port-to-port leakage (<0.05 ml/min.)	PASS No valve failures in 2.1 M cycles B_{10} life ≥2.0 M cycles Weibull MTTF ≥3.8 M cycles
	37% HCl acid at 80 PSIG @ 22°C for 2.1 M cycles	Minimum acceptable B_{10} Weibull life* of 2 million cycles. Inspected every 300k cycles for cracking pressure (≥88 PSIG) and port-to-port leakage (<0.05 ml/min.)	PASS No valve failures in 2.1 M cycles B_{10} life ≥2.0 M cycles Weibull MTTF ≥3.8 M cycles
	Cabot Semi-Sperse® 12 slurry at 30 PSIG @ 22°C for 2.1 M cycles	Minimum acceptable B_{10} Weibull life* of 2 million cycles. Inspected every 300k cycles for cracking pressure (≥88 PSIG) and port-to-port leakage (<20 ml/hr.)	PASS No valve failures in 2.1 M cycles B_{10} life ≥2.0 M cycles Weibull MTTF ≥3.8 M cycles
Pressure envelope	120 PSIG water @23°C (73°F)	No external leakage failures for 1 million cycles @ 1.5 rated pressure	PASS No external leakage
	60 PSIG hydraulic oil @160°C (320°F)	No external leakage failures for 1 million cycles @ 1.5 rated pressure	PASS No external leakage
Actuation cycle testing	40 PSIG hydraulic oil @ 160°C (320°F)	No leakage in functional performance for >2.1 million cycles	PASS No external leakage port-to-port <0.050 cc H_2O/hr.
	80 PSIG water @ 23°C (73°F)	No leakage in functional performance for >2.1 million cycles	PASS No external leakage port-to-port <0.050 cc H_2O/hr.

**B_{10} Weibull life is defined as the statistical number of cycles where 10% of the valves are expected to fail.*

Valve Test Procedure in Production

Test Type	Test Conditions	Acceptance Criteria
External media leak	80 PSIG CDA	Zero bubbles per minute through 1/32" ID tube immersed in DI water
Port-to-port valve test	40 PSIG CDA to valve outlet	Less than 4 bubbles per minute through 1/32" ID tube immersed in DI water
Valve actuation	Pressure decay 70 PSIG CDA	Less than 5 PSI pressure drop

Surface Extractable Specification

Entegris, Inc. certifies the Galtek corrosion-resistant SG series ¼″ valves comply with the SEMI® F57-0301 specification for Extractable Ionic and Metallic Contamination, Total Organic Carbon Contamination and Surface Roughness. Per SEMI F40 (section 12.1), the following test parameters were used:

a) The test fluid used was ultrapure water and the tests were carried out at 85°C.

b) The parts were leached after the prescribed rinse pretreatment.

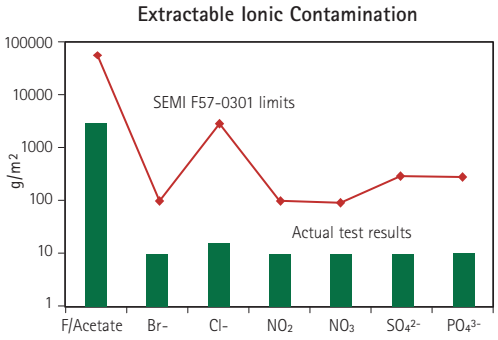
c) The volumes of the test fluids used were 4.5 ml.

d) The soak time was one week.

e) The calculated wetted surface areas were 0.0032 m².

Testing has verified the corrosion-resistant SG series ¼″ valves in standalone and PTFE manifolded configurations comply with the following specifications as outlined in SEMI F57-0301.

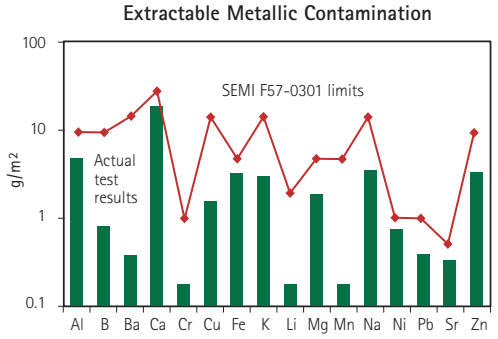
Surface Extractable Specification



SURFACE EXTRACTABLE IONIC CONTAMINATION

Aqueous Leachate Anions (IC)	SEMI F57-0301 Limits Static Value at 85 ±5°C for 7 days (µg/m²)	Actual Test Results Molded PFA CR4 Valves (µg/m²)
Fluoride (F-/Acetate)	≤60000	3904.0
Bromide (Br-)	≤100	<6.8*
Chloride (Cl-)	≤3000	<27.0*
Nitrate (NO_2-)	≤100	<0.3*
Nitrate (NO_3-)	≤100	14.0
Sulphate (SO_4^{2-})	≤300	9.0
Phosphate (PO_4^{3-})	≤300	<0.7*

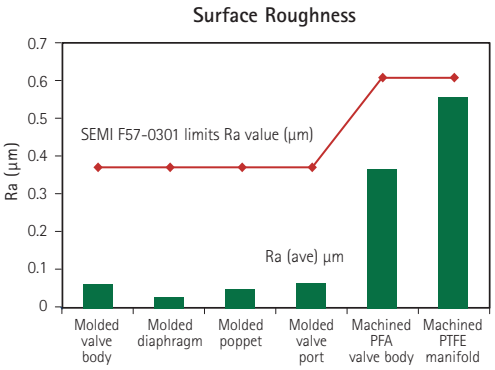
**Below detection limit*



SURFACE EXTRACTABLE METALLIC CONTAMINATION

Aqueous Leachate Trace Metals (ICP-MS)	SEMI F57-0301 Limits Static Value at 85 ±5°C for 7 days (µg/m²)	Actual Test Results Molded PFA CR4 Valves (µg/m²)
Al	≤10.0	3.10
B	≤10.0	2.70
Ba	≤15.0	0.08
Ca	≤30.0	6.20
Cr	≤1.0	0.19
Cu	≤15.0	0.50
Fe	≤5.0	3.30
K	≤15.0	1.90
Li	≤2.0	<0.04*
Mg	≤5.0	0.40
Mn	≤5.0	0.04
Na	≤15.0	1.60
Ni	≤1.0	1.00
Pb	≤1.0	<0.07*
Sr	≤0.5	<0.01*
Zn	≤10.0	3.12

**Below detection limit*



SURFACE ROUGHNESS SPECIFICATION

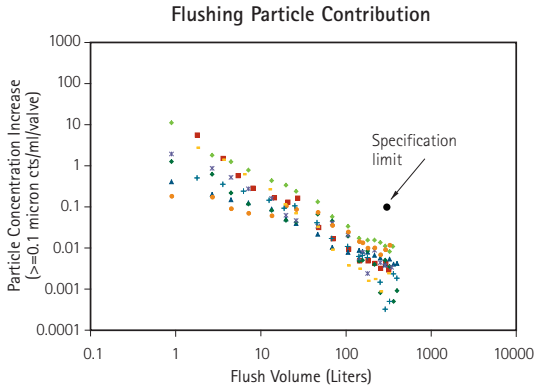
Component Description	SEMI F57-0301 Limits Ra Value µm (µin.)	Actual Test Results Ra (ave) µm (µin.)
Injection molded CR4 valve body	≤0.38 (≤15)	0.07 (2.6)
Injection molded CR4 diaphragm	≤0.38 (≤15)	0.03 (1.3)
Injection Molded CR4 poppet	≤0.38 (≤15)	0.05 (2.2)
Injection Molded CR4 valve port	≤0.38 (≤15)	0.07 (3.0)
Machined PFA CR4 valve body	≤0.62 (≤25)	0.37 (14.4)
Machined PTFE manifold body	≤0.62 (≤25)	0.57 (22.4)

TOTAL ORGANIC CARBON CONTAMINATION FOR MOLDED CR4

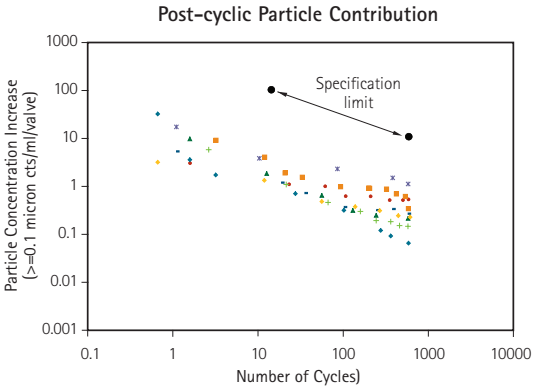
	SEMI F57-0301 Limits	Actual Test Results Molded PFA CR4 Valves
Total organic carbon contamination	60,000 µg/m²	623 µg/m²

Particle Contribution Specification

Because the SEMI F57-0301 Particle Contribution specification is still in development, Entegris has worked with several OEMs to establish a test method and particle contribution limits. Testing has verified the SG series ¼˝ valve in both stand-alone and manifolded configurations comply with the following particle contribution specification.

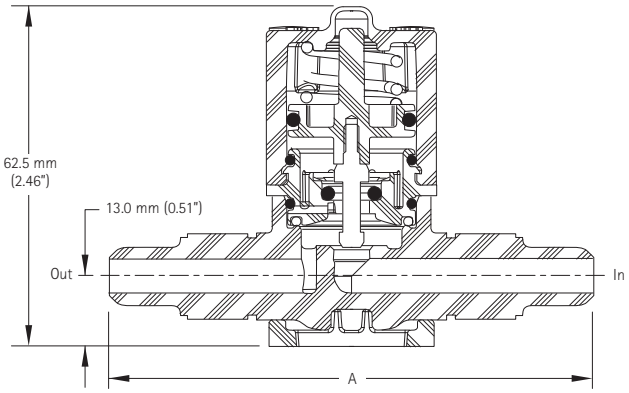


Note: During initial flushing, the device must contribute <0.1 particle/ml (particle size ≥0.1 µm) within 300 liters of flushing. During operation, the device must release <100 particles/actuation (particles size ≥0.1 µm) within 500 cycles and <10 particles/actuation (particles size ≥ 0.1 µm) within 10000 cycles.

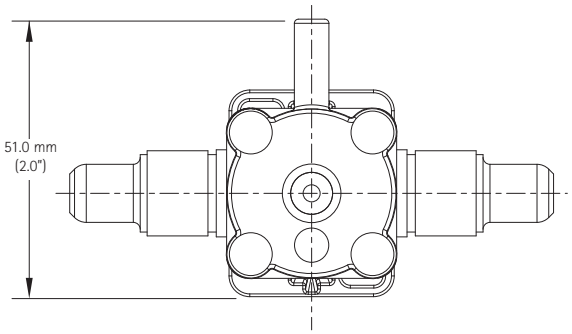


Note: After cycling the valves for 2.1 M cycles in 49 ±3% HF, the valves must also pass the particle contribution criteria.

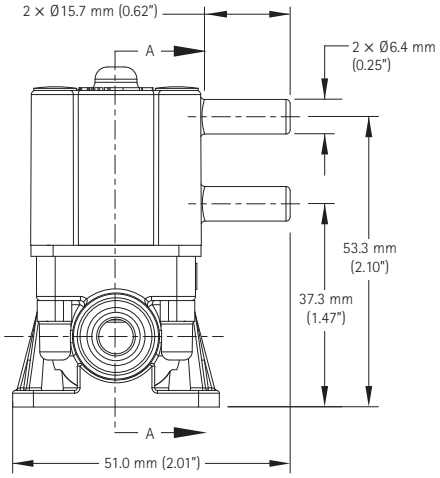
Dimensions



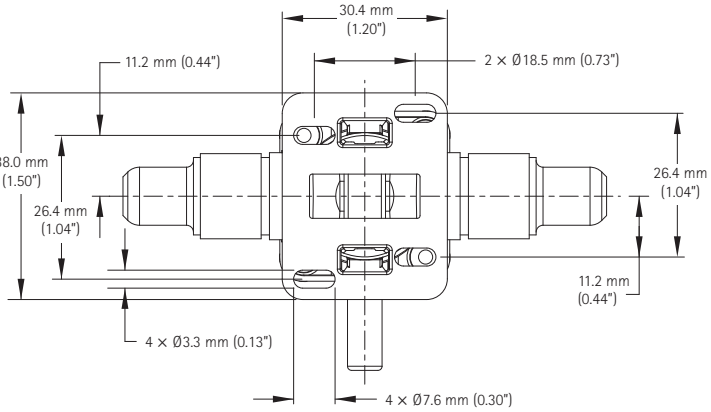
Top View



Side View



Bottom View



Ordering Information

Part Number	Flow Factor C_V	Flow Factor K_V	Port Connection	A
NORMALLY CLOSED				
CR4-2C-4F	0.29	4.2	1/4" Flaretek	85.3 mm (3.36")
CR4-2C-4N	0.84	12.0	1/4" FNPT	69.8 mm (2.75")
CR4-2C-4P	0.84	12.0	1/4" PureBond	68.1 mm (2.68")
CR4-2C-4SI	0.29	4.2	1/4" Flaretek, "SpaceSaver" inlet*	90.4 mm (3.56")
CR4-2C-4SO	0.29	4.2	1/4" Flaretek, "SpaceSaver" outlet*	90.4 mm (3.56")
CR4-2C-6F	0.84	12.0	3/8" Flaretek	88.9 mm (3.50")
CR4-2C-6SI	0.84	12.0	3/8" Flaretek, "SpaceSaver" inlet*	95.5 mm (3.76")
CR4-2C-6SO	0.84	12.0	3/8" Flaretek, "SpaceSaver" outlet*	95.5 mm (3.76")
NORMALLY OPEN				
CR4-2U-4F	0.29	4.2	1/4" Flaretek	85.3 mm (3.36")
CR4-2U-4N	0.84	12.0	1/4" FNPT	69.8 mm (2.75")
CR4-2U-4P	0.84	12.0	1/4" PureBond	68.1 mm (2.68")
CR4-2U-4SI	0.29	4.2	1/4" Flaretek, "SpaceSaver" inlet*	90.4 mm (3.56")
CR4-2U-4SO	0.29	4.2	1/4" Flaretek, "SpaceSaver" outlet*	90.4 mm (3.56")
CR4-2U-6F	0.84	12.0	3/8" Flaretek	88.9 mm (3.50")
CR4-2U-6SI	0.84	12.0	3/8" Flaretek, "SpaceSaver" inlet*	95.5 mm (3.76")
CR4-2U-6SO	0.84	12.0	3/8" Flaretek, "SpaceSaver" outlet*	95.5 mm (3.76")

**Dimension "A" with "SpaceSaver" nut*

Note: Contact factory if "SpaceSaver" port connections are to be used in media containing a fluorinated surfactant.

For More Information

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