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

TITLE

High-Temperature Thermal Cycling and Hydrostatic Proof Test of Alloy 825 Tubing with Stainless Steel Swagelok® Tube Fittings

PRODUCT TESTED

Samples Tested	Alloy 825 Tubing Size OD × Wall in.	Tubing Hardness 15T	Part Description Ordering Number	Part Description Ordering Number
4	1/4 × 0.035	86	Union Straight SS-400-6	Union Elbow SS-400-9
4	1/4 × 0.065	83	Union Straight SS-400-6	Union Elbow SS-400-9
4	3/8 × 0.035	85	Union Straight SS-600-6	Union Elbow SS-6400-9
4	3/8 × 0.065	82	Union Straight SS-600-6	Union Elbow SS-600-9
4	1/2 × 0.049	86	Union Straight SS-810-6	Union Elbow SS-810-9
4	1/2 × 0.065	84	Union Straight SS-810-6	Union Elbow SS-810-9
4	3/4 × 0.065	83	Union Straight SS-1210-6	Union Elbow SS-1210-9
4	3/4 × 0.095	84	Union Straight SS-1210-6	Union Elbow SS-1210-9
4	1 × 0.083	82	Union Straight SS-1610-6	Union Elbow SS-1610-9
4	1 × 0.109	85	Union Straight SS-1610-6	Union Elbow SS-1610-9

PURPOSE

These assemblies were tested under laboratory test conditions to observe the leak-tight performance (during and after thermal cycling) of stainless steel Swagelok tube fittings when installed on alloy 825 tubing.

TEST CONDITIONS

Original test date: November 2014

Laboratory environment

TEST METHOD

Hardness Measurements of Tubing:

1. Performed five measurements equally spaced apart on each tube OD 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.

High-Temperature Thermal Cycling Procedure:

1. Assembled one tube length with one union straight and one union elbow according to the Swagelok tube fitting installation instructions.
2. Attached the test samples to a high-temperature furnace and pressurized with nitrogen to test pressure.
3. Increased the samples to test temperature of 800°F (426°C) within a period of one hour. The samples were allowed to stabilize at temperature for a minimum of 2 hours while being monitored for pressure decay.
4. The temperature was then lowered to laboratory room temperature (within one hour) while the test pressure was maintained. Samples were then stabilized at room temperature for a minimum of two hours while being monitored for pressure decay.
5. Repeated the above cycle two additional times.
6. Monitored the samples for leakage during the test; the pass criterion was no pressure decay.

Hydrostatic Proof Test Procedure:

1. Upon completion of the high-temperature thermal cycling procedure, the samples were subjected to a hydraulic proof test at ambient laboratory temperature.
2. Samples were pressurized to 100 psig (6.8 bar) and held for a period of five minutes.
3. After 5 minutes at 100 psig (6.8 bar), the samples were pressurized to test pressure (1.5 times ambient working pressure) and held for an additional period of 5 minutes.
4. Monitored the samples for leakage throughout the test; the pass criterion was no visible leakage.

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TEST RESULTS

High-Temperature Thermal Cycle Test

Alloy 825 Tubing Size OD × Wall in.	Ambient Working Pressure① psig (bar)	Test Pressure at Elevated Temperature① psig (bar)	Test Results
1/4 × 0.035	6400 (440)	5056 (348)	Pass
1/4 × 0.065	10 200 (702)	8058 (555)	Pass
3/8 × 0.035	4100 (282)	3239 (223)	Pass
3/8 × 0.065	7500 (516)	5925 (408)	Pass
1/2 × 0.049	4300 (296)	3397 (234)	Pass
1/2 × 0.065	5900 (406)	4661 (321)	Pass
3/4 × 0.065	3800 (261)	3002 (206)	Pass
3/4 × 0.095	5800 (399)	4582 (315)	Pass
1 × 0.083	3600 (248)	2844 (195)	Pass
1 × 0.109	4200 (289)	3318 (228)	Pass

① A de-rating factor of 0.79 was applied to the ambient working pressures to determine the test pressures.

Hydrostatic Proof Test

Alloy 825 Tubing Size OD × Wall in.	Proof Test Pressure psig (bar)	Test Results
1/4 × 0.035	9600 (661)	Pass
1/4 × 0.065	15 300 (1054)	Pass
3/8 × 0.035	6150 (423)	Pass
3/8 × 0.065	11 250 (775)	Pass
1/2 × 0.049	6450 (444)	Pass
1/2 × 0.065	8850 (609)	Pass
3/4 × 0.065	5700 (392)	Pass
3/4 × 0.095	8700 (599)	Pass
1 × 0.083	5400 (372)	Pass
1 × 0.109	6300 (434)	Pass

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. 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