

**TITLE**

Vibration and Thermal Cycle Testing of Swagelok® VCR® Metal Gasket Face Seal Fittings

**PRODUCT TESTED**

Swagelok Ordering Number	Description	Quantity Tested
6LV-4-VCR-3-4TB7	1/4 in. VCR Gland	24
SS-4-VCR-2-GR	1/4 in. VCR SS Silver Plated Retained Gasket Assembly	12
SS-4-VCR-1	1/4 in. VCR Female Nut	12
SS-4-VCR-4	1/4 in. VCR Male Nut	12
6L-TB4-035EP-5088	1/4 in. x .035 Tubing, 5.088 in. long	24

**PURPOSE**

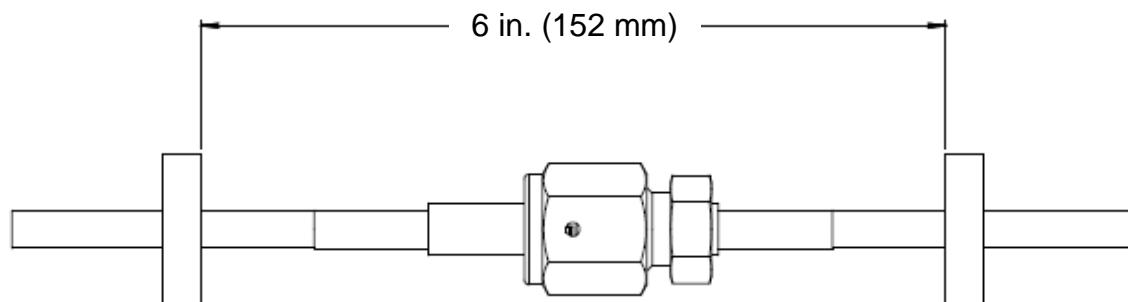
These fitting assemblies were tested to observe the vibration cycle life and thermal cycle performance of 1/4 in. Swagelok VCR metal gasket face seal fittings under laboratory conditions.

**TEST CONDITIONS**

Original test date: February 2004

Vibration testing – ambient room temperature: ~70°F (20°C)

Thermal cycle testing—System Pressure: 0.75 millitorr (0.001 mbar) to 45 psig (3.1 bar)  
—System Temperature: 72 to 400°F (22 to 204°C)

**TEST METHOD****Vibration Test**

**Figure 1**

1. Constructed 12 test samples from parts list and Figure 1 above to an appropriate length that allowed for a 6 in. unsupported length. Assembled the VCR fittings to one-eighth turn past finger-tight.
2. Conducted inboard helium leak test at ambient temperature using the helium leak detector.
  - o Vacuum rate was 0.75 millitorr (0.001 mbar).
  - o Pumped down to leak rate limit without helium.
  - o Sprayed helium in weep holes of VCR nuts, recorded any rise in leak rate.
3. Conducted vibration test with 12 samples according to MIL-STD-810F, Section 514.5, Table 514.5C-VII – U.S. Highway Truck Vibration Exposures.
4. Conducted the test for a period of 3 hours in the vertical, longitudinal, and transverse axes, to simultaneous vibration frequencies from 0 to 500 Hz in increments of 0.625 Hz at the amplitudes listed in Table 1.
5. Repeated inboard helium leak test according to step 2.

U.S Highway Truck Vibration Exposures					
Vertical Axis		Transverse Axis		Longitudinal Axis	
Hz	g <sup>2</sup> /Hz	Hz	g <sup>2</sup> /Hz	Hz	g <sup>2</sup> /Hz
10	0.01500	10	0.00013	10	0.00650
40	0.01500	20	0.00065	20	0.00650
500	0.00015	30	0.00065	120	0.00020
1.04 g rms	78	0.00002	121	0.00300	
	79	0.00019	200	0.00300	
	120	0.00019	240	0.00150	
	500	0.00001	340	0.00003	
	0.204 g rms		500	0.00015	0.740 g rms

MIL-STD-810F, Section 514.5, Table 514.5C-VII

**Table 1**

### **Thermal Cycle Test**

1. Mounted multiple fittings to a test tree to allow for multiple samples to be tested simultaneously. The 6 samples were taken from the vibration test samples.
2. Conducted inboard helium leak test (HLT) at ambient temperature, using the helium leak detector.
  - o Vacuum rate was 0.75 millitorr (0.001 mbar).
  - o Pumped down to leak rate limit without helium.
  - o Sprayed helium in weep holes of VCR nuts, record any rise in leak rate
3. Using sample cylinder, pressurized test samples with nitrogen gas to 45 psig (3.1 bar) for 10 minutes.
4. After testing was completed, removed samples from HLT, and placed in oven and heated temperature to 400°F (204°C). Repeated step 2.
5. Repeated steps 2 through 4 for two complete temperature cycles.



## Product Test Report

PTR-3523

Swagelok Semiconductor  
Services Company  
29495 F. A. Lennon Drive  
Solon, Ohio 44139 U.S.A.

Ver 03  
November 2022  
Page 3 of 3

### TEST RESULTS

#### Vibration Test

Samples Tested	Inboard HLT Background Requirement std cm <sup>3</sup> /s	HLT Results Prior to Vibration	HLT Results After Vibration
12	$4 \times 10^{-9}$	All Passed	All Passed

#### Thermal Cycle Test

Samples Tested	Inboard HLT Background Requirement std cm <sup>3</sup> /s	HLT Results			
		1st Thermal Cycle		2nd Thermal Cycle	
		400°F (204°C)	Ambient	400°F (204°C)	Ambient
6	$4 \times 10^{-9}$	All Passed	All Passed	All Passed	All Passed

These tests were performed to consider a specific set of conditions and should not be considered valid outside those conditions. Swagelok Company makes no representation or warranties regarding these selected conditions or the results attained. Laboratory tests cannot duplicate the variety of actual operating conditions. Test results are not offered as statistically significant. See the product catalog for technical data.

#### SAFE PRODUCT SELECTION

When selecting a product, 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.

#### Referenced Documents

MIL-STD-810F, *Environmental Engineering Considerations and Laboratory Tests*, Department of Defense Document Automation & Production Service, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, <http://www.dod.mil/pubs/about.html>

Swagelok, VCR—TM Swagelok Company