

## Data Package for Vacuum Chambers and Use of House Nitrogen in CINT Integration Lab, 518/1500 wing

### System name:

Responsible employee: Sean Hearne                      Org / phone number: 01132 / 845-0804

Name and location of systems: Multiple vacuum and Nitrogen cooled systems located in rooms: 1501, 1504, 1519, 1511, 1512, 1513, 1533, 1532, 1531, 1530, 1528, 1527, 1526, 1525, 1524, 1523, and 1522.

Training requirements: ES&H courses, all courses are listed in LAN.

### Reviewed by:

Pressure Installer (Designer):                                      Pressure Operators:

Pressure Advisor:

Optional Reviews:

ES&H Coordinator:    Safety Engineering / Pressure Safety SME:

Other ES&H Reviews (Fire Protection, Industrial Hygiene, etc.):

### Approved by:

Line Manager:

### Abstract / Overview:

These vacuum chambers are commercially available systems comprised of only commercially available vacuum components. All components will be used according to the manufacturers' recommendations. The total volume of each chamber is listed individually below. Pressure sources (sample gas cylinders) may be attached to these systems. A pressure relief valve (PRV) is not needed to protect the gas line components due to the low pressure in the sample cylinders and the higher pressure rating of the gas line components (tubing, valves, etc.) If these conditions are not true, a PRV will be used to protect lower pressure rated components. If the total gas volume in the cylinders exceeds the chamber volume, pressure relief valves will be installed on the vacuum chamber itself. These chambers use commercial glass viewports. If the viewports are not shielded, then safety glasses will be worn in the vicinity of the chambers.

#### Focus Ion beam system (518/1504):

The total volume of this vacuum chamber is at least 20 liters. House nitrogen plumbed to tool at 80psi for actuation of valves, and 5 psi line for venting of vacuum chamber. The chamber door is sealed by the vacuum and does not latch shut, resulting in an inherently safe system.

#### Bead blaster (518/1511):

The total volume of this chamber is at least 20 liters and is vented through a HEPA filter to atmosphere. No pressure relief is needed.

#### Oxidation Furnace (518/1533):

10 Liter, 6" diameter, quartz tube used for oxidation of Si and high temperature annealing of samples in an inert environment with gases vented to house exhaust system. 5 psi regulated gasses supplied to system. The system is not capable of being sealed so no overpressure situation is possible.

#### Gas distribution area (518/1531):

Multiple gas bottles are set up in this room to serve as a centralized distribution point. The pressure on the bottle will be stepped down to the working pressure of nominally 100psi using regulators on the bottles. The gasses include: nitrogen, nitrous oxide, oxygen, argon, helium, carbon dioxide, halocarbon C14, halocarbon C318, and sulferhexafluoride. The

automated panels are actively controlled to shut-down in an over-pressure event and do not require additional over pressure relief. The Manual panels all include a 95 psi pressure relief valve on the low pressure side. All pressure relief valves on the manual gas panels will be replaced on a yearly basis.

**Etch lab (518/1527):**

The etch lab contains two inductively coupled plasma (ICP) etch systems and a plasma enhanced chemical vapor deposition (PECVD) system. The chamber doors are sealed by the vacuum and does not latch shut, resulting in an inherently safe system. The vacuum chambers are nominally 20L and pumped into the  $10^{-7}$  torr range. These systems use house nitrogen (decreased to 5psi) and the process gasses located in 1531 are plumbed into the chambers. Also, internal of the systems are Silane, ammonia, chlorine, borontrichloride high pressure bottles that are regulated down to a few ccm into the chambers. All internal gas bottles are vented into enclosures that are evacuated with the house exhaust system and the chambers are monitored using a toxic gas monitor system that is connected to the building fire alarm.

**Metal deposition chambers (518/1525):**

There are two metals deposition systems. The first is an electron beam evaporation systems (base pressure  $10^{-7}$  torr) for the directional depositing of high purity material typically used in lift-off and subtractive etching processes. The system is plumbed with 10psi nitrogen for venting and 80 psi nitrogen for valve actuation. Second, the sputter deposition tool (base pressure  $10^{-7}$  torr) can be configured for sputter deposition of metals or dielectrics. This system is plumbed with house nitrogen at 2 psi for venting of the chamber, 80 psi nitrogen for valve actuation, and with Argon for the plasma source. The chamber door is sealed by the vacuum and does not latch shut, resulting in an inherently safe system.

**Rapid thermal annealer (518/1525):**

The rapid thermal annealer uses a mechanical roughing pump to evacuate the chamber into the tens of milli-torr range and then can backfill with nitrogen, argon, or forming gas. The forming gas bottle is located in chase 1526. The pressure is stepped down to the working pressure of nominally 5 psi in the chase (room 1526). The system contains an internal pressure relief valve.

**Oxford sputter deposition system (518/1525):**

This vacuum system (base pressure  $10^{-7}$  torr) uses argon to create a plasma for the vacuum sputtering of silicon wafers. The windows have been fitted with blast shield and will be inspected yearly for abrasions. The vacuum chamber has also been fitted with a rupture disk to prevent over pressurization.

**Wafer spinners (518/1523):**

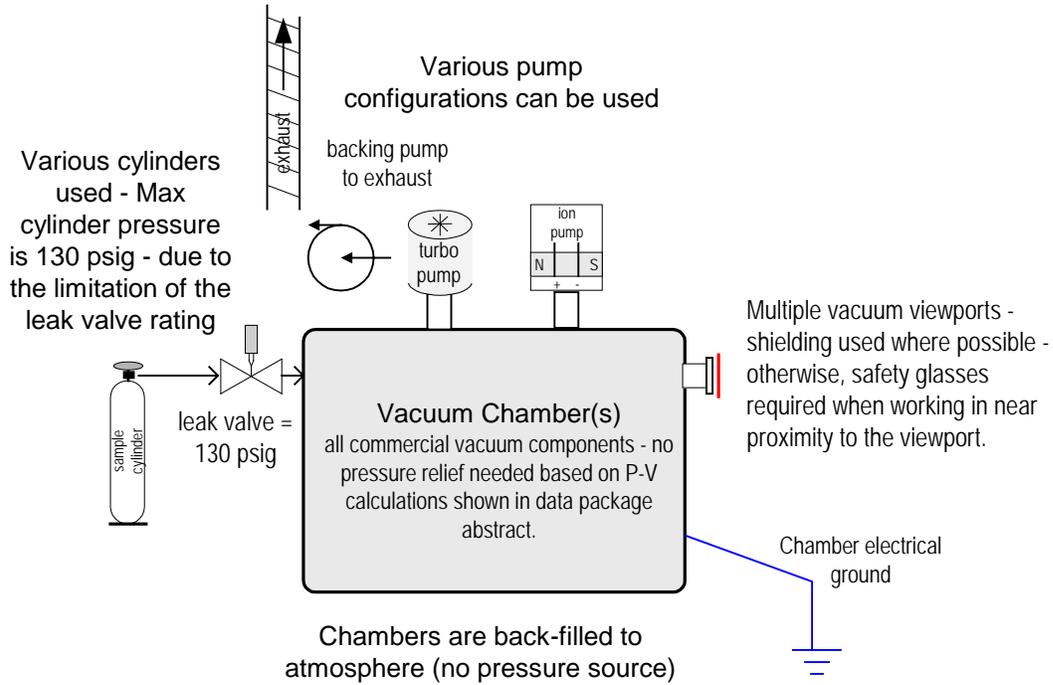
The wafer spinners use house vacuum to hold a silicon wafer onto a chuck during rotation. No pressure relief needed.

**Mask aligner (518/1523):**

The mask aligner uses house nitrogen regulated down to 2 psi to cool the UV bulb and 80 psi house nitrogen to operate the build in pneumatics and the optical table. No pressure relief needed.

**Parts Lists:**

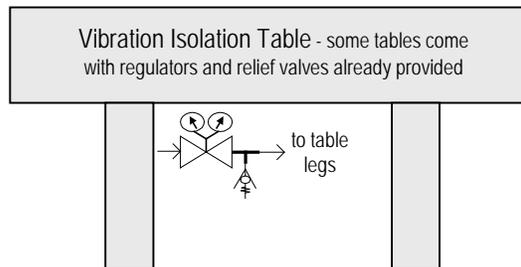
**Vacuum Systems - all commercial components**



**Vibration Isolation Tables**

Max inlet pressure = 120 psig  
 Table pressure source = House nitrogen at a max pressure of 80 psig and no relief valve is needed

\* An excess flow valve (Swagelok XS series with the low flow (-1 trip point) is used to limit any potential accidental releases on nitrogen into the area to a maximum of 5 scfm.



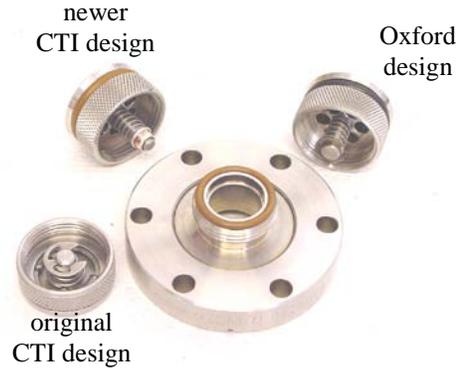
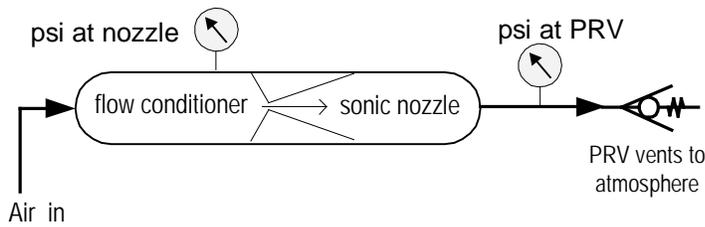
## Pressure Relief Valve (PRV) Data (up-dated October, 2006)

Questions related to pressure relief valve applications should be directed to:  
 Roger Shrouf, Sandia National Laboratories / Organization 10322 / Mail Stop 1094  
 Albuquerque, NM 87185 / (505) 845-9873 / rdshrou@sandia.gov

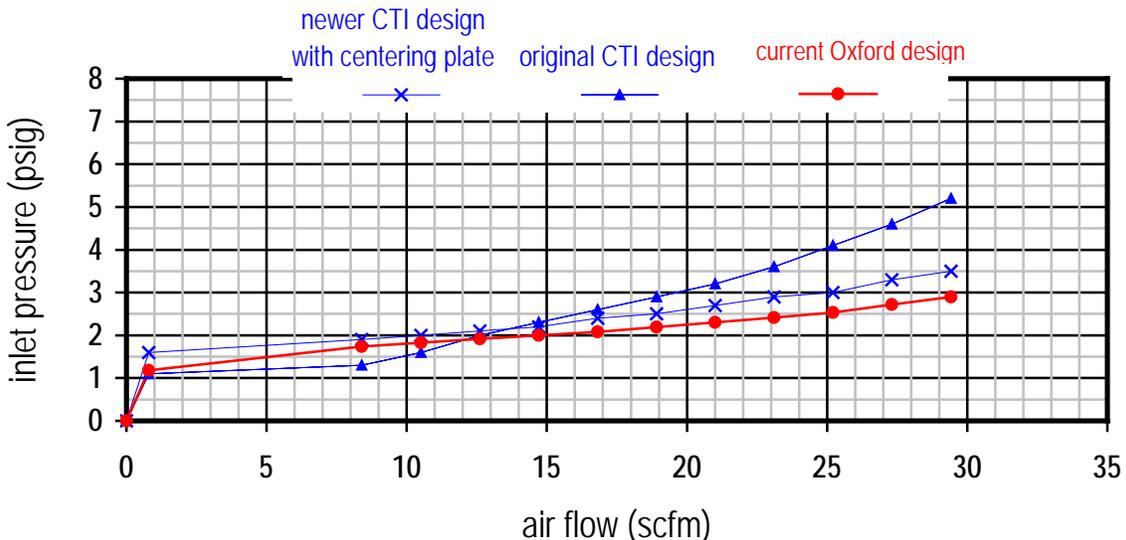
The flow / pressure measurements were performed at the Primary Physical Standards Laboratory (Organization 2541) at SNL/NM. Thanks to Christopher Flores for his efforts.

The drawing below illustrates the test configuration. These measurements document the performance of a typical cryopump pressure relief valve (nominal 1" size) that can also be used on any vacuum application requiring good seal integrity and a high flow capacity. Previous valves were manufactured by CTI-Cryogenics of Mansfield, MA. Current valves are manufactured by Oxford Instruments and supplied to Sandia by Scientific Vacuum Sales & Support (505 345-9680) in Albuquerque, NM. Three valve designs are represented here: the original CTI design with the retaining clip; the newer CTI design with the centering orifice plate; and the current Oxford design also incorporating a centering orifice plate. They are typically supplied on a 2.75" conflate flange - other connections are available on special request to Scientific Sales.

Configuration for Pressure vs Flow Measurements



**Pressure vs Flow Data** for vacuum-compatible PRV (nominal 1" size)  
 \* supplied to SNL by Scientific Vacuum Sales & Support (505) 345-9680  
 Part # SSA-PRV-275 (nominal cracking pressure between 1 and 2 psig)



# Valves

## Variable Leak Valve

### - Precision

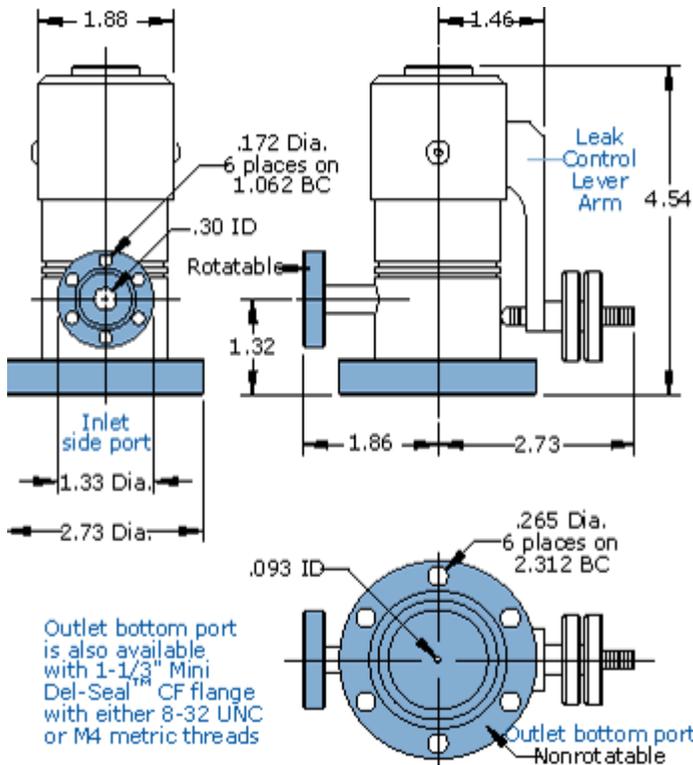


Leak  
Info from MDC Website



### Features

- Adjustable leaks to  $1 \times 10^{-10}$  Torr l/sec
- High temperature service to 450°C
- Replaceable sapphire poppet
- Replaceable OFE copper seat
- Manual cantilever actuator
- Stainless steel construction
- Dry film lubricated actuator
- Del-Seal™ CF ports



### Specifications

#### Material

Flanges	304ss
Valve Body / Seat	304ss / OFE Copper
Poppet	Sapphire
Bolts	300ss

#### Port Fastening

Bolt Type	Silver plated 12-point and socket head bolts
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Nut Type	Hexagonal nuts
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Leak Rate	$1 \times 10^{-10}$ Torr l/sec
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<b>Inlet Pressure</b>	<b><math>\leq 7500</math> Torr maximum (<math>\approx 130</math> psig)</b>
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Temperature Rating	450°C
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For conversion tables click [here](#)

For any question on this Section [Ask our Experts](#)

# Industrial Excess Flow Valves

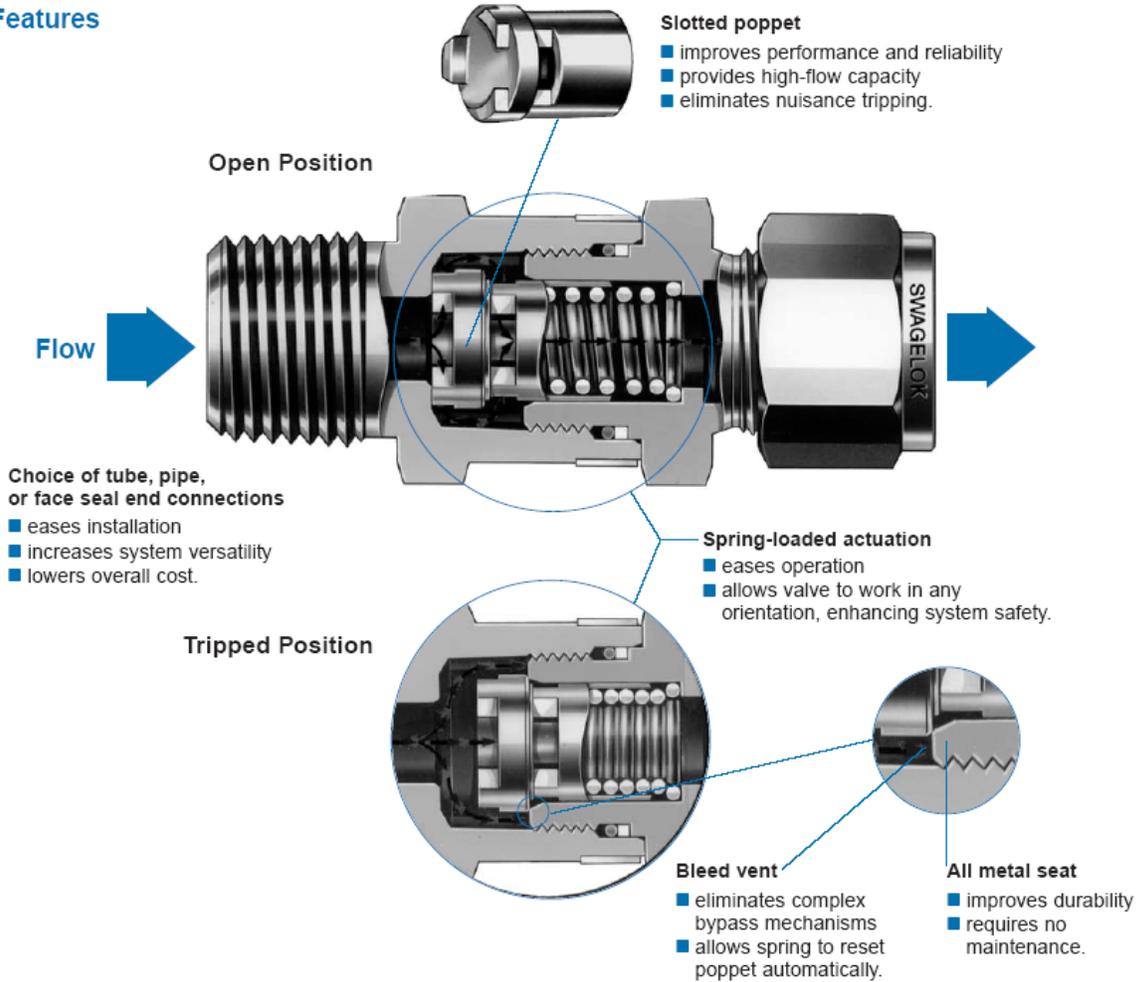
Stop uncontrolled release of system media if downstream line ruptures



## XS Series

- Pressures up to 6000 psig (413 bar)
- Temperatures up to 400°F (204°C)
- 1/8 to 1/2 in. and 6 to 12 mm end connections
- Stainless steel construction

## Features



## Operation

The spring-loaded poppet remains in the open position during normal system operation. Should an excess flow condition occur downstream, the poppet rapidly moves to the tripped position, stopping uncontrolled release of system media. When the system pressure equalizes through the bleed vent, the spring automatically resets the poppet to the open position. The flow through the bleed vent is less than 1 % of the flow rate in the trip range.

## Pressure-Temperature Ratings

Ratings based on fluorocarbon FKM O-rings. See **Optional O-ring Materials**, page 4. Ratings limited to:

- 5000 psig (344 bar) for XS series valves with 3/8 in. female NPT end connections.
- 4600 psig (316 bar) for XS series valves with 1/2 in. female NPT end connections.

ASME Class	2500
Material Group	2.2
Material Name	316 SS
Temperature, °F (°C)	Working Pressure, psig (bar)
-10 (-23) to 100 (37)	6000 (413)
200 (93)	5160 (355)
250 (121)	4910 (338)
300 (148)	4660 (321)
400 (204)	4280 (294)

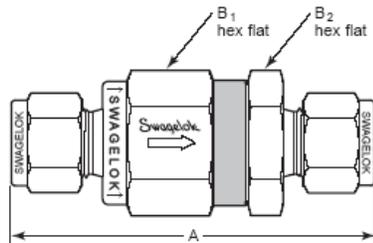
For more information about ASME classes, material groups, and ratings, see the *Swagelok Valve Pressure-Temperature Ratings* technical bulletin.

For more information about valves with tube fitting end connections, see the *Swagelok Tubing Data* catalog. Pressure ratings of valves with VCR® or VCO® fitting end connections are based on the ratings of the mating fitting; see the *Swagelok VCR Metal Gasket Face Seal Fittings* or the *Swagelok VCO O-ring Face Seal Fittings* catalog.

## Ordering Information and Dimensions

Dimensions are for reference only and are subject to change.

Select an ordering number.



### Optional O-ring Materials

Fluorocarbon FKM O-rings are standard. For an optional O-ring material, add a designator to the ordering number.

O-ring Material	Designator	Temperature Rating °F (°C)
Buna N	-BU	-40 to 250 (-40 to 121)
Ethylene propylene	-EP	-50 to 300 (-45 to 148)
Kalrez®	-KZ	-10 to 400 (-23 to 204)
Neoprene	-NE	-40 to 250 (-40 to 121)

Example: SS-XSS4-BU

### PEEK Backup Ring

For a PEEK backup ring, add **-PK** to the ordering number.

Example: SS-XSS4-PK

End Connections		Series	Ordering Number	Dimensions, in. (mm)		
Inlet/Outlet	Size			A	B <sub>1</sub>	B <sub>2</sub>
Fractional Swagelok tube fitting	1/4 in.	XS4	SS-XSS4	2.43 (61.7)	11/16	
	3/8 in.	XS6	SS-XSS6	2.75 (69.9)	1	
	1/2 in.	XS8	SS-XSS8	2.97 (75.4)		
Metric Swagelok tube fitting	6 mm	XS4	SS-XSS6MM	2.43 (61.7)	11/16	
	8 mm	XS6	SS-XSS8MM	2.70 (68.6)	1	
	10 mm	XS6	SS-XSS10MM	2.80 (71.1)		
	12 mm	XS8	SS-XSS12MM	2.96 (75.2)		
Female NPT	1/8 in.	XS4	SS-XSF2	1.87 (47.5)		
	1/4 in.	XS4	SS-XSF4	2.12 (53.8)	1	
	3/8 in.	XS6	SS-XSF6	2.55 (64.8)		
	1/2 in.	XS8	SS-XSF8	3.03 (77.0)		
Male NPT	1/8 in.	XS4	SS-XSM2	1.79 (45.5)	11/16	
	1/4 in.	XS4	SS-XSM4	2.17 (55.1)	1	
	3/8 in.	XS6	SS-XSM6	2.36 (59.9)		
	1/2 in.	XS8	SS-XSM8	2.73 (69.3)		
Male NPT/ Swagelok tube fitting	1/4 in.	XS4	SS-XSM4S4	2.30 (58.4)	11/16	
	3/8 in.	XS6	SS-XSM6S6	2.56 (65.0)	1	
	1/2 in.	XS8	SS-XSM8S8	2.85 (72.4)		
Male/female NPT	1/4 in.	XS4	SS-XSM4F4	2.13 (54.1)	11/16	
	3/8 in.	XS6	SS-XSM6F6	2.46 (62.5)	1	
	1/2 in.	XS8	SS-XSM8F8	2.89 (73.4)		
Male ISO <sup>①</sup>	1/4 in.	XS4	SS-XSM4RT	2.17 (55.1)	11/16	
	1/2 in.	XS8	SS-XSM8RT	2.74 (69.6)	1	
Female ISO <sup>①</sup>	1/2 in.	XS8	SS-XSF8RT	3.29 (83.6)	1 1/16	
Male SAE-MS	1/2 in.	XS8	SS-XSM8ST	2.48 (63.0)	1	
Female SAE-MS	1/2 in.	XS8	SS-XSF8ST	2.74 (69.6)		
Male VCR fitting	1/4 in.	XS4	SS-XSVCR4	2.28 (57.9)	11/16	
	1/2 in.	XS8	SS-XSVCR8	2.73 (69.3)	1	
Male VCO fitting	1/4 in.	XS4	SS-XSVCO4	1.98 (50.3)	11/16	
	1/2 in.	XS8	SS-XSVCO8	2.36 (59.9)	1	

Dimensions shown with Swagelok nuts finger-tight.

① See specification: ISO 7/1, BS21, DIN-2999, JIS B0203.

### Special Cleaning and Packaging (SC-11)

Swagelok XS series valves with VCR or VCO end connections are processed in accordance with *Swagelok Special Cleaning and Packaging (SC-11)* to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C.

To order special cleaning and packaging for XS series valves with other end connections, add **-SC11** to the valve ordering number.

Example: SS-XSS4-SC11

### Oxygen Service

For more information about hazards and risks of oxygen-enriched systems, see the *Swagelok Oxygen System Safety* technical report.

### Spring Kit information:

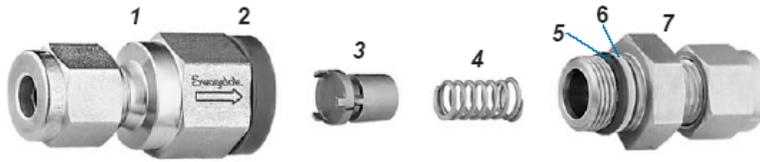
XS4 size: **MS-13K-XS4** has all 3 springs for the 1/4 inch size

Low pressure applications such as house nitrogen - the “-1” spring trips at around 3.5 to 5 scfm of air flow. The “-3” spring trips at around 18 scfm, and the standard spring trips around > 50 scfm.

XS6 size: **MS-13K-XS6** has all 3 springs for the 3/8 inch size

XS8 size: **MS-13K-XS8** has all 3 springs for the 1/2 inch size

### Materials of Construction



Component	Material Grade/ ASTM Specification
1 Inlet body	316 SS/A479
2 Identification ring	Polyetherimide
3 Poppet	316 SS/A479
4 Spring	302 SS/A313
5 O-ring	Fluorocarbon FKM
6 Backup ring	PTFE®/D1710
7 Outlet body	316 SS/A479
Lubricant	Silicone-based

Wetted components listed in *italics*.

① PEEK also available; see Ordering Information, page 4.

### Testing

Every XS series valve is factory tested for proper operation.

### Cleaning and Packaging

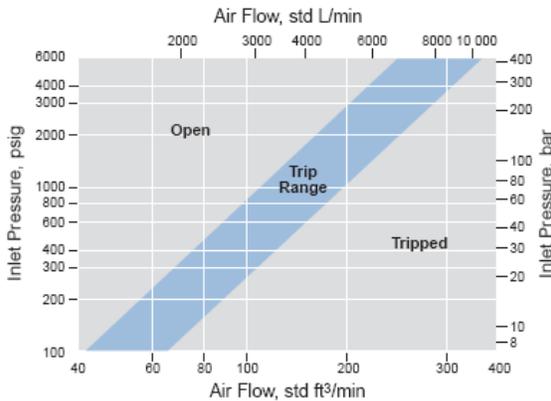
Swagelok XS series valves with VCR or VCO end connections are processed in accordance with *Swagelok Special Cleaning and Packaging (SC-11)* to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C.

Swagelok XS series valves with other end connections are processed in accordance with *Swagelok Specification SC-10*; special cleaning and packaging are available as an option.

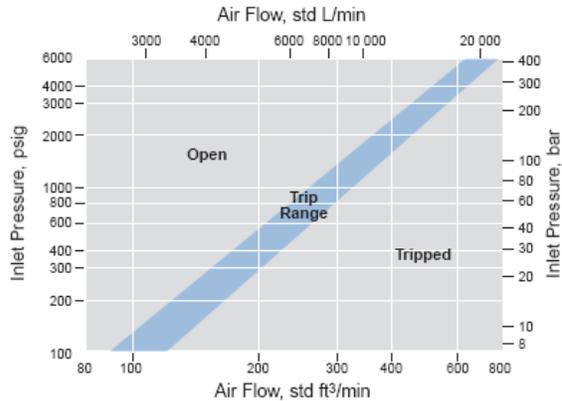
### Flow Data at 70°F (20°C)

Springs with lower trip ranges are available. See the *Swagelok XS Series Valve Technical Report*.

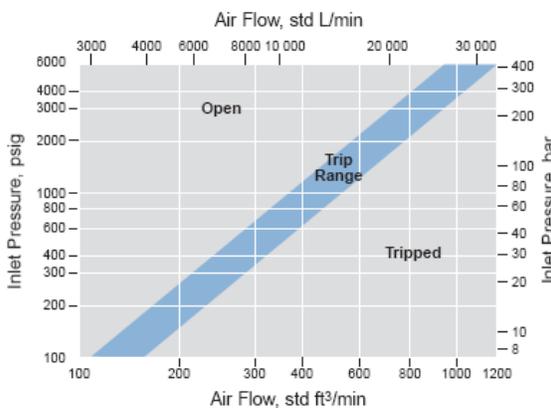
#### XS4 Series Air



#### XS6 Series Air



#### XS8 Series Air



#### XS4, XS6, XS8 Series Water

Series	C <sub>v</sub>	Trip Range U.S. gal/min (L/min)
XS4	0.5	3.9 to 5.8 (14.7 to 21.9)
XS6	1.1	8.2 to 10.0 (31.0 to 37.9)
XS8		11.2 to 14.9 (42.4 to 56.4)



# Sample Cylinders, Accessories, and Outage Tubes



## Features

- Sizes from 10 to 3785 cm<sup>3</sup> (1 gal)
- Working pressures up to 5000 psig (344 bar)
- 304L and 316L stainless steel and alloy 400

## Sample Cylinders

### Features

- Body made of seamless tubing provides consistent wall thickness, size, and capacity.
- Smooth internal neck transition allows easy cleaning and eliminates trapped fluids.
- Cold-formed female NPT threads provide greater strength.
- Heavy-wall end connections provide strength and resist flaring.
- Full-penetration gas tungsten arc-weld construction provides leaktight sample containment.
- Swagelok DOT sample cylinders conform to the "Shipping Container Specifications" from the U.S. Code of Federal Regulations, Title 49, or Bureau of Explosives, Tariff No. BOE 6000.
- Swagelok Transport Canada (TC) sample cylinders conform to requirements of the "Transportation of Dangerous Goods Regulations" and National Standard of Canada CAN/CSA B339.

### Single-Ended Cylinders

- 150, 300, and 500 cm<sup>3</sup> sizes meet a variety of sampling needs.
- 304L stainless steel construction resists intergranular corrosion.

### Testing

**DOT-4B** cylinders are hydrostatically proof tested at 1000 psig (69 bar) minimum.



### Double-Ended Cylinders

- Sizes from 40 to 3785 cm<sup>3</sup> (1 gal)
- Working pressures up to 5000 psig (344 bar)
- 304L and 316L stainless steel materials resist intergranular corrosion.
- 304L and 316L stainless steel double-ended cylinders are available with dual certification to DOT and TC requirements.

### Testing

Each cylinder is hydrostatically tested to at least 5/3 the working pressure.

**DOT-3E 1800/TC-SU6158 124** cylinders are hydrostatically proof tested at 3050 psig (210 bar).

**DOT-3A 1800 and 5000/TC-3ASM 124 and 344** cylinders are marked with a serial number. Volumetric expansion of each cylinder during hydrostatic testing must be within the limits set by DOT Specification 3A and TC Specification 3ASM.

**DOT-3A 1800/TC-3ASM 124** cylinders are hydrostatically proof tested at 3000 psig (206 bar) minimum.

**DOT-3A 5000** cylinders are hydrostatically proof tested at 8333 psig (574 bar) minimum.

**DOT-E7458 1800** cylinders are hydrostatically proof tested at 3000 psig (206 bar). All testing of DOT-E7458 cylinders is witnessed by a DOT-approved independent inspection agency.

**⚠ It is the responsibility of the party filling the cylinder to have it retested by an approved facility, at the required intervals, in accordance with DOT and TC regulations.**

## Pressure-Temperature Ratings

Material	316L SS	316L SS, 304L SS	Alloy 400	316 SS	304L SS
DOT Specification	3A 5000	3E 1800: 316L, all sizes, and 304L, 40 to 500 cm <sup>3</sup> 3A 1800: 304L, 1000 to 3785 cm <sup>3</sup>	E7458	—	4B 500
Temperature, °F (°C)	Working pressure, psig (bar)				
-65 (-53) to 100 (37)	5000 (344)	1800 (124)	1800 (124)	1000 (68.9)	500 (34.4)
200 (93)	3960 (272)	1360 (93.7)	1580 (108)	840 (57.8)	500 (34.4)
300 (148)	3570 (245)	1230 (84.7)	1490 (102)	760 (52.3)	500 (34.4)
400 (204)	3290 (226)	1130 (77.8)	1430 (98.5)	700 (48.2)	500 (34.4)
500 (260)	3060 (210)	1050 (72.3)	1420 (97.8)	650 (44.7)	500 (34.4)
600 (315)	2920 (201)	1000 (68.9)	1420 (97.8)	620 (42.7)	500 (34.4)
650 (343)	2870 (197)	980 (67.5)	1420 (97.8)	610 (42.0)	500 (34.4)
700 (371)	2810 (193)	970 (66.8)	1420 (97.8)	590 (40.6)	500 (34.4)
750 (398)	2750 (189)	950 (65.4)	1410 (97.1)	580 (39.9)	500 (34.4)
800 (426)	2700 (186)	930 (64.0)	—	570 (39.2)	500 (34.4)
850 (454)	2640 (181)	—	—	560 (38.5)	—

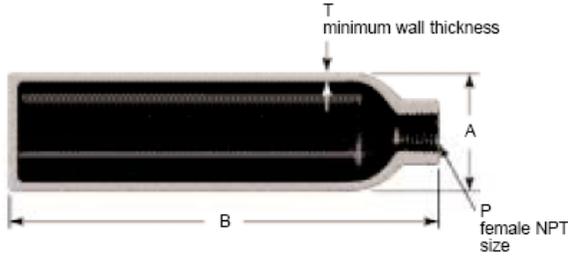
Ratings limited to 300°F (148°C) max with PTFE internal coating.  
Ratings may be limited by individual country government regulations.

**Ordering Information, Technical Data, and Dimensions**

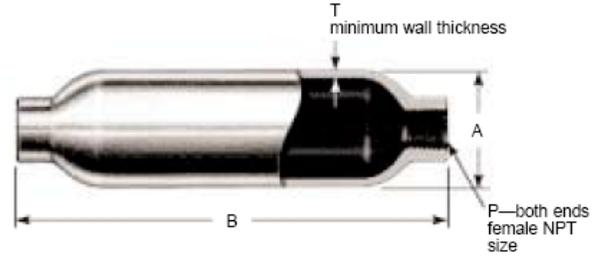
Select an ordering number.

Dimensions are for reference only and are subject to change.

**Single-Ended Cylinders**



**Double-Ended Cylinders**



Material Grade/Cylinder Specification	Pressure Rating psig (bar)	Internal Volume cm <sup>3</sup> ± 5 %	P in.	Ordering Number	Dimensions in. (mm)			Weight lb (kg)	
					A	B	T		
<b>Single-Ended</b>									
304L SS/ DOT 4B	500 (34.4)	150	1/4	304L-05SF4-150	2.00 (50.8)	4.88 (124)	0.093 (2.4)	1.1 (0.50)	
		300				8.62 (219)		1.8 (0.82)	
		500				13.6 (345)		2.7 (1.2)	
<b>Double-Ended</b>									
304L SS/ DOT 3E 1800 TC SU6158 124	1800 (124)	40	1/8	304L-HDF2-40	1.25 (31.8)	3.88 (98.6)	0.070 (1.8)	0.31 (0.14)	
		50	1/4	304L-HDF4-50	1.50 (38.1)	3.75 (95.2)	0.093 (2.4)	0.38 (0.17)	
		75		304L-HDF4-75		4.94 (125)		0.62 (0.28)	
		150		304L-HDF4-150	2.00 (50.8)	5.25 (133)		0.94 (0.43)	
		300		304L-HDF4-300		8.94 (227)		1.6 (0.73)	
		400		304L-HDF4-400		11.4 (290)		2.1 (0.95)	
		500		304L-HDF4-500		13.8 (351)		2.6 (1.2)	
1000	1/4	304L-HDF4-1000	3.50 (88.9)	10.9 (277)		0.180 (4.6)		6.5 (2.9)	
1000	1/2	304L-HDF8-1000							
304L SS/ DOT 3A 1800 TC 3ASM 124	1800 (124)	2250	1/4	304L-HDF4-2250	4.00 (102)	17.2 (437)	0.206 (5.2)	14.0 (6.4)	
			1/2	304L-HDF8-2250					
		3785 (1 gal)	1/4	304L-HDF4-1GAL	4.00 (102)	26.7 (678)		0.206 (5.2)	21.0 (9.5)
			1/2	304L-HDF8-1GAL					
316L SS/ DOT 3E 1800 TC SU6158 124	1800 (124)	150	1/4	316L-HDF4-150	2.00 (50.8)	5.25 (133)	0.093 (2.4)	0.94 (0.43)	
		300		316L-HDF4-300		8.94 (227)		1.6 (0.73)	
		500		316L-HDF4-500		13.8 (351)		2.6 (1.2)	
316L SS/ DOT 3A 5000 TC 3ASM 344	5000 (344)	150	1/4	316L-50DF4-150	1.90 (48.2)	8.00 (203)	0.240 (6.1)	3.0 (1.4)	
		300		316L-50DF4-300		14.5 (368)		5.6 (2.5)	
		500		316L-50DF4-500		23.5 (597)		9.1 (4.1)	
Alloy 400/ DOT E7458	1800 (124)	150	1/4	M-HDF4-150	2.00 (50.8)	5.25 (133)	0.093 (2.4)	0.94 (0.43)	
		300		M-HDF4-300		8.94 (227)		1.8 (0.82)	
		500		M-HDF4-500		13.8 (351)		2.9 (1.3)	

## Overpressure Protection

Compressed gas cylinders must be equipped with pressure relief devices in accordance with United States DOT regulations and CGA Pamphlet S-1.1. The CGA pamphlet lists devices that can be used with specific gases. It also contains information on other types of pressure relief devices.

⚠ **Be sure to use the correct pressure-relief device for the gas being used.**

⚠ **Proper filling of the cylinder according to DOT specifications, or other local regulations, is critical in preventing overpressurization.**

## Rupture Disc Units

Swagelok rupture disc units protect sample cylinders from overpressurization by venting the cylinder contents to atmosphere. The rupture disc is welded to a body that is threaded into a valve body or a rupture disc tee and sealed by an elastomer O-ring. The rupture disc can be easily replaced without removing the valve or the tee from the cylinder.



### Materials of Construction

Component	Material Grade/ASTM Specification
Body, inlet ring	316L/A479 or A213
O-ring	Fluorocarbon FKM
Rupture disc	Alloy 600/B168

### Ordering Information

Nominal Burst Pressure at 70°F (20°C)	Ordering Number
2850 psig ± 150 psig 196 bar ± 10.3 bar	SS-RDK-16-2850
1900 psig ± 100 psig 130 bar ± 6.8 bar	SS-RDK-16-1900

## Nonrotating-Stem Needle Valves with Rupture Disc Units



### Ordering Information and Dimensions

End Connections		Flow Pattern	Valve Ordering Number	Orifice in. (mm)
Inlet	Outlet			
<b>With 2850 psig (196 bar) rupture disc</b>				
1/4 in. male NPT	1/4 in. female NPT	Straight	SS-16DKM4F4-2	0.218 (5.5)
		Angle	SS-16DKM4F4-A-2	
1/2 in. male NPT			SS-16DKM8-F4-A-2	
<b>With 1900 psig (130 bar) rupture disc</b>				
1/4 in. male NPT	1/4 in. female NPT	Straight	SS-16DKM4-F4-1	0.218 (5.5)
		Angle	SS-16DKM4-F4-A-1	
1/2 in. male NPT			SS-16DKM8-F4-A-1	

Dimensions are for reference only and are subject to change.

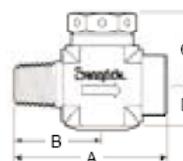
For more information, see the *Swagelok Nonrotating-Stem Needle Valves* catalog. Other Swagelok valves are available for use with sample cylinders. Contact your independent Swagelok sales and service representative for details.

## Rupture Disc Precautions

- Do not use rupture disc devices in a location where the release of the cylinder contents might create a hazard. The rupture disc vents to the atmosphere through six radial holes in the body. Pressure is released suddenly with a loud noise, and gases escape at high velocity.
- Know the burst pressure. (This rating is marked on the end face of the rupture disc unit, as required by CGA Pamphlet S-1.1.)
- Be sure the maximum burst pressure does not exceed the cylinder test pressure.
- Be sure the minimum burst pressure is at least 40 % higher than the cylinder filling pressure.
- Inspect rupture discs regularly. The strength of rupture discs deteriorates with time due to temperature, corrosion, and fatigue. Pulsating pressure, vacuum/pressure cycling, heat, and corrosive fluids and atmospheres can reduce the disc's burst pressure.
- Do not use rupture discs to protect vessels with volumes greater than 3 gal (11 355 cm<sup>3</sup>) for compressed gases or 1 1/2 gal (5677 cm<sup>3</sup>) for liquefied gases.
- Provide suitable means to isolate the sample cylinder from the system in case the rupture disc bursts while taking a sample.
- In cylinders with liquefied gases, a small temperature increase during transportation or storage will cause the liquid to expand and may cause the rupture disc to release its contents. See local regulations and other appropriate guidelines for safe filling limits for your application.

## Rupture Disc Tee

These compact assemblies are designed for use with various Swagelok valves. Tees are made of 316 stainless steel. Each tee includes a rupture disc unit.



Dimensions are for reference only and are subject to change.

### Ordering Information and Dimensions

End Connections		Ordering Number	Dimensions, in. (mm)			
Inlet	Outlet		A	B	C	D
<b>With 2850 psig (196 bar) rupture disc</b>						
1/4 in. male NPT	1/4 in. female NPT	SS-RTM4-F4-2	1.88 (47.7)	1.06 (26.9)	0.94 (23.9)	0.50 (12.7)
		SS-RTM8-F4-2	2.19 (55.6)	1.22 (31.0)	1.19 (30.2)	0.56 (14.2)
<b>With 1900 psig (130 bar) rupture disc</b>						
1/4 in. male NPT	1/4 in. female NPT	SS-RTM4-F4-1	1.88 (47.7)	1.06 (26.9)	0.94 (23.9)	0.50 (12.7)
		SS-RTM8-F4-1	2.19 (55.6)	1.22 (31.0)	1.19 (30.2)	0.56 (14.2)