



## Product Test Report

PTR-2853

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

Ver 03  
November 2018  
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### TITLE

Nitrogen Gas Seal Test with Repeated Reassembly of Super Austenitic 254 SMO® Stainless Steel (6-moly) Tubing with Stainless Steel Swagelok® Tube Fittings

### PRODUCT TESTED

| Samples Tested | 254 SMO SS Tubing Size OD x Wall in. | Tubing Hardness HRB | Working Pressure psig (bar) | Part Description Ordering Number | Part Description Ordering Number |
|----------------|--------------------------------------|---------------------|-----------------------------|----------------------------------|----------------------------------|
| 12             | 1/4 x 0.028                          | 85                  | 4000 (275)                  | Union Straight SS-400-6          | Union Elbow SS-400-9             |
| 12             | 1/4 x 0.065                          | 95                  | 10 200 (702)                | Union Straight SS-400-6          | Union Elbow SS-400-9             |
| 12             | 1/2 x 0.035                          | 87                  | 2600 (179)                  | Union Straight SS-810-6          | Union Elbow SS-810-9             |
| 12             | 1/2 x 0.083                          | 87                  | 6700 (461)                  | Union Straight SS-810-6          | Union Elbow SS-810-9             |
| 12             | 3/4 x 0.095                          | 90                  | 4900 (337)                  | Union Straight SS-1210-6         | Union Elbow SS-1210-9            |
| 12             | 1 x 0.083                            | 85                  | 3600 (248)                  | Union Straight SS-1610-6         | Union Elbow SS-1610-9            |
| 12             | 1 x 0.120                            | 86                  | 3600 (248)                  | Union Straight SS-1610-6         | Union Elbow SS-1610-9            |

### PURPOSE

These assemblies were tested under laboratory test conditions to observe the gas seal reassembly performance of stainless steel Swagelok tube fittings when installed on 254 SMO stainless steel tubing.

### TEST CONDITIONS

Original Test Date: October 2011

- Each sample tested consisted of one tube length and two test fittings. The fittings were assembled according to the Swagelok tube fitting installation instructions.
- Testing was completed in a room temperature laboratory environment.



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### TEST METHOD

#### Hardness Measurements of Tubing:

1. Performed five measurements equally spaced apart on each tube OD with the United Hardness Tester using the 15-T scale with the 1/16-inch diameter ball penetrator.
2. Reported the average of the five measurements.
3. Added the tubing cylindrical values taken from the Wilson Chart #53 Cylindrical Conversion Table.
4. Used the ASTM E140 Table 6—Austenitic Stainless Steel hardness conversion chart to convert the 15-T readings to the HRB values.

#### Gas Seal Testing

1. The samples were attached to a positive pressure gas test stand, submerged in water, and pressurized to working pressure with nitrogen gas for at least 10 minutes.
2. If leakage was observed, the pressure was dropped and samples showing leaks were tightened with a 1/8 turn-of-the-nut tightening. Step 1 was then repeated.
3. If leakage was not observed, the pressure was increased to 1.25 times working pressure for at least 10 minutes.

#### Gas Seal Reassembly Testing

4. The pressure was dropped, and the samples were disassembled and reassembled according to Swagelok reassembly instructions.
5. The samples were tested for at least 10 minutes at 1 times working pressure and 1.25 times working pressure.
6. Steps 4 and 5 were repeated at the reassembly points described in the test results tables. The acceptance criterion was less than 1 bubble per minute at the applied pressure.

### TEST RESULTS

| Tubing Size<br>OD × Wall<br>in. | 1.25 × WP<br>psig (bar) | End<br>Connections<br>Tested | Number of Acceptable Samples                         |   |  |
|---------------------------------|-------------------------|------------------------------|--|---|--|
|                                 |                         |                              | After<br>Standard<br>Assembly<br>and Initial<br>Test | After<br>Additional<br>1/8 Turn<br>and Retest | After 1, 5, 10,<br>15, 20 and 25<br>Reassemblies |
| 1/4 × 0.028                     | 5000 (344)              | 24                           | 24 / 24  | Not applicable                                | 24 / 24  |
| 1/4 × 0.065                     | 12 750 (878)            | 24                           | 24 / 24  | Not applicable                                | 24 / 24  |
| 1/2 × 0.035                     | 3250 (223)              | 24                           | 24 / 24  | Not applicable                                | 24 / 24  |
| 1/2 × 0.083                     | 8375 (577)              | 24                           | 21 / 24  | 3/3 <sup>①</sup>                              | 23 / 24 <sup>②</sup>                             |

① For tubing using gas at high-pressure, use of the Swagelok installation instructions for High-Pressure Applications and High Safety-Factor Systems is appropriate. Samples demonstrating leakage were tightened an additional 1/8 turn as defined in the test method simulating the High-Pressure Applications and High Safety-Factor Systems instructions. Nitrogen gas testing resulted in no detectable leakage of the re-tested samples.

② One fitting end leaked at reassemblies 1 and 5, but sealed upon subsequent reassemblies.



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| Tubing Size<br>OD x Wall<br>in. | 1.25 x WP<br>psig (bar) | End<br>Connections<br>Tested | Number of Acceptable Samples                         |   |  |
|---------------------------------|-------------------------|------------------------------|--|---|--|
|                                 |                         |                              | After<br>Standard<br>Assembly<br>and Initial<br>Test | After<br>Additional<br>1/8 Turn<br>and Retest | After 1, 5,<br>and 10,<br>Reassemblies |
| 3/4 x 0.095                     | 6125 (422)              | 24                           | 24 / 24  | Not applicable                                | 24 / 24                                |
| 1 x 0.083                       | 4500 (310)              | 24                           | 24 / 24  | Not applicable                                | 24 / 24                                |
| 1 x 0.120                       | 4500 (310)              | 24                           | 24 / 24  | Not applicable                                | 24 / 24                                |

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

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 there from. 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

*Wilson Cylindrical Correction Chart # 53*, Wilson Instrument Division, 929 Connecticut Avenue, Bridgeport, CT 06602

ASTM E140, *Table 6—Approximate Hardness Conversion Numbers for Austenitic SS*, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2858