SAND2019-14325R

PRESSURE SAFETY DATA PACKAGE FOR REMOTE BALLOON LAUNCHER (RBL)

Department: 8863
Radiosonde Balloon Fill System at Utqiaġvik Alaska
Date: October 10, 2019

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Pressure Safety Data Package
PSDP

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REMOTE BALLOON LAUNCHER (RBL)

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Date: October 10, 2019

Prepared by:
Fred Helsel

Radiosonde Balloon Fill System at Utqiaġvik Alaska

Responsible employee	Org. number	Phone Number	System name	System location
Fred Helsel	8863	505-284-3620	Hydrogen Balloon Fill System	NSA-Barrow Alaska

Training Requirements:

Course #	Course Title	Personnel	Training Interval (Years)
PRS150	PRESSURE SAFETY ORIENTATION	For all operators of the system	0
PRS150R	PRESSURE SAFETY ORIENTATION REFRESHER	*none*	3
PRS250	ADVANCED PRESSURE SAFETY	For all installers of the system	0
PRS250R	ADVANCED PRESSURE SAFETY REFRESHER	*none*	3

Review and Approval:

Reviewed by:	Printed Name	Signature	Date
Pressure Advisors	Brendan Davis (8367)		05/Nov/2019
Required reviews:			
Pressure Operator(s)	Fred Helsel		11/6/2019
Pressure Installer	Fred Helsel		11/6/2019
Manager Approval:			
Manger	Lori Parrott		11.12.2019

Table of Contents

Data Package for: AMF3 Helium Fill System

1. System Description

The Barrow Hydrogen Fill System is intended for use by the authorized Sandia National Laboratories personnel and its contractors who are involved in research relating to the deployment of weather balloons for the Department of Energy's Atmospheric Radiation Measurement Program (ARM) https://www.arm.gov/ and The National Weather Service (NWS) https://www.weather.gov/ . Hydrogen is supplied from a hydrogen generation shelter and outdoor storage tank. The balloons are filled and released by a remote balloon launcher (RBL) commercially available from Vaisala. The RBL was designed to be used with helium or hydrogen and has be recently inspected by Vaisala for hydrogen operation.

This system is composed of a pressure regulator, ball valves, pressure relief valves, tubing, hose. All pressurized components are "off the shelf items and have a minimum pressure rating of 300 psi and are assembled using "Best Practices" and trained pressure component installers. Non pressurized components are comprised of industry recommended components and are assembled using "Best Practices" techniques.

Key System Parameters

Parameter	Value	Notes
System MAWP	250 psig	See Appendix for statement and schematic from HOGEN dealer second check valve CV311 rated at 435 psi to protect HOGEN
Maximum OP	250 psig	Set output of Hogen S20
Maximum accumulated pressure	300 psig	Accumulated pressure is at the tank, fitted with 300 psi PRV. PRV protects the tank. Redundant check valves prevent accumulated gas backflowing to HOGEN.
Flow capacity	300LPM	Controlled by Vaisala Remote Balloon Launcher there is no RFO do to the high flow rates needed.

2. Compressed Hydrogen Gas

The H2 gas is delivered from a 200-gallon H2 stainless steel storage tank @ 200PSI. H2 is generated by a commercial HOGEN S20 hydrogen generator located in a steel conex net to the RBL. The Gas delivery pressure range is 0-50 psi and flow at max pressure is 300L a minute. A schematic is shown of the setup (Figure 4) and (Table 1) lists all the components. MAWP of weather balloons is 1-5 psi. Typically, the pressure regulator is set to 25 psig. The RBL balloon filling area is outside and it consists of a fiberglass tube with a clamshell door at the top. Although the unit is not airtight, it has an evacuation fan the make sure all hydrogen is clear every launch. Seen in photo on page 13.

3. Specific considerations

a. Relief valve set point and overall operability shall require verification every three years from the in-service date in accordance with Sandia policy CPR400.1.1.27. Required recertification or replacement date will be three years from the date on the PRV (pressure relief valve) tag. If the date is past, this PSDP (pressure safety data package) is invalid and PRV's must be recertified or replaced to validate PSDP.

b. The HOGEN has a check valve CV311 build in. In the case of the external check valve failed CV311 would protect the HOGEN from over pressure. See Appendix for statement and schematic from HOGEN dealer second check valve CV311 rated at 435 psi to protect HOGEN

4. Hazards and Personal Protection Equipment

- Sandia approved safety glasses should be worn when operating the gas system.
- Use of an RBL automates the balloon filling and release. Alleviating personnel from making direct contact with the balloon or the filling process. Normal operations: no personnel on site when balloon released.
- Hydrogen never enters the personnel section of the RBL all gas and lines remain on the outside of the RBL.
- For more information see fire protection plan in Appendix.
- Service and maintenance must be performed in compliance with Sandia's Lock-out/Tag-Out policy.

5. Regulator / PRV Flow

- High pressure side 200 psig normal operating pressure.
- Low pressure side 50 psig normal operating pressure.
- Maximum accumulated pressure 300psig with PRV series relief valve set at 300 psig This is adequate to protect the pressure vessel.

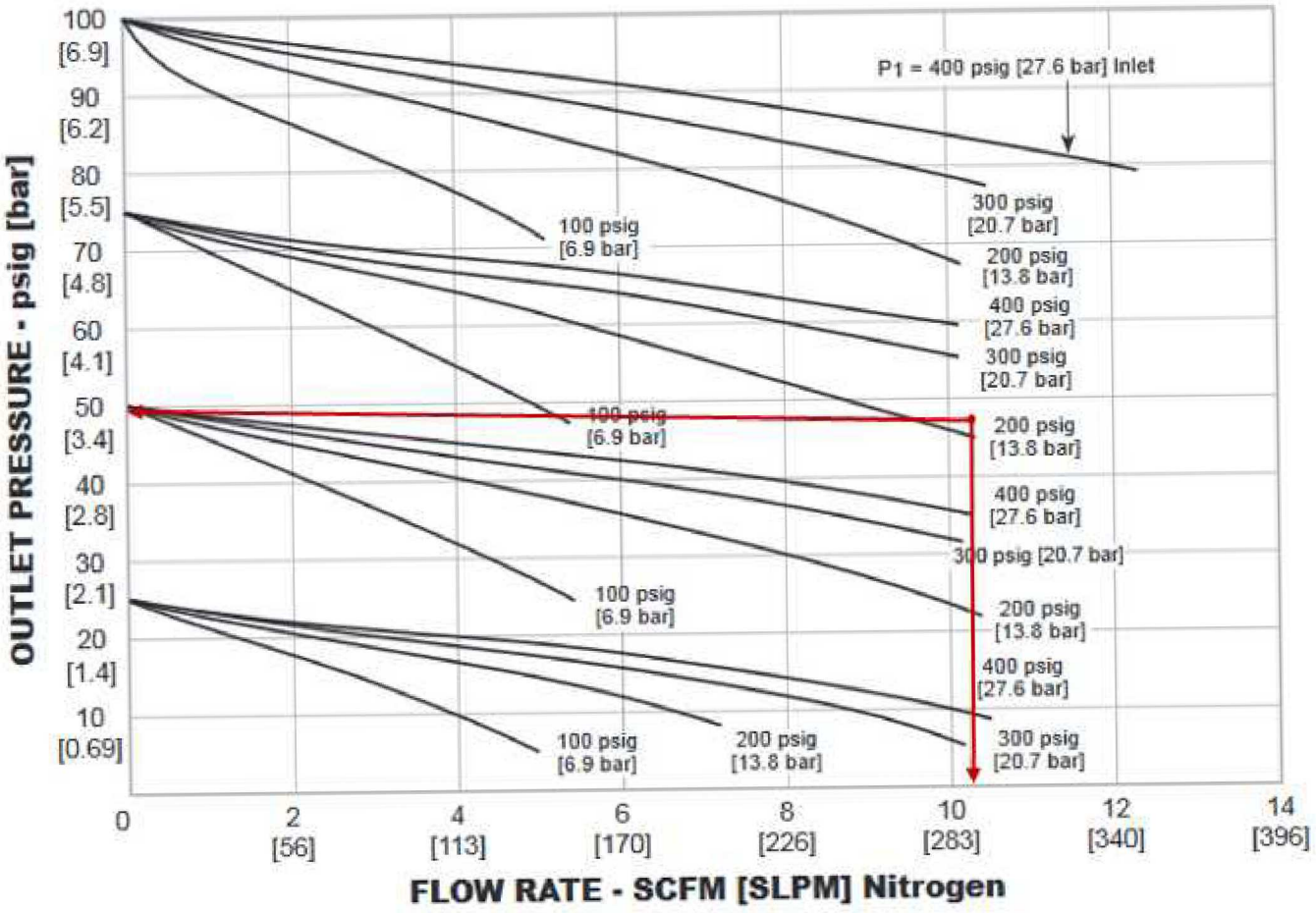


Figure 1: Regulator flow chart

Capacities - Models 910, 911, 912, 913, 916, 917, 918 and 919

NON-CODE[1] AND ASME SECTION VIII AIR (U.S., SCFM) - Flow coefficient = 0.878

	Orifice area, in²					
Set pressure (psig)	**D (0.1213)**	**E (0.2157)**	**F (0.3369)**	**G (0.553)**	**H (0.864)**	**J (1.415)**
3	28	50	77	127	198	325
4	32	57	89	146	228	374
5	36	64	99	163	255	417
6	39	70	109	178	278	456
7	42	75	117	192	300	491
8	45	80	125	205	320	524
9	48	85	132	217	338	554
10	50	89	139	228	356	583
11	52	93	145	238	372	610
12	54	97	151	248	388	635
13	57	101	157	258	403	660
14	59	104	163	267	417	683
15	64	114	177	291	455	745
25	83	148	232	380	594	972
35	104	185	288	474	740	1212
45	125	223	348	571	893	1462
55	147	261	408	669	1046	1713
65	168	299	467	767	1199	1963
75	190	337	527	865	1352	2214
85	211	376	587	963	1505	2464
95	233	414	646	1061	1658	2715
100	243	433	676	1110	1734	2840
125	297	528	825	1355	2116	3466
150	351	624	974	1599	2499	4093
175	405	719	1124	1844	2881	4719
200	458	815	1273	2089	3264	5345
225	512	910	1422	2334	3646	5971
250	566	1006	1571	2578	4029	6598
275	619	1101	1720	2823	4411	7224
300	673	1197	1869	3068	4793	7850
325	727	1292	2018	3313	5176	8477
350	780	1388	2167	3558	5558	9103
375	834	1483	2316	3802	5941	9729
400	888	1579	2466	4047	6323	10355
425	941	1674	2615	4292	6705	10982
450	995	1769	2764	4537	7088	11608
475	1049	1865	2913	4781	7470	12234
500	1102	1960	3062	5026	7853	12861
600	1317	2342	3658	6005	-	-
700	1532	2724	4255	-	-	-
800	1747	3106	-	-	-	-
900	1957	3489	-	-	-	-
1000	2176	3870	-	-	-	-
1100	2391	-	-	-	-	-
1200	2606	-	-	-	-	-
1300	2820	-	-	-	-	-
1400	3035	-	-	-	-	-

Figure 2: Accumulated Pressure for the Pressure Relief Valve.

Choke Flow Calculation

Choked Flow (Gas) Calculation		Choked flow is defined as **P1 > 2 x P2**
(Example) Input Information		P1 = inlet pressure and P2 = outlet pressure (assumes atmospheric pressure)
Gas type	air	- FYI (list the gas in question)
Specific Gravity (air = 1)	1.000	
Temp in degrees R	459.700	Room temp = 532 R
Atmospheric pressure (P2) in psia	14.500	Note - atmospheric pressure at SNL/NM = 12.2 at SNL/CA = 14.4
Inlet Pressure (psig)	250.000	
Choked flow test? (venting to atm)	choked	If P1 < 2 x P2, Link to "Low Pressure Drop Flow" calculation worksheet
Absolute pressure (psia)	264.500	
Cv (flow coefficient)	0.15	* published by the regulator (or valve) manufacturer
Flow (Q) in scfm =	19.758	
Back To T.O.C.		**Choked flow formula:**.
		$Q = 0.471 \times N_2 \times C_v \times P_1 \sqrt{\frac{1}{S_g \times T_1}} =$
		- from suppliers websites such as Swagelok, TESCOM, etc
		Q = flow in scfm (standard cubic feet per minute)
		0.471 = a constant for units of scfm
		N2 = a constant for units = 22.67 for scfm
		Cv = flow coefficient for the regulator (or valve) / unit-less number
		P1 = inlet pressure in psia
		T1 = temperature in ° R (° F + 460) room temp = 72 + 460 = 532
		Sg = specific gravity (relative density) of the fluid (air = 1.0)

Figure 3: Choke Flow Calculation

Vaisala DigiCORA®
Unmanned Sounding System
AUTOSONDE®

Fully automated upper-air observation from urban areas
to the remotest locations

Fully automated upper-air observation

The Vaisala DigiCORA® Unmanned Sounding System AUTOSONDE® automates the synoptic upper-air observations. It saves costs and gives the freedom to extend the coverage of upper-air networks everywhere. In populated areas, remote locations, or in climates ranging from polar to tropical, the efficiency of the unmanned sounding system has been proved.

An attendant only needs to reload the daisywheel with radiosondes and balloons every 12 days.

Minimize operating costs and maximize meteorological data availability

The Vaisala AUTOSONDE® has the capacity to perform entirely automatically for 24 consecutive synoptic soundings. It is only at this point the Vaisala AUTOSONDE® is restocked and checked manually. A restocking and check visit only takes three hours, which means eight synoptic observations per man-hour. This gives real benefits and operational reductions in costs. Fully automatic sounding in turn by preprogrammable and repeatable actions improves data quality and availability.

Whether it is a new station, or a replacement of an older system, setting up and reconfiguring the Vaisala AUTOSONDE® is quick and inexpensive. This compact package includes everything from the sounding station to the balloon filling unit. It can be transported on a trailer, making it easy to relocate. The system is also easy to reconfigure to suit new sites saving time and money.

Proven performance in every climate

The Vaisala AUTOSONDE® system has been used extensively in both highly and non -populated areas of the world. Its robust design and ability to operate automatically make it the ideal choice for the remotest regions and the most extreme climates.

The system is equipped with heaters and an air conditioner to cope with wide variations in any climate. In even more extreme conditions, a cold climate kit is available to deal with a minimum operating temperature of –40°C and additional windcovers raise the operating wind speed up to 25 m/s.

Benefits

- Entirely automatic for 12 consecutive days
- Remote configuration
- All benefits of Vaisala Radiosonde RS92 and Vaisala DigiCORA® Sounding System
- Cost effective due to low maintenance and low man-hours

Remote flexible operation

Vaisala AUTOSONDE® can be configured remotely from a central location by using the Remote Control System. It also allows the remote interruption of the systems regular sounding schedule to measure interesting events such as extreme weather phenomena. The whole system network can also be monitored from one central location

and remotely commanded to adapt actions according to changing weather conditions.

Superior performance with DigiCORA® Sounding system and Radiosonde RS92

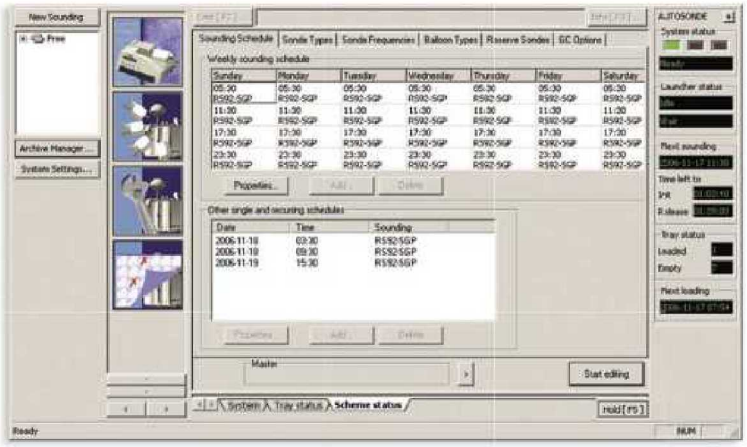
Vaisala DigiCORA® sounding system is a complete package for measuring the upper-air atmospheric profile. Vaisala Sounding Systems share the same standard software components, graphical tools, antennas and receivers. The Vaisala AUTOSONDE® also uses the Vaisala RS92 radiosonde, which is field proven and gives excellent data performance.

Data availability ensured

A Vaisala service contract ensures that your system keeps working productively, delivering the measurement data you require, over the systems entire lifecycle. Vaisala has over 70 years of experience in serving upper-air measurement.

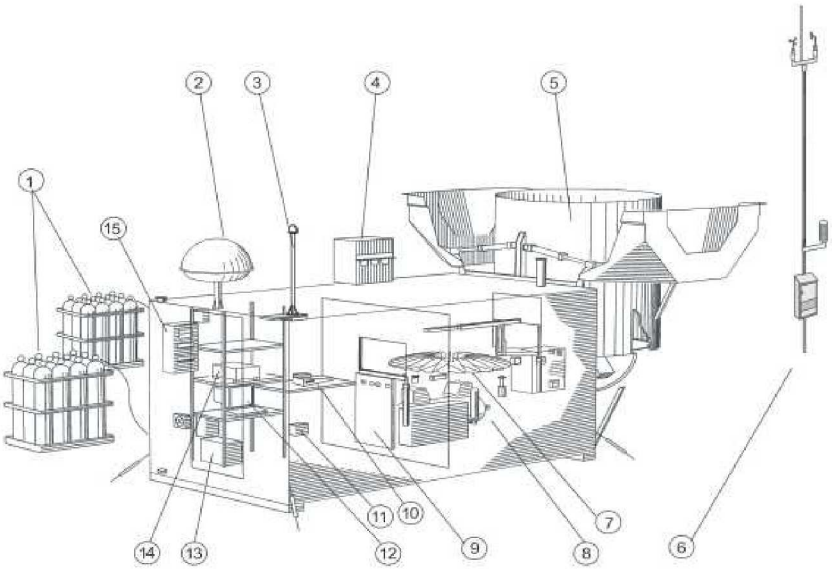
Supporting synoptic observations in Norway

The Norwegian Meteorological Institute (Meteorologisk institutt, NMI) has operated three Vaisala AUTOSONDE® systems for several years. Each Vaisala AUTOSONDE® operates automatically and performs two synoptic soundings daily. All of the systems are remotely controlled from one location. These systems operate reliably even in harsh conditions and high winds, which is crucial, since the sites are difficult to access. Regular maintenance visits are made once a year to check that everything is fine.



The sounding settings are defined in a familiar Windows® based graphical user interface that runs on the Sounding Workstation.

1 = Gas Banks
2 = UHF Antenna
3 = GPS Antenna
4 = Gas Measurement Unit
5 = Launcher Vessel
6 = Automatic Weather Station, MAWS
7 = Daisywheel
8 = Radiosonde Storage and Preparation Module
9 = Logic Controller
10 = Ground Check Set
11 = HMT Series Humidity/ Temperature Transmitter
12 = Sounding Workstation
13 = UPS Power Supply
14 = Sounding Processing Subsystem
15 = Mains Distribution Box



Technical information

Vaisala DigiCORA® Sounding System MW31

SOUNDING WORKSTATION

DigiCORA® Sounding software pre-installed:
Standard Software, METGRAPH software, AUTOSONDE® software
Operating system Windows 2003 Server, pre-installed
System recovery software

VAISALA SOUNDING PROCESSING SUBSYSTEM SPS311

Windfinding options: - Code correlating GPS

ANTENNAS

- Directional UHF antenna
- GPS antenna

GROUND CHECK DEVICE

UPS

VAISALA AUTOMATIC SURFACE WEATHER SYSTEM

Automatic launcher

SHELTER

Dimensions	4.9 m x 2.4 m x 2.5 m (length x width x height)
Total height with radiosonde launcher	3.7 m
Gross weight with radiosonde launcher	3 metric tons

MECHANICAL CONSTRUCTION

Shelter	Sandwich construction:
2 plastic-coated steel plates (Paroc)	
with 100 mm fireproof mineral wool insulation	
Fire protection class	EI 120
Access door with window	900 x 2100 mm
Window	600 x 800 mm

ELECTRICITY

Power consumption	230 V 50 Hz 20 A, 1-phase, or
	400 V/230 V 50 Hz 20 A, 3-phase
Mains cable	According to national regulations
Distribution box	Inside container, 3 circuit-breakers
	and fault current breakers, surge arrester(s)
Indoor cabling	Inside aluminum cable channels
Wall sockets	In the cable channels
Lights	On the ceiling, switch near the door
Heater	2 x 800 W with thermostat
Air conditioner	Standard
Air dryer	Optional

LAUNCHER VESSEL

Dimensions	Height 1.2 m, diameter 2 m
Construction	Steel frame
Cover lids	2 pcs, optionally 4 pcs
Balloon tube	Fiberglass with conductive gel inside
	fixed with steel bars to the shelter, canvas bag inside,
	pneumatic cylinders controlled with logic controller

LOGIC CONTROLLER

Installed in a box inside the shelter, microprocessor-based, pre-programmed, analog inputs, on/off inputs and on/off outputs

LAUNCHER VESSEL HEATER

Equipped with thermostat, installed in a sealed metal pipe, switched off automatically when launcher is operated

GAS MEASUREMENT

Measurement unit	Installed on the roof of the shelter,
	2 flexible input gas hoses, 8 m,
	extendable connection to local gas
	regulator to be specified,
	output hose to nozzle controlled by magnetic valves
Gas flow meter	With electrical current output,
	automatic measurement of gas amount

BALLOON FILLING AND SIZE

Balloon nozzle connected to the balloon during loading, gas-proof balloon nozzle connection

Balloon size	200-800 g
Balloon filling gas	Hydrogen or helium

CLASSIFICATION

EC 60079-14 (1996), IEC-79-10 (1995), IEC-364-7-708 (1988)
SFS-EN 60439-1 (1990), KY 204-92

OPTIONS

Additional wind shield
Cold climate kit
Dehumidifier
Mains transformer
Filling gas regulator
Additional Remote Control Software

Remote control system

WORKSTATION

DigiCORA® Sounding software pre-installed:
Standard Software, METGRAPH software, AUTOSONDE® software
Operating system Windows XP, pre-installed
System recovery software

Ref. B210402EN-B

VAISALA
Reliable.

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Fax +358 9 894 9227
metsales@vaisala.com

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CE

SERTIFIOITU inspecta ORGANISAATIO
ISO 9001
ISO 14001

Figure 4: Hydrogen Shelter

Balloon being automatically being released

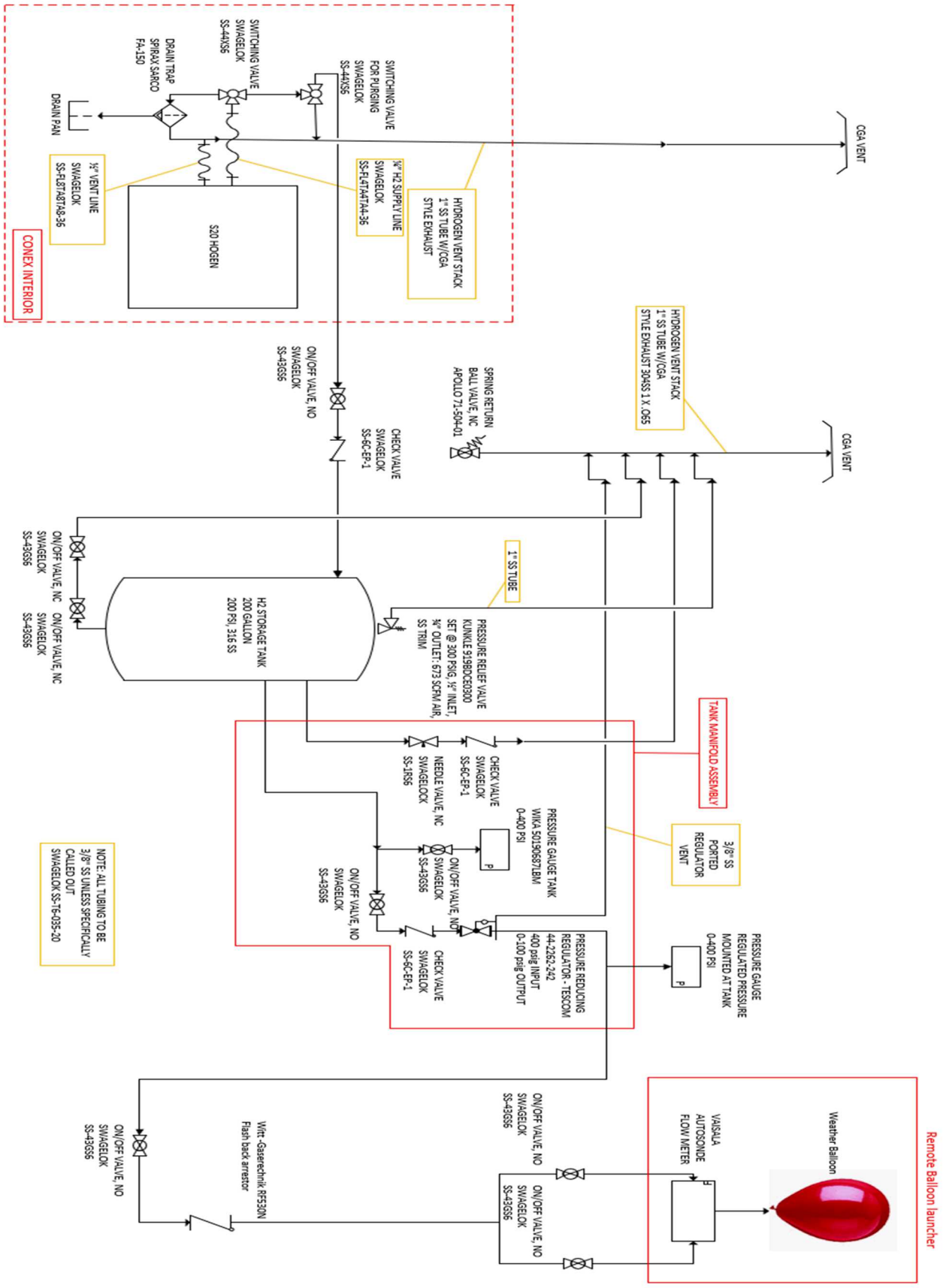


Figure 5: System Schematic

Table 1: Component List

PART NUMBER	MANUFACTURER	DESCRIPTION
SS-600-61	SWAGELOK	3/8" X 3/8" BULKHEAD FITTING
SS-600-3	SWAGELOK	3/8" X 3/8" X 3/8" 'T' UNION
SS-600-6	SWAGELOK	3/8" X 3/8" UNION
SS-600-7-6	SWAGELOK	3/8" TUBE X 3/8" FNPT
SS-600-8-8	SWAGELOK	3/8" TUBE X 1/2" FNPT
SS-600-9	SWAGELOK	3/8" 90 UNION
SS-43GXS4	SWAGELOK	1/4" 3-WAY VALVE
SS-43GS6	SWAGELOK	3/8" 2-WAY VALVE
SS-600-R-4	SWAGELOK	1/4" TUBE STUB X 3/8" TUBE REDUCER
SS-FL4TA4TA4-36	SWAGELOK	1/4" X 36" METAL HOSE
SS-FL8TA8TA8-36	SWAGELOK	1/2" X 36" METAL HOSE
SS-1610-1-12	SWAGELOK	1" UNION X 3/4" MNPT
SS-1610-6	SWAGELOK	1" UNION
SS-1610-3-16-6	SWAGELOK	1" X 1" X 3/8" 'T' UNION
SS-1610-3	SWAGELOK	1" X 1" X 1" 'T' UNION
SS-1610-9	SWAGELOK	1" 90 UNION
SS-1610-6-8	SWAGELOK	1" X 1/2" UNION REDUCER
SS-16-TA-1-12	SWAGELOK	1" TUBE STUB X 3/4" MNPT
3/4 X 1/4 FG-SS	PARKER	3/4" FNPT X 1/4" MNPT
SS-4-TA-1-4	SWAGELOK	1/4" MNPT X 1/4" TUBE STUB
SS-600-6-4	SWAGELOK	1/4" TUBE X 3/8 TUBE UNION
71497	SPIRAX SARCO	1/4" FA150 DRAIN TRAP, 150 PSIG
PGI-63C-PG200-LBGX	SWAGELOK	GAUGE, 3/8" TUBE STUB, 316SS, 0-200 PSIG
SS-6C-EP-1	SWAGELOK	BACKFLOW VALVE, 1 PSIG
71-504-01	APOLLO	SPRING VALVE
SS-1610-1-12	SWAGELOK	1" X 3/4" MNPT
919BDCE01-BKE	KUNKLE	PRESSURE RELIEF DEVICE, 673 SCFM CAPACITY
SS-1RS6	SWAGELOK	NEEDLE VALVE
232.53	WIKA	0-400 PSIG GAUGE
44-2263-241-1236	TESCOM	PRESSURE REGULATOR, 3500 PSIG INLET, 250 PSIG OUTLET
RF53DN	WITT-GASETECHNIK	VIASALA SUPPLIED FLAME ARRESTOR
SS-9037-06-06	TITAN	3/8" FBSPP X 3/8" MNPT
SS-9500V-06	TITAN	3/8" VITON SS BONDED SEAL GASKET
SS-9015-06-06	TITAN	3/8" FBSPP SWIVEL X 3/8" MBSPP
SS-9007-06-06	TITAN	3/8 MNPT X 3/8 MBSPP
SS-T6-S-035-20	SWAGELOK	3/8" X .035 SS TUBING
SS-JT6-S-035-250-U-JACKETED	SWAGELOK	3/8" X .035 SS JACKETED COIL TUBING
SS-T16-S-049-20	SWAGELOK	1" X .049 SS TUBING
SS-T16-S-083-20	SWAGELOK	1" X .083 SS TUBING
CVIP 6100V2	CVIP	Pressure Vessel Stainless Steel 757L

Components

PROTON
THE LEADER IN ON SITE GAS GENERATION.

Technical Specifications

S Series

Hydrogen Generation Systems

MODEL	S20	S40
	On-site hydrogen generator in an integrated, automated, site-ready enclosure. Load Following operation automatically adjusts output to match demand.	
ELECTROLYTE		
	Proton Exchange Membrane (PEM) - caustic-free	
HYDROGEN PRODUCTION		
Net Production Rate		
Nm^3/hr @ 0°C, 1 bar SCF/hr @ 70°F, 1 atm SLPM @ 70°F, 1 atm kg per 24 hours	0.53 Nm^3/hr 20 SCF/hr 9.4 SLPM 1.14 kg/24hr	1.05 Nm^3/hr 40 SCF/hr 18.8 SLPM 2.27 kg/24hr
Delivery Pressure - Nominal	13.8 barg / 200 psig	
Power Consumed per Volume of H_2 Gas Produced	6.7 kWh/Nm^3 17.6 kWh/100 ft^3	
Purity (Concentration of Impurities)	99.9995% (Water Vapor < 5 ppm, -65°C(-85°F) Dewpoint, N_2 < 2 ppm, O_2 < 1 ppm, All Other Undetectable)	
Turndown Range	0 to 100% net product delivery	
Upgradeability	N/A	
DI WATER REQUIREMENT		
Rate at Max Consumption Rate	0. 47 L/hr 0.13 gal/hr	0.94 L/hr 0.25 gal/hr
Temperature	5°C to 35°C / 41°F to 95°F	
Pressure	1.5 to 4 barg / 21.8 to 58.0 psig	
Input Water Quality	ASTM Type II Deionized Water required, < 1 micro Siemen/cm (> 1 megOhm-cm) ASTM Type I Deionized Water preferred, < 0.1 micro Siemen/cm (> 10 megOhm-cm)	
HEAT LOAD AND COOLANT REQUIREMENT		
Cooling	Air-Cooled; Ambient Air, 5°C to 40°C (41°F to 104°F)	
Max. Heat Load from System	2.2 kW 7,507 BTU/hr	4.3 kW 14,673 BTU/hr
ELECTRICAL SPECIFICATIONS		
Recommended Breaker Rating	8 kVA	12 kVA
Electrical Specification	205 to 240 VAC, single phase, 50 or 60 Hz	

ProtonOnSite.com | 01.203.949.8697 | Info@ProtonOnSite.com

	S20	S40
INTERFACE CONNECTIONS - Consult Installation Manual for details -		
H_2 Product Port	1/4" CPI™ compression tube fitting, SS	
H_2/H_2O Vent Port	1/2" CPI™ compression tube fitting, SS	
DI Water Port	1/4" tube push-to-lock, polypropylene	
Calibration-Gas Port	N/A	
Coolant Supply Port	N/A	
Coolant Return Port	N/A	
Drain Port	1/4" tube push-to-lock polypropylene	
Electrical	Connect to on-board circuit breaker	
Communications	RS 232, Ethernet	
CONTROL SYSTEMS		
Standard Features	• Fully automated, push button start/stop • E-stop • On-board H_2 leak detection • Automatic fault detection and system depressurization	
Remote Alarm	Form C relay 2A/30VDC rated switching	
Remote Shutdown	Circuit breaker shunt trip	
ENCLOSURE CHARACTERISTICS		
Dimensions, W x D x H Product Est. Shipping	 31" x 38" x 42" / 79 cm x 97 cm x 107 cm 38" x 45" x 52" / 97 cm x 114 cm x 132 cm	
Weight Product Est. Shipping	 475 lbs / 216 kg 650 lbs / 295 kg	
IP Rating	IP 22	
ENVIRONMENTAL CONSIDERATIONS -Do Not Freeze-		
Standard Siting Location	Indoor, level ± 1°, 0 to 90% RH non-condensing, Non-hazardous/non-classified environment	
Storage/Transport Temperature	5°C to 60°C / 41°F to 140°F	
Ambient Temperature Range	5°C to 40°C / 41°F to 104°F	
Altitude Range- Sea Level	1520 m / 5000 ft	
Ventilation	Proper ventilation must be provided from a non-hazardous area, at a rate in accordance with IEC60079-10, Zone 2 NE	
SAFETY AND REGULATORY CONFORMITY		
Max On-board H_2 Inventory at Full Production	0.016 Nm^3 0.6 SCF 0.0014 kg	
Cabinet Ventilation with Environment	NFPA 69 and EN 1127-1, Clause 6.2. Vent fan draws fresh air up to 28 Nm^3/min (1000 ft^3/min)	
Noise dB(A) at 1 Meter	< 70	
Approvals	cTUVus (UL and CSA equivalent), CE (PED, ATEX, LVD, Mach. Dir. EMC), NYFD Approval	

Specifications are subject to change. Please contact Proton OnSite for solutions to best fit your needs.
Consult Proton OnSite Applications Engineering Department for proper installation guidelines.

PROTON
THE LEADER IN ON SITE® GAS GENERATION.

PD-0600-0061 Rev D

ProtonOnSite.com | 01.203.949.8697 | Info@ProtonOnSite.com

Certified to ISO 9001:2008

Tank

FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS
(Alternative Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)
As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by CVIP Inc. 801 Broad Street, Emmaus PA 18049
(Name and address of Manufacturer)
2. Manufactured for Proton Energy Systems Technology 10 Technology Drive Wallingford CT 06492
(Name and address of Purchaser)
.ocation of installation Unknown
(Name and address)
4. Type Vertical (Horizontal or vertical, tank) 6100V02 (Manufacturer's serial number) - (CRN) CVIP 6100V02 Rev 1 (Drawing number) 420 (National Board number) 2013 (Year built)
5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSEL CODE. The design, construction, and workmanship conform to ASME Rules, Section VIII, Division 1 2013 Edition
Year
to _____ [Addenda, if applicable (date)] n/a (Code Case numbers) n/a [Special service per UG-120(d)]
6. Shell SA-240 316/316L (Material spec. number, grade) .375 (Nominal thickness) 0 (Corr. allow.) 29.25 (Inner diameter) 4' -9" [Length (overall)]
7. Seams 1 [Long. (welded, dbl., sngl., lap, butt)] None [R.T. (spot or full)] 85% (Eff., %) n/a (H.T. temp.) n/a (Time, hr) 1 [Girth (welded, dbl., sngl., lap, butt)] None [R.T. (spot or full)] 70% (Eff., %) 1 (No. of courses)
8. Heads: (a) Material SA-240 316/316L (Spec. no., grade) (b) Material SA-240 316/316L (Spec. no., grade)

	Location (Top, Bottom, Ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure (Convex or Concave)
(a)	Top	.2813"	0	-	-	2.1	-	-	-	Concave
(b)	Bottom	.2813"	0	-	-	2.1	-	-	-	Concave

If removable, bolts used (describe other fastenings) n/a
(Material spec. number, grade, size, number)
9. MAWP 300 (Internal) n/a (External) at max. temp. 144 F (Internal) n/a (External)
Min. design metal temp. -58 F at 300 ☐ Hydro., ☒ pneu., or ☐ comb. test pressure 330
Proof test -

10. Nozzles, inspection, and safety valve openings:

Purpose (Inlet, Outlet, Drain etc.)	No.	Diameter or Size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
Inlet A	1	.5"	CPLG	SA-182 F316/316L	-	3000#	0	-	UW16.1(c)	-	Shell
Outlet B	1	.5"	CPLG	SA-182 F316/316L	-	3000#	0	-	UW16.1(c)	-	Shell
Bit C	1	.5"	CPLG	SA-182 F316/316L	-	3000#	0	-	UW16.1(c)	-	Bot Head
Relief D	1	.75"	CPLG	SA-182 F316/316L	-	3000#	0	-	UW16.1(c)	-	Top Head
Purge E	1	.5"	CPLG	SA-182 F316/316L	-	3000#	0	-	UW16.1(c)	-	Shell

11. Supports: Skirt - (Yes or no) Lugs None (Number) Legs 3 (Number) Other Panel Support (Describe) Attached Welded to Shell (Where and how)
12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: _____
(Name of part, item number, Manufacturer's name and identifying stamp)
Material Exempt from Impact Testing per UHA-51(d), Liquid Penetrant Examination Performed per UW-50

CERTIFICATE OF SHOP/FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. "U" Certificate of Authorization Number 28713 expires 12/7/2015.

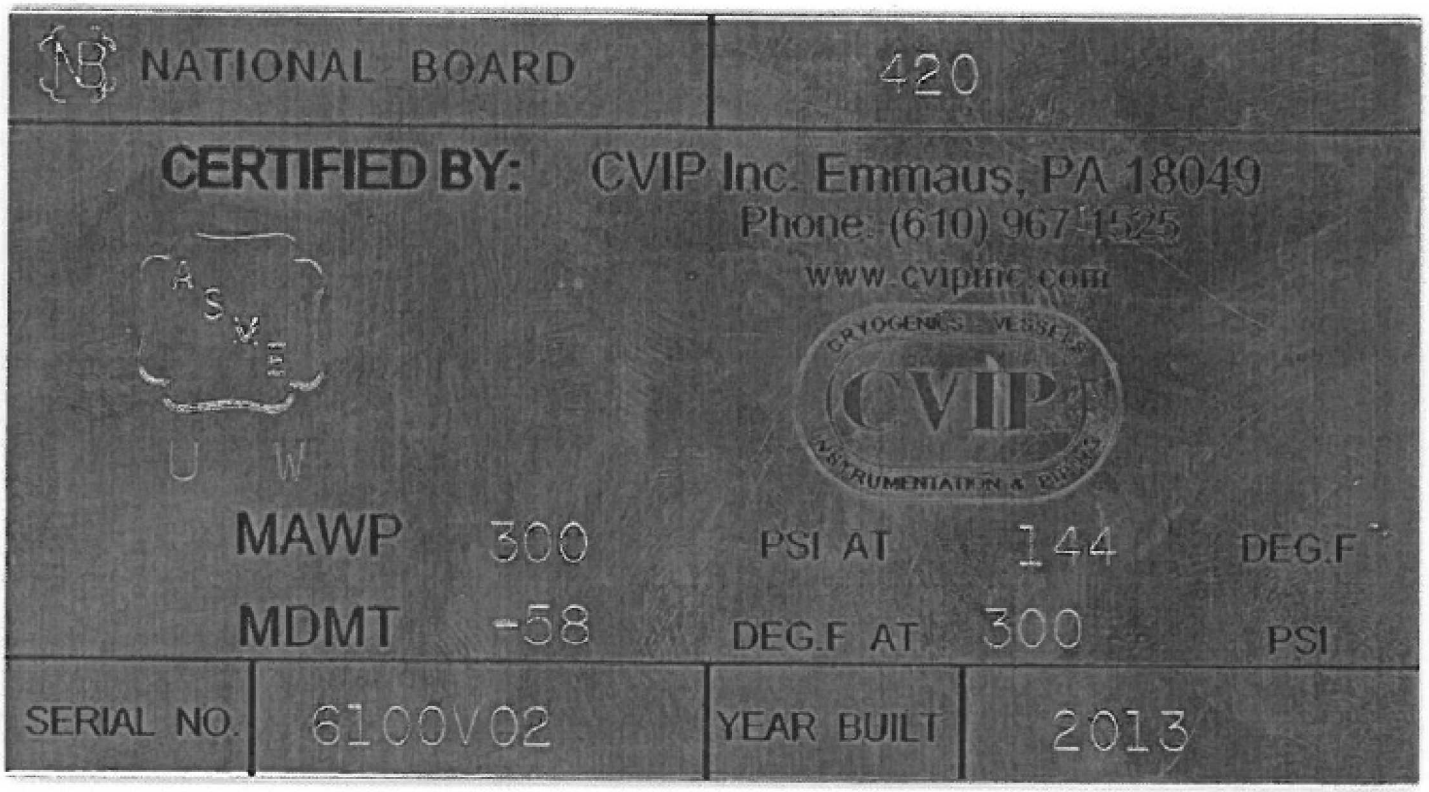
Date 8-30-13 Co. name CVIP Inc. (Manufacturer) Signed _____ (Representative)

CERTIFICATE OF SHOP/FIELD INSPECTION

Vessel constructed by CVIP Inc. at Emmaus, PA

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of _____ and employed by OneCIS Insurance have inspected the component described in this Manufacturer's Data Report on 8-30-13, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 8-30-2013 Signed _____ (Authorized Inspector) Commissions NB 9347A [National Board (incl. endorsements), State, Province, and number]


NATIONAL BOARD
420
CERTIFIED BY: CVIP Inc. Emmaus, PA 18049
Phone: (610) 967-1525
www.cvipinc.com
CRYOGENIC VESSELS
CVIP
INSTRUMENTATION & HOSES
U W
MAWP 300 PSI AT 144 DEG.F
MDMT -58 DEG.F AT 300 PSI
SERIAL NO. 6100V02
YEAR BUILT 2013

Swagelok

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www.swagelok.com

1-Piece Instrumentation, 40G and 40 Series

Part No.

SS-43GS6

Part Description

Stainless Steel 1-Piece 40G Series Ball Valve, 1.5 Cv, 3/8 in. Swagelok Tube Fitting

Specifications

General	
Actuator Type	Manual
Ball/Stem Material	Stainless Steel
Body Material	316 Stainless Steel
Cleaning Process	Standard Cleaning and Packaging (SC-10)
Connection 1 Size	3/8 in.
Connection 1 Type	Swagelok® Tube Fitting
Connection 2 Size	3/8 in.
Connection 2 Type	Swagelok® Tube Fitting
eClass (4.1)	37010401
eClass (5.1.4)	37010401
eClass (6.0)	37010401
eClass (6.1)	37010401
Flow Pattern	2-Way, Shutoff, Straight
Handle Color	Black
Handle Style	Lever
Lubricant	Dow M111
Max Temperature Pressure Rating	300°F @ 2500 PSIG /148°C @ 172 BAR
Orifice	0.187 in /4.7 mm
Packing	Modified PTFE
Ring/Disc Material	Stainless Steel
Room Temperature Pressure Rating	3000 PSIG @ 100°F /206 BAR @ 37°C

Swagelok

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www.swagelok.com

Poppet Check Valves

Part No.

SS-6C-1

Part Description

Stainless Steel Poppet Check Valve, Fixed Pressure, 3/8 in. Swagelok Tube Fitting, 1 psig (0.07 bar)

Specifications

General	
Body Material	316 Stainless Steel
Cleaning Process	Standard Cleaning and Packaging (SC-10)
Connection 1 Size	3/8 in.
Connection 1 Type	Swagelok® Tube Fitting
Connection 2 Size	3/8 in.
Connection 2 Type	Swagelok® Tube Fitting
Cracking Pressure	1 psi (0.07 bar, 0.007 MPa)
eClass (4.1)	37010801
eClass (5.1.4)	27300400
eClass (6.0)	27300601
eClass (6.1)	27300601
Feature	O-rings: Fluorocarbon FKM
Lubricant	Dow Vacuum
Max Temperature Pressure Rating	375°F @ 2185 PSIG /190°C @ 150 BAR
Room Temperature Pressure Rating	3000 PSIG @ 100°F /206 BAR @ 37°C
Seal Material	Fluorocarbon FKM
Spring Coating	None
Surface Finish	Standard

Regulators - Pressure Reducing

D44221731X012

Specifications

For other materials or modifications, please consult TESCOM.

OPERATING PARAMETERS

Pressure rating per criteria of ANSI/ASME B31.3

Maximum Inlet Pressure
400, 3500 psig
27.6, 241 bar

Outlet Pressure Ranges
0-25, 0-50, 0-100, 0-250, 0-500 psig
0-1.7, 0-3.4, 0-6.9, 0-17.2, 0-34.5 bar

Design Proof Pressure
150% maximum rated

Leakage
Internal: Bubble-tight
External: Design to meet ≤ 2 x 10^{-9} atm cc/sec He

Operating Temperature
-40°F to 165°F / -40°C to 74°C

Flow Capacity
3500 psig / 241 bar Inlet: C_V = 0.06
400 psig / 27.6 bar Inlet: C_V = 0.15

Maximum Operating Torque
30 in-lbs / 3.4 N•m

MEDIA CONTACT MATERIALS

Body
316L Stainless Steel, Brass, Nickel Alloy (Hastelloy®)* or Nickel Alloy (Monel®)

Bonnet
300 Series Stainless Steel, Brass

Diaphragm
316 Stainless Steel, Cobalt Chrome Nickel Alloy (Elgiloy®)

Seat
PTFE

Remaining Parts
316 Stainless Steel, Brass, Nickel Alloy (Hastelloy®)* or Nickel Alloy (Monel®)

OTHER

Cleaning
CGA 4.1 and ASTM G93

Internal Volume
6 cc

Weight (without gauges)
2 lbs / 0.9 kg

Teflon® is a registered trademark of E.I. du Pont de Nemours and Company.
Hastelloy® is a registered trademark of Haynes International, Inc.
Elgiloy® is a registered trademark of Elgiloy Corp.

**Material to be Hastelloy® or equivalent per ASTM B 574*

TESCOM 44-2200 Series is a compact, lightweight high purity single-stage regulator for specialty, flammable, and industrial gas flows of less than 5 SCFM / 141 SLPM. Its diffusion-resistant metal diaphragm seal ensures gas purity and integrity.

Applications

- Laboratory and point-of-use gas systems
- Sampling systems, zero, span and calibration analyzer gases
- Specialty and industrial gas cylinder regulator
- Chromatograph flame detector fuel supply

Features and Benefits

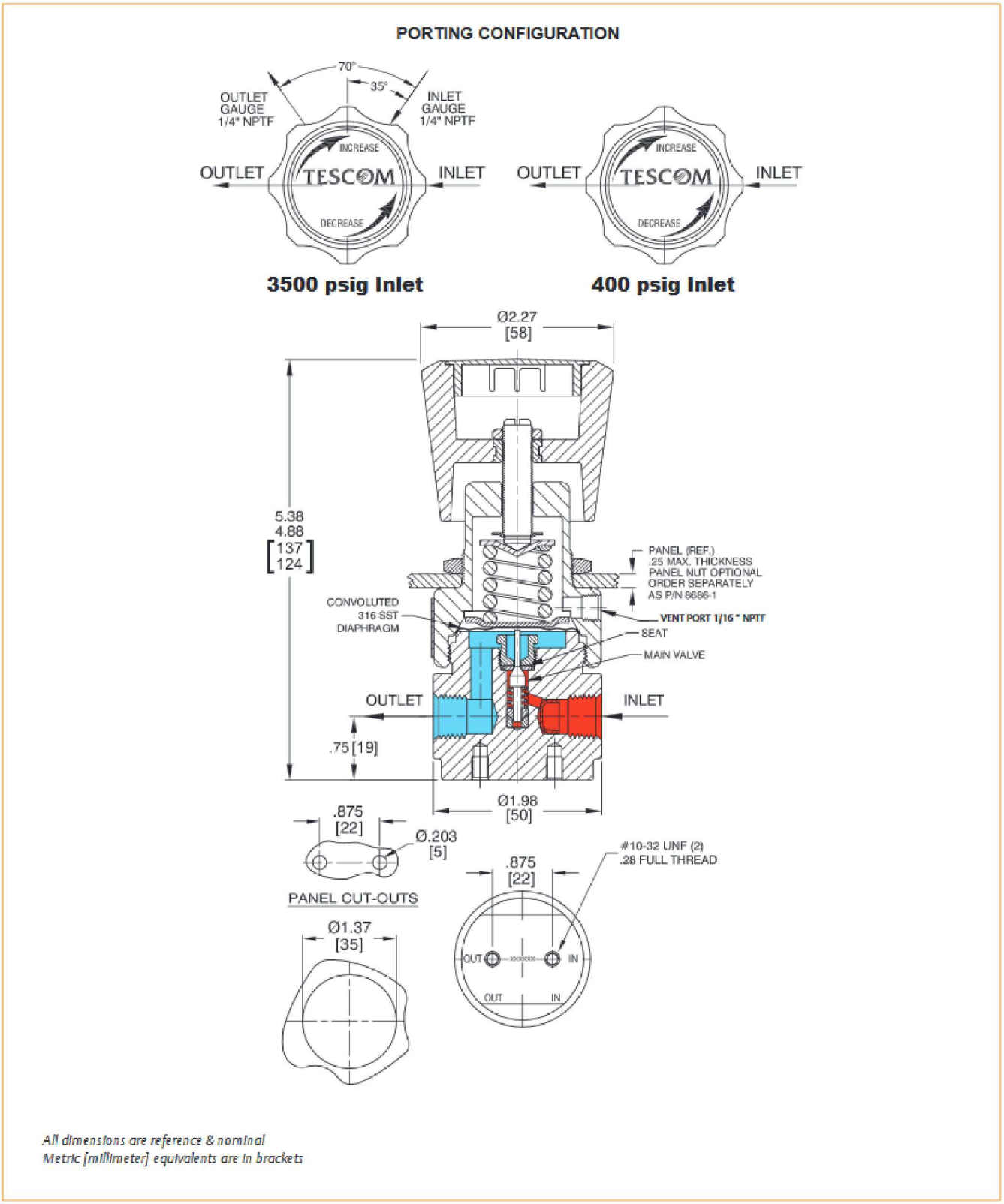
- Compact
- Designed to minimize contamination and provide accurate regulation of any corrosive, non-corrosive, or toxic gas
- Brass model provides added economy for control of non-corrosive media
- Metal-to-metal diaphragm to body seal ensures minimum inboard and outboard leakage
- Convoluted diaphragm delivers excellent accuracy and long service life
- Panel mounting is available
- 300 Series Stainless Steel or Brass bonnet
- NACE compliant designs are available

NOTE:
When choosing a regulator and control pressure, decaying inlet characteristic must be considered when the supply pressure is expected to change. The decaying inlet characteristic of a pressure reducing regulator is commonly known as the increase in control pressure due to the decrease in supply pressure. It is important to make sure this effect does not cause the control pressure to exceed the pressure rating of the unit's outlet or that of the downstream system.

For more information on decaying inlet, please refer to the Technical Information section of the product catalog and/or contact the TESCOM customer support further assistance.

44-2200 SERIES

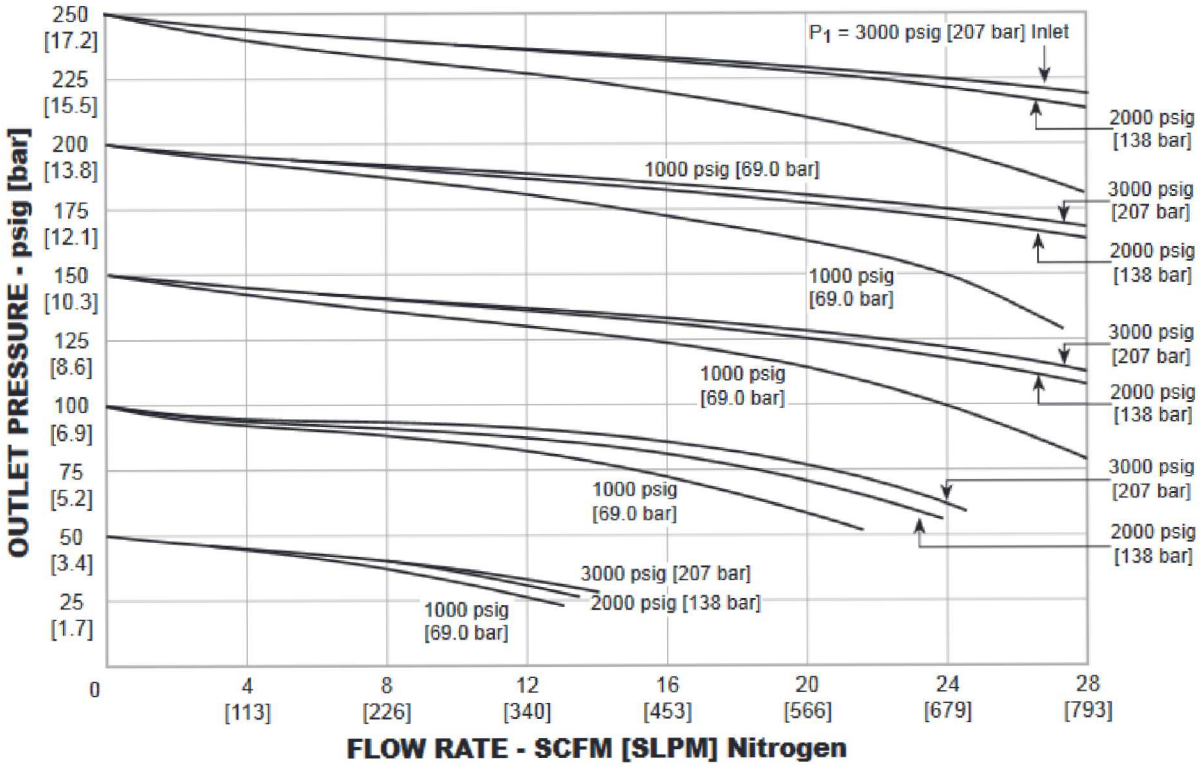
44-2200 Series Regulator Drawing

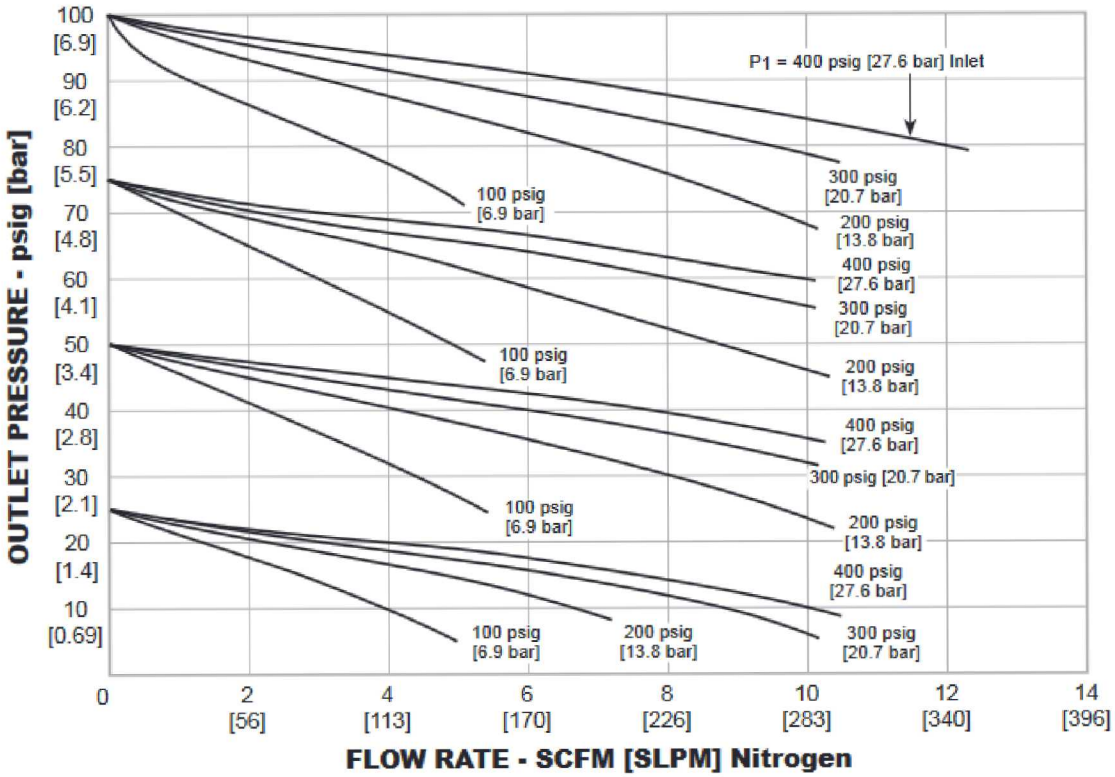


All dimensions are reference & nominal
Metric [millimeter] equivalents are in brackets

44-2200 Series Regulator Flow Charts

For more information on how to read flow curves, please refer to the Flow Curves and Calculations document (debul2007x012) in the TESCOM catalog or on www.tescom.com.





44-2200 SERIES

44-2200 Series Regulator Part Number Selector

Repair Kits, Accessories & Modifications may be available for this product. Please contact TESCOM for more information.

Example for selecting a part number:

44-22 6 0 - 2 4 1

BASIC SERIES	BODY MATERIAL	OUTLET PRESSURE RANGES	INLET AND OUTLET PORT TYPE	INLET AND OUTLET PORT SIZE	INLET PRESSURE	FLOW CAPACITY	MODIFICATIONS
44-22	**1** – Brass **5** – Nickel Alloy (Hastelloy®) **6** – 316L Stainless Steel **9** – Nickel Alloy (Monel®)	**0** – 0-25 psig 0-1.7 bar **1** – 0-50 psig 0-3.4 bar **2** – 0-100 psig 0-6.9 bar **3** – 0-250 psig 0-17.2 bar **4** – 0-500 psig 0-34.5 bar *(with 3500 psig / 241 bar inlet only)*	**2** – NPTF	**4** – 1/4"	**1** – 3500 psig 241 bar **2** – 400 psig 27.6 bar ***See porting configuration***	C_V = 0.06 C_V = 0.15	**-010** – Outlet gauge port at 90° **-115** – High temperature (400°F / 205°C) **-118** – Hydraulic service outlet gauge ports at 70°

MODELS 912, 913, 918, 919 OVERVIEW

Model 912: Full nozzle design. SS warn ring and disc with brass/bronze base. Bronze/brass body and bonnet.
Model 913: Full nozzle design. Bronze/brass body and bonnet. 316 SS trim (base, disc and disc holder).
Model 918: As Model 912 except resilient seat/seal. Superior 'leak-free' performance. FM approved with 316 SS base for fire pump installations in "BDD" and "BDE" sizes[2].
Model 919: As Model 913 except resilient seat/seal. Superior 'leak-free' performance. Bronze body and bonnet. 316 SS trim (base, disc and disc holder).

Code: ASME VIII and PED

MODEL 912

PRESSURE AND TEMPERATURE LIMITS

Pressure limits
Models 912, 913, 918, 919: See specification table on page 9 (except vacuum service)
Vacuum: 6" to 29" HG (200 to 1000 mbarg)

Temperature limits
Model 912[3]: -320°/406°F (-195°/208°C)
Model 913[3]: -320°/425°F (-195°/219°C)
Models 918 and 919: Temperatures limited by elastomer seat material. See 'Service Recommendations for Resilient Seat/Seal Materials' (page 9).

OPTIONS

- Threaded cap[4,5].
- Threaded cap with gag[4,5].
- Plain lever.
- Plain lever with gag.
- Plain lever with vibration dampener.
- Packed lever[4,5].
- Packed lever with gag[4,5].
- Models 913 and 919 available with 150#, 300# and 600# inlet flanges and 150# and 300# outlet flanges per ANSI B16.5 (see page 4 for applicable parts and materials information).
- Models 913 and 919 available with Tri-clover adapter inlet (see page 5 for applicable parts and materials information).

FLANGE CONFIGURATIONS[4]

Model	Inlet	Orifice	Outlet
9*DC	½"	D	1"
9*DD	¾"	D	1"
9*DE	1"	D	1"
9*ED	¾"	E	1 ¼"
9*FE	1"	F	1 ½"
9*GF	1 ¼"	G	2"
9*HG	1 ½"	H	2 ½"
9*JH	2"	J	3"

TRI-CLOVER CONFIGURATIONS[4]

Model	Inlet	Orifice	Outlet
9*ZDE	1"	D	1"
9*ZEE	1"	E	1¼"
9*ZFG	1½"	F	1½"
9*ZGG	1½"	G	2"
9*ZGH	2"	G	2"
9*ZHH	2"	H	2½"
9*ZJJ	2½"	J	3"

NOTES

1. ASME standard valves for air, steam and hot water above 140°F (60°C) must have lift lever.
2. Requires variations listed below for adjustable relief pressure settings:
   Variation 10: 60 - 125 psig (4.1 - 8.6 barg)
   Variation 11: 126 - 175 psig (8.7 - 12 barg)
   Variation 12: 176 - 250 psig (12.1 -17.2 barg)
3. For vacuum service: Temperature range is -30°/250°F (-34°/121°C).
4. Maximum back pressure 50 psig (3.4 barg).
5. Back pressure increases set pressure on a one to one basis, and reduces capacity. Back pressure in excess of 10% of set pressure is not recommended.
6. Same options available as Models 910, 911, 916, 917, 920, 921, and 927.

Specifications - Models 912, 913, 918, and 919

Models 912, 913, 918, 919 ASME Section VIII, steam/air/gas/ liquid, "UV" national board certified. Also available for vacuum service

SERVICE RECOMMENDATIONS FOR RESILIENT SEAT/SEAL MATERIALS

Seat/seal materials	Service recommendation
Buna-N (NBR) (-30° to 250°F) (-34° to 121°C)	Air, anhydrous ammonia, butane, carbon dioxide, diesel oil, ethyl chloride, ethyl ether, freons #11 and 12, fuel oil, gasoline, helium, hydrogen sulphide, kerosene, lube oil, natural gas, nitrogen, oxygen (gas), propane, propylene, sulphur dioxide, vinyl chloride
Viton A (FKM) O-Ring seat: (-10° to 406°F) (-23° to 208°C) Molded seat: (-10° to 290°F) (-23° to 143°C)	Acetone, air, amyl alcohol, aniline, benzine, butane, carbon disulphide, carbon tetrachloride dowtherm A and J, ethyl chloride, ethylene, ethylene glycol, ethyl alcohol, gasoline, hexane, hydrogen sulphide, isobutyl alcohol, JP - 4 fuel, JP - 5 fuel, kerosene, lube oil, natural gas, naphtha, nitrogen, propane, propylene, propyl alcohol, sulphur dioxide, toluene, trichloroethylene, turpentine, water, xylene
Silicone (-100° to 406°F) (-73° to 208°C)	Air, helium, nitrogen, oxygen (gas)
Ethylene propylene (-70° to 400°F) (-57° to 205°C)	Steam, hot water
Neoprene (-45° to 300°F) (-43° to 149°C)	Air, anhydrous ammonia, butane, butyl alcohol, castor oil, denatured alcohol, ethanol, ethyl alcohol, freons (12, 13, 14 and 22), glycols, natural gas and silicate esters
Katrez® 3018 (-15° to 608°F) (-26° to 320°C)	Aliphatic and aromatic hydrocarbons, chlorinated hydrocarbons, polar solvents (ketones, esters, ethers), inorganic and organic acids, water, and steam (steam service up to 380°F (193°C) / 200 psig saturated)
Aflas® (15° to 450°F) (-9°C to 232°C)	Bases, phosphate esters, amines, engine oils, pulp and paper liquors, hot water, and steam (steam service up to 360°F(182°C) / 150 psig saturated)
HNBR (-55° to 300°F) (-48° to 150°C)	Aliphatic hydrocarbons, vegetable and animal fats and oils, HFA and HFB and HFC hydraulic fluids, dilute acids and bases and salt solutions at moderate temperatures, ozone aging and weathering, water, and steam (steam service up to 300°F (148°C) / 50 psig saturated)

NOTE

1. These recommendations are a guide only. For the final selection of the proper material, your experience with available elastomers of various lading fluids should be considered.

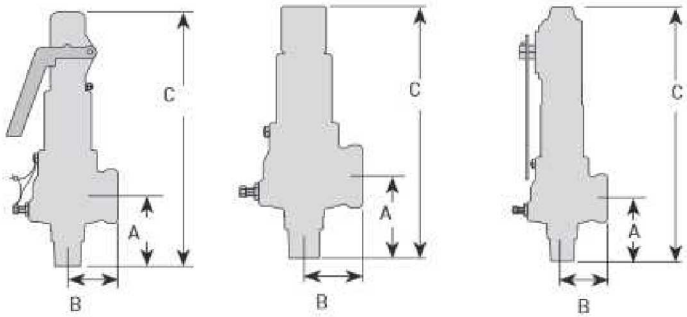
SPECIFICATIONS

Model[2] number	Orifice	Connections ANSI Standard Inlet	Outlet	Maximum set pressure psig (barg) 912-918[4,10]	913-919[5,10]	Dimensions, in (mm) A	B	C Plain lever	C Threaded cap	C Packed lever	Approx. Weight lb (kg)
9*BDC	D	½" (12.7)	¾" (19.0)	300 (20.7)	1400 (96.5)	2⅜ (60)	1⅝ (41)	8⅜ (213)	7¼ (184)	9 (229)	3 (1.4)
9*BDC*3	D	½" (12.7)	1" (25.4)	300 (20.7)	1400 (96.5)	2⅜ (60)	1⅝ (41)	8⅜ (213)	7¼ (184)	9 (229)	3 (1.4)
9*BDD[3]	D	¾" (19.0)	¾" (19.0)	-	1400 (96.5)	2⅜ (60)	1⅝ (41)	8⅜ (213)	7¼ (184)	9 (229)	3 (1.4)
9*BDD*3[3]	D	¾" (19.0)	1" (25.4)	-	1400 (96.5)	2⅜ (60)	1⅝ (41)	8⅜ (213)	7¼ (184)	9 (229)	3 (1.4)
9*BDE*3[3]	D	1" (25.4)	1" (25.4)	-	1400 (96.5)	2⅝ (67)	1⅝ (41)	8⅝ (219)	7½ (191)	9⅛ (232)	3 (1.4)
9*BED	E	¾" (19.0)	1¼" (31.8)	300 (20.7)	1000 (68.9)[7]	2¾ (67)	2 (51)	8¾ (222)	7⅝ (194)	9⅜ (238)	4 (1.8)
9*BEF[3]	E	1¼" (31.8)	1¼" (31.8)	-	1000 (68.9)[7]	3 (76)	2 (51)	9⅛ (232)	8 (203)	9¾ (248)	4 (1.8)
9*BFE	F	1" (25.4)	1½" (38.1)	300 (20.7)	700 (48.3)[8]	2⅞ (73)	2⅜ (60)	9⅞ (251)	8¾ (222)	10½ (267)	6 (2.7)
9*BFG[3]	F	1½" (38.1)	1½" (38.1)	-	700 (48.3)[8]	3 (76)	2⅜ (60)	10 (254)	8⅞ (225)	10⅝ (270)	6 (2.7)
9*BGF	G	1¼" (31.8)	2" (50.8)	300 (20.7)	600 (41.4)	3¼ (83)	2⅝ (67)	11¼ (286)	10⅛ (257)	11¾ (298)	8 (3.6)
9*BGH[3]	G	2" (50.8)	2" (50.8)	-	600 (41.4)	3¼ (83)	2⅝ (67)	11¼ (286)	10⅛ (257)	11¾ (298)	8 (3.6)
9*BHG	H	1½" (38.1)	2½" (63.5)	300 (20.7)	500 (34.5)	3½ (89)	2¾ (70)	13 (330)	11⅛ (283)	12½ (318)	11 (5.0)
9*BJH	J[4]	2" (50.8)	3" (76.2)	300 (20.7)	500 (34.5)[9]	4 (102)	3¼ (83)	14½ (368)	12½ (318)	15⅛ (384)	15 (6.8)

Dimensions are for reference only.

NOTES

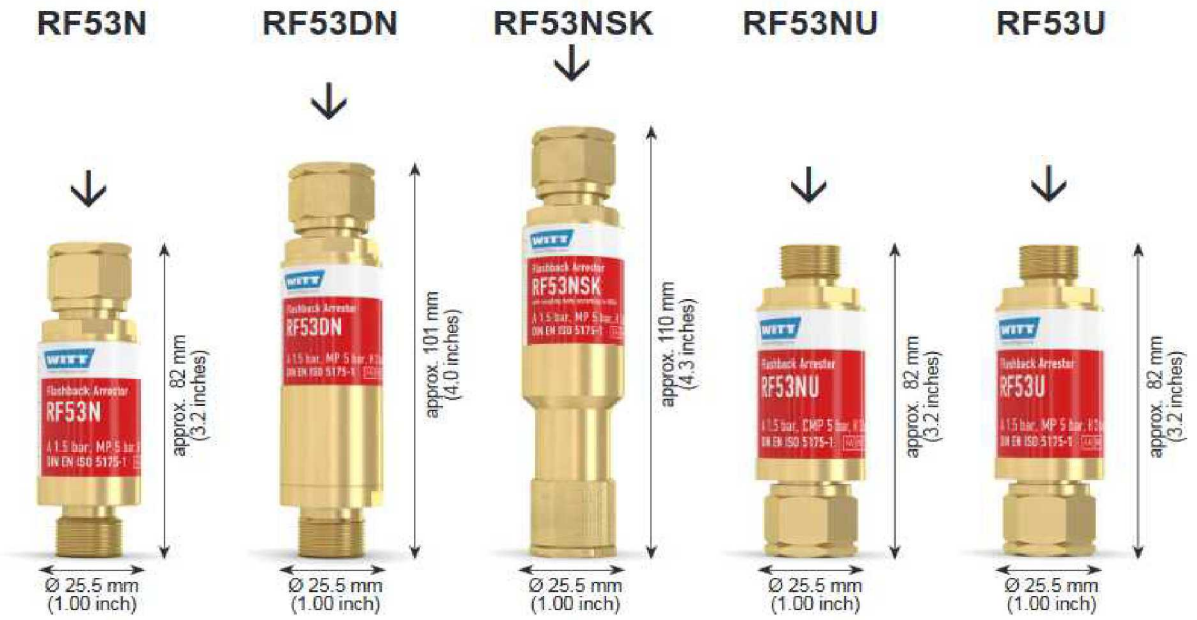
1. Maximum temperature controlled by resilient seat/seal material.
2. Replace asterisk with desired model number. Data applicable to all models.
3. Available with SS trim (models 913 and 919) only.
4. Maximum pressure on steam is 250 psig.
5. Maximum pressure on steam is 300 psig.
6. For C dimensions: pressures above 200 psig (14 barg) add 1.25" (31.8 mm) to the overall height.
7. 900 psig for liquid service or high temp alloy spring.
8. 600 psig for liquid service or high temp alloy spring.
9. 367 (25.3) for plain lever with gag.
10. Maximum back pressure 50 psig (3.4 barg).



Plain lever Threaded cap Packed lever

FLASHBACK ARRESTOR RF53

www.wittgas.com



WITT RF Flashback Arrestors for reliable protection against dangerous reverse gas flow and flashbacks according to DIN EN ISO 5175-1.
Every Arrestor 100% tested.

BAM Certified and under surveillance
Certification N°: BAM/ZBA/003/04

The best Flashback Arrestors in the world

- a large surface area flame arrestor FA of stainless steel construction extinguishes any dangerous flashback
- a temperature sensitive cut-off valve TV extinguishes sustained flashbacks long before the internal temperature of the arrestor reaches a dangerous level
- a spring loaded non-return valve NV prevents slow or sudden reverse gas flow from forming explosive mixtures in the gas supply
- a filter at the gas inlet protects the arrestor against dirt contamination, extending the service life
- a pressure relief valve vents excessive pressure and soot into the atmosphere, protecting the hose from bursting and the flame arrestor from clogging up, thus maintaining the flow rate (Model RF53DN only)

Operation / Usage

- RF Flashback Arrestors are used to protect gas cylinders and pipeline outlet points (hoses and any equipment) against dangerous reverse gas flow and flashbacks
- for pipeline outlets and single cylinders: Models RF53N, RF53DN and RF53NSK
- for torches or burners with high flow: Model RF53NU
- for cutting machines with high flow: Model RF53U
- WITT Flashback Arrestors may be mounted in any position/orientation
- only one piece of equipment may be connected to a single Flashback Arrestor
- the maximum ambient/working temperature is 158°F

Maintenance

- annual testing of the non-return valve, body leak tightness and flow capacity is recommended
- WITT is happy to supply special test equipment
- Flashback Arrestors are only to be serviced by the manufacturer; the dirt filter may be replaced by competent staff

Approvals

Company certified according to ISO 9001
Cleaned for Oxygen Service according to:
- EIGA IGC Doc 13/12/E: Oxygen Pipeline and Piping Systems

Safety devices	Model				
	RF53N	RF53DN	RF53NSK	RF53NU	RF53U
Flame arrestor FA	✔	✔	✔	✔	✔
Non-return valve NV	✔	✔	✔	✔	✔
Temperature sensitive cut-off valve TV	✔	✔	✔	✔	–
Pressure relief valve	–	✔	–	–	–
Weight [oz]	6.74	9.17	8.75	6.74	6.74
BAM certified	BAM/ZBA/003/04			–	–
Material	Brass (housing); Stainless steel (flame arrestor); Elastomer (seal)				

WITT Gas Controls LP, 3080 Northfield Place, Suite 111, Roswell, GA 30076, Tel. +1 770-664-4447, Fax +1 770-664-4448
witt-usa@wittgas.com www.wittgas.us

FLASHBACK ARRESTOR RF53

www.wittgas.com

	Model				
	RF53N	RF53DN	RF53NSK	RF53NU*	RF53U*
Gases	max. working pressure [PSI]				
Acetylene (A)	21	21	21	21	21
Natural gas (M)	72	72	72	72	72
LP (Propane)	72	43	72	72	72
Hydrogen (H)	43	43	43	43	43
Connections	Part No.				
1/4" NPT F	145-197	–	–	–	–
3/8" NPT F	145-205	–	–	–	–
9/16"-18 UNF LH (B-size)	145-025	145-044	145SK-004	145-236	145-145

	Model				
	RF53N	RF53DN	RF53NSK	RF53NU*	RF53U*
Gases	max. working pressure [PSI]				
Oxygen (O)	363	145	290	363	363
Connections	Part No.				
1/4" NPT F	145-197	–	–	–	–
3/8" NPT F	145-205	–	–	–	–
9/16"-18 UNF RH (B-size)	145-017	145-051	145SK-003	145-235	145-144

* no Certification BAM

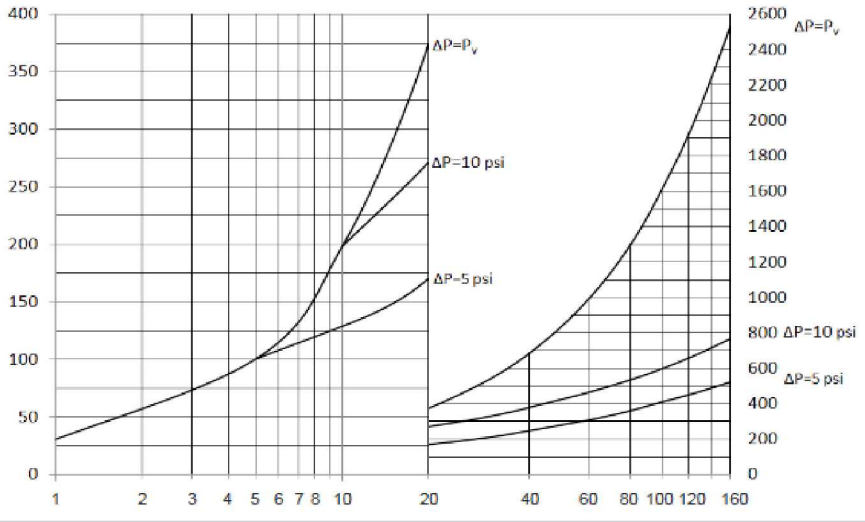
Other connections available upon request

Conversion factors:

Acetylene	x 1.04
Butane	x 0.68
Natural Gas	x 1.25
Methane	x 1.33
LP (Propane)	x 0.80
Oxygen	x 0.95
Hydrogen	x 3.75

RF53N
RF53NU
RF53U

Flow diagram for air (68°F)



WITT Gas Controls LP, 3080 Northfield Place, Suite 111, Roswell, GA 30076, Tel. +1 770-664-4447, Fax +1 770-664-4448
witt-usa@wittgas.com www.wittgas.us

71-500 SERIES

Bronze Ball Valve with Spring Return Handle

Female NPT Thread, 600 CWP (psig), Cold Non-Shock.
150 psig Saturated Steam.
Vacuum Service to 29 inches Hg.
MSS SP-110 compliant.

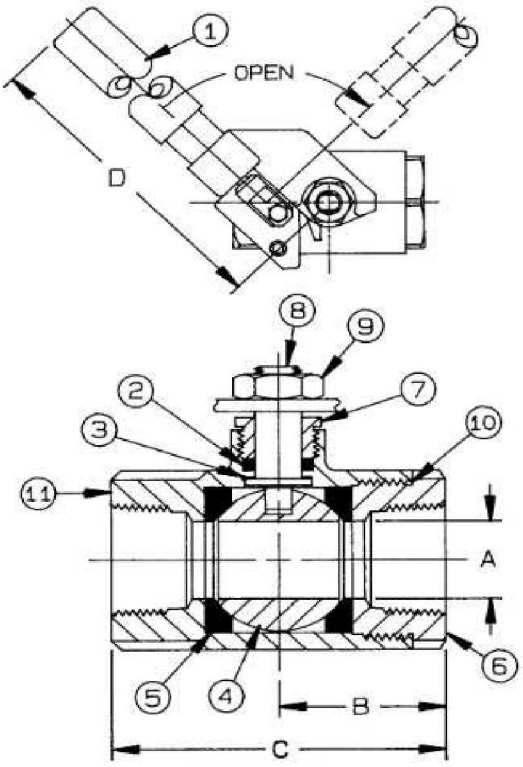
5 YEAR WARRANTY

FEATURES

- Spring return to close (-01)
- Spring return to open (-08)
- All components of lever are SS
- Operating torque is approximately three times standard valve torque
- Reinforced seats
- Blow-out-proof stem design
- Adjustable packing gland
- Chromium plated ball

VARIATIONS AVAILABLE:

71-540 Series (316 SS Ball & Stem)
71-590 Series (Pinned Retainer)



PRODUCT NUMBER	SIZE	A	B	C	D	WT.
71-501-01	1/4"	0.43	1.12	2.25	7.00	1.47
71-502-01	3/8"	0.50	1.12	2.25	7.00	1.45
71-503-01	1/2"	0.50	1.12	2.25	7.00	1.35
71-504-01	3/4"	0.68	1.50	3.00	7.00	2.33
71-505-01	1"	0.87	1.68	3.37	7.00	2.59
71-506-01	1.25"	1.00	2.00	4.00	9.00	4.18
71-507-01	1.5"	1.25	2.18	4.37	9.00	5.31
71-508-01	2"	1.50	2.34	4.68	9.00	6.41

FOR PRESSURE/TEMPERATURE RATINGS, REFER TO PAGE M-10, GRAPH NO. 4

OPTIONS AVAILABLE: (More information in Section J)

- Minimum quantities apply
- To specify an option, replace the "01" standard suffix with the suffix of the option.
- To specify multiple options, replace the "01" suffix with the desired suffixes in the numerical order shown below. NOTE: Not all suffixes can be combined together.

(SUFFIX)	OPTION	SIZES
-01	Standard Configuration	All
-P -01-	BSPP (Parallel) Thread Connection	1/4" to 2"
-T -01-	BSPT (Tapered) Thread Connection	1/4" to 2"
-08-	90° Reversed Stem	1/4" to 2"
-14-	Side Vented Ball (Uni-Directional)	1/4" to 2"
-20-	Slot Vented Ball	1/4" to 2"
-21-	UHMWPE Seats (Non-PTFE)	1/4" to 2"
-24-	Graphite Packing	1/4" to 2"
-35-	PTFE Trim	1/4" to 2"
-49-	No Lubrication. Assembled Dry.	1/4" to 2"
-57-	Oxygen Cleaned	1/4" to 2"

STANDARD MATERIAL LIST

	PART	MATERIAL
1	Handle	SS w/vinyl
2	Stem packing	Multifill PTFE
3	Stem bearing	RPTFE
4	Ball	B16 Brass, chrome plated
5	Seat (2)	Multifill PTFE
6	Retainer	B16 Brass (1/4" to 1") B584-C84400 (1.25" to 2")
7	Gland nut	B16 Brass
8	Stem	A276-316
9	Lever nut	Steel, zinc plated
10	Body seal	PTFE (1.25" to 2")
11	Body	B584-C84400

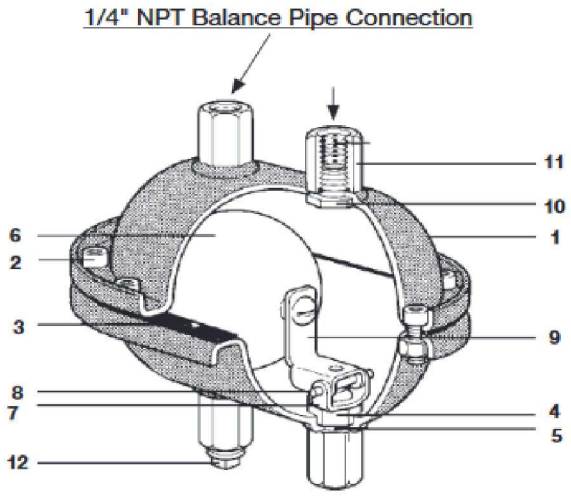
Stainless Steel Liquid Drain Trap
FA-150

The **float-operated liquid drain trap** discharges continuously in direct response to variations in liquid flow rate, assuring thorough drainage of the system.

Model	FA-150
PMO	150 psig
Sizes	1/4"
Connections	NPT
Construction	Stainless Steel Body and Internals

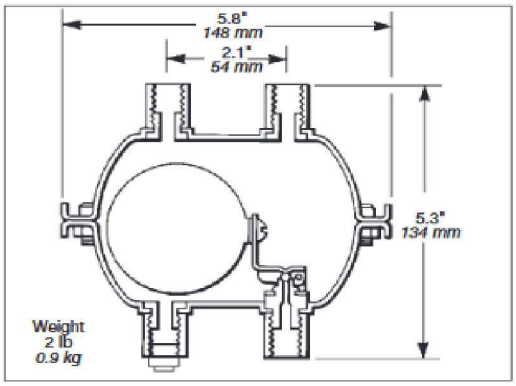
Typical Applications

Receiver and air line drainage, draining liquid from its vapor phase.



Construction Materials

No.	Part	Material	
1	Body	Stainless Steel	AISI 304
2	Cover Screws Cover Nuts	Plated Steel	ASTM A574 ASTM A 563
3	Cover Gasket	Graphite	
4	Valve Seat	Stainless Steel	AISI 420F
5	'O' Rings	BUNA-N	
6	Float	Stainless Steel	AISI 304
7	Seat Bracket	Stainless Steel	AISI 301
8	Pivot Pin	Stainless Steel	AISI 303
9	Valve Head & Arm	Stainless Steel	AISI 300/440
10	Connection Stud	Stainless Steel	AISI 304
11	Connection Nut	Stainless Steel	AISI 303
12	Drain Plug	Stainless Steel	AISI 316



Limiting Operating Conditions

Max. Operating Pressure (PMO)

Specific Gravity	psig	barg
1.0	150	10.3
.95	135	9.3
.90	119	8.2
.85	104	7.1
.80	89	6.1
.75	73	5.0
.70	58	4.0
.65	43	2.9
.60	25	1.7
.55	12	0.8

Max. Operating Temperature 250°F (121°C)

Pressure Shell Design Conditions

PMA150 psig/0-250°F 10 barg/0-121°C
Max. allowable pressure

TMA250°F/0-150 psig 121°C/0-10 barg
Max. allowable temperature

Cold Water Capacity lb/h .10" (2.5mm) orifice diameter

		Differential pressure											
	psi	1	2	5	10	20	30	50	65	75	100	125	150
	bar	*.07*	*.14*	*.34*	*.69*	*1.4*	*2.1*	*3.5*	*4.5*	*5.2*	*6.9*	*8.6*	*10.3*
1/4"	FA-150	125	165	250	330	450	530	650	750	790	900	980	1025

For kg/h, multiply lb/h by .454

Local regulation may restrict the use of this product below the conditions quoted. Limiting conditions refer to standard connections only.
In the interests of development and improvement of the product, we reserve the right to change the specification.

Stainless Steel Liquid Drain Trap
FA-150

Conversion Factors

for equivalent cold water capacity of light liquids

Specific gravity	.95-.99	.90-.94	.85-.89	.80-.84	.75-.79	.70-.74	.65-.69	.60-.64	.55-.59
Conversion Factor	1.03	1.06	1.09	1.12	1.16	1.20	1.24	1.29	1.35

Draining Cold Water & Liquids of specific gravity 1.0

Obtain the required cold water capacity by multiplying the peak load by a safety factor of 1.5. Select the drain trap from the capacity table which satisfies the required cold water capacity and operates at the minimum pressure differential of the application.

Draining Liquids of specific gravity 0.55 to 0.95

Determine the "Equivalent Cold Water Capacity" of the light liquid by multiplying its peak load (include a safety factor of 1.5) by the conversion factor given in the table above. If the maximum load is accurately known, the safety factor can be reduced or eliminated.
Refer next to Limiting Conditions table which gives the maximum operating pressure with various gravity liquids. For liquids between those listed, use the next lower specific gravity. Ensure that the maximum operating pressure is equal to, or greater than, the inlet pressure of the application.

Sample Specification

The liquid drain trap shall be of the float type with screwed NPT connections. Body shall be stainless steel, and valve mechanism shall be stainless steel with hardened working surfaces designed to retain a water seal at all times. An NPT tapping shall be provided for a balance pipe. All internals are to be renewable and field serviceable.

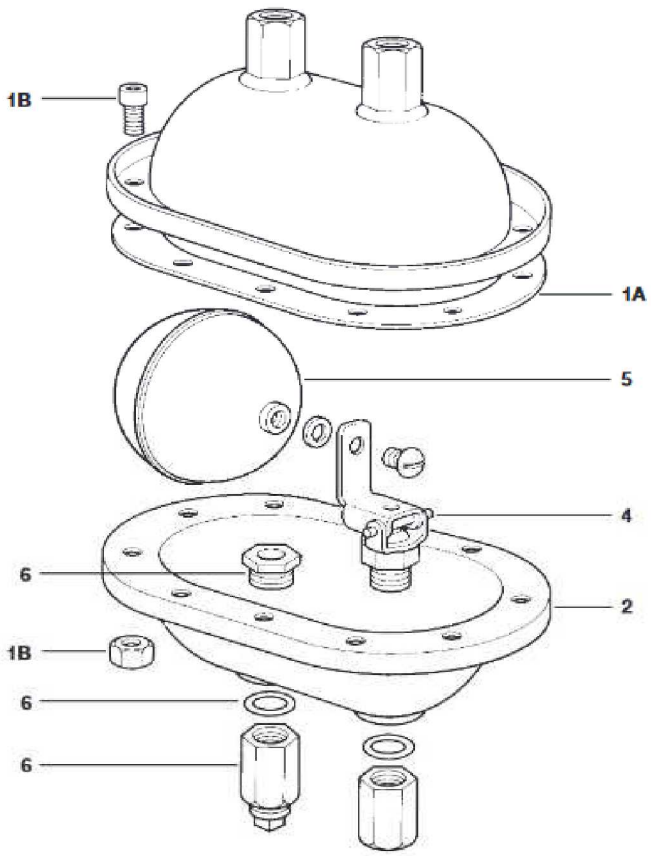
Installation

The trap must be fitted in a vertical pipe line so that the float mechanism is free to rise and fall in a vertical plane.
The high point of the cover is provided with a 1/4" NPT tapping for a balance pipe, which is essential for satisfactory operation of this unit. The balance pipe must be connected with a continuous rise between the tapping provided on the cover of the trap and the vessel being drained. The trap discharge should be piped to a safe place.

Maintenance

This product can be maintained without disturbing the inlet piping connections. Complete isolation of the trap from both supply and return line is required before any servicing is performed.
The trap should be disassembled periodically for inspection and cleaning of the valve head and seat.
Worn or damaged parts should be replaced using a complete repair kit. **Complete installation and maintenance instructions are given in IM-7-306-US which accompanies the product.**

Spare Parts



Gasket Kit (Set of 3)	1A
Complete valve mechanism assembly	4
Float with Screw & Washer	5

Liquid drain traps can be used to drain most liquids from most gases. However, some applications, particularly those involving hazardous or unusual fluids, may be subject to regulation or may otherwise require special consideration.
Spirax Sarco will endeavor to provide whatever data is necessary to assist in product selection.

Spirax Sarco, Inc., 1150 Northpoint Blvd, Blythewood, SC 29016 Telephone: (803) 714-2000 FAX (803) 714-2222

Bourdon Tube Pressure Gauges
Stainless Steel Series
Type 232.53 - Dry Case
Type 233.53 - Liquid-filled Case

Applications

- With liquid filled case for applications with high dynamic pressure pulsations or vibration
- Suitable for corrosive environments and gaseous or liquid media that will not obstruct the pressure system
- Process industry: chemical/petrochemical, power stations, mining, on and offshore, environmental technology, mechanical engineering and plant construction

Product features

- Excellent load-cycle stability and shock resistance
- All stainless steel construction
- Positive pressure ranges to 15,000 psi (1,000 bar)

Bourdon Tube Pressure Gauge Model 232.53 - 2½"

Specifications

Design
ASME B40.100 & EN 837-1

Sizes
2", 2½" & 4" (50, 63 and 100 mm)

Accuracy class
2" & 2½": ± 2/1/2% of span (ASME B40.100 Grade A)
4": ± 1.0% of span (ASME B40.100 Grade 1A)

Ranges
Vacuum / compound to 200 psi (16 bar)
Pressure from 15 psi (1 bar) to 15,000 psi (1,000 bar)
or other equivalent units of pressure or vacuum

Working pressure

2" & 2½":	Steady:	3/4 scale value
	Fluctuating:	2/3 full scale value
	Short time:	full scale value
4 ":	Steady:	full scale value
	Fluctuating:	0.9 x full scale value
	Short time:	1.3 x full scale value

Operating temperature
Ambient: -40°F to +140°F (-40°C to +60°C) - dry
-4°F to +140°F (-20°C to +60°C) - glycerine filled
-40°F to +140°F (-40°C to +60°C) - silicone filled
Medium: +212°F (+100°C) maximum

Temperature error
Additional error when temperature changes from reference temperature of 68°F (20°C) ±0.4% of span for every 18°F (10°K) rising or falling.

Weather protection
Weather tight (NEMA 4X / IP65)

Pressure connection
Material: 316 stainless steel
Lower mount (LM) or center back mount (CBM)
Lower back mount (LBM) for 4" size
1/8" NPT, 1/4" NPT or 1/2" NPT limited to wrench flat area

Bourdon tube
Material: 316 stainless steel
> 1,500 psi (100 bar): C-shape,
≤ 1,500 psi (100 bar): Helical type

Movement
Stainless steel

Dial
White aluminum with black lettering, 2" and 2½" with stop pin

Gaugeable Tube Fittings and Adapter Fittings

- Available in tube sizes from 1/16 to 2 in. and 2 to 50 mm
- Consistent gaugeability upon initial installation
- Easy to disconnect and retighten
- Wide variety of materials and configurations
- Demonstrated reliability and performance

Swagelok

Pressure Ratings

NPT/ISO Pipe Pressure Ratings

Ratings are based on ASME Code for Pressure Piping B31.3, Process Piping, at ambient temperature.

NPT/ISO Pipe Size in.	316 SS, Carbon Steel, Alloy (20, 600, and C-276)		Brass and Aluminum		Alloy 400		Titanium		Alloy 2507 and Alloy 625		6-Moly		Alloy 825	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	psig (bar)	psig (bar)	psig (bar)	psig (bar)	psig (bar)	psig (bar)	psig (bar)	psig (bar)	psig (bar)	psig (bar)	psig (bar)	psig (bar)	psig (bar)	psig (bar)
1/16	11 000 (757)	6 700 (461)	5 500 (378)	3 300 (227)	9 900 (682)	6 000 (413)	8 800 (606)	5 300 (365)	15 000 (1 033)	12 900 (888)	14 900 (1 026)	9 000 (620)	12 800 (881)	7800 (537)
1/8	10 000 (689)	6 500 (447)	5 000 (344)	3 200 (220)	9 000 (620)	5 800 (399)	8 000 (551)	5 200 (358)	15 000 (1 033)	12 500 (861)	13 500 (930)	8 800 (606)	11 600 (799)	7500 (516)
1/4	8 000 (551)	6 600 (454)	4 000 (275)	3 300 (227)	7 200 (496)	5 900 (406)	6 400 (440)	5 200 (358)	15 000 (1 033)	12 700 (875)	10 800 (744)	8 900 (613)	9 300 (640)	7600 (523)
3/8	7 800 (537)	5 300 (365)	3 900 (268)	2 600 (179)	7 000 (482)	4 700 (323)	6 200 (427)	4 200 (289)	15 000 (1 033)	10 200 (702)	10 500 (723)	7 100 (489)	9 000 (620)	6100 (420)
1/2	7 700 (530)	4 900 (337)	3 800 (261)	2 400 (165)	6 900 (475)	4 400 (303)	6 100 (420)	3 900 (268)	14 800 (1 019)	9 400 (647)	10 400 (716)	6 600 (454)	8 900 (613)	5700 (392)
3/4	7 300 (502)	4 600 (316)	3 600 (248)	2 300 (158)	6 500 (447)	4 100 (282)	5 800 (399)	3 600 (248)	10 000 (689)	8 900 (613)	9 800 (675)	6 200 (427)	8 500 (585)	5300 (365)
1	5 300 (365)	4 400 (303)	2 600 (179)	2 200 (151)	4 700 (323)	3 900 (268)	4 200 (289)	3 500 (241)	10 000 (689)	8 500 (585)	7 100 (489)	5 900 (406)	6 100 (420)	5100 (351)
1 1/4	6 000 (413)	5 000 (344)	3 000 (206)	2 500 (172)	5 400 (372)	4 500 (310)	4 800 (330)	4 000 (275)	10 000 (689)	9 600 (661)	8 100 (558)	6 700 (461)	6 900 (475)	5800 (399)
1 1/2	5 000 (344)	4 600 (316)	2 500 (172)	2 300 (158)	4 500 (310)	4 100 (282)	4 000 (275)	3 600 (248)	9 600 (661)	8 900 (613)	6 700 (461)	6 200 (427)	5 800 (399)	5300 (365)
2	3 900 (268)	3 900 (268)	1 900 (130)	1 900 (130)	3 500 (241)	3 500 (241)	3 100 (213)	3 100 (213)	7 500 (516)	7 500 (516)	5 200 (358)	5 200 (358)	4 500 (310)	4500 (310)

- To determine pressure ratings in accordance with ASME B31.1, Power Piping:
  - carbon steel material—multiply by 0.85.

  Stainless steel and brass material ratings remain the same.
- To determine MPa, multiply bar by 0.10.

6. Appendix

Fire Protection Plan

FP2 FIRE, INC.
ofc 303-642-3547 cell 303-618-2663 marty@fp2fire.com 1140 Indian Peak Road Golden, CO 80403

Mr. Steven Lyell
Facilities Program Manager
National Weather Service
Alaska Region Headquarters
Phone: 907-271-3482
Email: steven.lyell@noaa.gov

Subject: **Hydrogen Design Criteria**
Alaska Region Autosonde Installations
Date Prepared: 06-13-2017

Purpose and Scope

The NWS intends to install several Autosonde automatic weather balloon launchers at various locations in the Alaska Region. This document establishes relevant design criteria to be used in developing a detailed design for the installations.

Applicable Fire Codes and Standards

2012 IFC *International Fire Code* (as Amended by AK).

2016 NFPA 2, *Hydrogen Technologies Code*.

2015 IFCG *International Fuel Gas Code*.

Option Summary

Option 1 – Outside H2 tank (similar to existing @ Anchorage)

Option 2 – Inside H2 tank. Locate H2 tank inside electrolyzer enclosure.

Option 1 – Outside Hydrogen Tank

Pros	Cons
Similar to current design	Snow and weather issues with exposed tank components.
Reduced design costs – we've done this before.	More removal more
Safest approach – H2 storage outdoors	Need two separate vent stacks (one for tank and one for electrolyzer)
Vertex shelter known successful design.	Vertex shelter requires assembly of interior components on site (water supply and filtration, electrolyzer, ventilation, etc.) On site assembly is more expensive.

Option 2 – Hydrogen Tank inside Electrolyzer Shelter

Pros	Cons
Potential reduced cost.	More engineering costs due to new approach.

Pros	Cons
Preassemble most hydrogen components • Electrolyzer • Water supply • Electrical • Hydrogen storage Use shipping container (20 ft.) Ship to install site after operational testing	
Reduced onsite time for startup ($) Less need for specialized trades on site.	Different than Anchorage
Reduced footprint and site work. Need two similar sized pads or elevated platforms. (one for H2 source and one for Autosonde)	
Modular approach.	

Hydrogen System Narrative

Hydrogen Generator (electrolyzer) and Shelter

Electrolyzer and support components to be mounted in Vertex shelter (Option 1) OR A Shipping Container – pre-manufactured with hydrogen storage tank inside.

The electrolyzer will supply hydrogen to a 200 gallon water volume tank. Tank shall be sized similar to existing tank at Anchorage if located outside and sized to fit inside the electrolyzer enclosure if located inside.

Electrolyzer Output Pressure: 200 psi

Hydrogen generation rate: 20 or 40 SCFH (HOGEN 20 or 40)

Shut off pressure: 200 psi.

All hydrogen piping (product and vent lines) shall be 300 series stainless steel. (Type 304 Stainless preferred).

The H2/H2O vent line from the HOGEN shall be ½ inch stainless tubing or ½ inch stainless convoluted tubing.

> ***2015 IFGC §704.1.2.3 Piping design and construction.*** *Piping and tubing materials shall be 300 series stainless steel or materials listed or approved for hydrogen service and the use intended through the full range of operating conditions to which they will be subjected. Piping systems shall be designed and constructed to provide allowance for expansion, contraction, vibration, settlement and fire exposure.*

The vent stack and vent stack cap shall be per CGA-5.5 *Hydrogen Vent Systems* or approved alternative.

> ***2016 NFPA 2: §6.16* Vent Pipe Termination.*** *Hydrogen venting systems serving pressure relief devices discharging hydrogen to the atmosphere shall be in accordance with CGA G-5.5, Hydrogen Vent Systems. [55:10.2.3]*

The vent stack cap shall not discharge in the downward direction.

Minimum Room Ventilation: The electrolyzer room shall be provided with continuous ventilation per the electrolyzer manufacturer recommendations. (40 CFM or 75 CFM for 20 and 40 SCFH generation rates respectively). 1 CFM per SF floor area if pressure vessel inside

Room Heating: The shelter shall be heated to avoid freezing conditions inside.

Egress: All means of egress shall comply with the 2012 IFC and 2015 NFPA 101. Doors from the electrolyzer shelter as well as the surrounding fencing shall be compliant (single action latch hardware, no padlocks, compliant thresholds, door size and steps, etc.).

Note that egress from within the Autosonde is addressed separately.

Pressure vessel

- 200-gallon water capacity
- 300 psi MAWP (maximum allowable working pressure)
- Actual working pressure – 200 psi

Amount of hydrogen in pressure vessel: 339 cu. ft. at 200 psi. (see Attachment for calculation)

339 cu. ft < Indoor MAQ : 1,000 cu. ft.

339 cu. ft. < Outdoor MAQ: 3,000 cu. ft.

Therefore, additional requirements for > MAQ do not kick in for either indoor or outdoor storage.

PRD – Size relief valve and discharge piping per accepted standards such as API-520 or similar. 300 psi 0.5 inch PRD likely conservative.

Vent Stack/Cap – Connect all vents from electrolyzer tank PRD to a stainless (type 304 preferred) vent stack with approved vent cap that does not discharge downward. Stack and cap to be per CGA-5.5. Cap to be miter cut design. (See attached drawing for example).

Separation distances: 5 ft. min. between storage tank and Autosonde and Electrolyzer OR 5 ft between Autosonde enclosure and H2 enclosure.

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Separation distances: 5 ft. min. between storage tank and Autosonde and Electrolyzer OR 5 ft between Autosonde enclosure and H2 enclosure.

Letter from HOGEN

Morning Fred,

We received the following update from proton

Tom,

We checked the parts and they are the same ones that we use in our 30bar (435psi) systems. Those have an operating pressure above the 30bar so in short the S Series will hold the backpressure as you described below.

Regards,

Stephen

The scenario is that the H2 storage tank has a pressure relief valve on top rated to pop at 300psi, if there was a fire outside by the tank it could raise the tank pressure above the 250psi then causing a failure inside the shelter dumping all the gas inside the shelter instead of releasing at the tank PRV. That being said, if the check valve on the tank fails then the pressure above the 250psi could be channeled back to the HOGEN and not high enough to pop the pressure relief valve on top of the storage tank.
The question is: Is the rating of part # CV311 and BPR310 high enough that it would block any pressures up to the 300psithat the pressure relief valve on top of the storage tank is rated for?

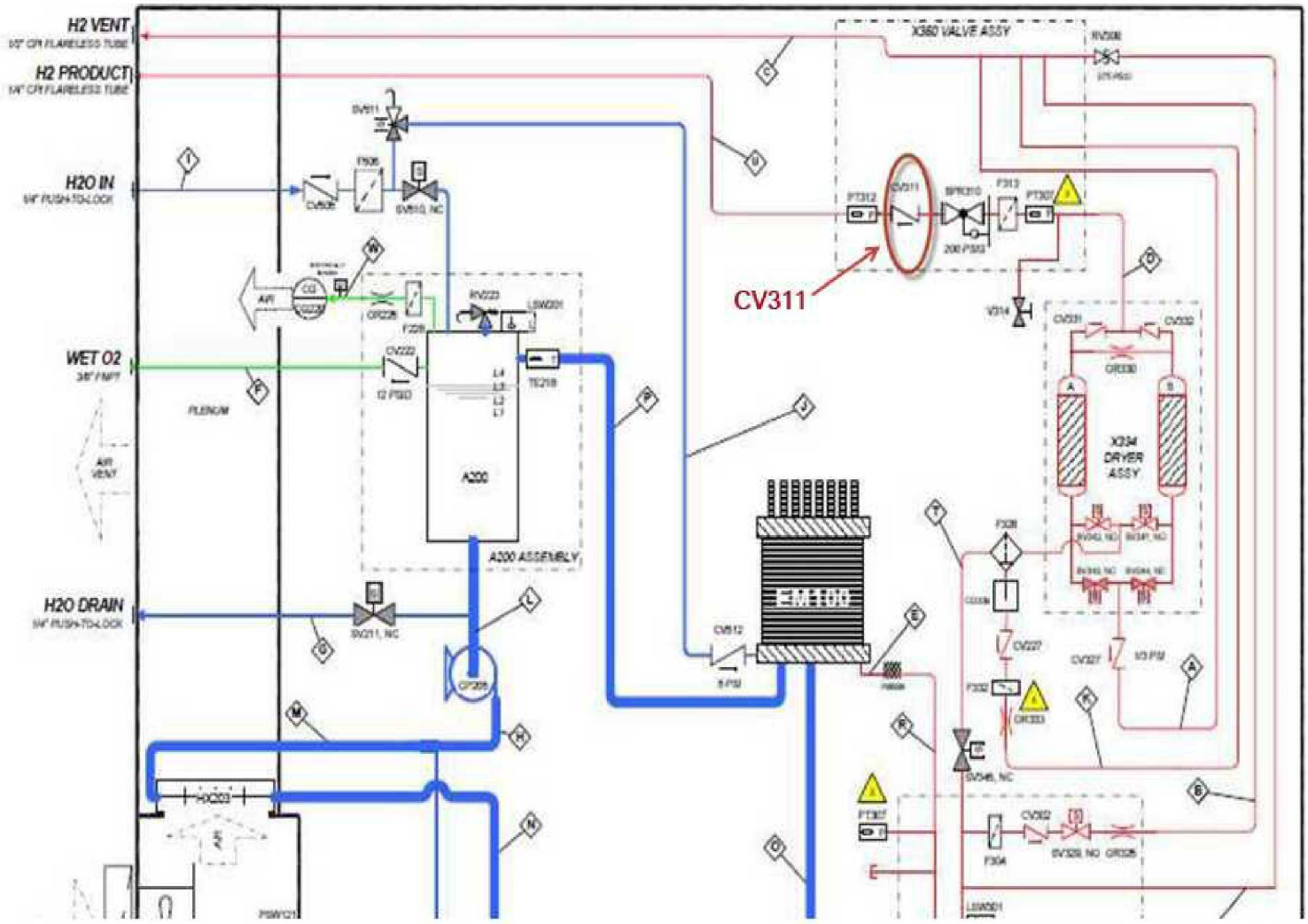
Stephen Porter
Director of Applications

number one by nature™

Nel Hydrogen
10 Technology Drive, Wallingford, CT 06492 USA
Office: D +1 203-678-2305
Fax: +1 203-949-8016

Steven Lyell
National Weather Service
Alaska Region

HOGEN check valve CV311 location



Sandia National Laboratories

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date: 05 November 2019

to: Fred Helsel, 8863, fmhelse@sandia.gov

from: Brendan Davis, 8367, bcdavi@sandia.gov

subject: Pressure Advisor Authorization for Remotely Located Pressure System (Org. 8863)

As the reviewing Pressure Advisor for the Radiosonde Balloon Fill System at Utqiaġvik Alaska, I am approving the system for use. This document will accompany my approval signature since there are unique circumstances involved with the Pressure Safety Data Package (PSDP) review for the Balloon Fill System. Due to the extreme remote location of the pressure system, it was not practical to perform the pressure safety review in-person. Since a physical walk-through is not explicitly required–though it is common practice–I sought guidance from Don Baker (Org. 0622) with Environment, Safety & Health about how to proceed. He recommended I verify the calculations and design, as well as get photos and documentation of critical pressure safety hardware.

I have reviewed the information in the data package compiled by the listed Pressure Installer, Fred Helsel, and to the furthest extent possible, have made an independent assessment of the system design and the pressure safety argument being made in the package. All of my concerns were communicated to the Pressure Installer and have been satisfied. The edits and clarifications I requested have been included in the package, and photos of pressure safety devices were sent to me for verification of critical hardware.

The expectation is that the system's owner, as well as the Pressure Installers and Operators involved with the maintaining and operating system, verify that the physical layout of the system is consistent with the design described in the PSDP prior to operation. Any and all changes that may have an impact on the pressure safety argument or the hydrogen compatibility of the system must be documented and the PSDP must be reviewed again. Any replacement hardware must be scrutinized to verify hydrogen compatibility, in addition to the pressure rating.

If any discrepancy is discovered between the PSDP and the physical system, cease system operations and immediately consult the Atmospheric Sciences (Org.8863) Manager and a Pressure Advisor familiar with the system or hardware. If there is any question or uncertainty about hydrogen compatibility, immediately get in touch with the Hydrogen and Materials Science (Org.8367) Manager or permanent Hydrogen Effects on Materials Laboratory personnel.

Include this memo in the PSDP appendices.