

TITLE

Cleanability Study of Swagelok® PTFE and PFA Crimped Hoses

PRODUCT TESTED

The tested products included two different model hoses from the Swagelok hose family. See Table 1 below for details.

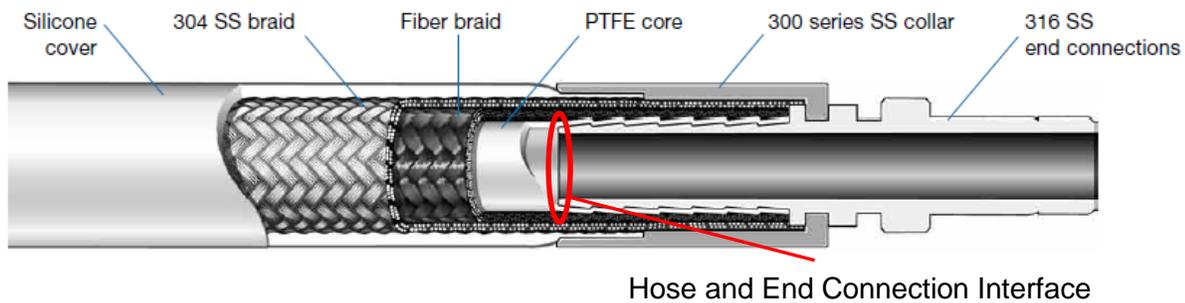
Table 1: Tested Product Information

Hose Series	Ordering Number	Quantity	Hose Overall Length in. (cm)	Hose Inner Diameter in. (mm)
S	SS-ST16KC16KC16-30	3	30 (76.2)	1.0 (25.4)
U	SS-UT16KC16KC16-30	3	30 (76.2)	1.0 (25.4)

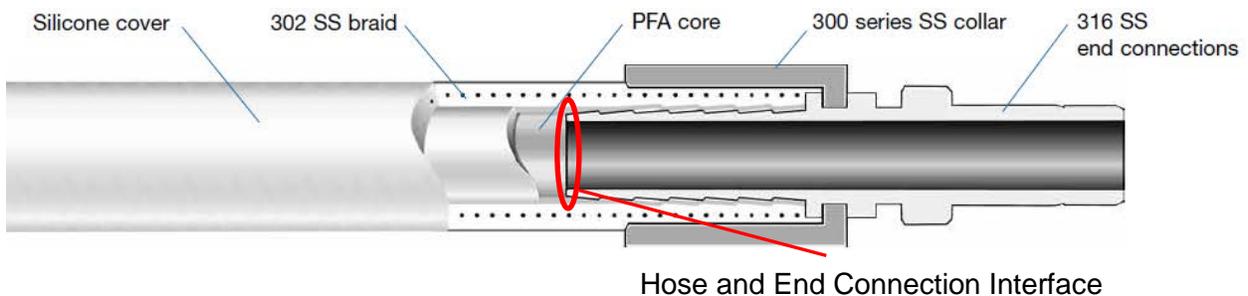
PURPOSE

These hose assemblies were tested under laboratory conditions by a third party to observe the cleanability of the hose and end connection interface (shown in the figures below) of Swagelok S and U series hose.

S Series PTFE Hose



U Series PFA Hose





Product Test Report

PTR-3294

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

Ver 05

July 2022

Page 2 of 5

TEST CONDITIONS

Original test date: October 2013

- External temperature: room temperature 70°F (20°C)
- Soiling media: solution containing protein and color, which simulates contamination present on the interior surface of the hoses after actual use
- Rinse media: deionized water (approx. 1 MΩ resistivity)
- Rinse media temperature: room temperature 70°F (20°C)
- Average flow rate: 9.4 gal/min (36 L/min)
 - Based on a velocity of 5 ft/s (1.5 m/s)
- Reynolds number: approx. 30 000
- Rinse time: 1 minute
- Cycles:
 1. Downward flow
 2. Upward flow

Acceptance Criteria

A scale based on the European Hygienic Engineering & Design Group (EHEDG) and industry practices for cleanability were used to assess the cleanliness of the tested hoses.

Cleaning Assessment Scale

CLEAN— The hose is deemed “clean” with a score of “5” if it does not have any residual soil on its inner surface at the hose and end connection interface at the specified flow conditions at the end of the designated rinse period.

SOILED—The hose is deemed “not clean” if it has residual soil on its inner surface at the hose and end connection interface at the specified flow conditions at the end of the designated rinse period. The score will be a “1” thru “4”. Specific degrees of cleanliness are ranked by the percentage of surface area/amount of residual soil at the hose and end connection interface.

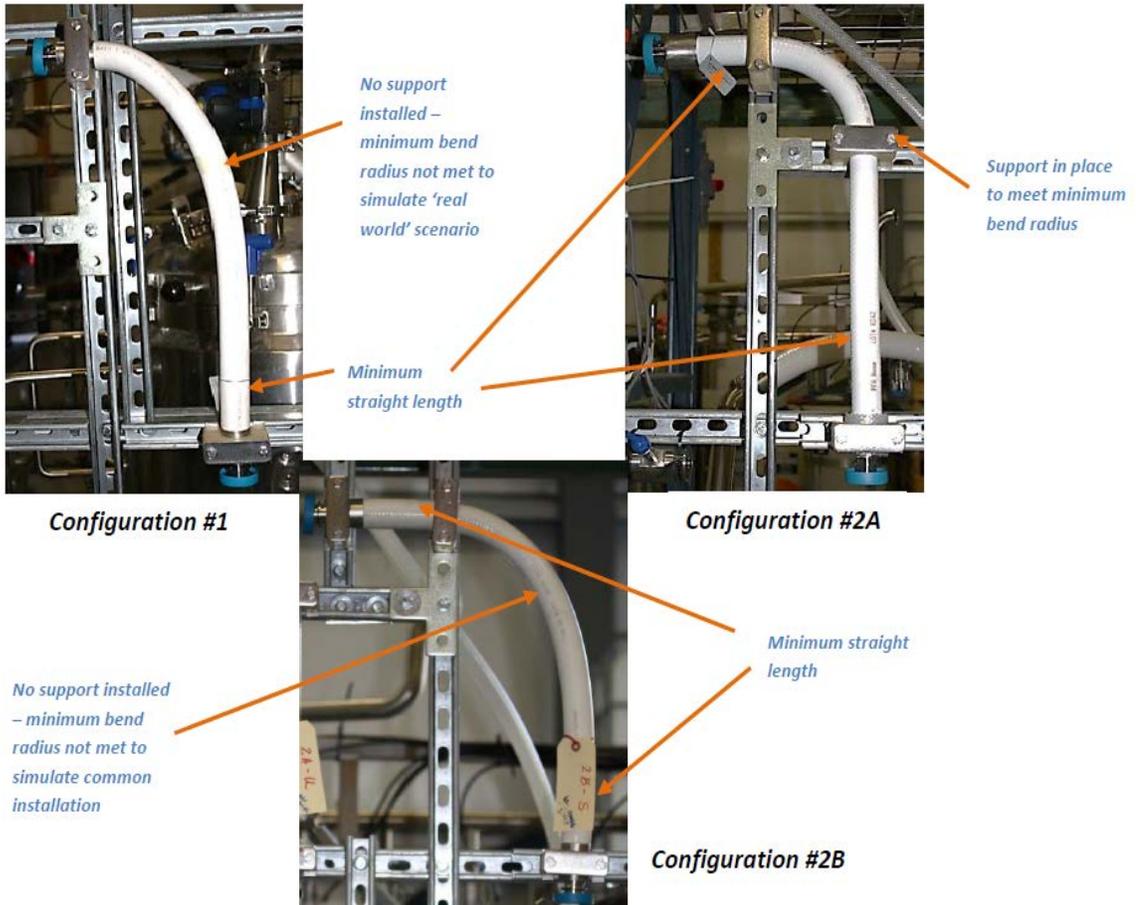
- 5 = greatest degree of cleanliness (complete absence of residual soil) = 100 % clean.
- 4 = 75 to 99 % clean, small spots of soil present
- 3 = 50 to 75 % clean, large spots of soil present
- 2 = 25 to 50 % clean, more than half of the interface is covered with soil
- 1 = least degree of cleanliness (significant amount of residual soil) = 0 to 25 % clean, the majority of the interface is covered with soil

Hose Configurations

Table 2: Hose Test Configurations

Hose Configuration ID	Hose Type	Configuration Properties
1	U Series	Elbow without MBR/support, support on horizontal collar
	S Series	
2A	U Series	Elbow with MBR/support, support at MSL on horizontal
	S Series	
2B	U Series	Elbow without MBR/support, support at MSL on horizontal
	S Series	

Abbreviations: MBR = Minimum Bend Radius, MSL = Minimum Straight Length





Product Test Report

PTR-3294

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

Ver 05

July 2022

Page 4 of 5

TEST METHOD

1. The hose assembly was set up for testing based on the desired test configuration.
2. Inner surface of the hose was examined using a borescope to observe pre-soiling conditions.
3. Soiling medium was applied and allowed to dry.
4. Inner surface of the hose was examined using a borescope to observe post-soiling conditions and to make sure that the soiling medium was adequately applied.
5. The hose was then rinsed using the rinse conditions stated above for 1 minute.
6. Inner surface of the hose was examined using a borescope to observe post-rinsing conditions.
7. Hose and end connection interface was then assessed and graded based on the cleanability scale shown above.

TEST RESULTS

The hose and end connection interface of Swagelok S and U series hose assemblies received a grade "5" level of clean (complete absence of residual soil, 100 % clean) according to EHEDG standards, with the exception of the 2B configuration of the S series hose with an upward rinse cycle.

Table 3: Cleanability Grades Based on EHEDG Standards

Hose Configuration ID	Hose Type	Hose Configuration	Hose and End Connection Interface Grade	
			Downward Rinse Cycles	Upward Rinse Cycles
1	U Series	Elbow without MBR/ support, support on horizontal collar	5	5
2A		Elbow with MBR/ support, support at MSL on horizontal	5	5
2B		Elbow without MBR/ support, support at MSL on horizontal	5	5
1	S Series	Elbow without MBR/ support, support on horizontal collar	5	5
2A		Elbow with MBR/ support, support at MSL on horizontal	5	5
2B		Elbow without MBR/ support, support at MSL on horizontal	5	4

Abbreviations: MBR = Minimum Bend Radius, MSL = Minimum Straight Length



Product Test Report

PTR-3294

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

Ver 05
July 2022
Page 5 of 5

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.

Swagelok—TM Swagelok Company