

Ultrahigh-Purity Valves for Atomic Layer Processing



Atomic Layer Deposition (ALD) Valves

- Ultrahigh cycle life with high-speed actuation
- C_v range from 0.27 to 1.7
- Temperature capability up to 482°F (250°C)
- Field flow adjustability options available
- Electronic or optical actuator position-sensing options available
- Suitable for ultrahigh-purity applications with 316L VIM-VAR stainless steel and Alloy 22 body options
- Modular surface-mount, tube butt weld, and VCR® end connections available

Swagelok®

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ALD Valve Selection

	Flow Coefficient (C _v)	Serviceability		Actuation		Working Pressure Vacuum to			Max Body Temperature Rating °F (°C)			Max Actuator Temperature Rating °F (°C)		
		Field Flow Adjustability	Seat/ Diaphragm Replaceability	Normally Open	Normally Closed	20 psig (1.4 bar)	60 psig (4.1 bar)	145 psig (10.0 bar)	248 (120)	392 (200)	482 (250)	248 (120)	302 (150)	482 (250)
ALD3	0.3			✓	✓			✓	✓			✓		
ALD3T	0.3			✓	✓			✓		✓		✓		
ALD6	0.6			✓	✓			✓	✓			✓		
ALD6T	0.6			✓	✓			✓		✓		✓		
ALD7A	0.7	✓			✓			✓		✓			✓	
ALD7C	0.7	✓	✓		✓		✓				✓			✓
ALD20	1.7				✓	✓					✓			✓

See technical reports for additional details.

ALD3 and ALD6 Diaphragm Valve Features

- Normally closed and normally open pneumatic actuation
- Flow coefficients of 0.27 to 0.62 standard; custom flow coefficients available
- Two-port straight and elbow configurations
- Two-, three-, and four-port multiport valves and multivalve manifolds
- Two- and three-port modular surface-mount valves in 1.125 in. (ALD3 series only) and 1.5 in. platforms
 - C-seal design (all valves)
 - W-seal design (ALD3 series only)
- VCR, “H” Type VCR, and tube butt weld end connections



Diaphragm

- Cobalt-based superalloy (UNS R30003) material for strength and corrosion resistance
- Optimized design for ultrahigh cycle life

Seat

- Fully contained seat design
- High-purity grade PFA, fully fluorinated
- Ultrahigh cycle life
- Broad range of chemical compatibility
- Excellent resistance to swelling and contamination
- High-integrity seat seal performance

Body

- Body seal provides ultrahigh cycle life
- 316L VIM-VAR stainless steel body material for ultrahigh-purity applications
- Fully swept flow path
 - minimizes entrapment areas
 - facilitates purging
 - maximizes flow capacity
- Optional body holes to accommodate heater cartridges

Actuators

Standard

- Pneumatic actuator for high-speed and repeatable actuation
- Capable of valve opening or closing time of less than 5 ms
- Factory-set flow adjusting mechanism ensures precise and consistent C_v from valve to valve
- Optional factory-set electronic actuator-position sensor verifies open position of pneumatically actuated valves
- Optional solenoid pilot valve for electronic control of high-speed actuation

Thermal

Same performance and options as standard actuator with the following additional features:

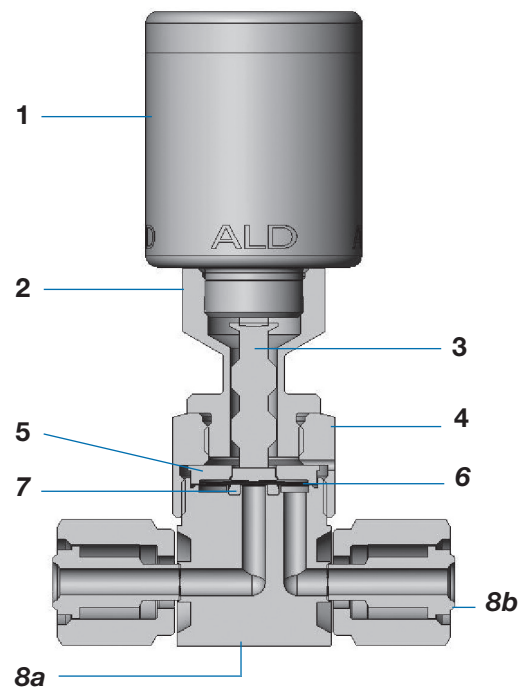
- Includes thermal isolation coupling for thermal applications
- Limits conductive heat transfer from the body to the actuator
- Provides a more uniform valve body temperature to reduce cold spots
- Significantly reduces electrical power required to heat the valve
- Extends the life of the actuator in applications where the body is heated

Materials of Construction (ALD3 and ALD6)

Component	Material Grade/ASTM Specification
1 Pneumatic actuator assembly	—
Cylinder, cap	Aluminum
Pistons	Powdered metal 300 series SS—normally open; aluminum—normally open and normally closed
Base	Powdered metal 300 series SS—normally open; none—normally closed
Flow adjusting mechanism	316 SS/A479
O-rings	Fluorocarbon FKM
Springs	S17700
Button	316 SS/A479
Bushing	Carbon-filled PTFE
2 Thermal isolation coupling housing (thermal model only)	316 SS/A479
3 Thermal isolation coupling stem (thermal model only)	S17400
4 Bonnet nut	316 SS/A479
5 Bonnet	S17400
6 Diaphragm	Cobalt-based superalloy (UNS R30003)/AMS 5876
7 Seat	High-purity PFA Type II/D3307
8a Body	316L VIM-VAR SS/SEMI F20 Ultrahigh-Purity ^①
8b Welded VCR end connections	316L VAR SS/SEMI F20 High-Purity ^①
Lubricant	PTFE-based

Wetted components listed in *italics*.

① 20 % minimum elongation allowed.



Normally Closed Actuator Shown

Process Specifications (ALD3 and ALD6)

See Swagelok® *Ultrahigh-Purity Process Specification (SC-01)* catalog, [MS-06-61](#) for details on processes, process controls, and process verification.

Cleaning	Assembly and Packaging	Wetted Surface Roughness (R_a)	Testing
Ultrahigh-purity cleaning with a continuously monitored, deionized water, ultrasonic cleaning system	Performed in ISO Class 4 work areas; valves are double bagged and vacuum sealed in cleanroom bags.	Electropolished and finished to an average of $< 5 \mu\text{in.}$ ($0.13 \mu\text{m}$)	ALD3 normally closed: Inboard helium leak tested to a rate of 1×10^{-9} std cm^3/s at the seat, envelope, and all seals. ALD3 and ALD6 normally open and ALD6 normally closed: Inboard helium leak tested to a rate of 1×10^{-8} std cm^3/s at the seat and to a rate of 1×10^{-9} std cm^3/s at the envelope and all other seals.

Technical Data (ALD3 and ALD6)

Valve Series	Working Pressure psig (bar)		Temperature Rating °F (°C)			Flow Coefficient (C _v) ^④	Orifice in. (mm)	Internal Volume ^⑤ in. ³ (cm ³)		Pneumatic Actuator ^⑤	
			Operating ^{②③}		Short-Term Bakeout			Tube Butt Weld Body	2-Port Surface-Mount	Actuation Pressure psig (bar)	Air Displacement in. ³ (cm ³)
	Operating ^①	Burst	Standard Actuator	Thermal Actuator ^②							
Normally Closed Actuation											
ALD3	Vacuum to 145 (10.0)	>3200 (220)	32 to 248 (0 to 120)	32 to 392 (0 to 200)	392 (200) (valve open)	0.27	0.16 (4.1)	0.086 (1.4)	0.048 (0.79)	50 to 90 (3.5 to 6.2)	0.042 (0.69)
ALD6						0.62	0.23 (5.8)	0.26 (4.3)	0.084 (1.4)		0.075 (1.2)
Normally Open Actuation											
ALD3	Vacuum to 145 (10.0)	>3200 (220)	32 to 248 (0 to 120)	32 to 392 (0 to 200)	392 (200) (valve open)	0.27	0.16 (4.1)	0.086 (1.4)	0.048 (0.79)	70 to 90 (4.9 to 6.2)	0.027 (0.44)
ALD6						0.62	0.23 (5.8)	0.26 (4.3)	0.084 (1.4)		0.046 (0.75)

① Recommended operating pressure of less than 35 psig (2.4 bar) for optimal cycle life.

② Actuator temperature is limited to 248°F (120°C); valve body temperature is rated to 392°F (200°C).

③ See pages 7 and 8 for maximum operating temperatures for products with an electronic actuator-position sensor, solenoid pilot valve, or both.

④ Custom flow coefficients available; contact your authorized Swagelok sales and service center for more information.

⑤ ALD3 series 1.125 in. platform surface-mount valve:

■ Internal volume for 2-port body: 0.078 in.³ (1.3 cm³)

■ Actuation pressure: normally closed, 60 to 90 psig (4.2 to 6.2 bar); normally open, 70 to 90 psig (4.9 to 6.2 bar).

■ Air displacement: 0.03 in.³ (0.49 cm³).

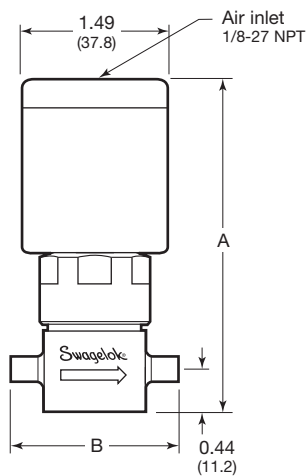
Ordering Information and Dimensions (ALD3 and ALD6)

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

Two-Port Valves

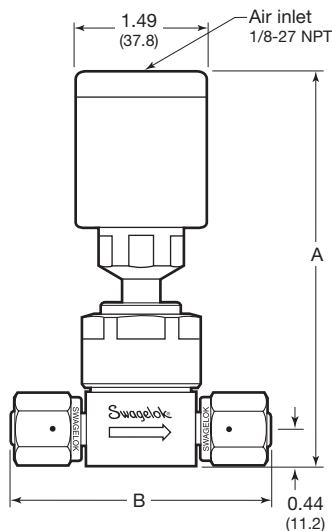
For a complete ordering number, add **C** for a normally closed actuator or **NO** for a normally open actuator.

**Normally Closed
Standard Actuator**



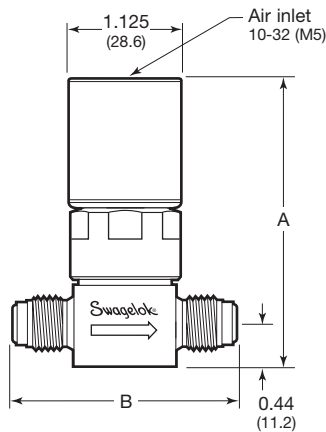
**Butt Weld End
Connections**

**Normally Closed
Thermal Actuator**



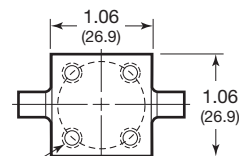
**Female VCR Fitting
End Connections**

**Normally Open
Standard Actuator**

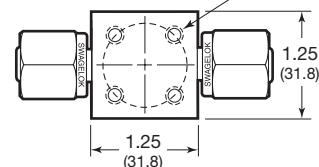


**Integral Male VCR
Fitting End Connections**

ALD3 Bottom



Four mounting holes, M5 × 0.8-6H thread, 0.25 (6.4) deep, located 45° from center line, on a 1.00 (25.4) bolt circle. M5 × 0.8-6H holes are compatible with 10-32 mounting screws.



ALD6 Bottom

End Connections		Standard Actuator Ordering Number	Thermal Actuator Ordering Number	Dimensions, in. (mm)		
				A		B
				Normally Closed	Normally Open	
Inlet/Outlet	Size					
ALD3 Series						
Female VCR fitting	1/4 in.	6LVV-ALD3FR4-P-	6LVV-ALD3TFR4-P-	3.50 (88.9) (standard actuator)	3.22 (81.8) (standard actuator)	2.78 (70.6)
Integral male VCR fitting	1/4 in.	6LVV-ALD3VR4-P-	6LVV-ALD3TVR4-P-			2.30 (58.4)
Rotatable male VCR fitting	1/4 in.	6LVV-ALD3MR4-P-	6LVV-ALD3TMR4-P-	4.50 (114) (thermal actuator)	4.22 (107) (thermal actuator)	2.78 (70.6)
Tube butt weld, 0.30 in. long	1/4 × 0.035 in.	6LVV-ALD3BW4-P-	6LVV-ALD3TBW4-P-			1.74 (44.2)
ALD6 Series						
Female VCR fitting	1/2 in.	6LVV-ALD6FR8-P-	6LVV-ALD6TFR8-P-	3.76 (95.5) (standard actuator)	3.48 (88.4) (standard actuator)	4.16 (106)
Female “H” type VCR fitting	1/4 in.	6LVV-ALD6HFR4-P-	6LVV-ALD6THFR4-P-			2.78 (70.6)
Rotatable male VCR fitting	1/2 in.	6LVV-ALD6MR8-P-	6LVV-ALD6TMR8-P-	4.76 (121) (thermal actuator)	4.48 (114) (thermal actuator)	4.16 (106)
Tube butt weld, 0.50 in. long	1/2 × 0.049 in.	6LVV-ALD6BW8-P-	6LVV-ALD6TBW8-P-			2.25 (57.2)

Additional end connections may be available upon request. Contact your authorized Swagelok sales and service center for more information.

Ordering Information and Dimensions (ALD3 and ALD6)

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

Modular Surface-Mount Valves

Standard and High-Flow

C-Seal Design

For a complete ordering number, add **C** for a normally closed actuator or **NO** for a normally open actuator.

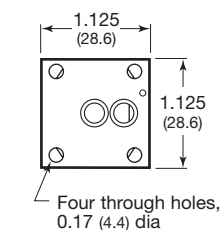
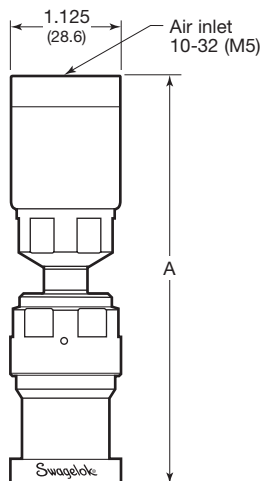
W-Seal Design

Insert **W** into an ALD3 series ordering number as shown.

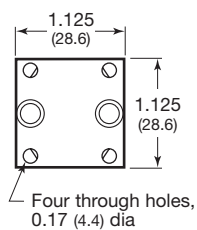
Examples:

- 6LVV-MSM-ALD3E-W2-P-C for a 1.125 in. 2-port valve with standard actuator
- 6LVV-MSM-ALD3T-W3-P-C for a 1.5 in. 3-port valve with thermal actuator

Normally Closed Thermal Actuator, 1.125 in. Platform

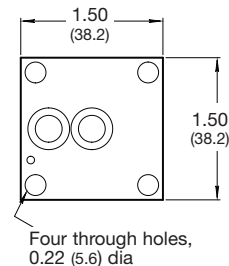
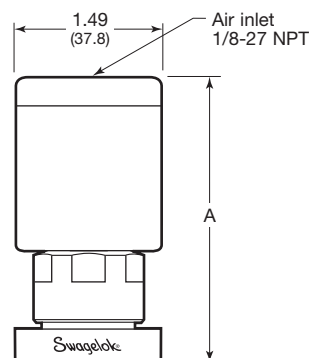


1.125 in. C-Seal Platform Bottom



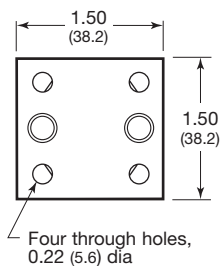
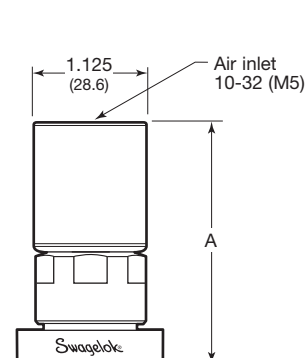
1.125 in. W-Seal Platform Bottom

Normally Closed Standard Actuator 1.5 in. Platform



1.5 in. High Flow C-Seal Platform Bottom

Normally Open Standard Actuator 1.5 in. Platform



1.5 in. W-Seal Platform Bottom

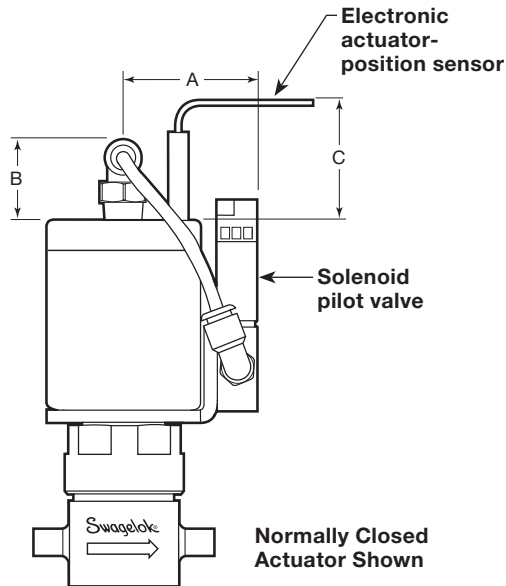
Surface-Mount Platform	Ports	Standard Actuator Ordering Number	Thermal Actuator Ordering Number	A, in. (mm)			
				Normally Closed		Normally Open	
				C-Seal	W-Seal	C-Seal	W-Seal
ALD3 Series							
1.125 in.	2	6LVV-MSM-ALD3E-2-P-	6LVV-MSM-ALD3ET-2-P-	3.40 (86.4) (standard)	3.40 (86.4) (standard)	3.45 (87.6) (standard)	3.45 (87.6) (standard)
	3	6LVV-MSM-ALD3E-3-P-	6LVV-MSM-ALD3ET-3-P-	4.40 (112) (thermal)	4.40 (112) (thermal)	4.45 (113) (thermal)	4.45 (113) (thermal)
ALD6 Series							
1.5 in. ^①	2	6LVV-MSM-ALD6-HF2-P-	6LVV-MSM-ALD6T-HF2-P-	3.15 (80.0) (standard)	—	2.87 (72.9) (standard)	—
	3	6LVV-MSM-ALD6-HF3-P-	6LVV-MSM-ALD6T-HF3-P-	4.15 (105) (thermal)		3.87 (98.3) (thermal)	

① For assembly using 10-32 mounting screws only. M5 holes are compatible with 10-32 mounting screws.

Additional end connections may be available upon request. Contact your authorized Swagelok sales and service center for more information.

Options and Accessories (ALD3 and ALD6)

Valves with electronic actuator-position sensors (right), solenoid pilot valve assemblies, page 8, heater cartridge holes, page 8, and optical position sensors, page 23, are available.



Dimensions

Actuator	Dimensions, in. (mm)		
	A	B	C
Normally closed	1.32 (33.5)	0.70 (17.8)	1.18 (30.0)
Normally open	1.14 (29.0)	0.63 (16.0)	

Ordering Information

To order one option, add a designator to the valve ordering number. To order two or more options, add the designators in the sequence shown below.

6LVV – ALD3BW4-P-C **S V**

Electronic
actuator-position
sensor

Solenoid pilot valve assembly

Examples:

6LVV-ALD3BW4-P-**CS** for a valve with electronic actuator-position sensor with short pigtail electrical connector

6LVV-ALD3BW4-P-**CSL** for a valve with electronic actuator-position sensor with long cable with flying leads electrical connector

6LVV-A3T1V333P-AA**V** for a multivalve manifold with solenoid pilot valve assembly on valve 2

6LVV-A31V333P-**ASVASV** for a multivalve manifold with electronic actuator-position sensor with short pigtail electrical connector and solenoid pilot valve assembly on both valves

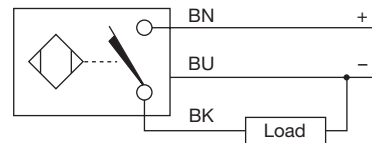
Electronic Actuator-Position Sensors

Transmit a signal to an electrical device indicating the open position of pneumatically actuated valves. Sensors and electrical connectors described below are third-party products.

Sensor Technical Information

Output	3-wire V (dc) — transistor (current-sourcing)
Output Function	Normally open
Voltage	10 to 30 V (dc) polarity protected — pulsed SCP
Operating Temperature	–10 to 158°F (–23 to 70°C)

Wiring Diagram



Factory-Assembled Electronic Actuator-Position Sensors

Factory-assembled position sensors are set for optimum performance and sealed with a tamper-evident paste that provides visible evidence of disassembly or adjustment.

To order an electronic actuator-position sensor factory assembled to a valve, add a designator to the valve ordering number.

Examples:

6LVV-ALD3BW4-P-**CS**

6LVV-MSM-ALD6-HF2-P-**CSL**

Sensor Electrical Connector	Designator
Short pigtail ^①	S
Long cable with flying leads	SL

^① A mating direct-current M8 3-wire push-on straight female connector is available.

Ordering number:
MS-CS-BALF-1

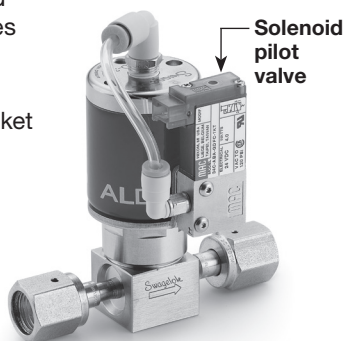
Note: optical sensors for ALD3 and ALD6 are available on page 23.

Options and Accessories (ALD3 and ALD6)

Solenoid Pilot Valve Assemblies

Fast-acting, high-flow solenoid pilot valve enhances ALD series valve response time.

- Includes tubing, connectors, and rotatable mounting bracket for installation versatility.
- See illustration on page 7 for assembly dimensions.
- See table below for technical information. For additional technical information, see MAC® valve part number 34B-AAA-GDFC



Solenoid Pilot Valve Technical Information

Component	MAC valve 34B-AAA
Solenoid Pilot Valve	24 V, 4 W
	Temperature rating: 50°C (122°F) maximum, continuous use
	Porting: M5 × 0.8-6H thread, compatible with 10-32 screws
Push-to-Connect Fitting	Material: C3604 brass, 304 SS, polybutylene terephthalate (PBT), polypropylene (PP), polyoxymethylene (POM), Nitrile rubber (NBR) (Buna N)
Tubing	Material: polyurethane
Bracket	Material: 316 SS
O-Ring	Material: Fluorocarbon FKM
Washer	Material: Nylon

Factory-Assembled Solenoid Pilot Valves

To order a solenoid pilot valve factory assembled, add **V** to the ordering number.

Examples: 6LVV-ALD3BW4-P-CV
6LVV-MSM-ALD6-2-P-CV

In modular surface-mount systems, the solenoid pilot valve may interfere with adjacent components.

Solenoid Pilot Valves for Field Assembly

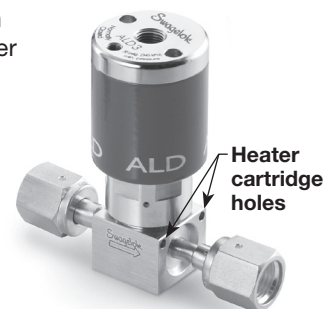
Ordering number for a solenoid pilot valve component only:

MS-PVK-ALD-MAC34CA

Heater Cartridge Holes

Valves are available with holes in the body to accommodate heater cartridges.

- Hole size: 1/8 in. through holes for two-port, three-port, and elbow bodies; 1/8 by 1 in. deep holes for monoblock bodies.
- Two-port and monoblock bodies feature two body holes; three-port and elbow bodies feature one body hole. For more information, contact your authorized Swagelok sales and service center.



Ordering Information.

To order a valve with heater cartridge holes, contact your authorized Swagelok sales and service center.

ALD7A Diaphragm Valve Features

- Normally closed pneumatic actuation
- Flow coefficients of 0.7 standard; custom flow coefficients available
- Two-port straight and elbow configurations
- Two-, three-, and four-port multiport valves and multivalve manifolds
- Two- and three-port modular surface-mount valves, with C-seal design, in 1.5 in. platforms
- VCR, "H" Type VCR, and tube butt weld end connections
- Field flow adjustability allows for up to 25% decrease of C_v from Factory Flow Set
- Optimized to maintain flow performance at high temperatures and reduced-pressure vacuum conditions



Diaphragm

- Cobalt-based superalloy (UNS R30003) material for strength and corrosion resistance
- Optimized design for ultrahigh cycle life

Seat

- Fully contained seat design
- High-purity grade PFA, fully fluorinated
- Ultrahigh cycle life
- Broad range of chemical compatibility
- Excellent resistance to swelling and contamination
- High-integrity seat seal performance

Body

- Body seal provides ultrahigh cycle life
- 316L VIM-VAR stainless steel body material for ultrahigh-purity applications
- Fully swept flow path
 - minimizes entrapment areas
 - facilitates purging
 - maximizes flow capacity
- Optional body holes to accommodate heater cartridges

Actuator

Thermal Immersion

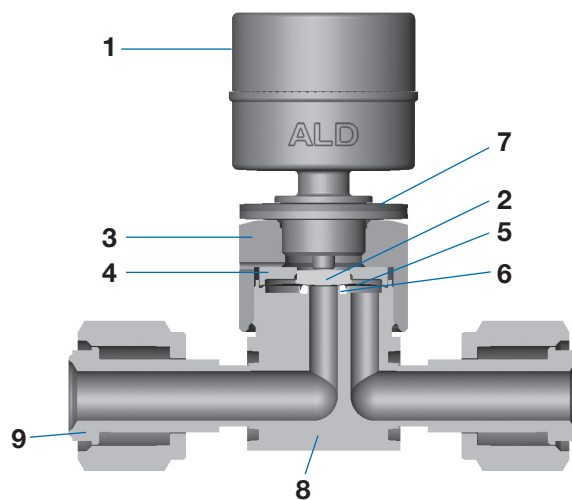
- Pneumatic actuator for high-speed and repeatable actuation
- Capable of valve opening or closing time of less than 3 ms
- Factory-set flow adjusting mechanism ensures precise and consistent C_v from valve to valve
- Optional factory-set electronic actuator-position sensor verifies open position of pneumatically actuated valves
- Optional solenoid pilot valve for electronic control of high-speed actuation
- Includes thermal isolation for thermal applications
 - limits conductive heat transfer from the body to the actuator
 - provides a more uniform valve body temperature to reduce cold spots
 - significantly reduces electrical power required to heat the valve
 - extends the life of the actuator in applications where the body is heated

Materials of Construction (ALD7A)

Component	Material Grade/ASTM Specification
1 Pneumatic actuator assembly	316 SS/A479
Lubricant	PTFE-based
2 Button	316 SS/A479
3 Bonnet nut	316 SS/A479
4 Bonnet	S17400
5 Diaphragm	Cobalt-based superalloy (UNS R30003)/AMS 5876
6 Seat	High-purity PFA Type II/D3307
7 Disc springs	316 SS/A479
8 Body	316L VIM-VAR SS/ SEMI F20 Ultrahigh-Purity ^①
9 Welded VCR end connections	316L VAR SS/ SEMI F20 High-Purity ^①

Wetted components listed in *italics*.

① 20 % minimum elongation allowed.



Process Specifications (ALD7A)

See Swagelok® *Ultrahigh-Purity Process Specification (SC-01)* catalog, [MS-06-61](#) for details on processes, process controls, and process verification.

Cleaning	Assembly and Packaging	Wetted Surface Roughness (R_a)	Testing
Ultrahigh-purity cleaning with a continuously monitored, deionized water, ultrasonic cleaning system	Performed in ISO Class 4 work areas; valves are double bagged and vacuum sealed in cleanroom bags.	Electropolished and finished to an average of $<5 \mu\text{in.}$ ($0.13 \mu\text{m}$)	Inboard helium leak tested to a rate of 1×10^{-8} std cm^3/s at the seat and to a rate of 1×10^{-9} std cm^3/s at the envelope and all other seals.

Technical Data (ALD7A)

Valve Series	Working Pressure psig (bar)		Operating Temperature Rating ^{②③} °F (°C)	Flow Coefficient (C _v) ^④	Flow Adjustability	Orifice in. (mm)	Internal Volume in. ³ (cm ³)		Pneumatic Actuator	
	Operating ^①	Burst					Tube Butt Weld Body	2-Port Surface-Mount	Actuation Pressure psig (bar)	Air Displacement in. ³ (cm ³)
Normally Closed Actuation										
ALD7A	Vacuum to 145 (10.0)	>3200 (220)	32 to 392 (0 to 200)	0.7	> 25% reduction	0.23 (5.8)	0.26 (4.3)	0.084 (1.4)	60 to 120 (4.1 to 8.2)	0.051 (0.84)

① Recommended operating pressure of less than 35 psig (2.4 bar) for optimal cycle life.

② Actuator temperature is limited to 302°F (150°C). Valve body temperature is rated to 392°F (200°C).

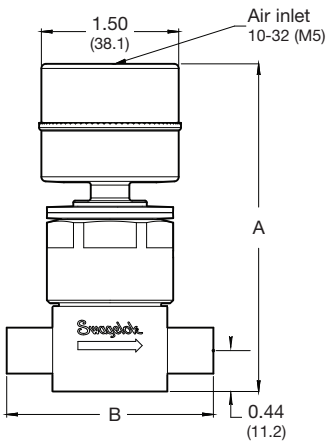
③ See pages 12 and 13 for maximum operating temperatures for products with an electronic actuator-position sensor, solenoid pilot valve, or both.

④ Custom flow coefficients available; contact your authorized Swagelok sales and service center for more information.

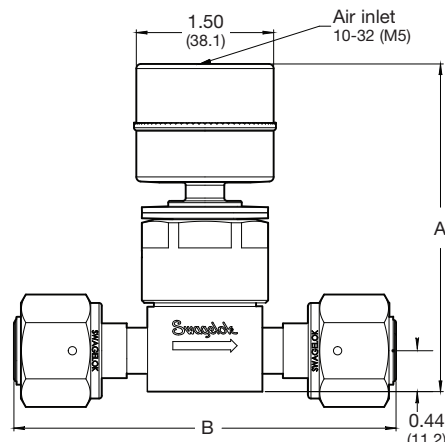
Ordering Information and Dimensions (ALD7A)

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

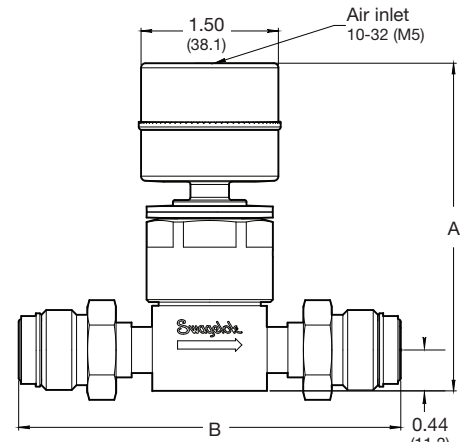
Two-Port Valves



Butt Weld End Connections

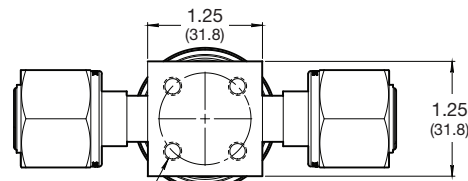


Female VCR Fitting End Connections



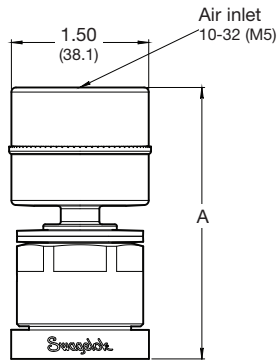
Rotatable Male VCR Fitting End Connections

Four mounting holes, M5 $\times$ 0.8-6H thread, 0.25 (6.4) deep, located 45° from center line, on a 1.00 (25.4) bolt circle. M5 $\times$ 0.8-6H holes are compatible with 10-32 mounting screws.

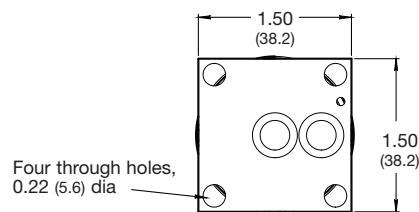


End Connections		Ordering Number	Dimensions, in. (mm)	
Inlet/Outlet	Size		A	B
Female VCR fitting	1/2 in.	6LVV-ALD7AFR8-P-C	3.63 (92.2)	4.16 (106)
Female "H" type VCR fitting	1/4 in.	6LVV-ALD7AHFR4-P-C		2.78 (70.6)
Rotatable male VCR fitting	1/2 in.	6LVV-ALD7AMR8-P-C		4.16 (106)
Tube butt weld, 0.50 in. long	1/2 $\times$ 0.049 in.	6LVV-ALD7ABW8-P-C		2.25 (57.2)

Additional end connections may be available upon request. Contact your authorized Swagelok sales and service center for more information.



Modular Surface Mount



C-Seal Platform Bottom

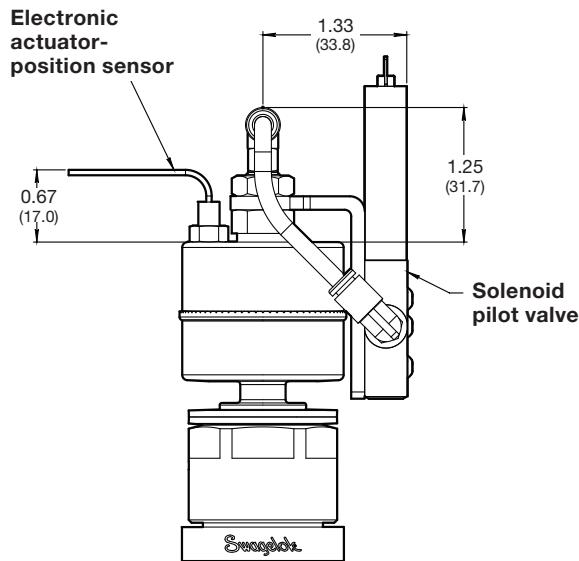
Surface-Mount Platform	Ports	Ordering Number	Dimensions, in. (mm)
			A
1.5 in. High Flow C-Seal ^①	2	6LVV-MSM-ALD7A-HF2-P-C	3.02 (76.7)
1.5 in. High Flow C-Seal ^①	3	6LVV-MSM-ALD7A-HF3-P-C	3.02 (76.7)

^① For assembly using 10-32 mounting screws only. M5 holes are compatible with 10-32 mounting screws.

Additional end connections may be available upon request. Contact your authorized Swagelok sales and service center for more information.

Options and Accessories (ALD7A)

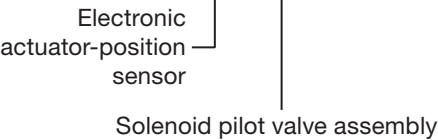
Valves with electronic actuator-position sensors (right), solenoid pilot valve assemblies, page 13, heater cartridge holes, page 13, and optical position sensors, page 23, are available.



Ordering Information

To order one option, add a designator to the valve ordering number. To order two or more options, add the designators in the sequence shown below.

6LVV-ALD7AMR8-P-C **S 7 V 7**



Examples:

6LVV-ALD7AMR8-P-**CS7** for a valve with electronic actuator-position sensor with short pigtail electrical connector
Contact your authorized Swagelok sales and service center for multiport options.

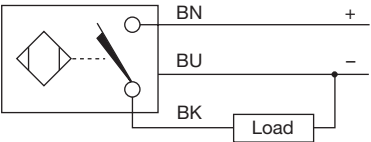
Electronic Actuator-Position Sensors

Transmit a signal to an electrical device indicating the open position of pneumatically actuated valves. Sensors and electrical connectors described below are third-party products.

Sensor Technical Information

Output	3-wire V (dc) — transistor (current-sourcing)
Output Function	Normally open
Voltage	10 to 30 V (dc) polarity protected — pulsed SCP
Operating Temperature	32 to 275°F (0 to 135°C)

Wiring Diagram



Factory-Assembled Electronic Actuator-Position Sensors

Factory-assembled position sensors are set for optimum performance and sealed with a tamper-evident paste that provides visible evidence of disassembly or adjustment.

To order an electronic actuator-position sensor factory assembled to a valve, add a designator to the valve ordering number.

Example:

6LVV-MSM-ALD7A-HF2-P-**CS7**

Sensor Electrical Connector	Designator
Short pigtail	S7

Contact your authorized Swagelok sales and service center for mating direct-current M8 3wire connector.

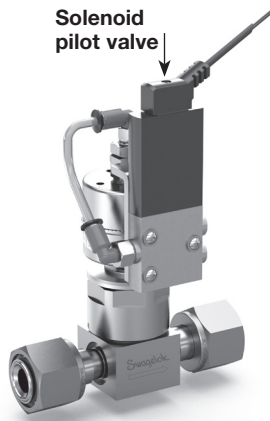
Note: optical sensors for ALD7A are available on page 23.

Options and Accessories (ALD7A)

Solenoid Pilot Valve Assemblies

Fast-acting, high-flow solenoid pilot valve enhances ALD series valve actuation response time.

- Includes tubing, connectors, and rotatable mounting bracket for installation versatility.
- See illustration on page 12 for assembly dimensions.
- See table below for technical information. For additional technical information, see Festo® valve part number 196131 (Type MHE2-MS1H-3/2G-M7).



Solenoid Pilot Valve Technical Information

Component	Festo valve 196131
Solenoid Pilot Valve	24 VDC, 5.0 W
	Temperature rating: 140°F (60°C) maximum, continuous use
	Porting: M7 × 1.0-6H thread
	Switching time off 2 ms Switching time on 1.7 ms
Push-to-Connect Fitting	Material: polybutylene terephthalate (PBT), stainless steel (SS), polyoxymethylene (POM), Nitrile rubber (NBR) (Buna N)
Tubing	Material: polyurethane
Bracket	Material: 316 SS
O-Ring	Material: Fluorocarbon FKM
Washer	Material: Nylon

Factory-Assembled Solenoid Pilot Valves

To order a solenoid pilot valve factory assembled, add **V7** to the ordering number.

Examples: 6LVV-ALD7AFR8-P-**CV7**
6LVV-MSM-ALD7A-HF2-P-**CV7**

In modular surface-mount systems, the solenoid pilot valve may interfere with adjacent components.

Solenoid Pilot Valves for Field Assembly

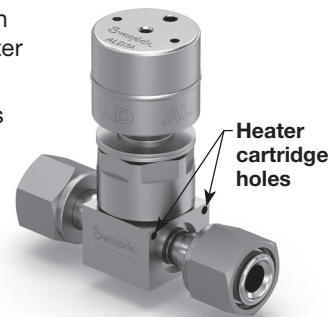
Ordering number for solenoid pilot valve kit, which includes all components for field assembly.

MS-PVK-ALD7-FESTO196131

Heater Cartridge Holes

Valves are available with holes in the body to accommodate heater cartridges.

- Hole size: 1/8 in. through holes for two-port, three-port, and elbow bodies; 1/8 by 1 in. deep holes for monoblock bodies.
- Two-port and monoblock bodies feature two body holes; three-port and elbow bodies feature one body hole. For more information, contact your authorized Swagelok sales and service center.



Ordering Information.

To order a valve with heater cartridge holes, contact your authorized Swagelok sales and service center. See page 18 for field flow adjustment tooling.

ALD7C Diaphragm Valve Features

- Normally closed pneumatic actuation
- Flow coefficients of 0.7 standard; custom flow coefficients available
- Two-port straight and elbow configurations
- Two-, three-, and four-port multiport valves
- VCR, “H” Type VCR, and tube butt weld end connections
- Field flow adjustability allows for up to 35% decrease of C_v from Factory Flow Set
- Optimized to maintain flow performance at high temperatures and reduced-pressure vacuum conditions
- Custom additively manufactured manifold solutions available, subject to application review. Contact your authorized Swagelok sales and service center for more information.



Cartridge (Diaphragm and Seat)

- Alloy 22 material for strength and corrosion resistance
- Optimized design for ultrahigh cycle life
- Replaceable design for low cost of ownership

Diaphragm

- Alloy 22 material for strength and corrosion resistance
- Optimized design for ultrahigh cycle life

Seat

- Fully contained seat design
- High-purity grade PFA, fully fluorinated
- Ultrahigh cycle life
- Broad range of chemical compatibility
- Excellent resistance to swelling and contamination
- High-integrity seat seal performance

Body

- Body seal provides ultrahigh cycle life
- Alloy 22 for enhanced corrosion resistance
- Fully swept flow path
 - minimizes entrapment areas
 - facilitates purging
 - maximizes flow capacity

Actuator

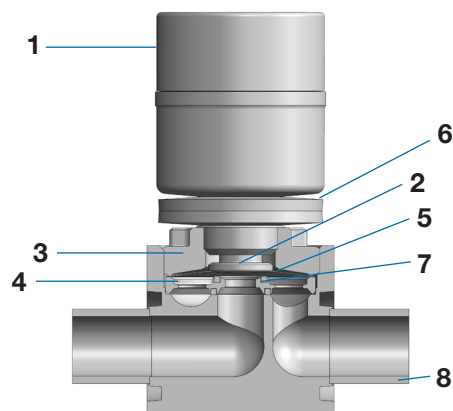
Thermal Immersion

- Pneumatic actuator for high-speed and repeatable actuation
- Capable of valve opening or closing time of less than 2 ms
- Factory-set flow adjusting mechanism ensures precise and consistent C_v from valve to valve
- Optional factory-set electronic actuator-position sensor verifies open position of pneumatically actuated valves
- Includes thermal isolation for thermal applications
 - limits conductive heat transfer from the body to the actuator
 - provides a more uniform valve body temperature to reduce cold spots
 - significantly reduces electrical power required to heat the valve
 - extends the life of the actuator in applications where the body is heated

Materials of Construction (ALD7C)

Component	Material Grade/ASTM Specification
1 Pneumatic actuator assembly	316 SS/A479
Lubricant	PTFE-based
2 Button	316 SS/A479
3 Bonnet nut	316 SS/A479
4 <i>Diaphragm Cartridge Material</i>	<i>Alloy 22/B574</i>
5 <i>Seat</i>	<i>High-purity PFA Type II/D3307</i>
6 Disc springs	Alloy X750/B637
7 <i>Body</i>	<i>Alloy 22/B574</i>
8 <i>Welded VCR end connections</i>	<i>Alloy 22/B574</i> 316 SS/A479 VCR nut

Wetted components listed in *italics*.



Process Specifications (ALD7C)

See Swagelok® *Ultrahigh-Purity Process Specification (SC-01)* catalog, [MS-06-61](#) for details on processes, process controls, and process verification.

Cleaning	Assembly and Packaging	Wetted Surface Roughness (R_a)	Testing
Ultrahigh-purity cleaning with a continuously monitored, deionized water, ultrasonic cleaning system	Performed in ISO Class 4 work areas; valves are double bagged and vacuum sealed in cleanroom bags.	Passivated and finished to an average of $< 5 \mu\text{in.}$ ($0.13 \mu\text{m}$)	Inboard helium leak tested to a rate of 1×10^{-7} std cm^3/s at the seat and to a rate of 1×10^{-9} std cm^3/s at the envelope and all other seals.

Technical Data (ALD7C)

Valve Series	Working Pressure psig (bar)		Operating Temperature Rating ^{①②} °F (°C)	Flow Coefficient (C _v) ^③	Flow Adjustability	Orifice in. (mm)	Tube Butt Weld Body Internal Volume in. ³ (cm ³)	Pneumatic Actuator	
	Operating ^①	Burst						Actuation Pressure psig (bar)	Air Displacement in. ³ (cm ³)
Normally Closed Actuation									
ALD7C	Vacuum to 60 (4.1)	>3200 (220)	50 to 482 (10 to 250)	0.7	> 35% reduction	0.20 (5.1)	0.27 (4.4)	70 to 100 (4.8 to 6.8)	0.051 (0.84)

① Operating pressure and temperature influence cycle life.

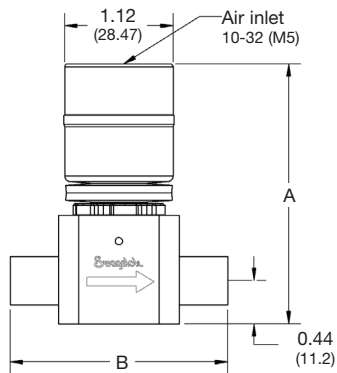
② See pages 12 and 13 for maximum operating temperatures for products with an electronic actuator-position sensor, solenoid pilot valve, or both.

③ Custom flow coefficients available; contact your authorized Swagelok sales and service center for more information.

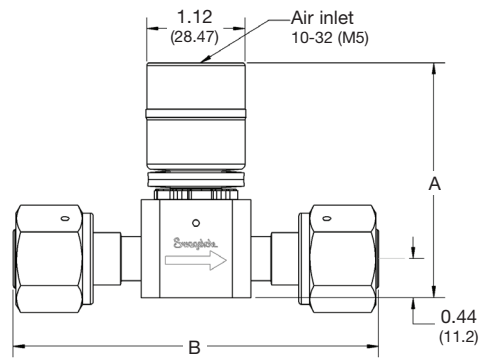
Ordering Information and Dimensions (ALD7C)

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

Two-Port Valves

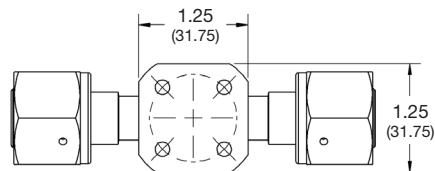


Butt Weld End Connections



Rotatable Male VCR Fitting End Connections

Four mounting holes, M5 $\times$ 0.8-6H thread, 0.25 (6.4) deep, located 45° from center line, on a 1.00 (25.4) bolt circle. M5 $\times$ 0.8-6H holes are compatible with 10-32 mounting screws.



Female VCR Fitting

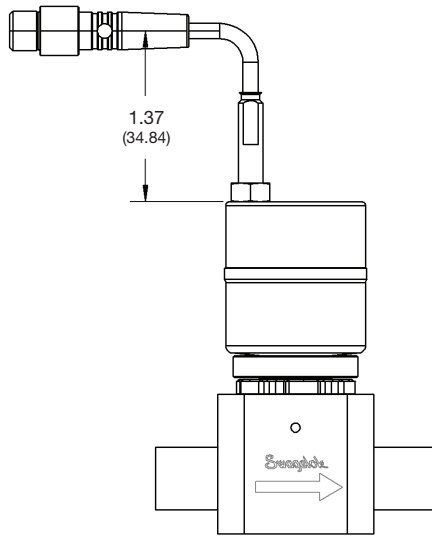
End Connections		Ordering Number	Dimensions, in. (mm)	
Inlet/Outlet	Size		A	B
Female VCR fitting	1/2 in.	C22-ALD7CFR8-P-C	2.65 (67.3)	4.16 (106)
Female "H" type VCR fitting	1/4 in.	C22-ALD7CHFR4-P-C		2.78 (70.6)
Rotatable male VCR fitting	1/2 in.	C22-ALD7CMR8-P-C		4.16 (106)
Tube butt weld, 0.50 in. long	1/2 $\times$ 0.049 in.	C22-ALD7CBW8-P-C		2.25 (57.2)

Additional end connections may be available upon request. Contact your authorized Swagelok sales and service center for more information.

Options and Accessories (ALD7C)

Valves with electronic actuator-position sensors (right).

Electronic actuator-position sensor



Ordering Information

To order one option, add a designator to the valve ordering number. To order two or more options, add the designators in the sequence shown below.

C22-ALD7CMR8-P-C S7 SP

Electronic actuator-position sensor — S7

Fixed Flow — SP

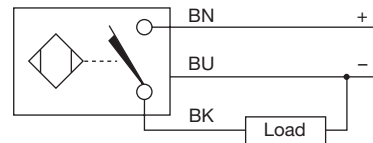
Electronic Actuator-Position Sensors

Transmit a signal to an electrical device indicating the open position of pneumatically actuated valves. Sensors and electrical connectors described below are third-party products.

Sensor Technical Information

Output	3-wire V (dc) — transistor (current-sourcing)
Output Function	Normally open
Voltage	10 to 30 V (dc) polarity protected — pulsed SCP
Operating Temperature	32 to 275°F (0 to 135°C)

Wiring Diagram



Factory-Assembled Electronic Actuator-Position Sensors

Factory-assembled position sensors are set for optimum performance and sealed with a tamper-evident paste that provides visible evidence of disassembly or adjustment.

To order an electronic actuator-position sensor factory assembled to a valve, add a designator to the valve ordering number.

Example:

C22-ALD7CBW6-P-CS7

Sensor Electrical Connector	Designator
Short pigtail	S7

Contact your authorized Swagelok sales and service center for mating direct-current M8 3wire connector.

Fixed Flow Configuration

Non-factory flow-set configuration available with nominal $C_v \geq 0.6$, for applications not requiring precise or consistent valve to valve flow control. Configuration is not field flow adjustable.

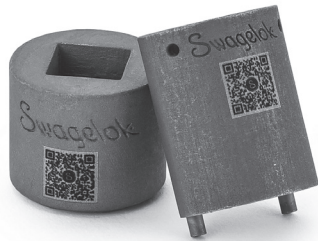
To order fixed flow configuration valve, add designator SP to the valve ordering number

Example:

C22-ALD7CMR8-P-CSP

ALD7A and ALD7C Tools and Maintenance Kits

Tools are required to service Swagelok field flow adjustable and replaceable cartridge valves. For more information, see Swagelok *ALD7C Series Diaphragm Valve Service Instructions*, [MS-CRD-0279](#) and Swagelok *ALD7A Series Diaphragm Valve Field Adjustable Valve Instructions*, [MS-CRD-0286](#).



Valve Service Tools

This tooling is designed specifically for Swagelok field flow adjustable and replaceable cartridge valves. Do not use on any other diaphragm-sealed valves.

The actuator field adjustment spanner tool easily adjusts valve flow capacity on ALD7A and ALD7C valves or can remove actuator for cartridge replacements on ALD7C valves.

The bonnet nut socket tool enables quick cartridge replacement for ALD7C valves.

Tool Description	Valve Series	Ordering Number
Actuator Field Flow Adjustment Spanner Tool	ALD7A and ALD7C	MS-TOOL-ALD-FA
Bonnet Nut Socket Tool	ALD7C	MS-TOOL-ALD-BNST

ALD7C Replacement Kits

Replacement kits are available for field servicing of ALD7C valves. For more information on content within each kit, Swagelok *ALD7C Service Kit*, [MS-CRD-0302](#).



Tool Description	Ordering Number
Actuator Replacement Kit	SS-ALD7C-K1-C-60HT
Standard Cartridge Kit	C22-2BSK-ALD7C
Flow Adjustment Disc Spring Kit	X750-13CK-ALD7C
Fixed Flow Spacer Kit	SS-9BK-ALD7C-OR
High Temperature Fitting Kit	SS-200-1-0157-ALD-K

ALD20 Valve Features

- Normally closed pneumatic actuation
- Flow coefficients of 1.2 to 1.7 standard; custom flow coefficients available
- Two-port straight and elbow configurations
- Two-, three- and four-port multiport valves
- 1.5 in. platforms with C-seal design
- 1/2 in. VCR and tube butt weld end connections
- Patent-pending design
- Optimized to maintain flow performance at high temperatures and reduced-pressure vacuum conditions



Seat

- Fully contained seat design
- High-purity grade PFA, fully fluorinated
- Ultrahigh cycle life
- Broad range of chemical compatibility
- Excellent resistance to swelling and contamination
- High-integrity seat seal performance

Body

- 316L VIM-VAR stainless steel body material for ultrahigh-purity applications
- Alloy 22 available for enhanced corrosion resistance

Bellows

- Highly polished ($< 5 \mu\text{in. } R_a$) bellows designed for ultra-high purity applications
- Alloy 22 material for enhanced corrosion resistance
- Optimized design for ultrahigh cycle life

Actuators

Thermal Immersion

- Pneumatic actuator for high-speed and repeatable actuation
- Fully temperature immersible
- Capable of valve opening or closing time of less than 10 ms
- Factory-set flow adjusting mechanism ensures precise and consistent C_v from valve to valve

ALD20 Valve for High Flow Applications

Features

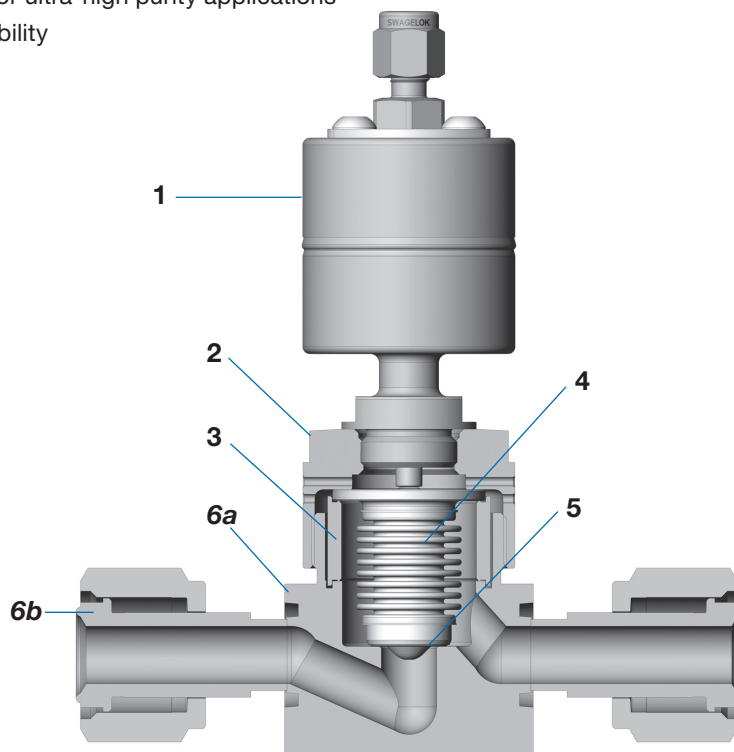
- High flow capacity (up to 1.7 C_v) in a compact footprint
- Valve and actuator fully immersible at elevated temperatures
- Allows configurable flow path to optimize systems
- Highly polished (< 5 µin. R_a) alloy 22 bellows designed for ultra-high purity applications
- PFA seat for enhanced purity and improved thermal stability

Materials of Construction (ALD20)

Component	Material Grade/ ASTM Specification
1 Pneumatic actuator assembly	316 SS/A479
Lubricant	PTFE-based
2 Bonnet nut	316 SS/A479
3 Spacer ring	Alloy 22/B574
4 Polished bellows assembly	Alloy 22/B575
5 Seat	High-purity PFA Type II/D3307
6a Body	316L VIM-VAR SS/ SEMI F20 Ultrahigh-Purity ^①
	Alloy 22/B574
6b Welded VCR end connections	316L VAR SS/ SEMI F20 High-Purity ^①
	316 SS/A479 VCR nut
	Alloy 22/B574 316 SS/A479 VCR nut

Wetted components listed in *italics*.

① 20 % minimum elongation allowed.



Process Specifications (ALD20)

See Swagelok *Ultrahigh-Purity Process Specification (SC-01)* catalog, [MS-06-61](#) for details on processes, process controls, and process verification. (For the alloy 22 option, reference the cleaning, assembly, and packaging sections in [MS-06-61](#).)

Cleaning	Assembly and Packaging	Wetted Surface Roughness (R _a)	Testing
Ultrahigh-purity cleaning with a continuously monitored, deionized water, ultrasonic cleaning system	Performed in ISO Class 4 work areas; valves are double bagged and vacuum sealed in cleanroom bags.	316L VIM-VAR SS electropolished and finished to an average of < 5 µin. (0.13 µm) Alloy 22 finished to an average of < 5 µin. (0.13 µm)	<i>Inboard Helium Leak Test:</i> ALD20 normally closed valves inboard helium leak tested to a rate of 1×10^{-9} std cm ³ /s at the envelope and all external seals.
			<i>Internal Helium Leak Test:</i> ALD20 normally closed valves internal helium leak tested to a rate of 1×10^{-7} std cm ³ /s at the seat.
			Internal seat seal may change during valve life cycle, contact Swagelok technical service for additional information.

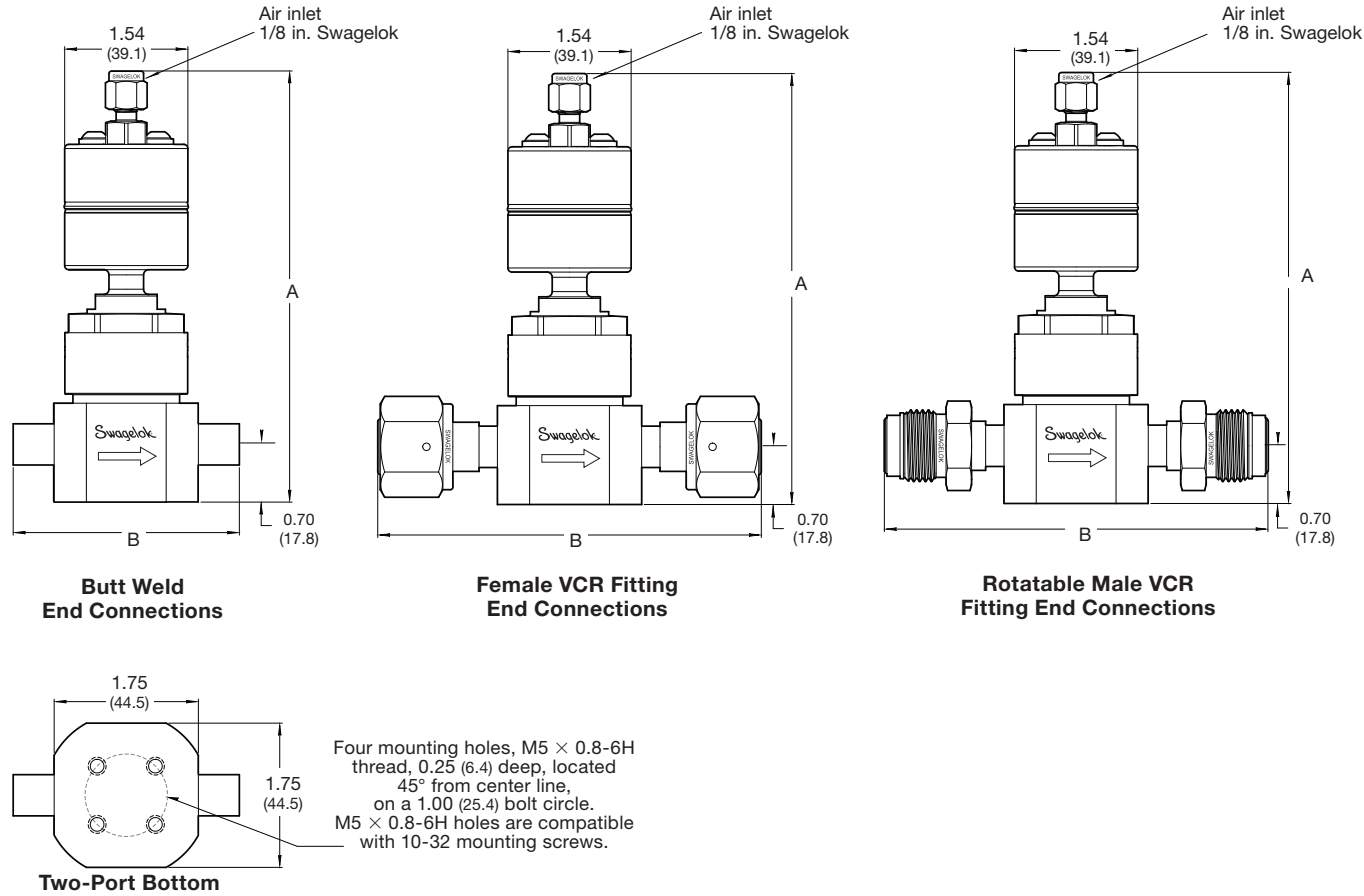
Technical Data (ALD20)

Body Style	Working Pressure psig (bar)		Temperature Rating °F (°C)	Flow Coefficient (C _v)	Orifice in. (mm)	Internal Volume in. ³ (cm ³)	Pneumatic Actuator	
	Operating	Burst	Operating (Immersion)				Actuation Pressure psig (bar)	Air Displacement in. ³ (cm ³)
							Normally Closed Actuation	
1/2 in. Ported	Vacuum to 20 (1.4)	>3200 (220)	50 to 482 (10 to 250)	1.7	0.36 (9.1)	0.75 (12.3) Tube Butt Weld	70 to 90 (4.9 to 6.2)	0.10 (1.6)
MSM High Flow C-seal				1.2	0.29 (7.2)	0.50 (8.1) 2-Port		

Ordering Information and Dimensions (ALD20)

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

Two-Port Valves



End Connections		Ordering Number	Dimensions, in. (mm)	
Inlet/Outlet	Size		A	B
Female VCR fitting	1/2 in.	6LVV-ALD20FR8-P-C	5.23 (133)	4.65 (118)
Rotatable male VCR fitting	1/2 in.	6LVV-ALD20MR8-P-C		
Tube butt weld, 0.50 in. long	1/2 × 0.049 in.	6LVV-ALD20BW8-P-C		2.74 (69.7)

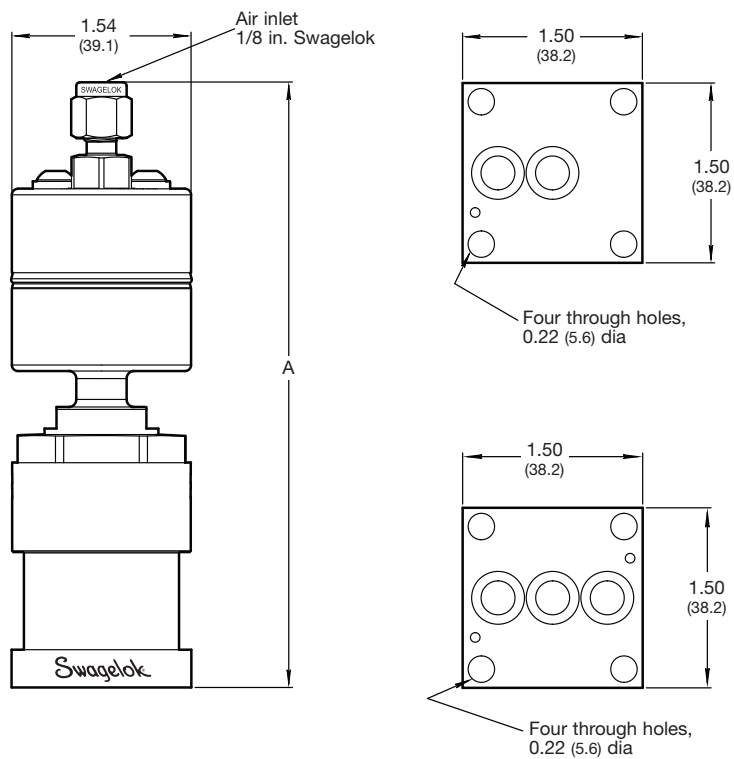
Additional end connections may be available upon request. Alloy 22 valve body may be available upon request. Contact your authorized Swagelok sales and service center for more information.

Ordering Information and Dimensions (ALD20)

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

Modular Surface-Mount Valves

High-Flow C-Seal Design



Ports	Ordering Number	A, in. (mm)
2	6LVV-MSM-ALD20-HF2-P-C	5.05 (128)
3	6LVV-MSM-ALD20-HF3-P-C	

Additional end connections may be available upon request.
Alloy 22 valve body may be available upon request.
Contact your authorized Swagelok sales and service center for more information.

Options and Accessories (ALD3, ALD6, ALD7A, ALD7C, ALD20)

Optical Position Sensors

Features

- Fast response times
- Compatible with high temperatures as noted in the Sensor Kit Technical Information below.
- Unaffected by Radio Frequency (RF) noise
- Transferable from one valve to another, without loss of factory settings

Optical Sensor Kits

Optical sensors detect the open position on normally closed pneumatically actuated valves. Optical sensor kits contain the hardware required to install the sensor onto an optical sensor ready valve and connect it to an amplifier.

Optical sensors kits are factory set to the correct depth and tested for proper functionality.

Sensor Kit Technical Information

Fiber Unit	FU-87
Temperature Rating	-76°F to 356°F (-60°C to 180°C)
Max Ambient Temperature	302°F (150°C)
Fiber Length^①	6.56 ft. (2 m)

① Every optical sensor kit includes a single use fiber cutting tool

Ordering Information

Optical Sensor Kit Ordering number:

MS-SOK-ALD-FU87

To order an Optical Sensor Kit with an amplifier add, **-AMP** to the ordering number.

MS-SOK-ALD-FU87-AMP

Optical Sensor Ready ALD3, ALD6, and ALD7A Valves*

Optical sensor ready valves are designed to allow an optical sensor kit to be easily installed onto the actuator. The modifications from standard ALD valves include the following:

- A sensor target is included in the actuator
- The actuator is 0.115 in. (2.9 mm) taller
- The 1/8-27 NPT air inlet is replaced with a 10-32 (M5) connection

Ordering Information (ALD3, ALD6, and ALD7A)*

To order an optical sensor ready valve, add **SO** to the ordering number.

Example: 6LVV-ALD3BW4-P-LI-CSO

Note: Optical sensor is only available on normally closed valves. LI indicates "less indicator" as sensor kits are sold separately for field assembly.

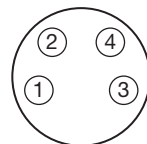
* All **ALD20** valves are optical sensor-ready. No special order information is required.

Optical Sensor Amplifiers

The optical sensor amplifiers work in conjunction with an Optical Sensor Kit and an Optical Sensor Ready Valve to transmit a signal to an electrical device. The signal indicates the open position of pneumatically actuated valves.

Amplifier Technical Information

Amplifier	FS-N11CP
Output	PNP, M8 Connector
Temperature Rating	-4° to 131°F (-20° to 55°C)
Power Requirement	12-24V DC $\pm$ 10% Ripple (P-P) 10 % or Less



M8 Connector
Pin Layout

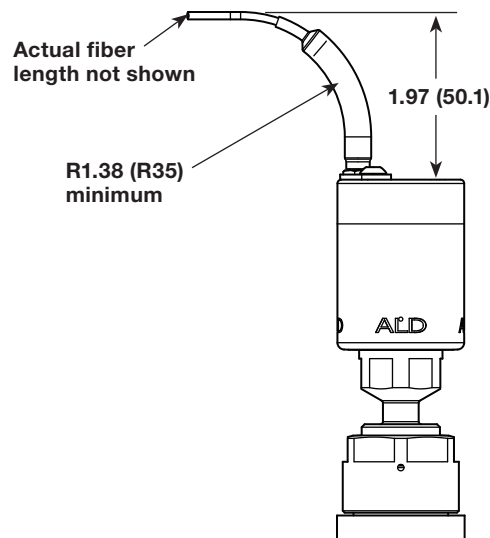
1	Power (12-24V DC)
2	Input
3	Ground (0V)
4	Digital Output

Factory Programmed Amplifiers

Factory programmed amplifiers are preset for optimum performance with Swagelok optical sensor ready valves and optical sensor kits. All factory programmed amplifiers are tested for proper functionality.

Optical Sensor Amplifier Ordering Number:

MS-SOK-ALD-AMP-M8



Multiport and Elbow Valves and Monoblock Manifolds

ALD series valves are available in multiport and elbow configurations and monoblock manifolds; refer to *Bellows- and Diaphragm-Sealed Multiport and Elbow Valves and Monoblock Manifolds* catalog, [MS-02-442](#).

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.



Warning: Do not mix/interchange Swagelok products or components not governed by industrial design standards, including Swagelok tube fitting end connections, 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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