



Product Test Report

Swagelok Company
29500 Solon Road
Solon, Ohio 44139 U.S.A.

PTR-1388
Ver 05
September 2022
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TITLE

Outboard Helium Leak Test of 316 Stainless Steel Swagelok® Tube Fittings at Cryogenic Temperature

PRODUCT TESTED

The following 316 stainless steel Swagelok tube fittings were tested with the identified stainless steel tubing.

Ordering Number	Quantity Tested	Tubing in.	Tubing Hardness HRB
SS-400-6	8	1/4 × 0.028	85
SS-400-9	8		
SS-400-P	8		
SS-600-6-4	8	3/8 × 0.035	77
SS-600-9	8		
SS-600-P	8		
SS-810-6-4	8	1/2 × 0.049	75
SS-810-9	8		
SS-810-P	8		
SS-1210-6-4	8	3/4 × 0.065	75
SS-1210-9	8		
SS-1210-P	8		
SS-1610-6-4	8	1 × 0.083	77
SS-1610-9	8		
SS-1610-P	8		

PURPOSE

These assemblies were tested to observe performance of 316 stainless steel Swagelok tube fittings at cryogenic temperature when pressurized with helium at the rated pressure of the tubing under laboratory conditions and compare to industry regulations *ECE Regulation No. 110* and *EHIP Rev. 12B Draft*.

TEST CONDITIONS

Original test date: February 2007

Each sample tested consisted of one tube length and two test fittings. The fitting was assembled according to the Swagelok tube fitting installation instructions.

TEST METHOD

Mass Spectrometry (Outboard Leakage Test —Detector Probe Method)

1. The Detector Probe method was used to measure the helium leakage of the test sample.
2. The test sample was pressurized with helium to the specified test pressure at room temperature and the detector probe was used to check each connection for leakage.



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3. The test sample was submerged into the liquid nitrogen at -325°F (-200°C), and the helium pressure was adjusted to maintain the specified test pressure.
4. The test sample was soaked for at least 10 minutes to ensure thermal stabilization.
5. After stabilization the test sample was raised above the surface of the liquid nitrogen and the detector probe was used to check each connection for leakage. The test sample temperature stabilized at -304°F (-186°C) when raised above the surface of the liquid nitrogen.
6. The test sample was exposed to ambient room temperature until all frost and condensation was removed. The helium pressure was adjusted to maintain the specified test pressure.
7. The test sample was cycled from room temperature to cryogenic temperature 3 times and was tested for leakage each time.
8. The judgment criteria were leakage less than the values listed in industry regulations *ECE Regulation No. 110* and *EHP Rev. 12B Draft*.
 - *ECE Regulation No. 110* lists a maximum leak rate of $15\text{ cm}^3/\text{hr}$ ($4.2 \times 10^{-3}\text{ std cm}^3/\text{s}$)
 - *EHP Rev. 12B Draft* lists a maximum leak rate of $10\text{ cm}^3/\text{hr}$ ($2.8 \times 10^{-3}\text{ std cm}^3/\text{s}$)

TEST RESULTS

The Swagelok tube fitting meets and outperforms these industry regulation leak rate requirements while experiencing cyclic exposure to cryogenic temperatures at the rated working pressure of the tubing.

Mass Spectrometry (Outboard Leakage Helium)				
Ordering Number	Quantity Tested	Tubing in.	Test Pressure psig (bar)	Test Result
SS-400-6	8	1/4 x 0.028	4000 (275)	Passed
SS-400-9	8			
SS-400-P	8			
SS-600-6-4	8	3/8 x 0.035	3300 (227)	Passed
SS-600-9	8			
SS-600-P	8			
SS-810-6-4	8	1/2 x 0.049	3700 (254)	Passed
SS-810-9	8			
SS-810-P	8			
SS-1210-6-4	8	3/4 x 0.065	3300 (227)	Passed
SS-1210-9	8			
SS-1210-P	8			
SS-1610-6-4	8	1 x 0.083	3100 (213)	Passed
SS-1610-9	8			
SS-1610-P	8			



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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

ECE Regulation No. 110, *Uniform provisions concerning the approval of specific components of motor vehicles using compressed natural gas (CNG) in their propulsion system, dated 2001-06-19, incl. Corrigendum 2 of 2001-08-03*, UNECE United Nations Economic Commission for Europe

EIHP Rev. 12B Draft, *Uniform provisions concerning the approval of specific components of motor vehicles using compressed gaseous hydrogen, dated 2003-12-10*, UNECE United Nations Economic Commission for Europe

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