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FB Series Ball Valve

TECHNICAL REPORT

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SSP INTRODUCTION

Since its inception in 1926, SSP has exhibited an expertise in the precision machining of tight tolerance, high quality fitting components. In fact, SSP's historical reputation for product quality, service and performance is recognized across the country and around the world.

In 1986, SSP relocated to its 25-acre property in Twinsburg, Ohio Southeast of Cleveland in North America's manufacturing heartland. Within its modern 165,000 square foot manufacturing facility, SSP has developed the internal ability to control its manufacturing variables as much or more than any other fittings' manufacturer. SSP designs and produces its own specialty cutting tools to proprietary standards with a 5 axis CNC tool and cutter grinder, high speed 4 axis CNC machining centers and ultra precise EDM's to allow manufacturing to the most stringent dimensional tolerances and surface finishes. Additionally, SSP's tool making capability supports an internal hot, closed-die forging operation. SSP plans, controls and performs its own metal forging operations on all elbows, tees and crosses manufactured into SSP fittings, connectors and adapters. Indeed, SSP's production capacity is among the largest single-site facilities in the entire industry with the capability to allow one-of-a kind, "specials" machining on single spindle CNC's to high volume production on multi-spindle automatics.

Furthermore, SSP's ISO9001 Quality System Certification and Registration by DNV assures conformance to the highest levels of quality. The substantial investment of time and funds to obtain and maintain such status has paid dividends for SSP and its customers in efficiencies in process and supply.

1.0 INTRODUCTION

This document's purpose is to report, in a published format for public review, a representative sampling of the FB Series Ball Valves' actual performance results from the Design Plan's 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 products from other manufacturers. A positive testing performance of the products in the Validation Tests was required to complete the final element of the design cycle and provide for the Design Release of the FB Series Ball Valve product family.

1.1 SCOPE

Scope: Performance testing of the FB Series Ball Valve – This test report documents the results of the performance testing for the SSP FB Series Ball Valve. The samples were tested for hydrostatic proof and burst strength, pneumatic leakage test at ambient, pneumatic leakage test at low temperature, pneumatic leakage test at high temperature, and a continuous operations test. The cold working pressure rating of this product is 6000 psig.

1.2 REFERENCES

- SSP No. QM06, "SSP Tech Center Laboratory Quality Manual"
- ISO 17025, "General Requirements for the Competence of Testing and Calibration Laboratories"
- ISO 9001:2008, "Quality Management Systems – Requirements"
- ANSI/NCSL Z540-1, "Calibration Laboratories and Measuring and Test Equipment, General Requirements"
- ASTM F1387-99, "Standard Specification for Performance of Piping and Tubing Mechanically Attached Fittings"
- ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment"
- MIL-STD-45662A, "Calibration System Requirements"
- ISO 15500-4, "Compressed natural gas (CNG) fuel system components – Part 4: Manual valve"

1.3 TEST SPECIMEN DESCRIPTION

This test report will document all of the testing involved in the validation of the design for the FB Series Ball Valve. While many of the validation tests performed were conducted in a similar manner to the functional testing described in ISO 15500-4, this validation testing was not meant to be an exact duplicate of the type approval testing outlined in those documents and certain details of this validation testing program may vary from these testing standards. All test samples were built in accordance with the FB Series Ball Valve Assembly documents. Reference assembly document numbers EAS-042 and EAS-043.

All body samples for this test were made from 316 grade stainless steel.

Sample#	Part#	End Type	Test Record
36-1 thru 36-9	36PD6-316	3/8” Tube End	ITR-1526
L36-1 thru L36-9	L36PD6-316	3/8” Tube End	ITR-1519
38-1 thru 38-9	38PD8-316	1/2” Tube End	ITR-1521
L38-1 thru L38-6	L38PD8-316	1/2" Tube End	ITR-1505

1.4 SUMMARY

Hydrostatic and burst test results were in excess of the minimum acceptable requirements. No detectable seat or shell leakage was observed from any of the ball valve test samples during the pneumatic leakage portions of the validation testing. No detectable seat or shell leakage was observed during the continued operation portion of the testing. The SSP FB Series 2-way ball valve is now considered to be adequately validated for use.

2.0 TEST PROCEDURES AND RESULTS

2.1 HYDROSTATIC STRENGTH AND BURST TESTING

Purpose: Each sample was tested for hydrostatic proof and burst testing. Each test sample was individually plumbed into a hydrostatic burst test stand. The procedure for the hydrostatic proof and burst test is outlined below.

Test Procedure: Each test sample was prepared with the outlet plugged and the inlet connected to the pressure source. The handle was turned to the open position for this test. This allowed for complete pressurization of the internal cavities. Hydrostatic (water) pressure was applied to the inlet port of each of the test samples at ambient temperature. The samples were pressurized and tested independently. The pressure was slowly increased until a minimum of 14,600 psig was reached and then held for three minutes. During this time, each sample was visually examined for leakage or deformation. The hydrostatic pressure was then increased to 4 times the cold working pressure of the valve for 1 minute. During this time, each sample was visually examined for leakage or deformation. The hydrostatic pressure was finally increased to the point where the integrity of the shell seal was lost. This pressure was then recorded as the "Burst Pressure" for the test sample.

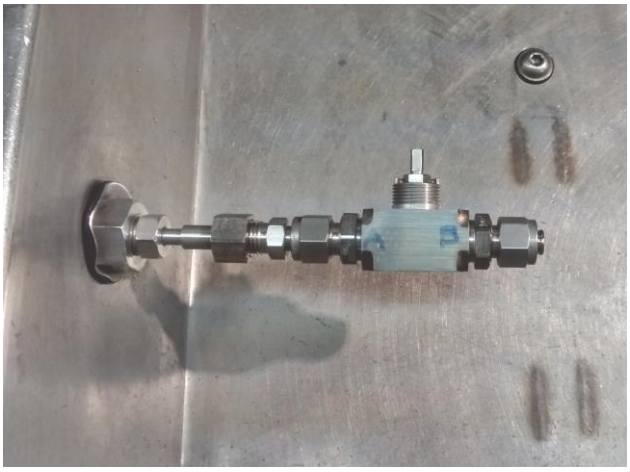

Figure 2.1 Hydrostatic Proof and Burst Setup

Acceptance Criteria: All test results met or exceeded the established Design Team's Acceptance Criteria for this product. The primary acceptance criteria for this test is similar to those documented in ISO 15500-4, where applicable. The acceptance criterion for the hydrostatic strength portion of the validation testing is to withstand a minimum internal pressure of 14,600 psig (1,006 bar) for a three minute time period without any signs of leakage or deformation. The acceptance criterion for the hydrostatic burst test portion of the validation test is to withstand a minimum internal pressure of 4 times the full rated pressure of the valve (4 x 6000 psig = 24,000 psig minimum) without significant loss of containment.

SSP FB Series Ball Valve Validation Testing: Hydrostatic Proof and Burst				
Sample No.	Hydrostatic Strength Test @ 14,600 psig	Hydrostatic Burst Test @ 24,000 psig	Burst Pressure Actual, psig	Failure Mode
36-1	Pass	Pass	36,268	N/A – Test Stopped (6X W.P.)
36-2	Pass	Pass	36,883	N/A – Test Stopped (6X W.P.)
36-3	Pass	Pass	37,253	N/A – Test Stopped (6X W.P.)
L36-1	Pass	Pass	32,479	Body/End Screw Joint Leak
L36-2	Pass	Pass	33,349	Body/End Screw Joint Leak
L36-3	Pass	Pass	27,242	Body/End Screw Joint Leak
38-1	Pass	Pass	28,846	Tube Adapter Fitting Leak
38-2	Pass	Pass	29,609	Body/End Screw Joint Leak
38-3	Pass	Pass	28,010	Body/End Screw Joint Leak
L38-1	Pass	Pass	26,035	Body/End Screw Joint Leak
L38-2	Pass	Pass	33,752	Body/End Screw Joint Leak
L38-3	Pass	Pass	33,761	Body/End Screw Joint & Body/Packing Bolt Joint

2.2 PNEUMATIC LEAKAGE TESTING (AMBIENT)

Purpose: Samples were tested for seat and shell leakage at ambient temperature. The procedure is outlined below.

Test Procedure: The valve was placed in the closed position for the duration of this test. The valve was prepared for testing by connecting the port labeled "side A" to the pressure source. The valve was submerged in water at ambient (room) temperature. A pneumatic pressure (air) of 70 psig was applied to the valve. The sample was visually examined for seat and shell leakage (bubble formation) for two minutes. The pressure was then increased to 6000 psig and the samples were visually examined for seat and shell leakage (bubble formation) for two minutes. Pressure was released from the valve. Next, the test was repeated with "side B" connected to the pressure source. This procedure ensures that both seats and all shell seals of each sample valve are tested for leak-tight performance.

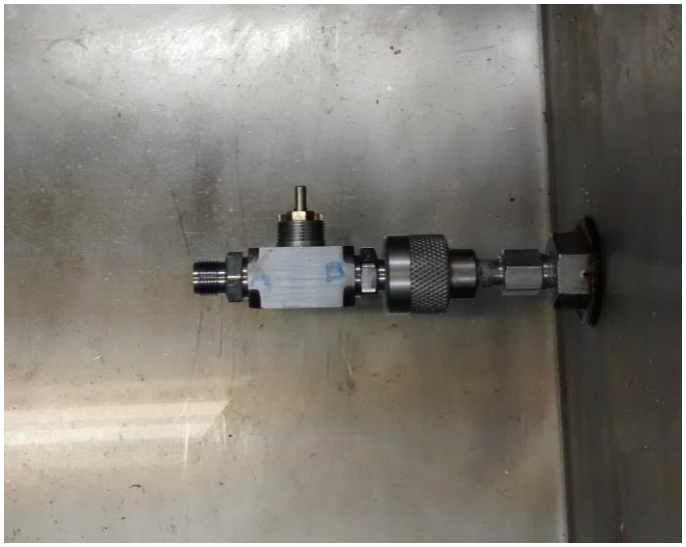

Figure 2.2 Leakage Test (Ambient) Setup

Acceptance Criteria: All test results met or exceeded the established Design Team's Acceptance Criteria for these products. The primary acceptance criteria for all validation testing are similar to those documented in ISO 15500-4, where applicable. The acceptance criterion for all internal and external leakage tests is a maximum leakage rate of less than 20 cm^3/hr.

SSP FB Series Ball Valve Leakage Testing - Seat and Shell Leakage at Ambient Temperature					
Sample No.	Port Side	Seat Leakage @ Ambient (70 psig)	Shell Leakage @ Ambient (70 psig)	Seat Leakage @ Ambient (6000 psig)	Shell Leakage @ Ambient (6000 psig)
36-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L36-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L36-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L36-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L38-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L38-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L38-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass

2.3 PNEUMATIC LEAKAGE TESTING (LOW TEMPERATURE)

Purpose: Samples were tested for seat and shell leakage at low temperature. The procedure is outlined below.

Test Procedure: The valve was placed in the closed position for the duration of this test. The 36 and 38 valves were soaked at -15°F for a minimum of four hours prior to leak testing. The L36 and L38 valves were soaked at -40°F for a minimum of four hours prior to leak testing. The valve was prepared for testing by connecting the port labeled "side A" to the pressure source. The valve was then submerged in denatured alcohol at -15°F (36/38) or -40°F (L36/L38). A pneumatic pressure (air) of 70 psig was applied to the valve. The sample was visually examined for seat and shell leakage (bubble formation) for two minutes. The pressure was then increased to 6000 psig and the samples were visually examined for seat and shell leakage (bubble formation) for two minutes. Pressure was released from the valve. Next, the test was repeated with "side B" connected to the pressure source. This procedure ensures that both seats and all shell seals of each sample valve are tested for leak-tight performance.

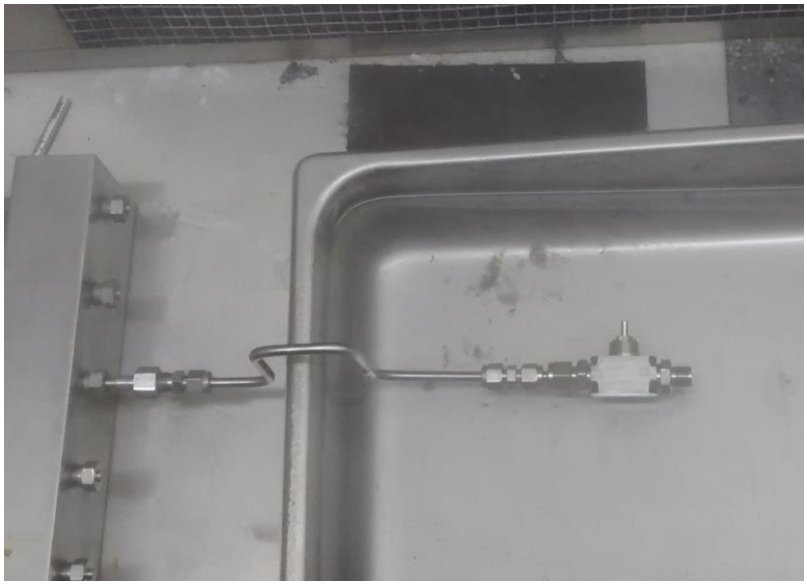

Figure 2.3 Leakage Test (Low Temperature) Setup

Acceptance Criteria: All test results met or exceeded the established Design Team's Acceptance Criteria for these products. The primary acceptance criteria for all validation testing is similar to those documented in ISO 15500-4, where applicable. The acceptance criterion for all internal and external leakage tests is a maximum leakage rate of less than 20 cm^3/hr under temperature conditions.

SSP FB Series Ball Valve Leakage Testing - Seat and Shell Leakage at -15°F					
Sample No.	Port Side	Seat Leakage @ -15°F (70 psig)	Shell Leakage @ -15°F (70 psig)	Seat Leakage @ -15°F (6000 psig)	Shell Leakage @ -15°F (6000 psig)
36-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass

SSP FB Series Ball Valve Leakage Testing - Seat and Shell Leakage at -40°F					
Sample No.	Port Side	Seat Leakage @ -40°F (70 psig)	Shell Leakage @ -40°F (70 psig)	Seat Leakage @ -40°F (6000 psig)	Shell Leakage @ -40°F (6000 psig)
L36-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L36-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L36-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L38-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L38-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L38-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass

2.4 PNEUMATIC LEAKAGE TESTING (HIGH TEMPERATURE)

Purpose: Samples were tested for seat and shell leakage at high temperature. The procedure is outlined below.

Test Procedure: The valve was placed in the closed position for the duration of this test. The valves were soaked at 200°F for a minimum of four hours in an oven prior to leak testing. After soaking, the valve was prepared for testing by connecting the port labeled "side A" to the pressure source. The valve was then submerged in water at 200°F. A pneumatic pressure (air) of 70 psig was applied to the valve. The sample was visually examined for seat and shell leakage (bubble formation) for two minutes. The pressure was then increased to 6000 psig and the samples were visually examined for seat and shell leakage (bubble formation) for two minutes. Pressure was released from the valve. Next, the test was repeated with "side B" connected to the pressure source. This procedure ensures that both seats and all shell seals of each sample valve are tested for leak-tight performance.

Additional testing was performed at temperatures of 250°F, 300°F, 350°F and 400°F on the 36 and 38 valves. The valves were soaked at temperature for a minimum of four hours in an oven prior to leak testing. The valve was leak tested in the oven at temperature. After soaking, the valve was prepared for testing by connecting the port labeled "side A" to the pressure source. A pneumatic pressure (air) of 70 psig was applied to the valve. A pressure gage was used to measure leakage by pressure decay method. The pressure was then increased to the maximum operating pressure for each temperature listed above and leakage was checked by pressure decay method. Pressure was released from the valve. Next, the test was repeated with "side B" connected to the pressure source. This procedure ensures that both seats and all shell seals of each sample valve are tested for leak-tight performance.

Figure 2.4.1 Leakage Test
High Temperature Soak Setup

Figure 2.4.2 Leakage Test (200°F) Setup

Figure 2.4.3 Leakage Test (Over 200°F) Setup

Acceptance Criteria: All test results met or exceeded the established Design Team's Acceptance Criteria for these products. The primary acceptance criteria for all validation testing are similar to those documented in ISO 15500-4, where applicable. The acceptance criterion for all internal and external leakage tests is a maximum leakage rate of less than 20 cm^3/hr under temperature conditions.

SSP FB Series Ball Valve Leakage Testing - Seat and Shell Leakage at 200°F					
Sample No.	Port Side	Seat Leakage @ 200°F (70 psig)	Shell Leakage @ 200°F (70 psig)	Seat Leakage @ 200°F (6000 psig)	Shell Leakage @ 200°F (6000 psig)
36-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L36-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L36-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L36-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L38-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L38-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L38-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass

SSP FB Series Ball Valve Leakage Testing - Seat and Shell Leakage at 250°F					
Sample No.	Port Side	Seat Leakage @ 250°F (70 psig)	Shell Leakage @ 250°F (70 psig)	Seat Leakage @ 250°F (6000 psig)	Shell Leakage @ 250°F (6000 psig)
36-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass

SSP FB Series Ball Valve Leakage Testing - Seat and Shell Leakage at 300°F					
Sample No.	Port Side	Seat Leakage @ 300°F (70 psig)	Shell Leakage @ 300°F (70 psig)	Seat Leakage @ 300°F (3000 psig)	Shell Leakage @ 300°F (3000 psig)
36-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass

SSP FB Series Ball Valve Leakage Testing - Seat and Shell Leakage at 350°F					
Sample No.	Port Side	Seat Leakage @ 350°F (70 psig)	Shell Leakage @ 350°F (70 psig)	Seat Leakage @ 350°F (2000 psig)	Shell Leakage @ 350°F (2000 psig)
36-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass

SSP FB Series Ball Valve Leakage Testing - Seat and Shell Leakage at 400°F					
Sample No.	Port Side	Seat Leakage @ 400°F (70 psig)	Shell Leakage @ 400°F (70 psig)	Seat Leakage @ 400°F (1000 psig)	Shell Leakage @ 400°F (1000 psig)
36-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass

2.5 CONTINUOUS OPERATION TEST

Purpose: Samples were tested for seat and seal durability over an increased number of cycles. Sample valves were mounted, in parallel, in the continued operation test cycle rig and cycled 20,000 times. Leak tests were performed initially, at 5000 cycle intervals and after 20,000 cycles.

Test Procedure: Samples were initially tested for leak tight sealing at ambient temperature at 70 psig and 6000 psig. The samples were then prepared for testing by connecting the port labeled side "A" to a high pressure, compressed air supply regulated to 3600 psig. The port labeled side "B" of each valve was connected to a flexible hose exhausting to atmospheric pressure. The test valves were mounted to pneumatically operated 90° - turn actuators. One complete cycle consisted of the following steps:

1) Actuating the valve from the closed to the open position.
2) Static in this position for approximately 1 second.
3) Actuating the valve from the open to the closed position.
4) Static in this position for approximately 10 seconds, then return to step 1.

The valves were disconnected from the cycle rig and tested for seat and shell leakage, at pressures of 70 and 6000 psig, every 5000 cycles. The samples were cycled until either 20,000 cycles were completed or until gross leakage was observed, whichever occurred first.

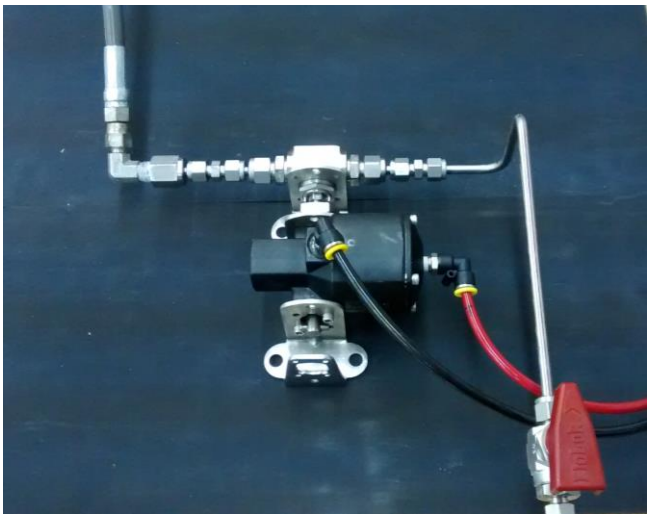

Figure 2.5 Continuous Operation Setup

Acceptance Criteria: All test results met or exceeded the established Design Team's Acceptance Criteria for these products. The acceptance criterion for all internal and external leakage tests is a maximum leakage rate of less than 20 cm^3/hr checked initially, at 5000 cycle intervals and after 20,000 cycles was completed.

SSP FB Series Ball Valve Continuous Operation Testing - Seat and Shell Leakage					
Sample No.	Port Side[1]	Seat Leakage @ Ambient (70 psig)	Shell Leakage @ Ambient (70 psig)	Seat Leakage @ Ambient (6000 psig)	Shell Leakage @ Ambient (6000 psig)
36-7	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-8	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
36-9	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L36-7	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L36-8	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L36-9	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-7	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-8	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
38-9	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L38-4	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L38-5	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass
L38-6	A	Pass	Pass	Pass	Pass
	B	Pass	Pass	Pass	Pass

Note 1: Port side "A" tested initially, at 5000 cycle intervals and after 20,000 cycles.
Port side "B" tested initially and after 20,000 cycles.

3.0 TEST EQUIPMENT AND INSTRUMENTATION

Calibration and Standardization:

1. Description: Gas Pressure Transducer
   Range: 0 - 10,000 psig
   ID#: 74466
   Calibration Date: 10/13/14 Due: 10/13/15

2. Description: Gas Pressure Gage
   Range: 0 - 10,000 psig
   ID#: 67176
   Calibration Date: 10/13/14 Due: 10/13/15

3. Description: Hydrostatic Pressure Transducer
   Range: 0 - 72,000 psig
   ID#: 096221
   Calibration Date: 06/10/14 Due: 06/10/15

4. Description: Hydrostatic Pressure Gage
   Range: 0 - 72,000 psig
   ID#: 096221–1
   Calibration Date: 06/10/14 Due: 06/10/15

5. Description: Microprocessor Thermometer
   Range: -328°F to 752°F
   ID#: 1016704
   Calibration Date: 09/02/14 Due: 09/02/15

6. Description: Oven
   Range: Ambient - 550°F
   ID#: 33-1025193
   Calibration Date: 09/03/14 Due: 09/03/15

7. Description: Pressure Standard
   Range: 0 - 15,000 psig
   ID#: A26156
   Calibration Date: 09/04/14 Due: 09/04/15

8. Description: Gas Pressure Gage
   Range: 0 - 5000 psig
   ID#: LAB-13
   Calibration Date: 08/14/14 Due: 08/14/15

4.0 QUALITY ASSURANCE PROGRAM

The preceding 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 SSP tests conducted on products are with laboratory equipment and instrumentation in current calibration in an ISO 17025 accredited laboratory. Trained personnel conducted tests by following approved, written test procedures. All test results were subjected to thorough engineering review and approval before internal publication.

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
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 Austenitic Alloy-Steel Boiler, Superheater and Heat-Exchanger Tubes
A 269	Tubing	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

Table 4.0.0

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

Table 4.0.1

5.0 ATTACHMENTS

A. MATERIAL CERTS

B. EQUIPMENT

Validation Test Equipment		
Section	**Test Description**	**Test Equipment Description**
2.1	Hydrostatic Strength and Burst Test	High Pressure Transducer – Stellar Technologies GT3202-72000G-101
		High Pressure Liquid Pump – Maximator L-400
2.2	Pneumatic Leakage Test (Ambient)	Pressure Transducer – Precise Sensors 555-10000-G-36-4F-6P3
		Air Booster Pump - Maximator DLE 15-75
2.3	Pneumatic Leakage Test (Low Temperature)	Pressure Transducer – Precise Sensors 555-10000-G-36-4F-6P3
		Air Booster Pump - Maximator DLE 15-75
		Ultra Low Industrial Freezer - Cincinnati Sub-Zero
2.4	Pneumatic Leakage Test (High Temperature 200°F)	Pressure Transducer – Precise Sensors 555-10000-G-36-4F-6P3
		Air Booster Pump - Maximator DLE 15-75
		Immersion Heater - Ulanet 492-4
	Pneumatic Leakage Test (High Temperature Over 200°F)	Pressure Standard - Condec UPS3000AAA
		Air Booster Pump - Maximator DLE 15-75
		Bench Oven - Quincy 51-550ER
2.5	Continuous Operation	Pressure Gage – McDaniel Controls
		Air Compressor – Mako MKI AM9H3 N3466

C. REVISIONS

SSP Document Number: