Compressed Gas Leak Detection Report

Company Name

Address

Prepared by: Swagelok Associate

Date

Swagelok Central and South Florida

SWAGELOK® COMPRESSED GAS LEAK DETECTION SERVICES

Swagelok Compressed Gas Leak Detection Services is a service program offered by Swagelok and its global distributor network in which we use our industry expertise in fluid system design to help improve compressed gas performance at your facilities.

A Swagelok Compressed Gas Leak Detection Service advisor serves as your partner and trusted advisor to troubleshoot compressed gas-related problem areas that may exist at your facilities.

DISCLAIMER

The contents and information provided in this report are meant to provide general information to interested parties. Neither Swagelok Company nor any of their employees make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus or process disclosed. Moreover, Swagelok Company accepts no responsibility for any omissions or deletions relating to this report. The information within this report is deemed entirely **CONFIDENTIAL** by Swagelok Company and may not be copied, shared or given to any other outside parties except those directly involved with the project as set forth in the report. A formal agreement, executed between Swagelok Company and the Customer, set forth the rights, duties and obligations of each respective party prior to commencement of any work.

Swagelok® Compressed Gas Leak Detection Team

Name Title Email
Name Title Email
Name Title Email

Customer Facility Team

Name Title Email
Name Title Email

Table of Contents

EXECUTIVE SUMMARY

Swagelok engineering team members conducted a Compressed Gas Leak Detection program for the **SITE NAME**. The goals were to determine the compressed gas leakage rate, review existing benchmarks/conditions, and determine a road map of correction for improvements in energy, reliability, operation, safety, and production. The Compressed Gas Leak Detection team met with SITE CONTACT.

BACKGROUND

Swagelok Compressed Gas Leak Detection Services evaluated these areas at **SITE NAME**:

- CNG, Hydrogen, Carbon Dioxide, Nitrogen, and Air systems for:
  - Units 3A and 3B
  - Units 2A, 2B, 2C, 2D, 2E, and 2F
- CEMS Shack for all units

Swagelok's investigation determined that the yearly cost of all leakage is **$507,365**. The following table breaks down the source and cost of each leak. A number of changes must occur in many areas to accomplish the goal of minimal leakage specified by **SITE NAME**. Leaks are categorized on the report by the area in the facility where they were detected, the type of gas, estimated CFM and annual losses. This will allow the facility to identify the high priority repairs. All detected leaks in the field were tagged with an identification number, which will allow the facility to quickly and easily locate the appropriate leak.

Compressed Gas	CFM	Dollars	Number of Leak Points
Carbon Dioxide	36.3	$278,041	15
CNG	85.6	$157,391	57
Clean Dry Air	237.5	$41,075	89
Hydrogen	2.7	$25,644	9
Nitrogen / NOX	5.5	$5,215	8
Total	**367.6**	**$507,365**	**178**

Root cause analysis needs to be part of the compressed gas leak detection program, and the facility should implement changes to the current system to eliminate leakage. Several areas have a high level of leakage due to component failures, improper installation, and/or product selection. The facility should focus on these areas when implementing changes. Please contact Swagelok if we can be of further assistance on any items in this report.

FINDINGS AND RECOMMENDATIONS

The program identified several areas for improvement:

- Threaded connections, tube fittings, valves and regulators have the highest number of priority items. Valves include manifolds, ball valves, and relief valves. An analysis should be done to repair or replace these items.
- Unit 2 Fire Suppression Systems all had leaks. Due to the cost of CO2, these should be given a priority. Target areas for improvement include the panels on the north end of the tanks and relief valves on the top of the tanks.
- A large number of high priority leaks are on the CNG system due to the higher cost per CFM. Many of these were located on the coalescing filter systems in Unit 2. Leaks were found on valve manifolds, threads, fittings, and regulators. Improvement in this area will reduce gas expenditures and improve system performance.
- Several ball valves in the off position with threaded caps on the outlet were found to be leaking through the valve and the cap. Most of these were on the CNG system. These valves should be evaluated to need, and repair/replace.
- Large volume air leaks were found on every unit near the collector cabinets. This system included 1” threaded pipe fittings. Over 75% of these connections were leaking

Based on the program’s findings, recommended action items are as follows:

- Training on the selection and installation of threaded and fitting products can greatly reduce the number of leaks in a facility. Swagelok offers certified training for proper installation, break and remake, and use of gap inspection gauges to assure proper tightening.
- Consider the use of small bore tubing systems to replace threaded pipe systems from ½” to 2”. This will reduce the number of potential leak points, improve flow, and reduce cost.
- Root cause analysis must be part of the compressed gas leak detection program, and the facility should implement changes to the current system to eliminate leakage.

PROCESS

INTRODUCTION

The process of performing a compressed gas leakage service begins in the hands of a dedicated Swagelok engineering professional working with your facility team. The capabilities of this compressed gas leak detection expert encompass design, problem solving, training, and project management. The skill set brought forth is applicable to both the finite analysis of system components and the assessment of a complete system.

No two facilities are identical. With this in mind, Swagelok's field personnel work with your organization to establish a customized framework for reliability and performance improvement. Swagelok works as a team with your personnel to define and establish the necessary benchmarks, flexibly tailoring the project's parameters to fit the facility's changing needs.

Swagelok certified engineers used a UE Systems UP9000KT ultrasonic detector. Leaks were verified using Swagelok Snoop liquid leak detector where possible. **SITE NAME** facility team witnessed the survey and took pictures to documents leaks.

TASK LIST

The Swagelok report lists and prioritizes opportunities for corrective action and includes the cost savings potential for each improvement. The total costs for achieving energy savings may include expenditures or investments in the following areas:

- engineering;
- design development and written specifications;
- requests for quotation (RFQ);
- purchasing the needed components;
- installation, mechanical, and electrical;
- commissioning; and
- training.

Therefore, each task is listed as an item and is all-encompassing, providing a complete view of the opportunities.

SURVEY GOALS

A. Compressed gas leak detection program
   1. Compressed gases to focus on during the program:
      a. CNG
      b. Hydrogen
      c. Carbon Dioxide
      d. Nitrogen
      e. Compressed air
   2. Tag each leak location

B. Determine the following items:
   1. Leakage location
   2. Device leaking
   3. Estimated volume of the leakage

C. Final report
   1. Compressed gas leakage printouts
   2. Suggested improvements to the compressed gas system to prevent further leakage
   3. Benefits of improving the system
      a. Energy
      b. Reliability
      c. Safety
      d. Performance improvements

COST OF COMPRESSED GAS

Knowing the correct cost of the different compressed gases is very important to all facility personnel. All calculations are based on electricy estimates and gas prices given to us by **SITE NAME**. The below table provides the information that Swagelok used as the basis for its calculations.

Estimated Electricity and Gas Costs

Utility	Cost	Unit
Electricity	$0.10	per kWh
Air	$0.33	per 1,000 cu. ft.
Nitrogen	$1.81	per 1,000 cu. ft.
Carbon Dioxide	$14.59	per 1,000 cu. ft.
Hydrogen	$18.20	per 1,000 cu. ft.
CNG	$3.50	per 1,000 cu. ft.

YEARLY COST OF LEAKAGE

The leak detection program found **178** leaks, and attributed to a total loss of **$507,365.11** per year.

RECOMMENDATIONS

Immediate action should be taken to repair the largest leaks (P1). Carbon Dioxide (CO2) and Natural Gas (CNG) leaks have a higher cost than air. Focus on the Fire Suppression Systems and Coalescing Filter Systems should also take priority. Leaks were found on all units in these areas. Repairs should not be made while the system is under pressure; as this could be dangerous to employees and components. The below table gives you a breakdown of the number and cost of the leaks.

Item	Number of Leaks	Cost
Repair P1 leaks	59	$441,442
Repair P2 leaks	60	$48,596
Repair P3 leaks	59	$17,327
Total	178	$507,365

Annual Leak Detection Program:

In order to continue progress towards a leak free facility, **SITE NAME** should consider implementation of a regular leak detection program. This includes annual energy surveys and training. Annual surveys will verify corrective action taken from previous surveys, help to locate new leaks; and will also create an annual metric, by which to measure improved system performance and/or minimize leakage costs.

Fitting Installation Training:

The number one cause for leaks on Swagelok tube fittings is improper installation. Swagelok offers customized on-site training based on customer needs. Our Swagelok Certification training is a hands-on, eight hour course that covers tubing, fittings, threads, and advanced tube bending. Based on the site survey, I would recommend our four hour course that covers everything in the eight hour course except the tube bending. Most tubing used in the facility is flexible and does not require tube bending. A quote for 10 associates is included as part of this survey.

Unit 2 Fire Suppression Systems:

With the high cost of carbon dioxide, leaks associated with the fire suppression system should be a high priority. There were two main areas with leaks on multiple units.

The relief system had two leaks that will require repair or replace of the relief valve. Swagelok proportional proportional relief valves are one option that are reliable and can be easily rebuilt if needed. A major focus of this survey was to determine nitrogen losses.

The gauge panels all had multiple leaks. Routine checks and maintenance of these panels will prevent costly leaks. Repeat causes for the leaks include unnecessary use of threaded fittings, improper installation, and intermixing of tube fitting components. Swagelok can offer a custom assembly to replace the leaking panels.

Unit 2 Coalescing Filter Systems:

Several leaks were found on each unit. Repeat areas for leaks included the valve manifold, gauges, threaded connections, regulators, and fittings. Causes include improper installation, intermixing, and excessive use of threaded connections. Improved maintenance and product selection will decrease costly leaks in this area and improve system reliability. A major concern is the number of regulator bodies leaking. Several manufacturers had severe leaks at connections, gauges, and body flanges.

Area and Condition	Image	Recommended Solution
Fire Suppression System Leaks on panels, valves, and pressure relief were found on every system in Unit 2. Panels and valves need to be repaired or replaced.	 	Replace leaking relief valves, valves, panels, and connections with a more leak resistant product. Consider selecting a single supplier for this application to maximize discount. A quote has been provided for Swagelok options. **Estimated Replacement Cost:** $51,165.72 **Estimated Leak Savings:** $278,040.52
CNG Valve Manifolds We found several manifolds that had severe leaks on the valves, threads, and fitting connections. Threaded connections tend to have the highest leak rate on most surveys. Various brands were noted throughout the facility. All brands had leaks.		Replace all leaking connections with a more leak resistant product. Eliminate threaded connections when possible. Reduce the number of connections and leak points when possible. A quote has been provided for a Swagelok option. **Estimated Replacement Cost:** $7,042.08 **Estimated Leak Savings:** $61,595.25

Area and Condition	Image	Recommended Solution
Regulators We found 9 regulators that had leaks at connections, gauges, or bodies. These were found throughout the facility. There may be more of these leaking regulators. Picture shows one case of what was in use and leaking.		Locate and check all regulators like this for leaks. Replace all leaking regulators with a more leak resistant product. A quote is attached for a Swagelok option. **Estimated Replacement Cost:** $4,124.43 **Estimated Leak Savings:** $13,150.15
Ball Valves with Caps We found 8 pieces of 1” welded ball valves off the main gas line with leaks. These valves were closed with a pipe cap threaded onto the outlet. In spite of this, there were several leaking.		Determine need for valves. Some may be eliminated. Remove, repair, or replace leaking valves with a more reliable valve and connection. A quote is attached for Swagelok 60 Series ball valves. **Estimated Replacement Cost:** $3,755.60 **Estimated Leak Savings:** $20,671.27
Small Bore Tubing: We found severe leaks on 1-2” pipe systems for air. In spite of the low cost, these leaks add up. Leaks like this contribute to moisture build up and pressure drop. Further investigation of the air system could find more leaks throughout the plant.		Schedule Swagelok presentation with maintenance and engineering on small bore tubing systems. Provide cost for highest priority location to determine feasibility. **Estimated Replacement Cost:** $7,166.22 **Estimated Leak Savings:** $14,030.60

APPENDIX A: VALIDATION

SITE NAME has invested the money and time to begin the process of understanding and improving the compressed gas system. This is a major undertaking by the facility. A key factor in any program's success is validating the compressed gas leakage correction program. Swagelok is committed to ensuring our clients achieve an ongoing and successful compressed gas leakage management program. The following details the validation process.

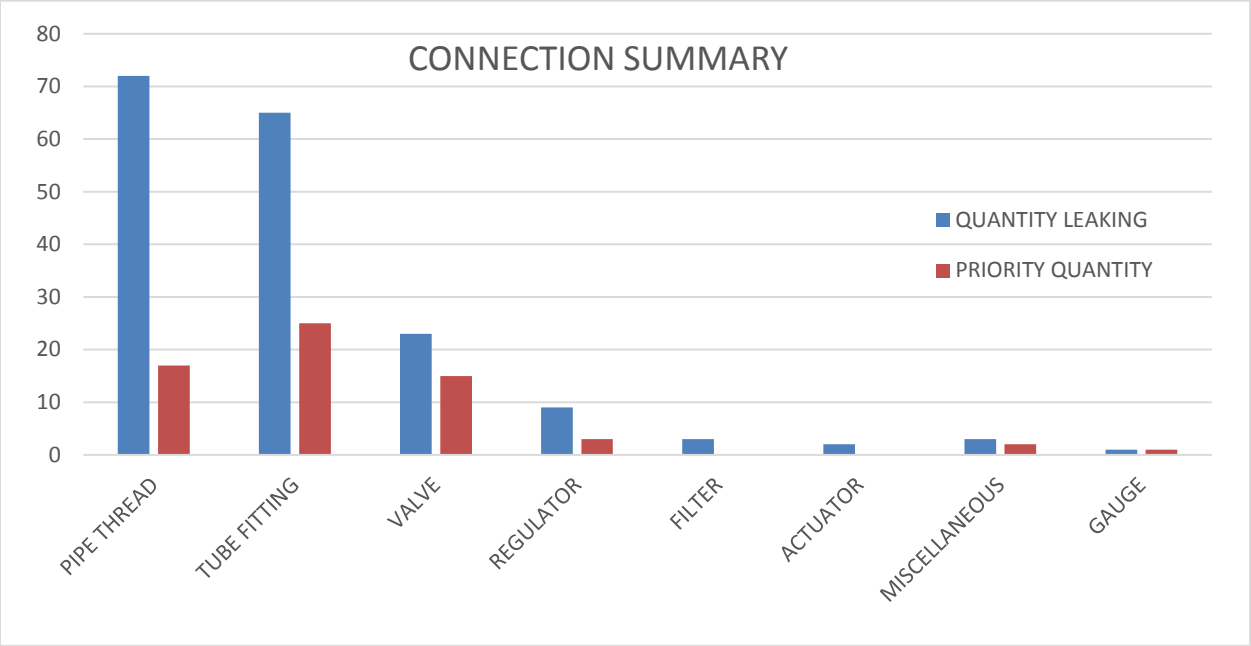
Validation Process

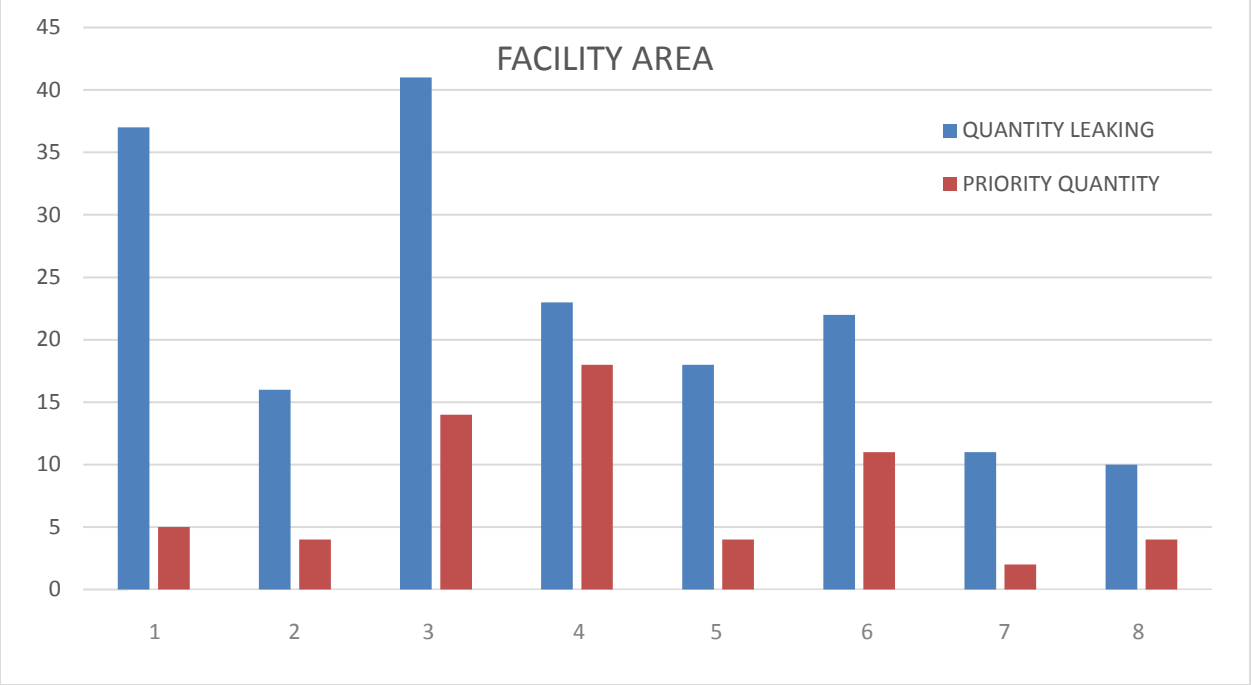
Start date for the validation process (date the report is delivered to the facility)

1. Six-month site visit after the report is delivered to the facility
    a) Swagelok engineer to review the progress on implementing the task list
    b) Set the new benchmarks to be achieved
    c) Update the report to reflect the changes that have occurred
    d) Establish any new goals if necessary
    e) Document the effects of implementing the opportunities
    f) Provide report on the site visit
2. Twelve-month site visit after the report is delivered to the facility
    a) Swagelok engineer to review the progress on implementing the task list
    b) Set the new benchmarks to be achieved
    c) Update the report to reflect the changes that have occurred
    d) Establish any new goals if necessary
    e) Document the effects of implementing the opportunities
    f) Provide report on the site visit
3. Annual site visit
    a) Swagelok engineer to review the progress on implementing the task list
    b) Set the new benchmarks to be achieved
    c) Update the report to reflect the changes that have occurred
    d) Establish any new goals if necessary
    e) Document the effects of implementing the opportunities
    f) Conduct Compressed Gas Leak Detection Survey
    g) Provide report on the site visit

APPENDIX B: LEAKAGE SUMMARY

A summary of all leaks detected is provided for your convenience. Leaks are categorized by types of connections, connection size, and facility location. The below graphs show the total number of leaks in blue and the high priority leaks in red for the connections and facility areas.





Date: 5/24/2017

Company: **SITE NAME** City: **NAME**
Type of Facility: Power State: Florida
Company Personnel Involved:
Signature of Customer Representative:
Distributor: Swagelok Central and South Florida
Distributor Personnel Involved:

TYPE OF CONNECTION	QUANTITY LEAKING	PERCENT OF TOTAL	PRIORITY QUANTITY
PIPE THREAD	72	40%	17
TUBE FITTING	65	37%	25
VALVE	23	13%	15
REGULATOR	9	5%	3
FILTER	3	2%	0
ACTUATOR	2	1%	0
MISCELLANEOUS	3	2%	2
GAUGE	1	1%	1

CONNECTION SIZE	QUANTITY LEAKING	PERCENT OF TOTAL	PRIORITY QUANTITY
1/8" - 1/4"	44	25%	12
3/8" - 3/4"	87	49%	27
> 1"	44	25%	14
N/A	3	2%	2

TUBE FITTING BRAND	QUANTITY CHECKED	QUANTITY LEAKING	PERCENT LEAKING
PARKER	168	33	20%
SWAGELOK	822	18	2%
INTERMIX	11	5	45%
UNKNOWN	2	2	100%
HY-LOK	18	2	11%
HAMLET	2	2	100%

APPENDIX C: YEARLY COST OF LEAKAGE

This report is directly from the Ultrasonic data recorded during the survey. Each data point calculates the volume (SCF) and cost based on the gas, system pressure, decibel reading, and gas price per 1,000 scfm. The facility area and leak location have been added. Each leak was tagged and numbered with pink tape. None of the leaks were repaired during the survey.

MASTER DATA TABLE

	Air Leaks Repaired			N2/NOX Leaks Repaired		CO2 Leaks Repaired		Hydrogen Leaks Repaired		CNG Leaks Repaired		Cost Avoidance	
	CFM	Cost		CFM	Cost	CFM	Cost	CFM	Cost	CFM	Cost	Identified	Repaired
	0.0	$0.00		0.0	$0.00	0.0	$0.00	0.0	$0.00	0.0	$0.00	$507,365.11	$0.00

Record Number	Group Name	Unit	Location Name	Type of Gas	Pressure at Leak	dB Reading	Failed Component	Manufacturer	Size	Repaired (Y/N)	Work Order Schedule #	Identified Leaks Cost Avoidance	Size of Leak (CFM)
1	17-05-24	3A	Cems	Air	100	36	Filter	Unknown	1/2"	N		$ 365.95	2.1
2	17-05-24	3A	Blend Heat	Air	50	52	Thread	Bi-Lok	3/8"	N		$ 420.00	2.4
3	17-05-24	3A	Blend Heat	Air	100	49	Filter	Valtek	1/4"	N		$ 563.55	3.3
4	17-05-24	3A	Blend Heat	Air	100	48	Thread	Bi-Lok	3/8"	N		$ 547.51	3.2
5	17-05-24	3A	Exhaust Comp	Air	100	8	Fitting	Intermix	1/2"	N		$ 44.53	0.3
6	17-05-24	3A	Liq Fuel Purge	N2/NOX	150	23	Fitting	Unknown	3/8"	N		$ 1,520.96	1.6
7	17-05-24	3A	H2 Dryer	Air	125	55	Thread	Unknown	1/4"	N		$ 742.67	4.3
8	17-05-24	3A	H2 Dryer	Air	125	63	Actuator	Unknown	Unknown	N		$ 890.88	5.2
9	17-05-24	3A	H2 Dryer	Air	125	30	Thread	Unknown	1/4"	N		$ 329.67	1.9
10	17-05-24	3A	South Collector	Air	125	28	Thread	Unknown	1/2"	N		$ 300.56	1.7
11	17-05-24	3A	South Collector	Air	125	65	Thread	Unknown	1/2"	N		$ 928.97	5.4
12	17-05-24	3A	South Collector	Air	125	66	Filter	Unknown	1/2"	N		$ 948.17	5.5
13	17-05-24	3A	South Collector	Air	125	32	Thread	Unknown	1/2"	N		$ 359.44	2.1
14	17-05-24	3A	South Collector	Air	125	38	Thread	Unknown	1/2"	N		$ 452.52	2.6
15	17-05-24	3A	South Collector	Air	125	60	Thread	Unknown	1/2"	N		$ 834.50	4.8
16	17-05-24	3A	South Collector	Air	125	55	Thread	Unknown	1/2"	N		$ 742.67	4.3
17	17-05-24	3A	South Collector	Air	125	51	Thread	Unknown	1/2"	N		$ 671.20	3.9
18	17-05-24	3A	South Collector	Air	125	69	Thread	Unknown	1/2"	N		$ 1,006.36	5.8
19	17-05-24	3A	South Collector	Hydrogen	50	26	Fitting	Swagelok	1/4"	N		$ 7,218.40	0.8
20	17-05-24	3A	Instr Air Dryer	Air	125	52	Misc.	Unknown	1/4"	N		$ 688.90	4.0
21	17-05-24	3A	Instr Air Dryer	Air	125	45	Thread	Unknown	1/4"	N		$ 567.57	3.3
22	17-05-24	3A	Instr Air Dryer	Air	125	43	Thread	Unknown	1/4"	N		$ 534.03	3.1
23	17-05-24	3A	Instr Air Dryer	Air	125	48	Thread	Unknown	1/4"	N		$ 618.84	3.6
24	17-05-24	3A	Instr Air Dryer	Air	125	48	Thread	Unknown	1/4"	N		$ 618.84	3.6
25	17-05-24	3A	Instr Air Dryer	Air	125	47	Thread	Unknown	1/4"	N		$ 601.62	3.5
26	17-05-24	3A	Lig Fuel Header	Air	25	51	Thread	Unknown	1/4"	N		$ 326.46	1.9
27	17-05-24	3A	Lig Fuel Header	Air	25	55	Thread	Unknown	1/4"	N		$ 377.34	2.2
28	17-05-24	3A	Lig Fuel Header	Air	125	30	Fitting	Hi-Lok	1/4"	N		$ 329.67	1.9
29	17-05-24	3A	Lig Fuel Header	Air	125	34	Actuator	ACTREG	1/2"	N		$ 389.86	2.3
30	17-05-24	3A	Lig Fuel Header	Air	125	16	Fitting	Hi-Lok	1/4"	N		$ 142.00	0.8
31	17-05-24	3A	Lig Fuel Header	Air	125	48	Valve	Unknown	2"	N		$ 618.84	3.6
32	17-05-24	3A	Lig Fuel Header	Air	125	25	Valve	Unknown	2"	N		$ 258.21	1.5
33	17-05-24	3A	Lig Fuel Header	Air	125	22	Regulator	Unknown	2"	N		$ 217.57	1.3
34	17-05-24	3B	H2 Dryer	Air	125	31	Thread	Unknown	1/4"	N		$ 344.47	2.0
35	17-05-24	3B	H2 Dryer	Air	125	45	Thread	Unknown	1/4"	N		$ 567.57	3.3
36	17-05-24	3B	H2 Dryer	Air	125	49	Valve	ASCO	1/4"	N		$ 636.17	3.7
37	17-05-24	3B	South Collector	Air	125	35	Thread	Unknown	1/2"	N		$ 405.30	2.3
38	17-05-24	3B	South Collector	Air	125	58	Thread	Unknown	1/2"	N		$ 797.44	4.6
39	17-05-24	3B	South Collector	Air	125	34	Thread	Unknown	1/2"	N		$ 389.86	2.3

MASTER DATA TABLE

	Air Leaks Repaired			N2/NOX Leaks Repaired		CO2 Leaks Repaired		Hydrogen Leaks Repaired		CNG Leaks Repaired		Cost Avoidance	
	CFM	Cost		CFM	Cost	CFM	Cost	CFM	Cost	CFM	Cost	Identified	Repaired
	0.0	$0.00		0.0	$0.00	0.0	$0.00	0.0	$0.00	0.0	$0.00	$507,365.11	$0.00
Record Number	Group Name	Unit	Location Name	Type of Gas	Pressure at Leak	dB Reading	Failed Component	Manufacturer	Size	Repaired (Y/N)	Work Order Schedule #	Identified Leaks Cost Avoidance	Size of Leak (CFM)
40	17-05-24	3B	South Collector	Air	125	44	Thread	Unknown	1/2"	N		$ 550.74	3.2
41	17-05-24	3B	South Collector	Air	125	48	Thread	Unknown	1/2"	N		$ 618.84	3.6
42	17-05-24	3B	South Collector	Air	125	60	Thread	Unknown	1/2"	N		$ 834.50	4.8
43	17-05-24	3B	South Collector	Air	125	48	Thread	Unknown	1/2"	N		$ 618.84	3.6
44	17-05-24	3B	South Collector	Air	125	28	Thread	Unknown	1/2"	N		$ 300.56	1.7
45	17-05-24	3B	South Collector	Air	125	31	Thread	Unknown	1/2"	N		$ 344.47	2.0
46	17-05-24	3B	Coalescing Filter	CNG	150	22	Valve	Richards	1/2"	N		$ 2,779.51	1.5
47	17-05-24	3B	Coalescing Filter	CNG	150	24	Valve	Richards	1/2"	N		$ 3,104.59	1.7
48	17-05-24	3B	Coalescing Filter	CNG	150	20	Valve	Richards	1/2"	N		$ 2,462.35	1.3
49	17-05-24	3B	Coalescing Filter	CNG	150	56	Valve	Richards	1/2"	N		$ 9,115.42	5.0
50	17-05-24	3A	Coalescing Filter	CNG	150	47	Valve	Richards	1/2"	N		$ 7,295.43	4.0
51	17-05-24	3A	Coalescing Filter	CNG	150	20	Thread	Swagelok	1/2"	N		$ 2,462.35	1.3
52	17-05-24	3A	Coalescing Filter	CNG	150	34	Gauge	Magnetrol	1/8"	N		$ 4,833.88	2.6
53	17-05-24	3A	Coalescing Filter	CNG	150	31	Misc.	Magnetrol	1/8"	N		$ 4,298.32	2.3
54	17-05-24	2F	Heat Exchanger	Air	125	40	Regulator	Unknown	1/4"	N		$ 484.71	2.8
55	17-05-24	2F	Heat Exchanger	Air	125	39	Fitting	Intermix	3/8"	N		$ 468.54	2.7
56	17-05-24	2F	Heat Exchanger	Air	125	32	Fitting	Swagelok	1/2"	N		$ 359.44	2.1
57	17-05-24	2F	Heat Exchanger	Air	125	30	Thread	Swagelok	1/2"	N		$ 329.67	1.9
58	17-05-24	2F	Cardox Tank	CO2	150	83	Fitting	Swagelok	1/4"	N		$ 62,661.27	8.2
59	17-05-24	2F	Cardox Tank	CO2	150	47	Fitting	Unknown	1/4"	N		$ 30,411.50	4.0
60	17-05-24	2F	Coalescing Filter	CNG	25	21	Fitting	Parker	1/2"	N		$ 633.00	0.3
61	17-05-24	2F	Coalescing Filter	CNG	150	19	Fitting	Parker	1/2"	N		$ 2,306.91	1.3
62	17-05-24	2F	Coalescing Filter	CNG	25	20	Fitting	Parker	1/2"	N		$ 576.43	0.3
63	17-05-24	2F	Coalescing Filter	CNG	150	20	Fitting	Parker	1/2"	N		$ 2,462.35	1.3
64	17-05-24	2E	East Collecting	Air	125	37	Thread	Unknown	1"	N		$ 436.63	2.5
65	17-05-24	2E	East Collecting	Air	125	35	Thread	Unknown	1"	N		$ 405.30	2.3
66	17-05-24	2E	Coalescing Filter	CNG	150	18	Fitting	Unknown	1/2"	N		$ 2,153.69	1.2
67	17-05-24	2E	Coalescing Filter	CNG	25	24	Fitting	Hamlet	1/2"	N		$ 817.82	0.4
68	17-05-24	2E	Coalescing Filter	CNG	25	18	Fitting	Hamlet	1/2"	N		$ 470.94	0.3
69	17-05-24	2E	Coalescing Filter	CNG	25	21	Regulator	Fisher	1/2"	N		$ 633.00	0.3
70	17-05-24	2E	Coalescing Filter	CNG	25	44	Regulator	Fisher	1/2"	N		$ 2,616.30	1.4
71	17-05-24	2E	Gas Flow Trans	CNG	150	14	Fitting	Swagelok	1/2"	N		$ 1,564.72	0.9
72	17-05-24	2E	Positioner	Air	25	36	Thread	Swagelok	1/4"	N		$ 167.35	1.0
73	17-05-24	2E	Positioner	Air	25	24	Fitting	Swagelok	3/8"	N		$ 76.88	0.4
74	17-05-24	2E	Heat Exchanger	Air	125	31	Regulator	Fisher	1/4"	N		$ 344.47	2.0
1	17-07-20	2D	ACV3	Hydrogen	50	22	Fitting	Parker	1/4"	N		$ 5,446.08	0.6
2	17-07-20	2D	HV2971	Hydrogen	50	24	Fitting	Parker	1/4"	N		$ 6,306.88	0.7
3	17-07-20	2D	HV2976	CNG	150	29	Thread	Unknown	1.5"	N		$ 3,948.94	2.1
4	17-07-20	2D	DFGA-BV-1	CNG	150	21	Misc.	Mastergear	8"	N		$ 2,619.90	1.4

MASTER DATA TABLE

	Air Leaks Repaired			N2/NOX Leaks Repaired		CO2 Leaks Repaired		Hydrogen Leaks Repaired		CNG Leaks Repaired		Cost Avoidance	
	CFM	Cost		CFM	Cost	CFM	Cost	CFM	Cost	CFM	Cost	Identified	Repaired
	0.0	$0.00		0.0	$0.00	0.0	$0.00	0.0	$0.00	0.0	$0.00	$507,365.11	$0.00

Record Number	Group Name	Unit	Location Name	Type of Gas	Pressure at Leak	dB Reading	Failed Component	Manufacturer	Size	Repaired (Y/N)	Work Order Schedule #	Identified Leaks Cost Avoidance	Size of Leak (CFM)
5	17-07-20	2D	500105	CNG	150	5	Thread	Unknown	1"	N		$ 422.68	0.2
6	17-07-20	2D	500105	CNG	150	7	Fitting	Unknown	1"	N		$ 648.29	0.4
7	17-07-20	2D	BV1004	CNG	150	16	Thread	Unknown	1"	N		$ 1,854.20	1.0
8	17-07-20	2D	CO2 Storage	CO2	150	17	Fitting	Swagelok	1/4"	N		$ 8,348.60	1.1
9	17-07-20	2D	CO2 Storage	CO2	150	44	Fitting	Swagelok	1/4"	N		$ 27,965.60	3.6
10	17-07-20	2D	CO2 Storage	CO2	150	34	Valve	Unknown	1/2"	N		$ 20,150.37	2.6
11	17-07-20	2D	CO2 Storage	CO2	150	37	Valve	Unknown	1"	N		$ 22,437.02	2.9
12	17-07-20	2D	Coalescing Filter	CNG	150	30	Fitting	Parker	1/2"	N		$ 4,122.84	2.2
13	17-07-20	2D	Coalescing Filter	CNG	150	26	Fitting	Parker	1/2"	N		$ 3,437.11	1.9
14	17-07-20	2D	Coalescing Filter	CNG	150	5	Fitting	Parker	1/2"	N		$ 422.68	0.2
15	17-07-20	2D	N2 Equalizer	N2/NOX	150	10	Fitting	Swagelok	3/8"	N		$ 527.58	0.6
16	17-07-20	2D	Cems	N2/NOX	100	16	Fitting	Swagelok	1/2"	N		$ 646.71	0.7
17	17-07-20	2C	Cems	Air	100	24	Fitting	Parker	1/2"	N		$ 207.41	1.2
18	17-07-20	2C	Cems	Air	100	20	Fitting	Parker	1/2"	N		$ 160.67	0.9
19	17-07-20	2C	CO2 Storage	CO2	150	34	Thread	Unknown	3/8"	N		$ 20,150.37	2.6
20	17-07-20	2C	CFGA-ABV-14	CNG	150	16	Thread	Unknown	1"	N		$ 1,854.20	1.0
21	17-07-20	2C	CFGA-ABV-14	CNG	150	15	Thread	Unknown	1"	N		$ 1,708.15	0.9
22	17-07-20	2C	BV1001	CNG	150	26	Thread	Unknown	1"	N		$ 3,437.11	1.9
23	17-07-20	2C	H702-2	N2/NOX	150	13	Fitting	Swagelok	3/8"	N		$ 736.44	0.8
24	17-07-20	2C	HV2984	Hydrogen	50	8	Fitting	Parker	1/4"	N		$ 988.89	0.1
25	17-07-20	2C	HV2976	Hydrogen	50	6	Fitting	Parker	1/4"	N		$ 608.75	0.1
26	17-07-20	2C	HV2972	Hydrogen	50	4	Fitting	Parker	1/4"	N		$ 307.23	0.0
27	17-07-20	2C	Collector Hose	Hydrogen	50	7	Valve	Unknown	3/4"	N		$ 789.49	0.1
28	17-07-20	2B	96HA-1	N2/NOX	150	17	Fitting	Swagelok	3/8"	N		$ 1,035.71	1.1
29	17-07-20	2B	BFG BV-1006	CNG	150	20	Valve	Unknown	1"	N		$ 2,462.35	1.3
1	17-08-24	2B	BV-1000	CNG	150	25	Valve	Velan	1"	N		$ 3,269.95	1.8
2	17-08-24	2B	BV-1001	CNG	150	43	Valve	Velan	1"	N		$ 6,515.46	3.5
3	17-08-24	2B	Cardox Tank	CO2	150	32	Valve	Unknown	1"	N		$ 18,655.79	2.4
4	17-08-24	2B	Fire Suppression	CO2	150	35	Thread	Unknown	1/2"	N		$ 20,906.74	2.7
5	17-08-24	2B	Fire Suppression	CO2	150	14	Thread	Unknown	1/4"	N		$ 6,522.66	0.9
6	17-08-24	2B	Fire Suppression	CO2	150	9	Fitting	Swagelok	1/4"	N		$ 3,719.63	0.5
7	17-08-24	2B	BFGA-BV-9051	CNG	150	30	Fitting	Swagelok	1/2"	N		$ 4,122.84	2.2
8	17-08-24	2B	BFGA-BV-9051	CNG	150	43	Thread	Unknown	1/2"	N		$ 6,515.46	3.5
9	17-08-24	2B	Gauge	CNG	150	23	Thread	Parker	1/2"	N		$ 2,941.09	1.6
10	17-08-24	2B	Manifold	CNG	150	45	Fitting	Parker	1/2"	N		$ 6,903.09	3.8
11	17-08-24	2B	Coalescing Filter	CNG	150	40	Fitting	Parker	1/2"	N		$ 5,943.17	3.2
12	17-08-24	2B	Coalescing Filter	CNG	150	25	Regulator	Fisher	1/2"	N		$ 3,269.95	1.8
13	17-08-24	2B	Coalescing Filter	CNG	150	20	Regulator	Fisher	1/2"	N		$ 2,462.35	1.3
14	17-08-24	2B	East Generator	Air	125	44	Thread	Unknown	1"	N		$ 550.74	3.2

MASTER DATA TABLE

	Air Leaks Repaired			N2/NOX Leaks Repaired		CO2 Leaks Repaired		Hydrogen Leaks Repaired		CNG Leaks Repaired		Cost Avoidance	
	CFM	Cost		CFM	Cost	CFM	Cost	CFM	Cost	CFM	Cost	Identified	Repaired
	0.0	$0.00		0.0	$0.00	0.0	$0.00	0.0	$0.00	0.0	$0.00	$507,365.11	$0.00

Record Number	Group Name	Unit	Location Name	Type of Gas	Pressure at Leak	dB Reading	Failed Component	Manufacturer	Size	Repaired (Y/N)	Work Order Schedule #	Identified Leaks Cost Avoidance	Size of Leak (CFM)
15	17-08-24	2B	East Generator	Air	125	39	Thread	Unknown	1"	N		$ 468.54	2.7
16	17-08-24	2B	East Generator	Air	125	58	Thread	Unknown	1"	N		$ 797.44	4.6
17	17-08-24	2B	East Generator	Air	125	50	Thread	Unknown	1/2"	N		$ 653.63	3.8
18	17-08-24	2B	Cems	Air	100	49	Regulator	Parker	1/4"	N		$ 563.55	3.3
19	17-08-24	2B	Cems	Air	100	34	Fitting	Parker	1/2"	N		$ 337.80	2.0
20	17-08-24	2B	Cems	Air	100	35	Fitting	Parker	1/2"	N		$ 351.80	2.0
21	17-08-24	2B	Cems	Air	100	31	Fitting	Parker	1/4"	N		$ 296.81	1.7
22	17-08-24	2A	BV-1001	CNG	150	24	Valve	Unknown	1"	N		$ 3,104.59	1.7
23	17-08-24	2A	Hot Reheat	Air	125	29	Thread	Unknown	1"	N		$ 315.03	1.8
24	17-08-24	2A	Hot Reheat	Air	50	20	Fitting	Unknown	3/8"	N		$ 83.83	0.5
25	17-08-24	2A	Manifold	CNG	150	39	Valve	Rosemount	Unknown	N		$ 5,754.95	3.1
26	17-08-24	2A	Manifold	CNG	150	20	Valve	Rosemount	Unknown	N		$ 2,462.35	1.3
27	17-08-24	2A	Needle Valve	CNG	150	7	Fitting	Swagelok	1/2"	N		$ 648.29	0.4
28	17-08-24	2A	Cardox Tank	CO2	150	33	Valve	Unknown	1"	N		$ 19,400.01	2.5
29	17-08-24	2A	Cardox Tank	CO2	100	26	Thread	Unknown	1"	N		$ 10,288.86	1.3
30	17-08-24	2A	Cardox Tank	CO2	150	9	Fitting	Swagelok	1/4"	N		$ 3,719.63	0.5
31	17-08-24	2A	Cardox Tank	CO2	150	7	Fitting	Swagelok	1/4"	N		$ 2,702.44	0.4
32	17-08-24	2A	CNG Supply	CNG	150	4	Fitting	Parker	1/2"	N		$ 318.29	0.2
33	17-08-24	2A	CNG Supply	CNG	150	23	Fitting	Parker	1/2"	N		$ 2,941.09	1.6
34	17-08-24	2A	CNG Supply	CNG	150	13	Fitting	Parker	1/2"	N		$ 1,424.05	0.8
35	17-08-24	2A	CNG Supply	CNG	150	21	Fitting	Parker	1/2"	N		$ 2,619.90	1.4
36	17-08-24	2A	CNG Supply	CNG	150	15	Fitting	Parker	1/2"	N		$ 1,708.15	0.9
37	17-08-24	2A	CNG Supply	CNG	150	13	Fitting	Parker	1/2"	N		$ 1,424.05	0.8
38	17-08-24	2A	CNG Supply	CNG	150	13	Fitting	Parker	1/2"	N		$ 1,424.05	0.8
39	17-08-24	2A	CNG Supply	CNG	150	14	Fitting	Parker	1/2"	N		$ 1,564.72	0.9
40	17-08-24	2A	CNG Supply	CNG	150	12	Thread	Parker	1/2"	N		$ 1,286.28	0.7
41	17-08-24	2A	CNG Supply	CNG	150	11	Valve	Unknown	1/2"	N		$ 1,151.59	0.6
42	17-08-24	2A	Gas Compartment	CNG	150	13	Valve	Velan	1"	N		$ 1,424.05	0.8
43	17-08-24	2A	Gas Compartment	CNG	150	23	Fitting	Parker	1/4"	N		$ 2,941.09	1.6
44	17-08-24	2A	Gas Compartment	CNG	150	21	Fitting	Parker	1/2"	N		$ 2,619.90	1.4
45	17-08-24	2A	Gas Compartment	CNG	150	24	Fitting	Parker	1/2"	N		$ 3,104.59	1.7
46	17-08-24	2A	Collector Cabinet	Hydrogen	50	2	Fitting	Parker	1/4"	N		$ 95.45	0.0
47	17-08-24	2A	Collector Cabinet	Hydrogen	50	18	Fitting	Parker	1/4"	N		$ 3,882.45	0.4
48	17-08-24	2A	Collector Cabinet	Air	125	31	Thread	Unknown	1/2"	N		$ 344.47	2.0
49	17-08-24	2A	Collector Cabinet	Air	125	28	Thread	Unknown	1"	N		$ 300.56	1.7
50	17-08-24	2A	Collector Cabinet	Air	125	14	Thread	Unknown	1"	N		$ 118.73	0.7
51	17-08-24	2A	Collector Cabinet	Air	125	18	Thread	Unknown	1"	N		$ 166.27	1.0
52	17-08-24	2A	Collector Cabinet	Air	125	23	Thread	Unknown	1"	N		$ 230.92	1.3
53	17-08-24	2A	Collector Cabinet	Air	125	23	Thread	Unknown	1"	N		$ 230.92	1.3

MASTER DATA TABLE

	Air Leaks Repaired			N2/NOX Leaks Repaired		CO2 Leaks Repaired		Hydrogen Leaks Repaired		CNG Leaks Repaired		Cost Avoidance	
	CFM	Cost		CFM	Cost	CFM	Cost	CFM	Cost	CFM	Cost	Identified	Repaired
	0.0	$0.00		0.0	$0.00	0.0	$0.00	0.0	$0.00	0.0	$0.00	$507,365.11	$0.00

Record Number	Group Name	Unit	Location Name	Type of Gas	Pressure at Leak	dB Reading	Failed Component	Manufacturer	Size	Repaired (Y/N)	Work Order Schedule #	Identified Leaks Cost Avoidance	Size of Leak (CFM)
54	17-08-24	2A	Collector Cabinet	Air	125	24	Thread	Unknown	1"	N		$ 244.47	1.4
55	17-08-24	2A	Cems	Air	100	20	Fitting	Parker	1/2"	N		$ 160.67	0.9
56	17-08-24	2A	Cems	Air	100	36	Regulator	Conoflow	1/4"	N		$ 365.95	2.1
57	17-08-24	2A	Cems	Air	100	15	Fitting	Intermix	1/2"	N		$ 107.39	0.6
2-1	17-08-24-2	2A	Cems	Air	150	6	Fitting	Swagelok	1/2"	N		$ 50.09	0.3
2-2	17-08-24-2	2A	Cems	Air	100	6	Fitting	Swagelok	1/2"	N		$ 29.76	0.2
2-3	17-08-24-2	2A	Cems	N2/NOX	150	13	Valve	Parker	1/4"	N		$ 736.44	0.8
2-4	17-08-24-2	2A	Cems	N2/NOX	25	3	Fitting	Intermix	1/4"	N		$ 7.83	0.0
2-5	17-08-24-2	2A	Cems	N2/NOX	25	2	Fitting	Intermix	1/4"	N		$ 3.60	0.0
2-6	17-08-24-2	2D	East Collecting	Air	125	54	Thread	Unknown	1"	N		$ 724.63	4.2
2-7	17-08-24-2	2D	East Collecting	Air	125	38	Thread	Unknown	1"	N		$ 452.52	2.6
2-8	17-08-24-2	2D	East Collecting	Air	125	44	Thread	Unknown	1"	N		$ 550.74	3.2
2-9	17-08-24-2	2D	East Collecting	Air	125	53	Thread	Unknown	1"	N		$ 706.71	4.1
2-10	17-08-24-2	2D	East Collecting	Air	125	31	Thread	Unknown	1"	N		$ 344.47	2.0
2-11	17-08-24-2	2D	East Collecting	Air	125	62	Thread	Unknown	1/2"	N		$ 871.98	5.0
2-12	17-08-24-2	2C	East Collecting	Air	125	31	Valve	Apollo	1"	N		$ 344.47	2.0
2-13	17-08-24-2	2C	East Collecting	Air	125	55	Thread	Unknown	1"	N		$ 742.67	4.3
2-14	17-08-24-2	2C	East Collecting	Air	125	63	Thread	Unknown	1"	N		$ 890.88	5.2
2-15	17-08-24-2	2C	East Collecting	Air	125	35	Thread	Unknown	1"	N		$ 405.30	2.3
2-16	17-08-24-2	2C	East Collecting	Air	125	48	Thread	Unknown	1"	N		$ 618.84	3.6
2-17	17-08-24-2	2C	East Collecting	Air	125	46	Thread	Unknown	1"	N		$ 584.53	3.4
2-18	17-08-24-2	2C	East Collecting	Air	125	57	Thread	Unknown	1"	N		$ 779.07	4.5

APPENDIX D: TECHNICAL INFORMATION

These are the quotes and technical data for the following items:

- Quotes for:
    - Solution 1
    - Solution 2
    - Solution 3
- Technical Info for:
    - Proportion Safety Relief Valve
    - Pipe Socket Valve
    - Tube Fitting Valve
    - 5 Valve Manifold
    - KPR Regulator

Swagelok Central & South Florida
5906 Breckenridge Parkway
Suite A
Tampa, FL 33610
863-425-3222

10/5/2017 2:03:59 PM
www.swagelok.com

Proportional Safety Relief Valve

Part No.
PRVN8F-02-2-VV

Part Description
316L SS Pressure Relief Valve, 1" FNPT Ports, Flourocarbon FKM Seats/Seals, 1160 – 2175 psig set pressure range

Specifications

Technical Data

Valve Series	PRV2	PRV6
Working Pressure, psig (bar)	6000 (413)	
Set Pressure, psig (bar)	145 to 6000 (10.0 to 413)	
Temperature, °F (°C)	Fluorocarbon FKM seal material: 5 to 176 (–15 to 80) Nitrile seal material: –4 to 176 (–20 to 80)	
Seal Materials	Fluorocarbon FKM and nitrile	
Flow Coefficient (C_v)	0.49	4.30
Seat Diameter, in. (mm)	0.20 (5.0)	0.45 (11.5)
Weight, lb (kg)	1.7 (0.77)	5.7 (2.6)

Set Pressure and Reseating Pressure

- Set pressure is the upstream pressure at which the first indication of flow occurs. Set pressure of each valve after initial relief is repeatable within ± 5 % at room temperature.
- Reseating pressure is the upstream pressure at which there is no indication of flow. Reseating pressure is always lower than set pressure. See table below for details.
- Blowdown is the difference between the set pressure and the reseating pressure. It is usually expressed as a percentage of the set pressure.

Set Pressure psig (bar)	Minimum Reseating Pressure as a Percentage of Set Pressure, %
2900 (200)	95
1450 (100)	90

Features

- All 316L stainless steel wetted metal components
- Five set spring pressure ranges
- Factory-set, tested, locked, and tagged with the set pressure
- CE-marked in accordance with the Pressure Equipment Directive as a safety valve according to ISO-4126-1
- Available integral end connections—1/4 and 3/4 in. female NPT and ISO/BSP parallel thread
- Available end connection adapters—1/2 in. male and female NPT and ISO/BSP parallel thread, 3/4 in. male NPT, and 1 in. male and female NPT and ISO/BSP parallel thread end connections

1	2	3	4	5	6	7	8	9
PRV	B	2	F	- 02	- 0	- V	V	- Q

1 Series
PRV = 6000 psig (413 bar) maximum inlet pressure

2 Inlet / Outlet
B = ISO/BSP parallel thread
N = NPT

3 End Connection Size
2 = 1/4 in.
4 = 1/2 in. adapter, 3/4 in. main body
6 = 3/4 in.
8 = 1 in. adapter, 3/4 in. main body

4 End Connection Thread Style
M = Male
F = Female

5 Body Material
02 = 316L SS

6 Set Pressure Range
0 = 145 to 580 psig (10.0 to 40.0 bar)
1 = 580 to 1160 psig (40.0 to 80.0 bar)
2 = 1160 to 2175 psig (80.0 to 150 bar)
3 = 2175 to 4060 psig (150 to 280 bar)
4 = 4060 to 6000 psig (280 to 413 bar)

7 Seal Material
V = Fluorocarbon FKM
N = Nitrile

8 Seat Seal Material
V = Fluorocarbon FKM
N = Nitrile

9 Options
Omit designator if option is not ordered.
Q = Independent 3rd party witness testing of set pressure

Swagelok Central & South Florida
5906 Breckenridge Parkway
Suite A
Tampa, FL 33610
863-425-3222

10/5/2017 2:02:13 PM

www.swagelok.com

3 Piece Process/Instrumentation, 60 Series

Part No.

SS-65TW16P40

Part Description

Stainless Steel 3-Piece 60 Series Ball Valve, Reinforced PTFE Seats, 1 in. Pipe Butt Weld, Schedule 40

Specifications

General	
Ball/Stem Material	Stainless Steel
Body Material	316 Stainless Steel
Cleaning Process	Standard Cleaning and Packaging (SC-10)
Connection 1 Size	1 in.
Connection 1 Type	Pipe Butt Weld
Connection 2 Size	1 in.
Connection 2 Type	Pipe Butt Weld
eClass (4.1)	37010401
eClass (5.1.4)	37010401
eClass (6.0)	37-01-04-01
eClass (6.1)	37-01-04-01
Fastener Material	316 Stainless Steel
Flange Seal Material	Fluorocarbon FKM
Flow Pattern	2-Way, Shutoff, Straight
Handle Color	Black
Handle Style	Lever
Lubricant	DOW 111 and WL8 Mix
Max Temperature Pressure Rating	450°F @ 100 PSIG /232°C @ 6.8 BAR
Packing	Reinforced PTFE
Room Temperature Pressure Rating	2200 PSIG @ 100°F /151 BAR @ 37°C
Seat Material	Reinforced PTFE
Seat Spring Material	316 Stainless Steel
Service Class	General
Size	1 in. Nominal - 65 Series
Stem Bearing Material	Alloy X750
Testing	Testing according to WS-22
UNSPSC (10.0)	40141607
UNSPSC (11.0501)	40141607
UNSPSC (13.0601)	40141607

Swagelok Central & South Florida
5906 Breckenridge Parkway
Suite A
Tampa, FL 33610
863-425-3222

10/5/2017 2:02:13 PM

www.swagelok.com

UNSPSC (15.1)	40141607
UNSPSC (17.1001)	40141600
UNSPSC (4.03)	40141607
UNSPSC (SWG01)	40141607
Valve Material	Stainless Steel

! The complete catalog contents must be reviewed to ensure that the system designer and user make a safe product selection. When selecting products, 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.

Caution: Do not mix or interchange valve components with those of other manufacturers.

Swagelok Central & South Florida
5906 Breckenridge Parkway
Suite A
Tampa, FL 33610
863-425-3222

10/5/2017 2:03:59 PM

www.swagelok.com

3 Piece Process/Instrumentation, 60 Series

Part No.

SS-65TS16

Part Description

Stainless Steel 3-Piece 60 Series Ball Valve, Reinforced PTFE Seats, 1 in. Swagelok Tube Fitting

Specifications

General	
Ball/Stem Material	Stainless Steel
Body Material	316 Stainless Steel
Cleaning Process	Standard Cleaning and Packaging (SC-10)
Connection 1 Size	1 in.
Connection 1 Type	Swagelok® Tube Fitting
Connection 2 Size	1 in.
Connection 2 Type	Swagelok® Tube Fitting
eClass (4.1)	37010401
eClass (5.1.4)	37010401
eClass (6.0)	37-01-04-01
eClass (6.1)	37-01-04-01
Fastener Material	316 Stainless Steel
Flange Seal Material	Fluorocarbon FKM
Flow Pattern	2-Way, Shutoff, Straight
Handle Color	Black
Handle Style	Lever
Lubricant	DOW 111 and WL8 Mix
Max Temperature Pressure Rating	450°F @ 100 PSIG /232°C @ 6.8 BAR
Packing	Reinforced PTFE
Room Temperature Pressure Rating	2200 PSIG @ 100°F /151 BAR @ 37°C
Seat Material	Reinforced PTFE
Seat Spring Material	316 Stainless Steel
Service Class	General
Size	1 in. Nominal - 65 Series
Stem Bearing Material	Alloy X750
Testing	Testing according to WS-22
UNSPSC (10.0)	40141607
UNSPSC (11.0501)	40141607
UNSPSC (13.0601)	40141607

Swagelok Central & South Florida
5906 Breckenridge Parkway
Suite A
Tampa, FL 33610
863-425-3222

10/5/2017 2:03:59 PM

www.swagelok.com

UNSPSC (15.1)	40141607
UNSPSC (17.1001)	40141600
UNSPSC (4.03)	40141607
UNSPSC (SWG01)	40141607
Valve Material	Stainless Steel

The complete catalog contents must be reviewed to ensure that the system designer and user make a safe product selection. When selecting products, 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.

Caution: Do not mix or interchange valve components with those of other manufacturers.

Swagelok Central & South Florida
5906 Breckenridge Parkway
Suite A
Tampa, FL 33610
863-425-3222

10/5/2017 2:00:48 PM

www.swagelok.com

5-Valve Manifolds, Instrument

Part No.

SS-VB5NBF8

Part Description

Stainless Steel 5-Valve Instrument Manifold, 1/2 in. Female NPT x 1/2 in. Female NPT x 1/8 in. Female NPT

Specifications

General	
Body Material	316 Stainless Steel
Cleaning Process	Standard Cleaning and Packaging (SC-10)
Connection 1 Size	1/2 in.
Connection 1 Type	Female NPT
Connection 2 Size	1/2 in.
Connection 2 Type	Female NPT
Connection 3 Size	1/8 in.
Connection 3 Type	Female NPT
eClass (4.1)	37010269
eClass (5.1.4)	37010269
eClass (6.0)	37-01-02-69
eClass (6.1)	37-01-02-69
UNSPSC (10.0)	40141600
UNSPSC (11.0501)	40141600
UNSPSC (13.0601)	40141600
UNSPSC (15.1)	40141600
UNSPSC (4.03)	40141600
UNSPSC (SWG01)	40141602

! The complete catalog contents must be reviewed to ensure that the system designer and user make a safe product selection. When selecting products, 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.

⚠ Caution: Do not mix or interchange valve components with those of other manufacturers.

Swagelok Central & South Florida
5906 Breckenridge Parkway
Suite A
Tampa, FL 33610
863-425-3222

10/5/2017 1:58:19 PM

www.swagelok.com

General-Purpose

Part No.

KPR1FJA415A20000

Part Description

Stainless Steel PR Regulator, 0 to 100 psig (6.8 bar), 500 psig (34.4 bar) inlet, A Config, PCTFE Seat, 1/4 in. FNPT, 0.02 Cv

Specifications

General	
Body Material	316 Stainless Steel
Cap Assembly	Standard
Cleaning Process	Standard Cleaning and Packaging (SC-10)
eClass (4.1)	37011108
eClass (5.1.4)	37011108
eClass (6.0)	37-01-11-08
eClass (6.1)	37-01-11-08
Maximum Inlet Pressure	500 psig (34.4 bar)
Outlet Range	0 to 100 psig (6.8 bar)
Port Configuration	Inlet/Outlet; No Gauge Port {A}
Port Type	1/4 in. Female NPT
UNSPSC (10.0)	40142202
UNSPSC (11.0501)	40142202
UNSPSC (13.0601)	40142202
UNSPSC (15.1)	40142202
UNSPSC (4.03)	41112404
UNSPSC (SWG01)	41112404

! The complete catalog contents must be reviewed to ensure that the system designer and user make a safe product selection. When selecting products, 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.

⚠ Caution: Do not mix or interchange valve components with those of other manufacturers.

APPENDIX E: COMPRESSED GAS LEAKAGE DATA SHEETS

These are the data sheets used to collect the information during the survey. We always had an **SITE NAME** employee present to witness the entire survey. **SITE NAME** employees varied over the three days.

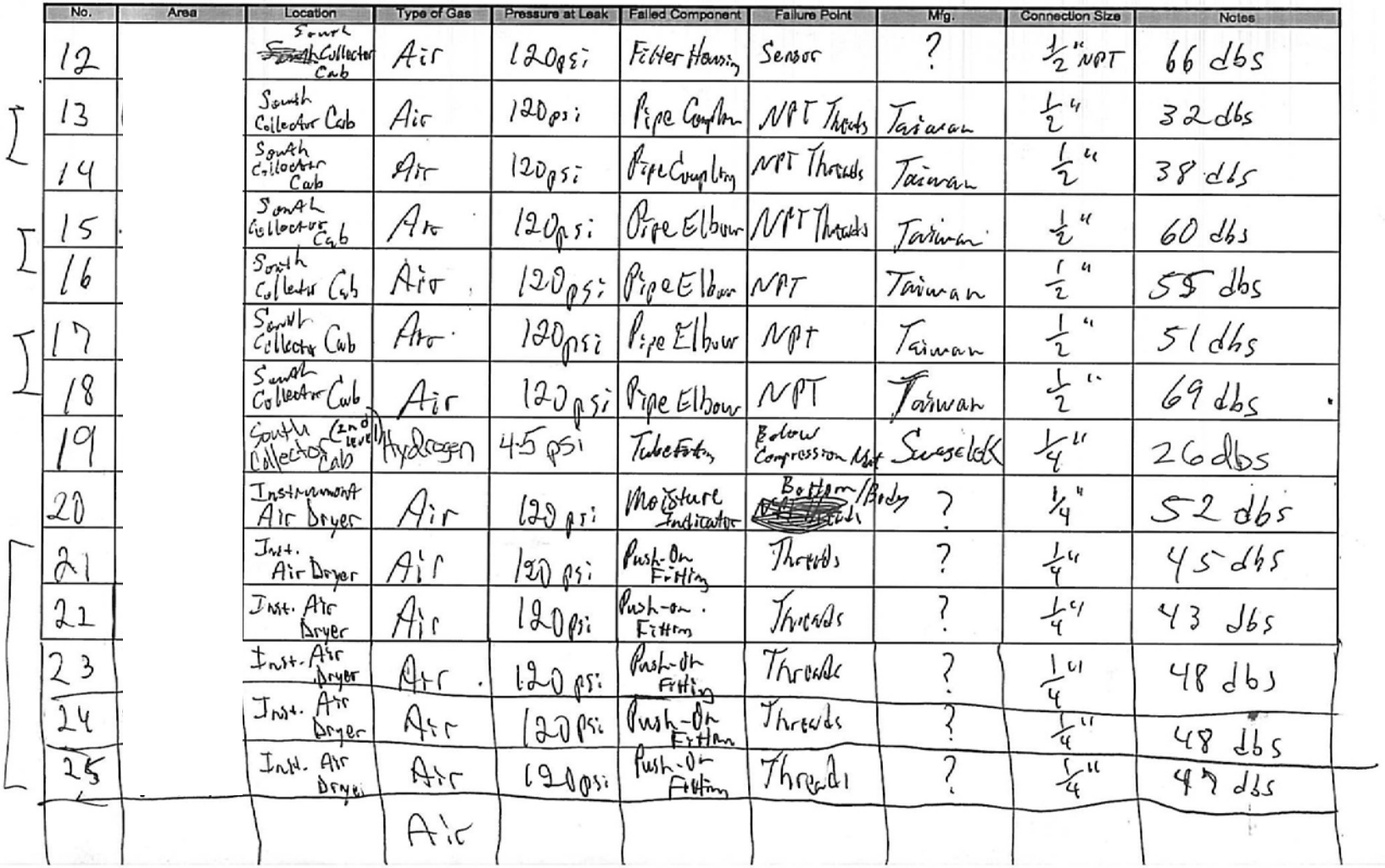
05-24-17

No.	Area	Location	Type of Gas	Pressure at Leak	Failed Component	Failure Point	Mfg.	Connection Size	Notes
1		SEMs Shelter	Inst. Air	100psi	Filter	Possibly on the seal	?	½"	37 decibels
2		Bleed Heat System →	Control Valve Air	35psi	Tube Fitting	NPT Threads	Bi-Lok	⅜"	47 decibels
3		Bleed Heat System (Control Valve)	Air	100psi	Filter	Body Across	Valtek Filter	¼" Threads	53 dbs
4		Bleed Heat System (Cont. Valve)	Air	100psi	Tube Fitting	NPT Threads	Bi-Lok	⅜"	45 DBi
5		Exhaust Conflattum	Air	100psi	Tube Fitting	Compression	InAlesmix	½"	8 dbs
6		Liquid Fuel Purge System (3rd Level)	Nitrogen	170psi	Tube Bulkhead Fitting	Compression	?	⅜"	23 dbs
7		Hydrogen Dryer	Air	120psi	Pipe Fitting	NPT Threads	? Forged	¼"	55 dbs
8		Hydrogen Dryer	~~Hydrogen~~ Air	120 psi	Actuator Housing	Body	?	Body	63 dbs
9		Hydrogen Dryer	~~Hydrogen~~ Air	120 psi	Pipe fitting	Npt Threads	?	¼"	30 dbs
10		South Collector Cab	Air	120psi	Pipe Elbow	NPT Threads	Taiwan	½"	28 dbs
11		South Collector Cab	Air	120psi	Pipe Elbow	NPT Threads	Taiwan	½"	65dbs

66 dbs (12

- Pressure Transducer Assy.
  - Prime (Unit 3A - second Level)
  - see photo (JB34D)

Swagelok



No.	Area	Location	Type of Gas	Pressure at Leak	Failed Component	Failure Point	Mfg.	Connection Size	Notes
12		South Collector Cab	Air	120psi	Filter Housing	Sensor	?	½" NPT	66 dbs
13		South Collector Cab	Air	120psi	Pipe Coupling	NPT Threads	Taiwan	½"	32 dbs
14		South Collector Cab	Air	120psi	Pipe Coupling	NPT Threads	Taiwan	½"	38 dbs
15		South Collector Cab	Air	120psi	Pipe Elbow	NPT Threads	Taiwan	½"	60 dbs
16		South Collector Cab	Air	120psi	Pipe Elbow	NPT	Taiwan	½"	55 dbs
17		South Collector Cab	Air	120psi	Pipe Elbow	NPT	Taiwan	½"	51 dbs
18		South Collector Cab	Air	120psi	Pipe Elbow	NPT	Taiwan	½"	69 dbs
19		South Collector Cab (2nd level)	Hydrogen	4.5 psi	Tube Fitting	Below Compression Nut	Swagelok	¼"	26 dbs
20		Instrument Air Dryer	Air	120 psi	Moisture Indicator	Bottom/Body Threads	?	¼"	52 dbs
21		Inst. Air Dryer	Air	120 psi	Push-On Fitting	Threads	?	¼"	45 dbs
22		Inst. Air Dryer	Air	120psi	Push-on Fitting	Threads	?	¼"	43 dbs
23		Inst. Air Dryer	Air	120 psi	Push-On Fitting	Threads	?	¼"	48 dbs
24		Inst. Air Dryer	Air	120 psi	Push-On Fitting	Threads	?	¼"	48 dbs
25		Inst. Air Dryer	Air	120psi	Push-On Fitting	Threads	?	¼"	47 dbs
			Air						

Swagelok

No.	Area	Location	Type of Gas	Pressure at Leak	Failed Component	Failure Point	Mfg.	Connection Size	Notes
26		Liquid Fuel Header	Air	35 psi	Pipe Tee	Pipe Run NPT	?	1/4"	51 dbs.
27		Liquid Fuel Heater	Air	35 psi	Pipe Tee	Pipe Branch NPT	?	1/4"	55 dbs
28		Liquid Fuel Header	Inst. Air	[illegible]	Pipe Bushing	1/4" NPT	Hi-Lok	1/4"	30 dbs
29		↓	Inst. Air	120 psi	Valve Body	Actuator	ACTREG.	1/2"	34 dbs
30		↓	Air	120 psi	Male Elbow	1/4" NPT threads	Hi-Lok	1/4"	16 dbs
31		↓	Air	120 psi	Valve NPT	Threads	?	2"	48 dbs
32		↓	Air	120 psi	Valve NPT	Threads	?	2"	25 dbs
33		↓	Air	120 psi	Regulator NPT	Threads	?	2"	22 dbs
34		Hydrogen Dryer	Air	120 psi	Pipe Tee Branch	Threads	?	1/4"	31 dbs
35		↓	Air	120 psi	Push to Connect	Threads	?	1/4"	45 dbs
36		↓	Air	120 psi	Solenoid Valve	Threads	ASCO	1/4"	49 dbs

No.	Area	Location	Type of Gas	Pressure at Leak	Failed Component	Failure Point	Mfg.	Connection Size	Notes
37		South Collector Cab	Air	120 psi	Pipe Elbow	Threads	Taiwan	1/2"	35 dbs
38		↓	Air	120 psi	Pipe Elbow	Threads	↓	1/2"	58 dbs
39			Air	120 psi	Pipe Elbow	Threads		1/2"	34 dbs
40			Air	120 psi	Pipe Elbow	Threads		1/2"	44 dbs
41			Air	120 psi	Pipe Elow	Threads		1/2"	50 dbs
42			Air	120 psi	Pipe Elbow	Threads	Taiwan	1/2"	60 dbs
43			Air	120 psi	Pipe Elbow	Threads	Taiwan	1/2"	48 dbs
44			Air	120 psi	Pipe Elbow	Threads	↓	1/2"	28 dbs
45		↓	AIR	120 psi	Pipe Elbow	Threads		1/2"	31 dbs
46		Coalescing Filter	CNG	500	DP Manifold	Valve Bonnet	Richards Industries	1/2"	22 dbs
47		Coalescing Filter	CNG	500	DP Manifold	Valve Bonnet	Richards Industries	1/2"	24 dbs

No.	Area	Location	Type of Gas	Pressure at Leak	Failed Component	Failure Point	Mfg.	Connection Size	Notes
48		Coalescing Filter	CNG	500	DP Manifold	Valve Bonnet	Richards Industries	1/2"	20 dbs
49		Coalescing Filter	CNG	500	DP Manifold	Plug Threads	Richards Industries	1/2"	56 dbs
50		Coalescing Filter	CNG	500	DP Manifold	Valve Bonnet	Richards Industries	1/2"	47 dbs
51		Coalescing Filter	CNG	500	DP Manifold	Fitting NPT Thread	Swagelok	1/2"	20 dbs
52		Coalescing Filter	CNG	280	Gauge	Threads	Magnetrol	1/8"	~~55 dbs~~ 34
53		Coalescing Filter	CNG	280	Misc Grey Item	Body Seal	Magnetrol	1/8"	~~39~~ 31 dbs
54		Heat Exchanger	Air	120	Regulator	Body Seal	?	1/4"	40 dbs
55		Heat Exchanger	Air	120	Tube Fitting Union	Left Connection	Intermix Swagelok	3/8"	39 dbs
56		Heat Exchanger	Air	120	Fitting	Tube	Swagelok	1/2"	32 dbs
57		Heat Exchanger	Air	120	Fitting	Thread	Swagelok	1/2"	30 dbs
58		Cardox Tank	CO_2	330	Tube Fitting	Tube	Swagelok	1/4"	83 dbs

Behind Panel

56 wasn't pulled up sufficiently

	No.	Area	Location	Type of Gas	Pressure at Leak	Failed Component	Failure Point	Mfg.	Connection Size	Notes
Behind Panel	59		Cardox Tank	CO2	330	Tube Fitting	Tube	?	1/4"	47 lbs
	60		Coalescing Filter	CNG	~~350~~ 40	Tube Fitting	Tube	Parker	1/2"	21 lbs
	61		Coalescing Filter	CNG	350	Tube Fitting	Tube	Parker	1/2"	19 lbs
	62		Coalescing Filter	CNG	~~350~~ 40	Tube Fitting	Tube	Parker	1/2"	20 lbs
	63		Coalescing Filter	CNG	350	Tube Fitting	Tube	Parker	1/2"	20 lbs
	64		East Collecting	Air	120	Pipe Tee	Thread	Taiwan	1"	37 lbs
	65		East Collecting	Air	120	Pipe Tee	Thread	Taiwan	1"	35 lbs
	66		Coalescing Filter	CNG	475	Tube Fitting	Tube	?	1/2"	18 lbs
	67		Coalescing Filter	CNG	~~475~~ 40	Tube Fitting	~~Tube~~ Thread	Hamlet	1/2"	24 lbs
	68		Coalescing Filter	CNG	~~475~~ 40	Tube Fitting	Tube	Hamlet	1/2"	18 lbs
	69		Coalescing Filter	CNG	~~475~~ 40	Regulator	Body Seal	Fischer	1/2"	21 lbs

No.	Area	Location	Type of Gas	Pressure at Leak	Failed Component	Failure Point	Mfg.	Connection Size	Notes
70		Coalescing Filter	CNG	40	Regulator	Body Seal	Fischer	1/2"	44 dbs
71		Gas Flow Transmitter	CNG	500	Tube Fitting Elbow	Tube	Swagelok	1/2"	14 dbs
72		Positioner	Air	20	Fitting	Thread	Swagelok	1/4"	36 dbs
73		Positioner	Air	20	Tube Fitting	Tube	Swagelok	3/8"	24 dbs
74		Heat Exchanger	Air	120	Regulator	Body Seal	Fischer	1/4"	31 dbs

71 overtightened or missing ferrule

Number	Decibels	Area	Location	Fluid	Pressure	Component	Manufacturer	Size	Under Tight?	Comments
17	24		CEMS SMAKE	AIR	100	BRASS	PARKER	1/2		
18	21		〃	〃	〃	〃	〃	〃		
19	34		CO2 STORAGE TANK	CO2	320	PT		3/4		
20	16		CF9A-ABV-14	CNG	500	PT		1 CAP		
21	15		〃	〃	〃	〃		〃		
22	26		BV 1001	〃	〃	〃		〃		
23	13		H 702-2	N2	1632	TF	SWAGELOK	3/8		
24	8		HV2984	H2	46	TF	PARKER	1/4		
25	6		HV2976 HV2976	H2	46	TF	PARKER	〃		
26	4		HV2972	H2	〃	〃	〃	〃		
27	7		CLOCTER HOSE	H2	〃	BALL VALVE		3/4		
28	17		96HA-1	N2	1608	TF	SWAGELOK	3/8		
29	20		BF9 BV-1006	CNG	500	PT CAP		1		

Distributor Staff: Joe Ford, [illegible]

Number	Decibels	Area	Location	Fluid	Pressure	Component	Manufacturer	Size	Under Tight?	Comments
3	29		ACV3	CNG	500	PT	—	1 1/4	—	
1	22		HV 2971 H2	H2	46	TF	PARKER	1/4		
2	24		HV2970 H2	H2	46	TF	"	1/4		
4	21		LEFT FIRING DFGA-BV-1	CNG	500	FIRING	MASTERGEAR	8		
5	5		SDD105	CNG	"	PT		1		
6	7			CNG	500	TF				RUSTED NUTS ON TUB
7	16		BV1004 VENT VALVE	CNG	500	PT		1		DOWN STREAM VAVLE
8	17		CO2 STORAGE	CO2	320	TF	SWAGELOK	1/4		
9	44		TAG	CO2	320	TF	"	1/4		
10	34		↓	CO2	320	TF	BAIIVALE BODY	1/2		
11	37		"	CO2	320	MPT ON VAVLE		1		
12	30		COALESCING FILTER	CNG	320	TF	PARKER	1/2		
13	26		↓	CNG	320	TF	PARKER	1/2		
14	5		↓	CNG	320	TF	PARKER	1/2		
15	10		H702-2	N2	1574	TF	SWAGELOK	3/8		
16	16		MAINTAIN	NOX	104	TF	SWAGELOK	1/2		

Number	Decibels	Area	Location	Fluid	Pressure	Component	Manufacturer	Size	Under Tight?	Comments
1	23 db		Ground	Nat. Gas	~~500~~ psi	Valve + Cap	VELAN	1"		B-FGA-BV1000
2	42 db		Ground	Nat. Gas	500psi	Valve + Cap	VELAN	1"		
3	32 db		Cardox Fire Suppression	~~Carbon Dioxide~~ CO2	300psi	Relief Valve	?	1"		*RHPS solution
4	35db		Fire Suppression Tank	CO2	325psi	Pipe Coupling	?	½" Pipe Thread		
5	14db		Fire Suppression Tank	CO2	325psi	Swagelok Tube Fitting	Swagelok	¼"	no	
6	9db		Fire Suppression Tank	CO2	325psi	Tube Fitting Tee	Swagelok	¼"	no	
7	30 db		BFGA-BV 9051	Nat. Gas	500psi	Pipe Thread	?	½"		* Coalescing Filter
8	43 db		BFGA-BV 9051	Nat. Gas	500psi	Pipe Thread	Parker	½"		* Coalescing Filter
9	23 db		Gauge	Nat. Gas	500psi	Tube Fitting	Parker	½"	—	* Coalescing Filter
10	45 db		Manifold	Nat. Gas	500psi	Tube Fitting	Parker	½"	—	* Coalescing Filter
11	40 db		Coalescing Filter	Nat. Gas	500psi	Tube Fitting	Parker	½"	—	* Coalescing Filter
12	25 db		Coalescing Filter	Nat. Gas	500psi	~~Regulator~~ Body	Fisher	½"	—	
13	20 db		Carbon Filter	Nat. Gas	500psi	Regulator Body	Fisher	½"	—	*BFGA-BCV-9050 (Regulator)
14	40db		Generator East	Air	120psi	Pipe Tee	?	1"	—	
15	39db		Generator East	Air	120psi	Pipe Tee	?	1"	—	
16	58db		Generator East	Air	120psi	Pipe Tee	?	1"	—	
17	50db		East	Air	120psi	Pipe Elbow	?	½"		

Distributor Staff: _____ Company Staff: _____ Signature: _____

Number	Decibels	Area	Location	Fluid	Pressure	Component	Manufacturer	Size	Under Tight?	Comments
18	49 db		CEMS supply	Air	100psi	Regulator	A-Lok	1/4"		* Body Leak
19	34db		cems	Air	100psi	Tube Fitting	"	1/2"		
20	35db		cems	Air	100psi	Tube Fitting	"	1/2"		
21	31db		cems	Air	100psi	Tube Fitting	A-Lok	1/4"		
	Begin		nt 2A							
22	24 db		Fuel Gas System BV-1001	Nat. Gas	500psi	Valve	?	1"		
23	29db		Hot Re-Heat	~~Air~~	120 psi	Pipe Thread	?	1"		
24	20db		Hot Re-heat	Air	60psi	Tube Fitting	?	3/8"		* No Tag (Too High)
25	39db		Main Gas	Nat. Gas	500psi	Valve	Rosemount	?		* off Transmitter
26	20db		main gas	Nat. Gas	500psi	Valve	Rosemount	?		" ↓ "
27	7db		near needle valve	Nat. Gas	500psi	Tube Fitting	Swagelok	1/2"		
28	33db		Cardox Fire Suppression	CO2	350psi	Relief	?	1"		
29	26db		" "	CO2	100psi	Pipe	?	1"		
30	9db		" "	CO2	350psi	Tube Fitting Tee	Swagelok	1/4"		* overtightened
31	7db		" "	CO2	350psi	Tube Fitting	Swagelok	1/4"		* overtightened
32	4db		Nat. Gas Supply	Nat. Gas	500psi	Parker	Tube Fitting	1/2"		* A-Lok
33	23db		" "	" "	500psi	Parker	Tube Fitting	1/4"		* A-L-K (AFGA-RV-9157)

Swagelok

Distributor Staff: _____ Company Staff: _____ Signature: _____

Number	Decibels	Area	Location	Fluid	Pressure	Component	Manufacturer	Size	Under Tight?	Comments
34	13db		Gas Supply	Nat. Gas	500psi	Tube Fitting	Parker A-Lok	1/2"		
35	26db		Gas Supply	Nat. Gas	500psi	Tube Fitting	Parker A-Lok	1/2"		
36	15db		Gas Supply	Nat. Gas	500psi	Tube Fitting	Parker	1/2"		
37	13db		Gas Supply	Nat. Gas	500psi	Tube Fitting Union	Parker	1/2"		
38	13db		Gas Supply	"	"	"	Parker	1/2"		
39	14db		"	"	"	Tube Fitting MPT Thread	Parker	1/2"		
40	12db		"	"	"	Fitting Thread	Parker	1/2"		
41	11db		"	"	"	Inline Relief	? Parker	1/2"		
42	13db		Gas Compartment	"	500psi	Valve Pipe Cap	VELAN	1"		
43	23db		Gas Compartment	"	500psi	Tube Fitting	Parker	1/4"		
44	21db		Gas Compartment	"	500psi	Tube Fitting	Parker	1/2"		
45	24db		Gas Compartment	"	500psi	Tube Fitting	Parker	1/2"		
46	2db		Collector Cab	Hydrogen	50psi	Tube Fitting	Parker	1/4"		
47	18db		Collector Cab	Hydrogen	50psi	Tube Fitting	Parker	1/4"		
48	31db		Collector Cab	Air	120psi	Pipe Thread	?	1/2"		
49	28db		Collector Cab Controller	Air	120psi	Pipe Thread	?	1"		
50	14db		" "	Air	120psi	Pipe Thread	?	1"		

Distributor Staff: _____ Company Staff: _____ Signature: _____

Number	Decibels	Area	Location	Fluid	Pressure	Component	Manufacturer	Size	Under Tight?	Comments
S1	18db		Collector Cube Exterior	Air	120psi	Pipe	?	1"		
S2	23db		" "	Air	120psi	Pipe	?	1"		
S3	23db		" "	" "	" "	" "	?	1"		
S4	24db		" "	" "	" "	" "	?	1"		
S5	20db		2A	"Air"	100psi	Tube Fitting	Parker	1/2"		
S6	36db		CEMS	Air	100psi	Regulator	Cemo Flow	1/4"		
S7	15db		CEMS	" "	" "	Tube Fitting	Intermix	1/2"		* Swagelok & Parker
2-1	6db		CEMS	" "	" "	Tube Fitting	Swagelok	1/2"		
2-2	6db		CEMS	" "	" "	Tube Fitting	Swagelok	1/2"		* No Tape on NPT Threads
2-3	13db		CEMS	"NOx High"	1200psi	Check Valve	Parker	1/4"		P/N # 4F-CA2 25-ERR-SS
2-4	3db		CEMS	Zero Gas	30psi	Tube Fitting	Intermix	1/4"		* Swagelok Nut + Body?
2-5	2db		CEMS	Low NOx	30psi	Tube Fitting	Intermix	1/4"		"
2-6	54db		East Side Collector Cab	Air	120psi	Pipe	Pipe	1"		
2-7	38db		" "	Air	120psi	Pipe	Pipe	1"		
2-8	44db		" "	Air	" "	Pipe	Pipe	1"		
2-9	53db		" "	" "	" "	" "	" "	1"		
2-10	31db		" "	" "	" "	" "	" "	1"		

Number	Decibels	Area	Location	Fluid	Pressure	Component	Manufacturer	Size	Under Tight?	Comments
2-11	62db	Collector Cab (East side)		Air	120psi	Pipe	Pipe	½"		
2-12	31db	Collector Cab (East side)		Air	120psi	Valve	Apollo	1"		#60 series Bpp.
2-13	55db	"		Air	" "	MPT Nipple	Pipe	1"		
2-14	63db	" "		Air	120psi	Pipe Tee	Pipe	1"		
2-15	35db	" "		Air	120psi	" "	" "	1"		
2-16	48db	" "		Air	" "	Nipple Coupling	Pipe	1"		
2-17	46db	" "		Air	" "	Nipple	Pipe	1"		

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 Central and South Florida
5906 Breckenridge Parkway Suite A
Tampa, FL 33610
Phone: 863-425-3222
info@florida.swagelok.com