

For General Applications Diaphragm Valve

New

RoHS

For wide variety of applications
from semiconductor to general.

Multiple port available in various configurations Compression, Rc, R, NPT

Cleaned for O₂ service

Process Gas
Equipment

AK

Air Operated Type Series AK3542/4542

- Compact and lightweight by making the actuator shorter
- M5 actuation port

Weight **280 g** Height **57 mm**



Manually Operated Type Series AK3652/4652

- Compact and lightweight by modifying the knob design
- The knob is a unique design that combines a scalloped round knob with a raised rectangular section to provide two choices of gripping.

Actuation is 90 degrees open to closed with a cutout window, on both sides of raised rectangular section, providing visual status of open or closed state.

Weight **260 g** Height **55 mm**



Direction of a raised rectangular section indicate open/close status



Series **AK**



ATech

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Air Operated Type
Series **AK3542/AK4542**



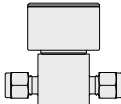
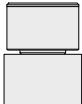
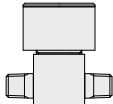
Manually Operated Type
Series **AK3652/AK4652**



■ **Body material**

316 SS
Passivation internals

■ **Various configurations available**

Body			
Connection	Compression	Rc NPT female	R NPT male
Connection size (inch)	1/4, 3/8		

■ **Air Operated Type**

 Female thread type	 Compression	Series	Status	Body material	Max. operating pressure psig (MPa)	Cv (Note)	Connections	Page
							Fitting	
		AK3542	N.C.	316 SS	125 (0.9)	0.29	Compression Rc, R, NPT	P.823
		AK4542						

■ **Manually Operated Type**

 Female thread type	 Compression	Series	Knob	Body material	Max. operating pressure psig (MPa)	Cv (Note)	Connections	Page
							Fitting	
		AK3652	Knob with a raised section on top (indication window)	316 SS	250 (1.7)	0.29	Compression Rc, R, NPT	P.825
		AK4652						

(Note) Cv calculation based on SEMI Standard

Series AZ

- SEMI standard
- Body material: 316L SS
- Face seal
- Tube weld



Air Operated
Type



Manually Operated
Type

For details, refer to the product catalog available on SMC website.

<http://www.smcworld.com>





Series AK

Applicable Fluid

Precautions for selection

The proper regulator and valve selection can be significantly affected by parameters such as system design, flow duration, frequency of use, ambient conditions and outlet pressure. It is important to understand that one may follow this guide's recommendation, yet have a failure due to a parameter specific to the given application, as noted.

Applicable Fluid

Process Gas	Molecular Formula
Argon	Ar
Halocarbon 114	C ₂ Cl ₂ F ₄
Halocarbon 115	C ₂ ClF ₅
Halocarbon 116	C ₂ F ₆
Acetylene	C ₂ H ₂
Halocarbon 134A	C ₂ H ₂ F ₄
Halocarbon 125	C ₂ HF ₅
Halocarbon R218	C ₃ F ₈
Propene	C ₃ H ₆
Propane	C ₃ H ₈
Halocarbon C318	C ₄ F ₈
Butene-1	C ₄ H ₈
Halocarbon 13B1	CBrF ₃
Halocarbon 12	CCl ₂ F ₂

Process Gas	Molecular Formula
Halocarbon 13	CClF ₃
Halocarbon 14	CF ₄
Halocarbon 32	CH ₂ F ₂
Methane	CH ₄
Halocarbon 23	CHF ₃
Carbon Dioxide	CO ₂
Hydrogen	H ₂
Helium	He
Krypton	Kr
Nitrogen	N ₂
Neon	Ne
Oxygen	O ₂
Xenon	Xe

· Following * symbols indicate toxic gas (allowable concentration 200 ppm or less). In Japan, according to METI, pipe thread (Rc, R, NPT etc) should not be used as connections of piping, fittings, and valves installed in gas systems.

Process Gas	Molecular Formula
Boron 11 Trifluoride*	11BF ₃
Arsine*	AsH ₃
Boron Trichloride*	BCl ₃
Boron Trifluoride*	BF ₃
Ethylene*	C ₂ H ₄
Dimethylsilane*	C ₂ SiH ₆
Perfluoro-butadiene*	C ₄ F ₆
Octafluorocyclopentene*	C ₅ F ₈
Halocarbon 12B2*	CB ₂ F ₂
Trimethylsilane*	(CH ₃) ₃ SiH
Methyl Chloride*	CH ₃ Cl
Methyl Fluoride*	CH ₃ F
Methanol*	CH ₃ OH
Methylsilane*	CH ₃ SiH ₃
Halocarbon 21*	CHCl ₂ F
Chlorine*	Cl ₂
Chlorine Trifluoride*	ClF ₃
Carbon Monoxide*	CO
Germane*	GeH ₄
Hydrogen Sulfide*	H ₂ S
Hydrogen Selenide*	H ₂ Se

Process Gas	Molecular Formula
Hydrogen Bromide*	HBr
Hydrogen Chloride*	HCl
Hydrogen Fluoride*	HF
Nitrogen Oxide*	N ₂ O
Nitrogen Trifluoride*	NF ₃
Ammonia*	NH ₃
Nitric Oxide*	NO
Phosphorous Pentafluoride*	PF ₅
Phosphine*	PH ₃
Sulfur Tetrafluoride*	SF ₄
Sulfur Hexafluoride*	SF ₆
Disilane*	Si ₂ H ₆
Silicon Tetrachloride*	SiCl ₄
Silicon Tetrafluoride*	SiF ₄
Dichlorosilane*	SiH ₂ Cl ₂
Silane*	SiH ₄
Trichlorosilane*	SiHCl ₃
Sulfur Dioxide*	SO ₂
Diethyltelluride*	Te(C ₂ H ₅) ₂
Tungsten Hexafluoride*	WF ₆

· This applicable fluid is a reference guide and does not apply to product guarantee.

· Please consult SMC for a specific recommendation beyond the scope of this document.

Caution

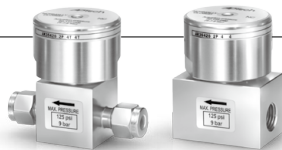
Since the product specified here is used under various operating conditions, its compatibility with fluid and specific equipment must be decided by the person who designs the equipment or decided its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product regardless of any recommendation. Proper installation, operation and maintenance are also required to assure safe, trouble free performance.

Diaphragm Valves for General Applications

Air operated type

Series AK3542 & 4542

- Body material: 316 SS
- Normally closed



RoHS

How to Order

AK 3 542 S 2P 4T 4T

Size

Code	Cv
3	0.29
4	0.5

Model

Code	Status	Maximum operating pressure
542	Normally closed (N.C.)	125 psig (0.9 MPa)

Material

Code	Body material
S	316 SS

Ports

Code	Ports
2P	2 ports

Seat material

Code	Material
No code	PCTFE (Standard)
VS	Polyimide

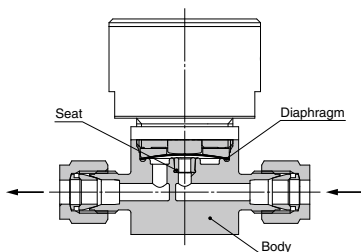
Connections

Code	Connections	AK3	AK4
4T	1/4 inch compression	●	—
4BR	Rc 1/4		
4BRN	R 1/4		
4	NPT 1/4 female		
4N	NPT 1/4 male	—	●
6T	3/8 inch compression		
6BR	Rc 3/8		
6BRN	R 3/8		
6	NPT 3/8 female	—	●
6N	NPT 3/8 male		

(Note) Only available with same type fittings inlet and outlet.

Construction

AK3542



Wetted Parts Material

Wetted Parts	S
Body	316 SS
Diaphragm	Ni-Co Alloy
Seat	PCTFE (Option: Polyimide)

Specifications

Operating Parameters	AK3542	AK4542
Status	Normally closed (N.C.)	
Gas	Select compatible materials of construction for the gas	
Operating pressure	Vacuum to 125 psig (0.9 MPa)	
Proof pressure	200 psig (1.4 MPa)	
Ambient and operating temperature	-10 to 71°C (No freezing)	
Cv	0.29	0.5
Leak rate	1 x 10 ⁻¹⁰ Pa·m ³ /s	
Connections	Compression, Rc, R, NPT	
Actuation pressure	60 to 110 psig (0.4 to 0.76 MPa)	
Actuation port connection	M5 x 0.8	
Actuation port location	Top	
Installation	Bottom mount	
Internal volume	0.06 in ³ (1.07 cm ³)	
Weight	0.28 kg ^{Note}	

Note) Weight for AK3542S2P4T4T including individual boxed weight. It may vary depending on connections or options.

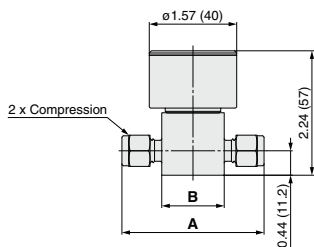
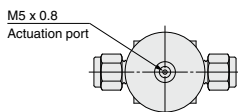
Process Gas
Equipment

AK

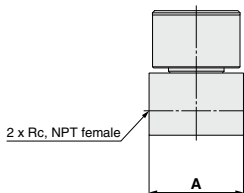
Dimensions

inch (mm)

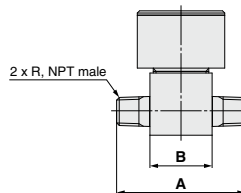
AK3542 & 4542



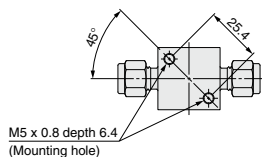
Connections: 4T, 6T



Connections: 4, 6, 1/2N, 1/2BR



Connections: 1/2N, 1/2BR



Ports	A		B		Connections
	inch	(mm)	inch	(mm)	
4T	2.56	(65.0)	1.12 sq.	(28.4)	1/4 inch compression
4BR	1.70	(43.2)	—	—	Rc 1/4
4BRN	2.32	(58.9)	1.12 sq.	(28.4)	R 1/4
4	1.70	(43.2)	—	—	NPT 1/4 female
4N	2.32	(58.9)	1.12 sq.	(28.4)	NPT 1/4 male
6T	2.68	(68.1)	1.12 sq.	(28.4)	3/8 inch compression
6BR	2.32	(58.9)	—	—	Rc 3/8
6BRN	2.32	(58.9)	1.12 sq.	(28.4)	R 3/8
6	2.32	(58.9)	—	—	NPT 3/8 female
6N	2.32	(58.9)	1.12 sq.	(28.4)	NPT 3/8 male

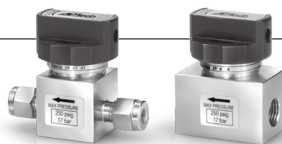
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Diaphragm Valves for General Applications

Manually operated type

Series AK3652 & 4652

- Body material: 316 SS



RoHS

How to Order

AK 3 652 S 2P 4T 4T

Size

Code	Cv
3	0.29
4	0.5

Model

Code	Knob	Maximum operating pressure
652	1/4 turn indicating round knob with a raised rectangular section	250 psig (1.7 MPa)

Material

Code	Body material
S	316 SS

Ports

Code	Ports
2P	2 ports

Seat material

Code	Material
No code	PCTFE (Standard)
VS	Polyimide

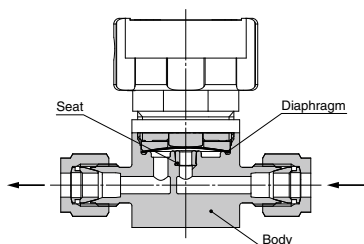
Connections

Code	Connections	AK3	AK4
4T	1/4 inch compression	●	—
4BR	Rc 1/4		
4BRN	R 1/4		
4	NPT 1/4 female		
4N	NPT 1/4 male	—	●
6T	3/8 inch compression		
6BR	Rc 3/8		
6BRN	R 3/8		
6	NPT 3/8 female	—	●
6N	NPT 3/8 male		

(Note) Only available with same type fittings inlet and outlet.

Construction

AK3652



Wetted Parts Material

Wetted Parts	S
Body	316 SS
Diaphragm	Ni-Co Alloy
Seat	PCTFE (Option: Polyimide)

Specifications

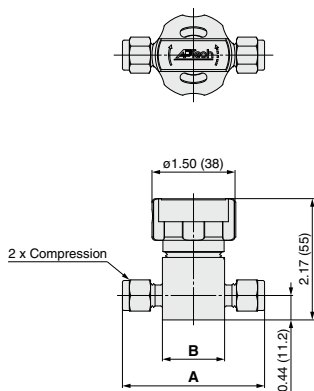
Operating Parameters	AK3652	AK4652
Gas	Select compatible materials of construction for the gas	
Operating pressure	Vacuum to 250 psig (1.7 MPa)	
Proof pressure	375 psig (2.6 MPa)	
Ambient and operating temperature	-40 to 71°C (No freezing)	
Cv	0.29	0.5
Leak rate	1 x 10 ⁻¹⁰ Pa·m ³ /s	
Connections	Compression, Rc, R, NPT	
Installation	Bottom mount	
Internal volume	0.06 in ³ (1.07 cm ³)	
Weight	0.26 kg Note	
Knob	1/4 turn indicating round knob with a raised rectangular section	

Note) Weight for AK3652S2P4T4T including individual boxed weight. It may vary depending on connections.

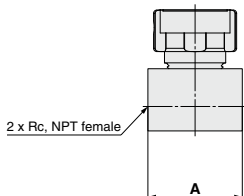
Dimensions

inch (mm)

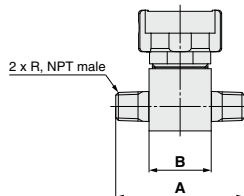
AK3652 & 4652



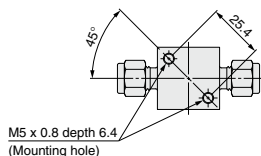
Connections: 4T, 6T



Connections: 4, 6, 4BR



Connections: 4N, 6BRN



Ports	A		B		Connections
	inch	(mm)	inch	(mm)	
4T	2.56	(65.0)	1.12 sq.	(28.4)	1/4 inch compression
4BR	1.70	(43.2)	—	—	Rc 1/4
4BRN	2.32	(58.9)	1.12 sq.	(28.4)	R 1/4
4	1.70	(43.2)	—	—	NPT 1/4 female
4N	2.32	(58.9)	1.12 sq.	(28.4)	NPT 1/4 male
6T	2.68	(68.1)	1.12 sq.	(28.4)	3/8 inch compression
6BR	2.32	(58.9)	—	—	Rc 3/8
6BRN	2.32	(58.9)	1.12 sq.	(28.4)	R 3/8
6	2.32	(58.9)	—	—	NPT 3/8 female
6N	2.32	(58.9)	1.12 sq.	(28.4)	NPT 3/8 male



Process Gas Equipment Common Precautions 1

Be sure to read before handling.

Design

Warning

1. Confirm the specifications.

The compatibility of the product with specific equipment must be decided by the person who designs the equipment or decided its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.

Selection

Warning

1. Confirm the specifications.

When selecting the product, confirm the operating conditions, such as type of gas, operating pressure (inlet and outlet), flow rate, operating temperature etc., and use within the operating range specified in the catalog. The product may not be suitable for use with specific gases and applications/environments. Check the compatibility of the product materials with the process gas.

Design the equipment and select the product by understanding the characteristics of gas.

2. Follow the regulations and laws, defined by the country or local government, or organization standards.

Reference: High Pressure Gas Safety Act, Labor Safety and Sanitation Law etc.

Mounting

Warning

1. Operation Manual

Mount and operate the product after reading the manual carefully and understanding its contents. Also keep the manual where it can be referred to as necessary.

Caution

1. Flush the piping thoroughly with inert gas before installing the products.

Remove any dust or scales thoroughly as they could cause malfunction or failure of the product. Do not flush with gas other than inert gas, as this could cause dangerous situations.

2. Do not touch the fitting or the wetted parts of the products by hand. Do not apply grease or oil to the products.

3. Ensure sufficient space for maintenance activities.

Ensure sufficient space for maintenance activities.

4. Connect compression fittings.

Typically 1-1/4 turn past finger tight of the nut after inserting the tube into the fitting. Please use stainless steel material for piping. After installation, perform a leak test.

Mounting

Caution

5. Connect pipe thread fittings.

Thread fitting or piping into body and tighten it at recommended torque. When holding the product, hold its body section.

Apply PTFE tape or sealant on the thread of the piping, fitting, etc. When using the sealant, other than the PTFE, it will be difficult to fully remove the sealant and this could cause malfunction or failure of the product.

6. After installation, perform a leak test.

Perform a leak test, such as helium leak test, pressure decay test, bubble leak test, etc., depending on the application. It is recommended to perform a helium leak test on all face seal connections and tube welds per the industry standards (refer to SEMI F1).

Storage and Operating Environment

Warning

1. Do not use in an area having chemicals, sea water or water, or where there is direct contact with any of these.

2. Do not use in a place subject to heavy vibration and/or shock.

3. Keep ambient temperature and use gas within the specified operating temperature. Remove any sources of excessive heat.

4. Do not keep the products in stock in an area, where any dust or water coming in, and keep in dry conditions, where there is no contact with humidity.



Process Gas Equipment Common Precautions 2

Be sure to read before handling.

Maintenance

Warning

1. Perform a routine maintenance.

Perform a routine maintenance at customer's responsibility by taking into consideration the operating conditions of the equipment. It is recommended to perform a routine maintenance for the following:

External leakage, Internal leakage (Across the seat leak), Performance etc.

2. Shut down system before removing the product from system for repair or replacement.

Follow the proper procedures to shut off the process gas supply and vent the system.

3. Purge hazardous gases from system before removing the product from system.

4. Do not disassemble products under warranty.

The warranty may be voided if product is disassembled.

Operation

Warning

1. Do not put the heavy objects on the products. Do not use the products as scaffold.

2. Do not use the products in conditions that do not meet the product specifications.

Product Returns

When returning the product to SMC, make sure to properly purge to remove all hazardous materials and return the product complying with SMC specified procedures.

For details, please contact SMC.

Export

Warning

The products fall within the United States Export Administration Regulations (EAR) regarding sale, export and re-exports. It is the exporter's responsibility to assure that these regulations are followed when the products are exported. Export Control Classification Number (ECCN) related to the products is as follows.

Regulations (including ECCN) are subject to change with amendment of law.

Latest information regarding these regulations should be checked by customer.

Reference: Bureau of Industry and Security (USA)

<http://www.bis.doc.gov/>

1) 2B999.g <Applicable conditions>

(1) Product name : Diaphragm valve

(2) Body material : 316 SS



Process Gas Equipment / Diaphragm Valve Specific Product Precautions

Be sure to read before handling. Refer to page 1154 for Safety Instructions and pages 827 and 828 and the Operation Manual for common precautions. Operation manual is available from the SMC website. <http://www.smcworld.com>

Selection

Warning

1. Confirm the specifications.

This product is used in gas delivery systems to shutoff gas flow. When selecting the product, confirm the operating conditions, such as type of gas, operating pressure (inlet and outlet), flow rate, actuating pressure, operating temperature etc., and use within the operating range specified in the catalog. The product may not be suitable for use with specific gases and applications/environments. Check the compatibility of the product materials with the process gas.

Design the equipment and select the product by understanding the characteristics of gas.

Mounting

Warning

1. Confirm the mounting direction of the product.

Direction of gas flow from inlet to outlet is indicated by an arrow on each label.

Orient the valve as specified by the system designer.

2. Connect actuation pressure to the valve actuator connection. (Air operated type)

Use nitrogen or clean dry air for actuation pressure. The connection M5 thread. Tighten thread to recommended torque value.

3. After installation, check internal leakage (leakage across seat) with inert gases.

Perform a helium leak test depending on applications.

Maintenance

Warning

1. If a valve requires repair, contact SMC or sales representative.

Operation (Air operate type)

Warning

1. Use nitrogen or clean dry air as actuation pressure.

2. Confirm the valve type (N.C.).

In the case of N.C. (Normally Closed), valve will open when applying actuation pressure to the valve actuator connection and valve will close when actuation pressure is vented to atmospheric pressure.

3. Apply actuation pressure within the range of specifications.

Operation (Manually operated type)

Warning

1. When closing the valve, rotate the handle clockwise until it completely stops.

There is the internal stop in the handle or in the valve body. Rotate the handle clockwise until the internal stop is reached and it completely stops.

2. When opening the valve, rotate the handle counterclockwise until it completely stops.

There is the internal stop in the handle. Rotate the handle counterclockwise until the internal stop is reached and it completely stops.

3. Do not use a tool when rotating the handle.

When the handle is rotated with a tool, it may apply excessive torque to the handle or inside the valve body and it may cause damage. Rotate the handle by hand.