



Product Test Report

PTR-2849

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

Ver 04
November 2018
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TITLE

Hydraulic Impulse Test and Hydrostatic Proof Test of Super Austenitic 254 SMO® (6-moly) Stainless Steel 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
6	1/4 x 0.028	84	4000 (275)	Union Straight SS-400-6	Union Elbow SS-400-9
6	1/4 x 0.065	96	10 200 (702)	Union Straight SS-400-6	Union Elbow SS-400-9
6	1/2 x 0.035	87	2600 (179)	Union Straight SS-810-6	Union Elbow SS-810-9
6	1/2 x 0.083	86	6700 (461)	Union Straight SS-810-6	Union Elbow SS-810-9
6	3/4 x 0.049	86	3300 (227)	Union Straight SS-1210-6	Union Elbow SS-1210-9
6	3/4 x 0.095	90	4900 (337)	Union Straight SS-1210-6	Union Elbow SS-1210-9
6	1 x 0.065	83	3300 (227)	Union Straight SS-1610-6	Union Elbow SS-1610-9
6	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 hydraulic performance (during and after impulse testing) of stainless steel Swagelok tube fittings when installed on 254 SMO stainless steel tubing.

TEST CONDITIONS

Original Test Date: October 2011

Laboratory environment

TEST METHOD

Hardness Measurements of Tubing:

1. Performed five measurements equally spaced apart on each tube O.D. 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.



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Impulse Test with Repeat Assembly (Reference ASTM F1387):

1. Assembled one tube length with one union straight and one union elbow according to Swagelok assembly procedures.
2. Prior to impulse testing, some of the samples were identified for repeat assembly according to ASTM F1837 Annex A9. These samples were disassembled and reassembled once according to Swagelok procedures. In order to reseal the ferrules at a different location, the disassembled samples were rotated approximately 90° between each disassembly / reassembly cycle.
3. Impulse testing was then performed according to ASTM F1387 Annex A5. The samples were attached to an impulse stand, pressurized with hydraulic oil to 133 +/- 5 % of the working pressure, and then depressurized to 20 +/- 5 % of the working pressure. This constituted one impulse cycle.
4. Impulse cycles were modeled with a square waveform, and cycling continued for 1 000 000 cycles at a rate of one Hz (one cycle per second) with the rate not exceeding 75 cycles per minute.
5. At the conclusion of 250 000 impulse cycles, the samples identified for repeat assembly were disassembled and reassembled twice as described in step 2.
6. This cycling and reassembly process was repeated with two remakes of the identified samples at the conclusion of 500 000, 750 000, and 1 000 000 of the impulse cycles. There were 9 total reassemblies for the repeat assembly samples.
7. Monitored the samples for leakage during the test; the pass criterion was no visible leakage.

Hydrostatic Proof Test Procedure (Reference ASTM F1387 Annex A4):

1. Upon completion of the Impulse Test with Repeat Assembly, the samples were subjected to a hydrostatic 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 150 % (+/- 5%) of the 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

Impulse Test with Repeat Assembly

254 SMO SS Tubing Size OD x Wall in.	Impulse Test Pressure Cycle psig (bar)	Samples Tested	Number of Reassemblies at % of 1 000 000 Total Cycles					Results
			0 % (Prior to Impulse)	25 %	50 %	75 %	100 %	
1/4 x 0.028	800 to 5320 (55.1 to 366)	2	Not required					Pass
		4	1	2	2	2	2	Pass
1/4 x 0.065	2040 to 13 566 (140 to 934)	2	Not required					Pass
		4	1	Pass	2	2	2	Pass
1/2 x 0.035	520 to 3458 (35.8 to 238)	2	Not required					Pass
		4	1	Pass	2	2	2	Pass
1/2 x 0.083	1340 to 8911 (92.3 to 613)	2	Not required					Pass
		4	1	Pass	2	2	2	Pass
3/4 x 0.049	660 to 4400 (45.4 to 303)	2	Not required					Pass
		4	1	2	2	2	2	Pass
3/4 x 0.095	980 to 6500 (67.5 to 447)	2	Not required					Pass
		4	1	Pass	2	2	2	Pass
1 x 0.065	660 to 4400 (45.4 to 303)	2	Not required					Pass
		4	1	Pass	2	2	2	Pass
1 x 0.120	720 to 4800 (49.6 to 330)	2	Not required					Pass
		4	1	Pass	2	2	2	Pass

Hydrostatic Proof Test

254 SMO SS Tubing Size OD x Wall in.	Samples Tested	Proof Test Pressure psig (bar)	Test Results
1/4 x 0.028	6	6000 (413)	Pass
1/4 x 0.065	6	15 300 (1054)	Pass
1/2 x 0.035	6	3900 (268)	Pass
1/2 x 0.083	6	10 050 (692)	Pass
3/4 x 0.049	6	4950 (341)	Pass
3/4 x 0.095	6	7350 (506)	Pass
1 x 0.065	6	4950 (341)	Pass
1 x 0.120	6	5400 (372)	Pass



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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

ASTM F1387-99, *Standard Specification for Performance of Piping and Tubing Mechanically Attached Fittings*, American Society of Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428