# Product Test Report



Swagelok Company
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## TITLE

Nitrogen Gas Seal Test with Repeated Reassembly of 316 Stainless Steel Swagelok® Tube Fittings with Thin-Wall Stainless Steel Tubing

## PRODUCT TESTED

The following bar stock and forged body Swagelok tube fittings were tested with 316 stainless steel seamless tubing.

| Ordering Number | Part Form | Tubing Size | Tubing Hardness HRB |
|---|---|---|---|
| **Fractional**, in. | | | |
| SS-400-1-4 | Bar stock | 1/4 × 0.028 | 77 to 84 |
| SS-400-9 | Forging | | |
| SS-500-1-4 | Bar stock | 5/16 × 0.035 | 84 |
| SS-500-9 | Forging | | |
| SS-600-1-4 | Bar stock | 3/8 × 0.035 | 88 |
| SS-600-9 | Forging | | |
| SS-810-1-4 | Bar stock | 1/2 × 0.049 | 76 |
| SS-810-9 | Forging | | |
| **Metric**, mm | | | |
| SS-6M0-1-4 | Bar stock | 6 × 0.8 | 79 |
| SS-6M0-9 | Forging | | |
| SS-10M0-1-4 | Bar stock | 10 × 1.0 | 82 |
| SS-10M0-9 | Forging | | |
| SS-12M0-1-4 | Bar stock | 12 × 1.0 | 83 |
| SS-12M0-9 | Forging | | |

## PURPOSE

These assemblies were tested to observe the performance of stainless steel Swagelok tube fittings with advanced geometry back ferrules with thin-wall stainless steel tubing during a gas seal test with repeated reassembly under laboratory conditions.

## TEST CONDITIONS

Original test date: December 2001

**Tube preparation:**
Tubing samples were cut to length using a tube cutter for 1/2 in. diameter and under.

**Fitting assembly:**
The test fittings and tubing were initially assembled 1 1/4 turns past finger-tight per Swagelok tube fitting installation instructions.

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## TEST METHOD

1. The assemblies were attached to a positive pressure gas test stand, submerged in water, pressurized to working pressure with nitrogen gas for at least 10 minutes and monitored for leakage.
2. Pressure was dropped, and the fittings were reassembled according to the proper Swagelok reassembly specifications.
3. The fittings were leak tested using nitrogen gas at the working pressure for at least 10 minutes at every fifth reassembly.
4. A total of 25 reassemblies were conducted on each test end.

## TEST RESULTS

**Fractional**

| **Size** in. | **Samples Tested** | **Working Pressure** psig (bar) | **Results** |
|---|---|---|---|
| 1/4 × 0.028 | 16 | 4000 (275) | Pass |
| 5/16 × 0.035 | 16 | 4000 (275) | Pass |
| 3/8 × 0.035 | 16 | 3300 (227) | Pass |
| 1/2 × 0.049 | 16 | 3700 (254) | Pass① |

**Metric**

| **Size** mm | **Samples Tested** | **Working Pressure** bar (psig) | **Results** |
|---|---|---|---|
| 6 × 0.8 | 8 | 320 (4599)② | Pass |
| 10 × 1.0 | 16 | 240 (3483) | Pass① |
| 12 × 1.0 | 8 | 200 (2912) | Pass |

① One ½ in. sample experienced an estimated 0.05 std $cm^3$/min leak rate at the $15^{th}$ reassembly, and one 10 mm sample experienced an estimated 0.1 std $cm^3$/min leak rate at the $10^{th}$ reassembly, both due to improper re-tightening of the nut. After an additional tightening, the samples were re-tested with no detectable leakage.

② These tube sizes were tested at a lower working pressure because the original testing was performed prior to the update of some metric pressure ratings in Swagelok's *Tubing Data Sheet* (MS-01-107) in 2021. These ratings were increased slightly to align with metric allowable stresses that had been added to ASME B31.3, Code for Process Piping, and were supported by Swagelok's calculations and legacy burst data.

No detectable leakage (except as indicated) was observed on any of the products tested during initial testing and after the $5^{th}$, $10^{th}$, $15^{th}$, $20^{th}$, and $25^{th}$ reassemblies.
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

MS-01-107, *Tubing Data Sheet,* Swagelok Company, 29500 Solon Rd, Solon, OH 44139, www.swagelok.com

ASME B31.3, *Process Piping, ASME Code for Pressure Piping, B31,* ASME International, Three Park Avenue, New York, NY 10016-5990, www.asme.org