INTERCHANGE/INTERMIX

SSP Unilok® vs. Parker-Hannifin CPI™

TUBE FITTINGS

TECHNICAL REPORT

January 2011

8250 Boyle PKWY
Twinsburg, OH 44087-2200, USA

Table 1: Contents

Table 1.0, Contents

Introduction

Since 1970, Parker CPI™ Instrumentation Tube Fittings have been designed as leak-free connections for process, power and instrumentation applications. The Parker CPI™ single ferrule system requires only two metal-to-metal seal points to effect a leak-tight seal. These seals are to the fitting and to the tubing. The Parker CPI™ tube fitting is designed so that repeated remakes will not affect sealing performance. Even in the over-made condition sealing ability is excellent. The single-ferrule design is responsible for this performance. The Parker CPI™ single ferrule design allows the ferrule to bow during make-up. The bowing action of the ferrule creates an active element that can expand and contract with temperature cycling and maintain a leak-tight seal.[1]

In 1993 in response to continued customer requests for an alternative product offering in the Instrumentation marketplace, strategic plans were developed within SSP to design, manufacture and distribute American manufactured, Instrumentation quality tube fittings as a direct alternative to the registered trademark brand of Parker CPI ™. Following an ISO 9001 design process pattern, the critical elements of design planning, including the detailed documentation of design inputs and outputs occurred for the development of **Unilok®** tube fittings.

To accomplish the required design plan tasks of verification and validation, a specialized Technical Center was built within SSP. In addition to the exhaustive engineering calculations for confirmation of design conformance to industry standards and other engineering developed criteria, customized NIST traceable testing equipment was procured to allow comprehensive validation of design inputs.

In 1998, SSP Unilok brand tube fittings were offered to the marketplace as a direct alternative to Parker CPI™ single ferrule instrumentation tube fittings. Since then, hundreds of thousands of SSP Unilok tube fittings have been manufactured and installed throughout the world.

[1] *US Patent 3,499,671; Parker Instrumentation CPI Tube Fittings catalog 4230, February 2000, p. 2.*

In 2010, SSP's Technical Center Laboratory was certified by A2LA to be compliant with the requirements of ISO/IEC 17025:2005 (A2LA Certificate No. 3030.01). This certification assures that results developed by SSP's Technical Center Laboratory meet the same standard of accuracy, independence and integrity as other certified third-party commercial laboratories. The scope of SSP's accreditation, includes the following test methods:

- Impulse Testing (ASTM F1387, A5)
- Pneumatic Proof Test (ASTM F1387, A3)
- Hydrostatic Proof Test (ASTM F1387, A4)
- Flexural Fatigue Test (ASTM F1387, A6)
- Tensile Test (ASTM F1387, A7)
- Hydrostatic Burst Test (ASTM F1387, A8)
- Rotary Flex Test (ASTM F1387, A10)
- Hardness – Rockwell C, B & N (ASTM E18)
- Hardness – Vickers (ASTM E384)

Section 1: Document Introduction

This document's purpose is to report, in a published format for public review, a representative sampling of the **Unilok** tube fitting's actual performance results from Production Validation Tests. The performance results are measured against the Design Team's Approved Acceptance Criteria, which are based on meeting or exceeding the published and / or test-based performance of equivalent Parker CPI™ tube fittings.

Section 2: Tests and General Conclusions of Results

The preceding table (Table 1.0) lists the major Validation Tests that were performed, and the sections which follow describe the tests and outline specific results. All products manufactured at SSP are to approved and controlled engineering documentation, to established process and quality procedures at every stage of manufacture, with fully calibrated quality and process instrumentation, using only certified and traceable materials. Tested products were selected randomly from documented normal production runs. Before and after test samples were retained for reference. All tubing used in testing meets applicable ASTM specifications, and has approved material and chemical certifications.

All product testing was conducted in SSPs accredited Technical Center Laboratory with laboratory equipment and instrumentation in current calibration. Trained personnel conducted tests by following approved, written test procedures. All test results were subjected to thorough engineering review and approval before internal publication.

In every case **Unilok** test results met or exceeded the established Design Team's Acceptance Criteria for these products. As such, they also met or exceeded equivalent major competitive product performance, as measured in test data and / or reported in publications.

Section 3.0: Validation Tests and Results

Section 3.1: Interchange Test

Purpose: Test determines if all combinations of both a tube fitting body and a tubing assembly (tube, ferrule, and nut, assembled together per standard assembly instructions) of Unilok and a Parker CPI fitting can be Interchanged in a complete tube fitting assembly, resulting in both adequate gas and liquid pressure-retaining capability, based on ANSI / ASME B 31.3 maximum allowable working pressure of the tubing.

This test simulates the interchange of fitting bodies with already made up tube assemblies in the field, for components from either Unilok or Parker CPI fittings.

Equipment & Configuration: Five fittings of a given combination of fitting components are tested at a time – one on each end of a 4 ½" long test tube. Maximum recommended wall tubing (worst case condition) is used for each tested product configuration. See Figures 3.1.1 – 2.

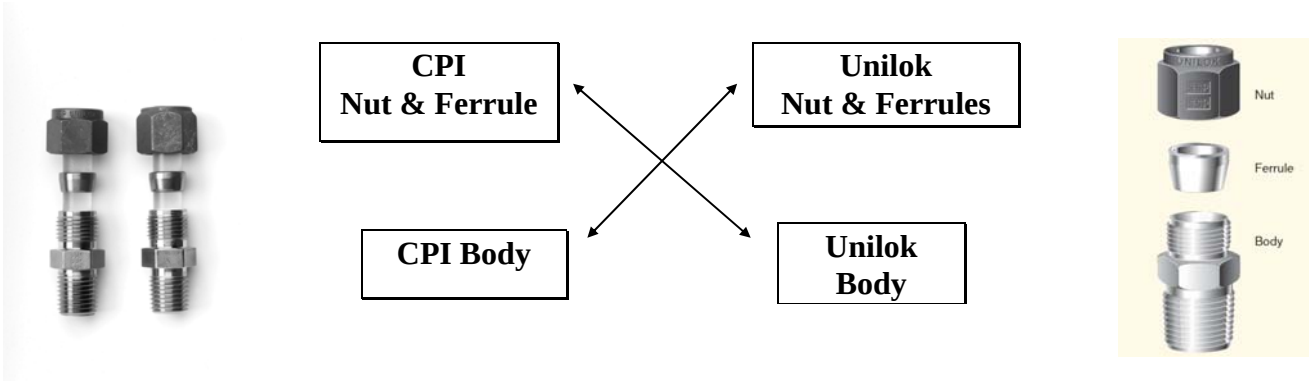


Figure 3.1.1, Interchange Test Combinations

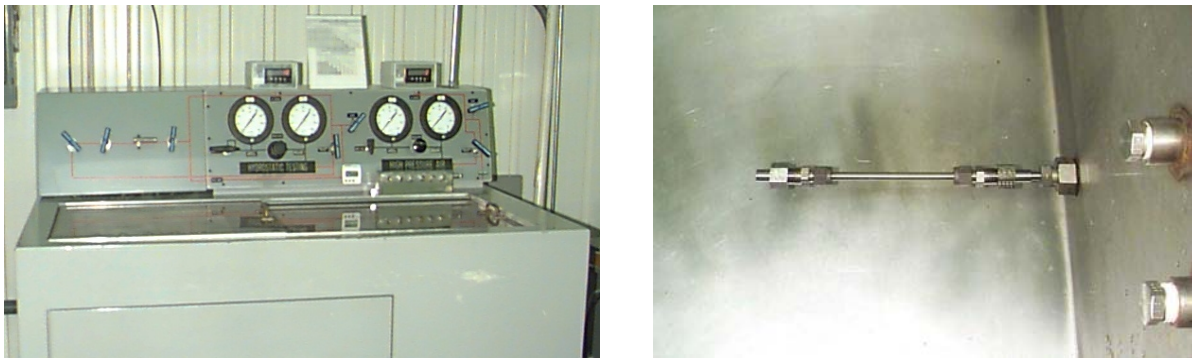


Figure 3.1.2, Interchange Test Equipment

Test Procedure: The tube fitting assembly is assembled with body and components of same brand then subjected to the Pneumatic Proof Test (ASTM F1387, A3), the bodies are then interchanged with the components of the competitive brand and subjected again to the Pneumatic Proof Test before being subjected to the hydrostatic Proof Test (ASTM F1387, A4) and Hydrostatic Burst Test (ASTM F1387, A8) in this interchanged condition.

Figure 3.1.3, Burst Test Specimen

Acceptance Criteria: Pneumatic Proof Test: The tube fitting assembly is to sustain an air booster test pressure of 100 PSIG, and then again at 1.25 times the ANSI / ASME maximum allowable working pressure of the tubing, up to a maximum pressure of 10,000 PSIG. Failure is any observed air leakage bubble.

Hydrostatic Proof Test: The tube fitting assembly is to sustain an air booster test pressure of 100 PSIG, and then again at 1.50 times the ANSI / ASME maximum allowable working pressure of the tubing, up to a maximum pressure of 10,000 PSIG. Failure is any observed water leakage.

Burst Test: The tube fitting assembly is to sustain a hydrostatic pressure, without observed leakage, exceeding a minimum of 4 times the ANSI / ASME maximum allowable working pressure of the tubing. Failure is to be by tubing burst, not by tube pushout from fitting.

Test Results: Actual test results are shown in Section 5.0 of this document.

Conclusions: All interchanged Unilok assemblies met or exceeded the approved Acceptance Criteria. All Unilok tube fittings sustained the required maximum allowable working pressure without leakage, and held leak free to tubing burst without exhibiting tube push out from the fitting.

Section 3.2: Intermix Test

Purpose: Test determines if all combinations of tube fitting components (nut, ferrule and fitting body) of Unilok and Parker CPI can be intermixed in a tube fitting assembly, resulting in both adequate gas and liquid pressure-retaining capability, based on ANSI / ASME B 31.3 maximum allowable working pressure of the tubing.

This test simulates the random intermixing of inventoried Unilok and Parker CPI fitting components in the field to make up tube fitting assemblies.

Equipment & Configuration: Five samples of each intermix combination are tested. Two fittings of a given combination of fitting components are tested at a time – one on each end of a 4 ½" long test tube. Maximum recommended wall tubing (worst case condition) is used for each tested product configuration. See Table 3.2.1 below for the intermix combinations tested and figure 3.1.2 above for the test equipment.

Intermix Sample Numbers						
1	2	3	4	5	6	
7	8	9	10	11	12	
13	14	15	16	17	18	
19	20	21	22	23	24	
25	26	27	28	29	30	
CPI	CPI	Unilok	CPI	Unilok	Unilok	**BODY**
CPI	Unilok	CPI	Unilok	CPI	Unilok	**NUT**
Unilok	CPI	CPI	Unilok	Unilok	CPI	**FERRULE**

Table 3.2.1 Intermix Combination Sampling Configuration

Test Procedure: The tube fitting assembly is subjected to the Pneumatic Proof Test (ASTM F1387, A3), and then the Hydrostatic Proof Test (ASTM F1387, A4) and finally the Hydrostatic Burst Test (ASTM F1387, A8).

Acceptance Criteria: **Pneumatic Proof Test:** The tube fitting assembly is to sustain an air booster test pressure of 100 PSIG, and then again at 1.25 times the ANSI / ASME maximum allowable working pressure of the tubing, up to a maximum pressure of 10,000 PSIG. Failure is any observed air leakage bubble.

Hydrostatic Proof Test: The tube fitting assembly is to sustain an air booster test pressure of 100 PSIG, and then again at 1.50 times the ANSI / ASME maximum allowable working pressure of the tubing, up to a maximum pressure of 10,000 PSIG. Failure is any observed water leakage.

Burst Test: The tube fitting assembly is to sustain a hydrostatic pressure, without observed leakage, exceeding a minimum of 4 times the ANSI / ASME maximum allowable working pressure of the tubing. Failure is to be by tubing burst, not by tube pushout from fitting.

Test Results: Actual test results are shown in Section 5.0 of this document.

Conclusions: All Unilok assemblies met or exceeded the approved Acceptance Criteria.[2] All Unilok tube fittings sustained the required maximum allowable working pressure without leakage, and held leak free to tubing burst without exhibiting tube push out from the fitting.

Section 4: Bibliography, Equipment, References

Table 4.1: ASTM Material Standards

Standard	Material Shape	Description
A 182	Forged Fittings, Parts	Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
A 276	Bars	Standard Specification for Stainless Steel Bars and Shapes
A 479	Bar, Shapes	Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels
B 16	Bar, Shapes	Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines
B 124	Bar, Shapes	Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes
B 453	Bar, Shapes	Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Rod
A 179	Tube	Standard Specification for Seamless Cold-Drawn Low-Carbon Steel Heat-Exchanger and Condenser Tubes
A 213	Tube	Standard Specification for Seamless Ferritic and Austinitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes
A 249	Tube	Standard Specification for Welded Austenitic Steel Boiler, Superheater, Heat-Exchanger, and Condenser Tubes
A 269	Tubing	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
B 68	Tube	Standard Specification for Copper Tube, Bright Annealed
B 75	Tube	Standard Specification for Seamless Copper Tube
B 88	Tube	Standard Specification for Seamless Copper Water Tube

Table 4.2: Applicable Codes and Standards

Section	Test Description
ANSI / ASME B 31.1	Power Piping Code
ANSI / ASME B 31.3	Process Piping Code
ANSI / ASME BPV Section VIII	Boiler & Pressure Vessel Code
ISO 7257	Aircraft - Hydraulic tubing joints and fittings - Rotary flexure test

Table 4.3: Validation Test Equipment

Section	Test Description	Test Equipment Description
3.1/3.2	Hydrostatic Burst Pressure Test……	1279 Ashcroft Pressure Gage
		L-400 Maximator Liquid Pump
3.1	Interchange Assurance Test……	DLE 15-75 Maximator Air Booster Pump
		L-400 Maximator Liquid Pump
3.2	Intermix Assurance Test……	DLE 15-75 Maximator Air Booster Pump
		L-400 Maximator Liquid Pump
3.1/3.2	Gas Pressure Leak Test……	HP 224 McDaniels Pressure Gage
		DLE 15-75 Maximator Air Booster Pump

Section 5: Actual Test Results/Calibration & Uncertainty

Size 16 (1 inch) – see section 5.1 below
Size 12 (3/4 inch) – see section 5.2 below
Size 8 (1/2 inch) – see section 5.3 below
Size 4 (1/4 inch) – see section 5.4 below

Calibration & Uncertainty – see section 5.5 below

Section 5.1: Size 16 (1 inch) Results

SSP Instrumentation

SSP I-Line Doc. # ITR - 1091 - 00 - **Rev.**

Input values:
Intermediate (computed) values:
Output (computed) values:

Calibration Certificate No. 3030.01

Subject: ASTM F 1387 Testing Data Sheets
ITR - 1091 - 00, Test Data

A.C.							
Tubing			Pneumatic Proof		Hydrostatic Proof		Burst
Size	Wall	WP	Test Press.	Leak	Test Press.	Leak	Press.
#	in	psig	psig	Leak / None	psig	Leak / None	psig
16	0.095	3,650	4,563	None	5,475	None	14,600

Intermix Sample Numbers						
1	2	3	4	5	6	
7	8	9	10	11	12	
13	14	15	16	17	18	
19	20	21	22	23	24	
25	26	27	28	29	30	
CPI	CPI	Unilok	CPI	Unilok	Unilok	**BODY**
CPI	Unilok	CPI	Unilok	CPI	Unilok	**NUT**
Unilok	CPI	CPI	Unilok	Unilok	CPI	**FERRULE**

Interchange			
Unilok nut and ferrule			CPI nut and ferrule
Unilok Body			CPI Body

Part		Heat Code
Name	P/N	
Male Connector	ISS-16MC8	ESL
Nut	ISSU16N	RRJ
Ferrule	ISSU16F	VAE
CPI Male Connector	N/A	ECZS
CPI Nut	N/A	LBK
CPI Ferrule	N/A	CITU
SS Tubing	1" X .095	,035653

Sam #	Test	1st Pneumatic Proof Test 100 PSI		1st Pneumatic Proof Test Press. 4,563 PSI		2nd Pneumatic Proof Test 100 PSI		2nd Pneumatic Proof Test Press. 4,563 PSI		Hydrostatic Proof 100 psi		Hydrostatic Proof Test Pressure 5,475 PSI		Hydro Burst => 14,600 PSI		
		Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Test Press.	None Burst Leak push-off	Pass Fail
1-SSP	Interchange	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	14,650	other-end	Pass
2-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	14,913	Burst	Pass
3-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	14,923	Burst	Pass
4-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	14,922	Burst	Pass
5-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	14,918	Burst	Pass
6-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	14,650	push-off	Pass
7-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	14,913	Burst	Pass
8-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	14,923	Burst	Pass
9-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	14,922	Burst	Pass
10-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	14,918	Burst	Pass
1	Intermix	None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	15,054	Burst	Pass
2		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	15,054	Burst	Pass
3		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,959	Burst	Pass
4		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,959	Burst	Pass
5		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,974	Burst	Pass
6		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,974	Burst	Pass
7		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,929	Burst	Pass
8		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,929	Burst	Pass
9		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,858	Burst	Pass
10		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,858	Burst	Pass
11		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,856	Burst	Pass
12		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,856	Burst	Pass
13		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,747	Burst	Pass
14		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,747	Burst	Pass
15		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,831	Burst	Pass
16		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,831	Burst	Pass
17		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,764	Burst	Pass
18		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,764	Burst	Pass
19		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,702	Burst	Pass
20		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,702	Burst	Pass
21		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,859	Burst	Pass
22		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,859	Burst	Pass
23		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,823	Burst	Pass
24		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,823	Burst	Pass
25		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,787	Burst	Pass
26		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,787	Burst	Pass
27		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,725	Burst	Pass
28		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,725	Burst	Pass
29		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,918	Burst	Pass
30		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	14,918	Burst	Pass

Section 5.2: Size 12 (3/4 inch) Results

SSP Instrumentation

SSP I-Line Doc. # ITR - 1091 - 00 - **Rev.**

Input values:
Intermediate (computed) values:
Output (computed) values:

Calibration Certificate No. 3030.01

Subject: ASTM F 1387 Testing Data Sheets
ITR - 1091 - 00, Test Data

A.C.							
Tubing			Pneumatic Proof		Hydrostatic Proof		Burst
Size	Wall	WP	Test Press.	Leak	Test Press.	Leak	Press.
#	in	psig	psig	Leak / None	psig	Leak / None	psig
12	0.095	4,950	6,188	None	7,425	None	19,800

Intermix Sample Numbers						
1	2	3	4	5	6	
7	8	9	10	11	12	
13	14	15	16	17	18	
19	20	21	22	23	24	
25	26	27	28	29	30	
CPI	CPI	Unilok	CPI	Unilok	Unilok	BODY
CPI	Unilok	CPI	Unilok	CPI	Unilok	NUT
Unilok	CPI	CPI	Unilok	Unilok	CPI	FERRULE

Interchange	
Unilok nut and ferrule	CPI nut and ferrule
Unilok Body	CPI Body

Part		Heat Code
Name	P/N	
Male Connector	ISS-12MC8	CNN
Nut	ISSU12N	BRV
Ferrule	ISSU12F	RAA
CPI Male Connector	N/A	EBJP
CPI Nut	N/A	LAM
CPI Ferrule	N/A	UHYJ
SS Tubing	3/4" X .095	,035616

Sam #	Test	1st Pneumatic Proof Test 100 PSI		1st Pneumatic Proof Test Press. 6,188 PSI		2nd Pneumatic Proof Test 100 PSI		2nd Pneumatic Proof Test Press. 6,188 PSI		Hydrostatic Proof 100 psi		Hydrostatic Proof Test Pressure 7,425 PSI		Hydro Burst => 19,800 PSI		
		Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Test Press.	None Burst Leak push-off	Pass Fail
1-SSP	Interchange	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	21212	Burst	Pass
2-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	21254	Burst	Pass
3-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	20,635	Burst	Pass
4-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	21080	Burst	Pass
5-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	21205	Burst	Pass
6-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	21212	Burst	Pass
7-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	21254	Burst	Pass
8-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	20,635	Burst	Pass
9-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	21080	Burst	Pass
10-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	21205	Burst	Pass
1	Intermix	None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	21,090	Burst	Pass
2		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	21,090	Burst	Pass
3		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,861	Burst	Pass
4		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,861	Burst	Pass
5		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,730	Burst	Pass
6		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,730	Burst	Pass
7		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,552	Burst	Pass
8		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,552	Burst	Pass
9		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,966	Burst	Pass
10		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,966	Burst	Pass
11		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,778	Burst	Pass
12		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,778	Burst	Pass
13		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,673	Burst	Pass
14		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,673	Burst	Pass
15		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	21,039	Burst	Pass
16		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	21,039	Burst	Pass
17		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	21,093	Burst	Pass
18		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	21,093	Burst	Pass
19		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,945	Burst	Pass
20		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,945	Burst	Pass
21		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,742	Burst	Pass
22		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,742	Burst	Pass
23		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,754	Burst	Pass
24		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,754	Burst	Pass
25		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	21,023	Burst	Pass
26		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	21,023	Burst	Pass
27		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,755	Burst	Pass
28		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,755	Burst	Pass
29		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,861	Burst	Pass
30		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,861	Burst	Pass

Section 5.3: Size 8 (1/2 inch) Results

SSP Instrumentation

SSP I-Line Doc. # ITR - 1091 - 00 - **Rev.**

Input values:
Intermediate (computed) values:
Output (computed) values:

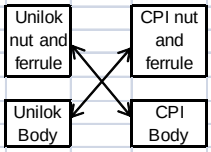
Calibration Certificate No. 3030.01

Subject: ASTM F 1387 Testing Data Sheets
ITR - 1091 - 00, Test Data

A.C.							
Tubing			Pneumatic Proof		Hydrostatic Proof		Burst
Size	Wall	WP	Test Press.	Leak	Test Press.	Leak	Press.
#	in	psig	psig	Leak / None	psig	Leak / None	psig
8	0.065	4,750	5,938	None	7,125	None	19,000

Intermix Sample Numbers						
1	2	3	4	5	6	
7	8	9	10	11	12	
13	14	15	16	17	18	
19	20	21	22	23	24	
25	26	27	28	29	30	
CPI	CPI	Unilok	CPI	Unilok	Unilok	**BODY**
CPI	Unilok	CPI	Unilok	CPI	Unilok	**NUT**
Unilok	CPI	CPI	Unilok	Unilok	CPI	**FERRULE**

Interchange



Part		Heat Code
Name	P/N	
Male Connector	ISS-8MC4	CRO
Nut	ISSU8N	BRV
Ferrule	ISSU8F	RAR
CPI Male Connector	N/A	ECAA
CPI Nut	N/A	TJN
CPI Ferrule	N/A	UH8K
SS Tubing	1/2" X .065	Y80184

Sam #	Test	1st Pneumatic Proof Test 100 PSI		1st Pneumatic Proof Test Press. 5,939 PSI		2nd Pneumatic Proof Test 100 PSI		2nd Pneumatic Proof Test Press.5,938 PSI		Hydrostatic Proof 100 psi		Hydrostatic Proof Test Pressure 7,125 PSI		Hydro Burst => 19,00 PSI		
		Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Test Press.	None Burst Leak push-off	Pass Fail
1-SSP	Interchange	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	20,300	Burst	Pass
2-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	20,293	Burst	Pass
3-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	20,500	Burst	Pass
4-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	20,506	Burst	Pass
5-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	20,400	Burst	Pass
6-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	20,300	Burst	Pass
7-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	20,293	Burst	Pass
8-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	20,500	Burst	Pass
9-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	20,506	Burst	Pass
10-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	20,400	Burst	Pass
1	Intermix	None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,061	Burst	Pass
2		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,061	Burst	Pass
3		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,413	Burst	Pass
4		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,413	Burst	Pass
5		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	19,575	other-end	Pass
6		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	19,575	push-off	Pass
7		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,313	Burst	Pass
8		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,313	Burst	Pass
9		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,020	Burst	Pass
10		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,020	Burst	Pass
11		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,018	Burst	Pass
12		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,018	Burst	Pass
13		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	19,985	Burst	Pass
14		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	19,985	Burst	Pass
15		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,428	Burst	Pass
16		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,428	Burst	Pass
17		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	19,963	Burst	Pass
18		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	19,963	Burst	Pass
19		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,381	Burst	Pass
20		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,381	Burst	Pass
21		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,603	Burst	Pass
22		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,603	Burst	Pass
23		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,883	Burst	Pass
24		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,883	Burst	Pass
25		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,293	Burst	Pass
26		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,293	Burst	Pass
27		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	19,861	Burst	Pass
28		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	19,861	Burst	Pass
29		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,241	Burst	Pass
30		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	20,241	Burst	Pass

Section 5.4: Size 4 (1/4 inch) Results

Originated by: T Foos (Print) Date: 11/12/10 Approved by: Effective Date:
ECN No.: Date Requested: Released by: Release Date:

SSP Instrumentation

SSP I-Line Doc. # ITR - 1091 - 00 - Rev.

Input values:
Intermediate (computed) values:
Output (computed) values:

Subject: ASTM F 1387 Testing Data Sheets
ITR - 1091 - 00, Test Data

A.C.							
Tubing			Pneumatic Proof		Hydrostatic Proof		Burst
Size	Wall	WP	Test Press.	Leak	Test Press.	Leak	Press.
#	in	psig	psig	Leak / None	psig	Leak / None	psig
4	0.049	7,500	9,375	None	11,250	None	30,000

Intermix Sample Numbers						
1	2	3	4	5	6	
7	8	9	10	11	12	
13	14	15	16	17	18	
19	20	21	22	23	24	
25	26	27	28	29	30	
CPI	CPI	Unilok	CPI	Unilok	Unilok	BODY
CPI	Unilok	CPI	Unilok	CPI	Unilok	NUT
Unilok	CPI	CPI	Unilok	Unilok	CPI	FERRULE

Interchange	
Unilok nut and ferrule	CPI nut and ferrule
Unilok Body	CPI Body

Part		Heat Code
Name	P/N	
Male Connector	ISS-4MC4	CRO
Nut	ISSU4N	BRJ
Ferrule	ISSU4F	RAC
CPI Male Connector	N/A	EPX
CPI Nut	N/A	TJX
CPI Ferrule	N/A	EOO
SS Tubing	1/4" X .049	772-1038

Sam #	Test	1st Pneumatic Proof Test 100 PSI		1st Pneumatic Proof Test Press. 9,375 PSI		2nd Pneumatic Proof Test 100 PSI		2nd Pneumatic Proof Test Press. 9,375 PSI		Hydrostatic Proof 100 psi		Hydrostatic Proof Test Pressure 11,250 PSI		Hydro Burst => 30,000 PSI		
		Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Leak None	Pass Fail	Test Press.	None Burst Leak push-off	Pass Fail
1-SSP	Interchange	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	35,330	Burst	Pass
2-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	34,982	Burst	Pass
3-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	35,187	Burst	Pass
4-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	34,980	Leak	Pass
5-SSP		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	40,164	Burst	Pass
6-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	35,330	Burst	Pass
7-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	34,982	Burst	Pass
8-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	35,187	Burst	Pass
9-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	34,980	Leak	Pass
10-CPI		None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	None	Pass	40,164	Burst	Pass
1	Intermix	None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	39,822	Burst	Pass
2		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	39,822	Burst	Pass
3		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	39,802	Burst	Pass
4		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	39,802	Burst	Pass
5		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	36,153	Burst	Pass
6		None	Pass	Leak	Fail	N/A	N/A	N/A	N/A	None	Pass	None	Pass	36,153	Burst	Pass
7		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	36,158	Burst	Pass
8		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	36,158	Burst	Pass
9		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	39,164	Burst	Pass
10		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	39,164	Burst	Pass
11		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	35,256	Burst	Pass
12		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	35,256	Burst	Pass
13		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	35,551	Burst	Pass
14		None	Pass	Leak	Fail	N/A	N/A	N/A	N/A	None	Pass	None	Pass	35,551	Burst	Pass
15		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	38,097	Burst	Pass
16		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	38,097	Burst	Pass
17		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	34,709	Burst	Pass
18		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	34,709	Burst	Pass
19		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	34,122	Burst	Pass
20		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	34,122	Burst	Pass
21		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	33,977	Burst	Pass
22		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	33,977	Burst	Pass
23		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	35,714	Burst	Pass
24		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	35,714	Burst	Pass
25		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	35,248	Burst	Pass
26		None	Pass	Leak	Fail	N/A	N/A	N/A	N/A	None	Pass	None	Pass	35,248	Burst	Pass
27		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	39,195	Burst	Pass
28		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	39,195	Burst	Pass
29		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	39,748	Burst	Pass
30		None	Pass	None	Pass	N/A	N/A	N/A	N/A	None	Pass	None	Pass	39,748	Burst	Pass

[2] *– Three size 4 samples (6, 14 & 26) exhibited small gas leaks at proof pressure (1.25 x MAWP) during the Pneumatic Proof Test. This occurs occasionally due to the subjective nature of tightening 1.25 turns from "finger" tight position, as called for in published marketplace instructions. Subsequent testing from a "snug" makeup during Hydrostatic Burst Test demonstrated that these same fittings held leak free to tubing burst without exhibiting tube push out from the fitting.*

Section 5.5: Calibration & Uncertainty

Calibration and Standardization: The following equipment used in this test is entered into the calibration system:

Equipment name/type	Model #	Cal Date	Due Date	Traceability #	Calibration Location
10,000 psi digital gage	N/A	01/21/10	01/21/11	67176	SSP Fitting Test Lab
10,000 psi transducer	N/A	01/21/10	01/21/11	74466	SSP Fitting Test Lab
72,000 psi digital gage	N/A	12/01/09	12/01/10	096221-1	GE Infrastructure Sensing 10300 Westpark Drive Houston, TX
72,000 psi transducer	N/A	12/01/09	12/01/10	,096221	GE Infrastructure Sensing 10300 Westpark Drive Houston, TX

Measurement uncertainty associated with the observed burst test values contained in this test report are estimated to be ± 298.62 PSIG

TRADEMARKS:

Unilok is a trademark of SSP Fittings Corp.
CPI is a trademark of Parker Hannifin Corporation