Sample Cylinders, Accessories, and Outage Tubes

Features

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

Swagelok

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 leak-tight 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^3 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^3 (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^3 3A 1800: 304L, 1000 to 3785 cm^3	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.

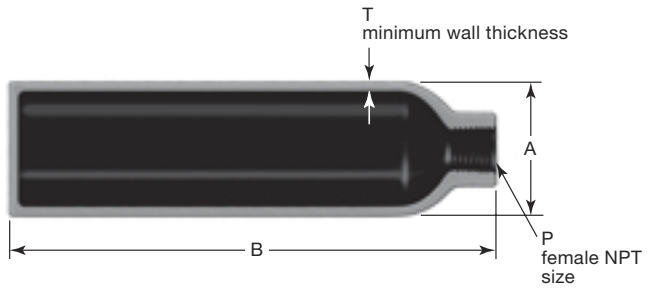
Ratings may be limited by individual country government regulations.

Ordering Information, Technical Data, and Dimensions

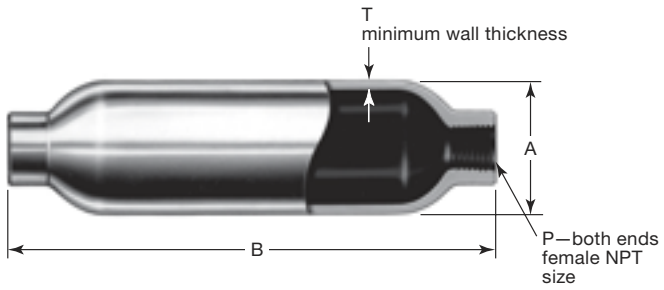
Select an ordering number.

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^3 ± 5 %	P in.	Ordering Number	Dimensions, in. (mm) A	B	T	Weight lb (kg)
Single-Ended								
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		304L-05SF4-300		8.62 (219)		1.8 (0.82)
		500		304L-05SF4-500		13.6 (345)		2.7 (1.2)
Double-Ended								
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)
304L SS/ DOT-3A 1800 TC-3ASM 124	1800 (124)	1000	1/4	304L-HDF4-1000	3.50 (88.9)	10.9 (277)	0.180 (4.6)	6.5 (2.9)
			1/2	304L-HDF8-1000				
		2250	1/4	304L-HDF4-2250	4.00 (102)	17.2 (437)	0.206 (5.2)	14 (6.4)
			1/2	304L-HDF8-2250				
		3785 (1 gal)	1/4	304L-HDF4-1GAL		26.7 (678)		21 (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		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		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.

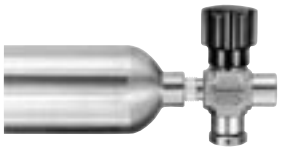
Materials of Construction

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			
With 2850 psig (196 bar) Rupture Disc				
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	
With 1900 psig (130 bar) Rupture Disc				
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.

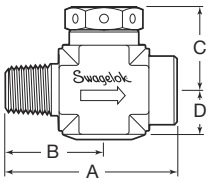
For more information, see the Swagelok *Nonrotating-Stem Needle Valves* catalog, MS-01-42. Other Swagelok valves are available for use with sample cylinders. Contact your authorized Swagelok sales and service representative for details.

Rupture Disc Precautions

1. 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.
2. 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.)
3. Be sure the maximum burst pressure does not exceed the cylinder test pressure.
4. Be sure the minimum burst pressure is at least 40 % higher than the cylinder filling pressure.
5. 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.
6. Do not use rupture discs to protect vessels with volumes greater than 3 gal (11 355 cm^3) for compressed gases or 1 1/2 gal (5677 cm^3) for liquefied gases.
7. Provide suitable means to isolate the sample cylinder from the system in case the rupture disc bursts while taking a sample.
8. In cylinders with liquefied gases, a small temperature increase during transportation or storage will cause the liquid to expand and may cause the rupture disk 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
With 2850 psig (196 bar) Rupture Disc						
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)
1/2 in. male NPT		SS-RTM8-F4-2	2.19 (55.6)	1.22 (31.0)	1.19 (30.2)	0.56 (14.2)
With 1900 psig (130 bar) Rupture Disc						
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)
1/2 in. male NPT		SS-RTM8-F4-1	2.19 (55.6)	1.22 (31.0)	1.19 (30.2)	0.56 (14.2)

Options and Accessories

PTFE Coating

Internal cylinder surfaces can be coated with PTFE to provide a nonstick surface, which aids in cleaning. To order, add **-T** to the cylinder ordering number.

Example: 304L-HDF4-300**-T**

Electropolishing

Electropolishing provides a clean internal surface with a high degree of passivation. To order, add **-EP** to the cylinder ordering number.

Example: 304L-HDF4-300**-EP**

Additional Marking

Cylinders can be furnished roll stamped or laser etched to meet specific identification requirements, such as company name, address, serial number, or order number. We will not mark cylinders with the intended contents.

Roll Stamping—To order, add **-RS** to the cylinder ordering number, followed by the specific information.

Example: 304L-HDF4-300**-RS Company Name and Address**

DOT-3E, 4B, and E7458 cylinders are roll stamped on the cylinder wall. DOT-3A cylinders are roll stamped on the crown.

Laser Etching—To order, add **-LE** to the cylinder ordering number, followed by the specific information.

Example: 304L-HDF4-300**-LE Company Name and Address**

This information will be laser etched on the cylinder wall.

Cylinders with the above options conform to DOT specifications.

German Pressurized Container Regulations

Cylinders that meet the requirements of the German Pressurized Container Regulations (Druckbehalterverordnung) are available.

Swagelok has been granted Design Approval (Bauartrzulassung) number 02 USA 1 for sizes from 40 through 1000 cm^3. Each cylinder produced under this approval bears a TÜV approval mark.

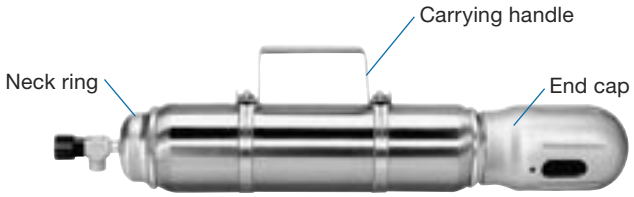
For information, contact your authorized Swagelok representative.

End Caps

End caps protect valves from damage. Each cap threads onto a neck ring that has been peened to the cylinder neck. End caps are made from plated carbon steel and are available for use on 2250 and 3785 cm^3 (1 gal) cylinders. Swagelok angle-pattern valves can be used on cylinders with end caps.

To order, add **C** to the cylinder ordering number.

Example: 304L-HDF8-2250**C**



Carrying Handle

This accessory provides a convenient way to carry sample cylinders.The handle is made from 304 stainless steel and is available for use on 400 cm^3 and larger cylinders, as well as 300 cm^3 cylinders rated to 5000 psig (344 bar).

To order a sample cylinder to be shipped with a carrying handle, add **H** to the cylinder ordering number.

Example: 304L-HDF4-300**H**

To order a carrying handle as a separate component, use one of the following ordering numbers:

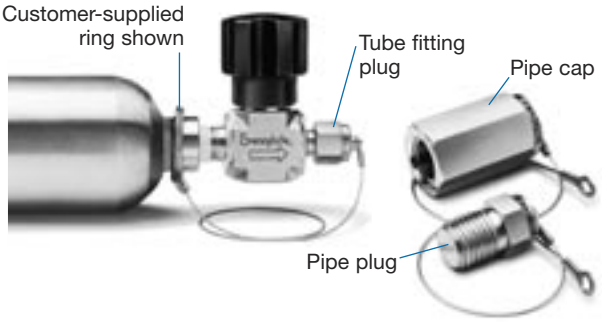
Cylinder OD in. (mm)	Ordering Number
1.9, 2 (48.2, 50.8)	MS-5K-CY-2″
3.5, 4 (88.9, 102)	MS-5K-CY-4″

To order a 2250 or 3785 cm^3 (1 gal) sample cylinder with factory-assembled end caps and neck rings to be shipped with a carrying handle, add **CH** to the cylinder ordering number.

Example: 304L-HDF8-2250**CH**

Caps and Plugs

Caps and plugs protect Swagelok tube fitting or NPT end connections on valves during cylinder transport. Contact your authorized Swagelok representative for details.



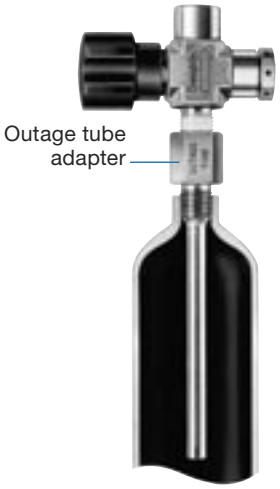
Outage Tubes

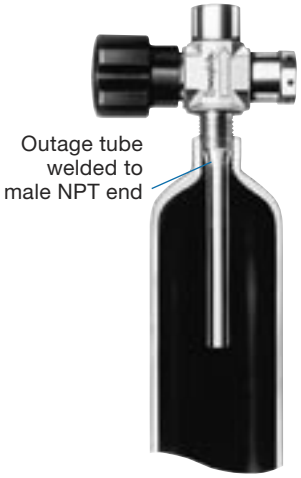
Features

- Made from 316 stainless steel or alloy 400 tubing
- Offered in 1/4 or 1/2 in. NPT sizes
- Marked “Outage Tube” for identification

Construction

Outage tubes are welded to the male inlet end of an adapter or tee. This adapter or tee is then threaded into the female port of a sample cylinder.





Outage tubes can also be welded directly to the male inlet of a Swagelok nonrotating stem needle valve. The valve is then threaded into the female port of a sample cylinder.

Tube Length

Outage tube length *(L)* is measured from the end of the pipe fitting to the end of the tube. Standard tube length is 10.4 in. (26.4 cm). Tubing can be cut to a desired length; instructions are included.

Purpose

Outage tubes provide a vapor space of the desired volume in cylinders containing liquefied gases, so that liquid in the cylinder can expand if the temperature increases. Without enough vapor space, a small temperature increase can cause the liquid to expand and increase the pressure dramatically.

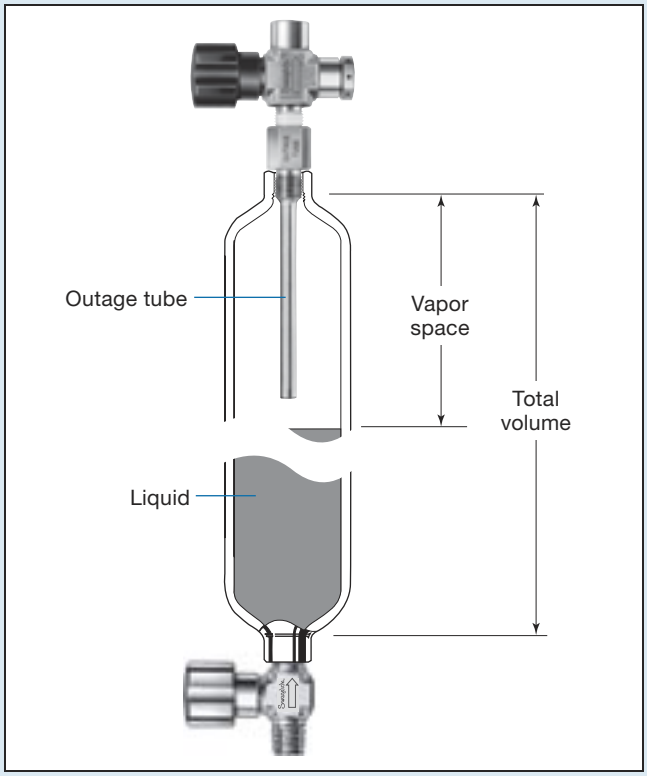
See local regulations and other appropriate guidelines for safe filling limits for your application.

Use

Outage is the vapor space in the cylinder expressed as a percentage of the total volume of the cylinder.

$$\% \text{ outage} = (\text{vapor space/total volume}) \times 100$$

The cylinder is held vertically with the outage tube at the top, as shown. The length of the outage tube determines the amount of vapor space. Sampling methods and the use of the outage tube are described in technical publications such as ASTM D1265, *Standard Method of Sampling Liquefied Petroleum Gases.*



Ordering Information

Adapters with Outage Tubes

Select an adapter ordering number.

For alloy 400 material, replace **SS** with **M.**

Example: **M**-DTM4-F4-104

End Connections		Adapter Ordering Number	Tube Length in. (cm)	Tube OD
Inlet	Outlet			
1/4 in. male NPT	1/4 in. female NPT	SS-DTM4-F4-104	10.4 (26.4)	5/16 in.
1/2 in. male NPT		SS-DTM8-F4-104		1/2 in.

Nonrotating Stem Needle Valves with Outage Tubes

Select a valve ordering number.

For alloy 400 material, replace **SS** with **M.**

Example: **M**-14DKM4-104

End Connections		Valve Ordering Number	Tube Length in. (cm)	Tube OD
Inlet	Outlet			
1/4 in. male NPT		SS-14DKM4-104	10.4 (26.4)	5/16 in.
1/4 in. male NPT	1/4 in. female NPT	SS-16DKM4-F4-104		1/2 in.

Valves do not include rupture disc units. Contact your authorized Swagelok representative for information about valves with outage tubes and rupture disc units.

Factory-Cut Tube Lengths

Follow the example below to determine how to order outage tubes cut at the factory to a length other than 10.4 in. (26.4 cm).

Sample cylinder ordering number is 304L-HDF4-150.

Outage required is 30 %.

See **Outage Tube Lengths** table at right:

1. Find 304L-HDF4-150, the cylinder ordering number.
2. Read across to the 30 % column.
3. Tube length is 1.79 in.
4. Designator is 018.
5. Replace **104** in the outage tube adapter or valve ordering number with **018.**

   Examples: SS-DTM4-F4-**018**
   SS-16DKM4-F4-**018**

⚠ **Caution:**
Tolerances on cylinder volume, dimensions, and thread fit can change the outage obtained by as much as 20 %. To obtain an exact outage, each outage tube and cylinder assembly should be calibrated by a suitable method.

Outage Tube Lengths

Tube OD	Cylinder Ordering Number	Minimum Outage, %				
		10	20	30	40	50
		Tube Length, in.				
		Designator				
1/4 in.	304L-HDF2-40	0.87	1.11	1.35	1.59	1.84
		009	011	014	016	018
5/16 in.	304L-HDF4-50	0.85	1.07	1.28	1.50	1.71
		009	011	013	015	017
	304L-HDF4-75	1.02	1.34	1.66	1.98	2.31
		010	013	017	020	023
	304L-HDF4-150	1.12	1.45	1.79	2.13	2.46
		011	015	018	021	025
	304L-HDF4-300	1.65	2.32	2.99	3.67	4.34
		017	023	030	037	043
	304L-HDF4-400	2.00	2.90	3.79	4.69	5.59
		020	029	038	047	056
	304L-HDF4-500	2.26	3.38	4.50	5.62	6.74
		023	034	045	056	067
	304L-HDF4-1000	2.31	3.06	3.81	4.56	5.31
		023	031	038	046	053
	304L-HDF4-2250	3.30	4.59	5.88	7.17	8.46
		033	046	059	072	085
	304L-HDF4-1GAL	4.62	6.79	8.96	11.14	13.31
		046	068	090	111	133
1/2 in.	304L-HDF8-1000	2.21	2.96	3.71	4.46	5.21
		022	030	037	045	052
	304L-HDF8-2250	3.20	4.49	5.78	7.07	8.36
		032	045	058	071	084
	304L-HDF8-1GAL	4.52	6.69	8.86	11.04	13.21
		045	067	089	110	132
5/16 in.	316L-HDF4-150	1.12	1.45	1.79	2.13	2.46
		011	015	018	021	025
	316L-HDF4-300	1.65	2.32	2.99	3.67	4.34
		017	023	030	037	043
	316L-HDF4-500	2.26	3.38	4.50	5.62	6.74
		023	034	045	056	067
	M-HDF4-150	1.12	1.45	1.79	2.13	2.46
		011	015	018	021	025
	M-HDF4-300	1.65	2.32	2.99	3.67	4.34
		017	023	030	037	043
	M-HDF4-500	2.26	3.38	4.50	5.62	6.74
		023	034	045	056	067
	304L-05SF4-150	1.09	1.43	1.77	2.12	2.46
		010	014	018	021	025
	304L-05SF4-300	1.59	2.27	2.96	3.65	4.34
		016	023	030	037	043
	304L-05SF4-500	2.16	3.30	4.45	5.60	6.74
		022	033	045	056	067
	316L-50DF4-150	1.62	2.17	2.71	3.26	3.81
		016	022	027	033	038
	316L-50DF4-300	2.74	3.84	4.93	6.03	7.12
		027	038	049	060	071
	316L-50DF4-500	4.39	6.21	8.04	9.86	11.68
		044	062	080	099	117

Miniature Sample Cylinders

Miniature sample cylinders with 3/8 in. Swagelok tube adapters allow transport of low volumes of fluids. The tube adapter ends can be connected to 3/8 in. Swagelok tube fittings or welded to 1/4 or 3/8 in. tubing.

Features

- Single-ended or double-ended designs
- Corrosion-resistant 316 stainless steel construction
- Pressure rating of 1000 psig (68.9 bar)
- Sizes include 10, 25, and 50 cm^3 capacities
- Smooth internal port transition for easy cleaning
- Volume is closely controlled
- Full-penetration butt weld construction

Cleaning and Testing

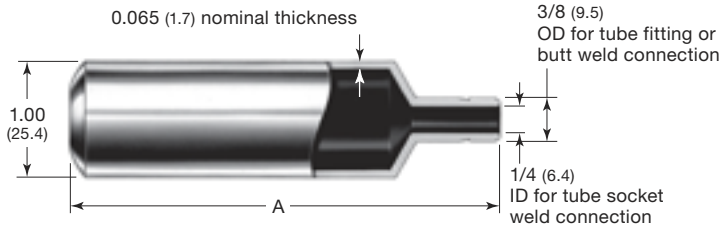
Every miniature sample cylinder is cleaned in accordance with Swagelok *Special Cleaning and Packaging (SC-11),* MS-06-63.

Every miniature sample cylinder is proof tested at 1667 psig (114 bar) with dry nitrogen gas.

Ordering Information and Dimensions

Select an ordering number.

Dimensions, in inches (millimeters), are for reference only and are subject to change.



Cylinder Model	Internal Volume cm^3	Volume Tolerance	Ordering Number	Pressure Rating psig (bar)	A in. (mm)	Average Weight oz (g)
Single-ended	10	± 10 %	SS-4CS-TW-10	1000 (68.9)	2.19 (55.6)	2.2 (62)
	25	±5 %	SS-4CS-TW-25		3.69 (93.7)	3.2 (91)
	50		SS-4CS-TW-50		6.25 (159)	5.6 (159)
Double-ended	10	± 10 %	SS-4CD-TW-10		2.75 (69.8)	1.9 (54)
	25	±5 %	SS-4CD-TW-25		4.25 (108)	3.3 (94)
	50		SS-4CD-TW-50		6.81 (173)	5.1 (145)

Existing DOT specifications do not cover miniature cylinders of this size, construction, and pressure rating.

Safe Product Selection
When selecting a product, the total system design must be considered to ensure safe, trouble-free performance. Function, material compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibilities of the system designer and user.

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

Warranty Information

Swagelok products are backed by The Swagelok Limited Lifetime Warranty. For a copy, visit swagelok.com or contact your authorized Swagelok representative.

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