Air Operated Valve Control Valve

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Step 0 Type/Structure/Features

Please refer to this for structure and feature of Air Operated Valve and Control Valve.

Step 1 Selection

Please refer to the ID chart to select the right products depending on the intended of uses. Confirm the additional details on the product page.

Step 2 Sizing

Please confirm the essential Cv value on the sizing data P.12-5. or Please confirm the essential sizes on the nominal diameter selection chart of the product page.

Step 3 Attentions for usage

Please check some guidelines for optimal usage of the products such as installation.

Selection of Air Operated Valve and Control Valve



What is Air Operated Valve?

Opening and shutting take place with the power of air pressure

What is Control Valve?

Control valve is a pneumatic. hydraulic, or electrically powered device to control operating conditions such as flow, pressure, temperature, and liquid level by fully or partially opening or closing in response to a process signal

Valve that opens and closes the valve directly by applying air pressure to the actuator

Application

Control on/off of the fluid line for explosion proof area that cannot use electricity

Diaphragm motive pressure type

Control the opening and shutting of valve take place with air pressure in addition to diaphragm

Application

Various process control by a combination of controller

Best Selection Chart (Except control valve)

This chart include solenoid valve (DD series) and motor valve (MD series) of block 11 other than air operated valve.

Requirem	ent	1st recommendation	2nd recommendation	
High apod roopopoo	Steam	DP-100-100F	DP-10	
High-speed response	Cold and hot water	DP-200 Series	PD Series	
Water home a provention	Steam	MD-54		
water nammer prevention	Cold and hot water	DP-200 Series	PD Series + Speed controller	
No rubber material (Stainless steel, PTFE)		DP-100-100F	MD Series	
Easy mainte	nance	DP•DD Series		
Manual ope	ration	MD Series		
On/Off sw	itch	MD Series		
Usable in explosion	n-proof area	DP-34N	PD Series	
Less scale problems		PD Series	MD Series	
Lightweight, compact a	ind space-saving	DD Series	DP Series	

Air Operated Valve ID-Charts

\searrow	Model	Туре	Fluid	Material	Working Press. (MPa)	Max. Temp. (°C)	Connection	Size	Feature	Page		
	PD-1	Diaphragm	Diaphragm	Diaphragm	Steam,	CAC406		190°C	JIS Rc	15-25A	Screwed type	12 -9
A	PD-2	type	Water, Oil	FC200	0 1.0	100 0	JIS 10KFF	15-50A	· Flanged type	12 -9		
	PD-3	Piston type	Steam, Air, Water, Oil	Equivalent to SCS14A	0-2.2 *1	200°C	JIS Rc	15-50A	· Screwed type	12-11		

* Max. pressure depends on size. Please refer to P.12-11 for details.

* Please contact us for fluid and connections except those mentioned above.

Control valve ID-Charts

Model	Туре	Fluid	Material	Working Press. (MPa)	Max. Temp. (°C)	Connection	Size	Feature	Page
CT-1	2 ways valve	Steam, Air, Cold and hot water, Oil	SCPH2	0-1.0	210°C	JIS 10KRF	15-100A	Diaphragm motive pressure type	12 -12

Step

Nominal Size Selection for Air Operated Valve and Control Valve

Calculation formula for Cv value

$$\begin{array}{l} (1) \mbox{ For steam} \\ \mbox{ When } P_2 > \frac{P_1}{2} \quad Cv = \frac{Wk}{138\sqrt{\Delta P(P_1+P_2)}} \\ \mbox{ When } P_2 \leq \frac{P_1}{2} \quad Cv = \frac{Wk}{120P_1} \\ (2) \mbox{ For gas} \\ \mbox{ When } P_2 > \frac{P_1}{2} \quad Cv = \frac{Q}{2940} \sqrt{\frac{(273+t)\,G}{\Delta P(P_1+P_2)}} \\ \mbox{ When } P_2 \leq \frac{P_1}{2} \quad Cv = \frac{Q\sqrt{(273+t)G}}{2560P_1} \\ (3) \mbox{ For liquid} \\ \mbox{ } Cv = \frac{0.365V\sqrt{G}}{\sqrt{\Delta P}} \\ \end{array}$$

- W : Max. steam flow rate [kg/h]
- P1 : Inlet pressure [MPa · A]
- P2 : Outlet pressure [MPa · A]
- ΔP : P1 P2 [MPa]
- k : 1 + 0.0013 x {superheated steam temp. [°C] - saturated steam temp. [°C] }
- Q : Max. gas flow rate [m³/h (standard condition)]
- G : Specific gravity (relative to air for gas, or relative to water for liquid)
- t : Fluid temperature [°C]
- V : Max. liquid flow rate [m³/h]
- Cv : Cv value of each nominal size
- Iv : Viscosity index
- Mcst: Viscosity [cSt]

Formula for correction of viscosity

Step

$$Iv = \frac{72780}{Mcst} \left(\frac{\Delta P}{G}\right)^{\frac{1}{4}} V^{\frac{1}{2}}$$

Viscosity correction curve



_	_				
	Cv	va		tah	
	Uv	va	ue	lab	IC

Model Nominal size	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A
PD-1, 2		5	7	11	16	24	40			
PD-3		4	9.2	17.4	27.8	40.6	63.8			
CT-1		6	9	14	25	33	50	85	106	175

Guidelines for Installing Air Operated Valve



Piping example



Warning and caution for installation

pressure inlet port must be faced upward).

1. Before connecting the product to piping, remove foreign substances and scales inside the piping. Note that the seal material must not flow into the inside of the product.

* Contamination of foreign substances can cause valve seat leakage and malfunction.

- 2. When installation, check the direction of the product so that the fluid flowing and the arrow marked on the product are in the same direction.
- 3. As shown in the above figure, it is recommended that stop valves, strainers, pressure gauges and bypass line to be installed to the piping. For screwed valve, a union joint is recommended to install for easy maintenance and inspection.
- 4. Make sure to install a strainer with the mesh size 80-100mesh at the inlet side of the product.
- 5. Avoid over-tightening of screw and excessive stress imposed from the piping in order to prevent malfunction due to the distortion of the body.
- 6. Secure a space required for disassembly or removal of the product at the time of maintenance and inspection.

Installation posture



Air Operated Valve/Control Valve

Any direction is possible.

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Guidelines for Installing Control Valve

Warning and caution for installation

- 1. Before connecting the product to piping, remove foreign substances and scales inside the piping. Note that the seal material must not flow into the inside of the product.
- * Contamination of foreign substances can cause valve seat leakage and malfunction.
- When installation, check the direction of the product so that the fluid flowing and the arrow marked on the product are in the same direction.
- 3. As shown in the above figure, it is recommended that stop valves, strainers, pressure gauges and bypass line are installed to the piping. For screwed valve, a union joint is recommended to install for easy maintenance and inspection.
- 4. Make sure to install a strainer with the mesh size 80-100 at the inlet side of the product.
- 5. Avoid over-tightening of screw and excessive stress imposed from the piping in order to prevent malfunction due to the distortion of the body.
- 6. Recommend the upright installing position for the control valve (top drive unit).
- 7. Secure a space required for disassembly or removal of the product at the time of maintenance and inspection.
- 8. Control Valve is not explosion-proof. Do not use in the area or ambience where explosive gasses accumulate.
- 9. When using at the outdoor, set eaves to avoid direct rain.

Piping example



·Standard opening signal and valve opening, flow rate, temperature relationship.



Installation posture



Air Operated Valve/Control Valve



Other usage examples













Air Operated Valve

PD-1,2

Features

- 1. Usable for air, water, oil and steam.
- 2. No chattering due to closing action against the flow direction of fluid.
- 3. Excellent durability of stainless steel valve seat.
- 4. Excellent durability of synthetic rubber diaphragm.

s

3 way







Specifications

	Model	PD-1	PD-2			
Ap	plication	Steam, Air, Cold and hot wa	ter, Other non-dangerous fluids			
Working pressure		0-1.	0 MPa			
Max.temperature		18	30°C			
0	peration	Air-to-open				
Pilot pressure 0.2-0.25 MPa			25 MPa			
	Body	Bronze	Cast iron			
Material	Valve	Stainle	ess steel			
	Valve seat	Stainle	ess steel			
Co	onnection	JIS Rc screwed	JIS 10K FF flanged			

Available with air-to-close operation type.

* For air operated pressure reducing valve, please refer to the block P.10-10 (GD-37UN standard unit for operation or GD-37N pressure reducing valve).

For 3 way solenoid valve, please refer to the block P.10-11 (DD-37 3way solenoid valve).

Dimensions (mm) and Weights (kg)

·PD-1



Nominal size	d	L	н	H1	Cv value	Weight
15A	Rc 1/2	90	210	50	5	4
20A	Rc 3/4	100	221	56	7	4.4
25A	Rc 1	110	221	56	11	4.7

·PD-2



Structure is a little different depending on size.

Nominal size	L	н	H1	φA	Cv value	Weight
15A	120	210	50	140	5	5.9
20A	130	221	56	140	7	6.6
25A	140	221	56	140	11	8.1
32A	180	412	100	256	16	28.5
40A	180	412	100	256	24	29.0
50A	180	422	105	256	40	30.0

PD-3

Features

- 1. Compact design and high durability.
- 2. Stainless steel cast body and metal actuator are suitable for wide range of fluids, applications and ambient conditions.
- 3. Wide variety of actuator can be used for low pilot pressure.



Specifications

	Application	Steam, Air, Cold and hot water, Oil, Other non-dangerous fluids (600 cSt or less)					
N	lominal size	15-50A					
Wo	rking pressure	15A: 0-2.2 MPa *1 20A: 0-1.3 MPa 25A: 0-0.9 MPa 25A: 0-2.2 MPa *1 32A: 0-1.2 MPa 40A: 0-1.0 MPa 50A: 0-0.75 MPa					
Ρ	ilot pressure	15A: 0.35-10 MPa 20A: 0.45-1.0 MPa 25A: 0.57-1.0 MPa 25A: 0.35-1.0 MPa 32A: 0.35-1.0 MPa 40A: 0.44-1.0 MPa 50A: 0.56-1.0 MPa					
Tem	perature range	-30 to 200°C (no freeze condition)					
Ambi	ent temperature	-15 to 60°C					
	Body	Stainless steel					
Material	Valve disc	PTFE					
	Bonnet	Brass, Chrome-plated					
Installation posture		Any direction is available					
(Connection	JIS Rc screwed					
	Operation	Normally closed *2					

*1 For steam: 0-1.5 MPa

*2 Available with normally open type.

· Please contact us for working pressure, pilot pressure or connections other than the above.

Dimensions (mm) and Weights (kg)

Nominal size	d	L	А	Н	В	D	G	Weight
15A	Rc 1/2	65	135	130	34.5	62	G 1/8	1.1
20A	Rc 3/4	75	140	135	34.5	62	G 1/8	1.2
25A *1	Rc 1	90	150	140	34.5	62	G 1/8	1.4
25A *2	Rc 1	90	190	185	55	96	G 1/4	3
32A	Rc 1-1/4	110	205	200	55	96	G 1/4	3.3
40A	Rc 1-1/2	120	210	205	55	96	G 1/4	3.6
50A	Rc 2	150	225	225	55	96	G 1/4	4.2

*1 Max. working pressure is 0.9 MPa.

*2 Max. working pressure is 2.2 MPa.





CT-1 is a pneumatic control valve. Its valve-opening is accurately controlled by signals output from controller. The single-seat globe valve body offers large capacity and excellent controllability. The actuator is a multispring, single-action type.



Features

- CT-1 offers the standard type electro-pneumatic positioner and the air regulator as accessories and also offers several options of positioner (E/P, Smart Positioner) to be mounted depending on request from end user.
- 2. Drive part is a compact and lightweight.
- Spherical main valve offers great sealability and great reduction of valve seat leakage (ANSI Class IV).

■Specifications

Mc	del		CT-1					
Nomir	al size		15-100A					
Anni	ention	Controlled fluid	Cold and hot water, Air, Steam, Oil, Other non-dangerous fluids					
Арри	cation	Driving fluids	Compressed air					
Flange C	onnection		JIS 10KRF					
Max. worki	ng pressure		1.0 MPa					
Working te	emperature		-5 to 210°C (no freezing condition)					
Plug char	acteristics		Equal percentage					
Range	ability		30:1					
Sealing (plu	ig and seat)		Metal to metal					
Seat le	eakage		ANSI class IV					
Actuator			Single action					
Valve action			Reverse (fail to close)*1					
Supply ai	r pressure	0.35-0.4MPa*2						
Ambient te	emperature	-20 to 70°C						
	Body		Cast carbon steel					
	Plug		Stainless steel					
	Seat ring		Stainless steel					
Material	Gasket		SUS + GRAFOIL®					
	Grand packing		V-PTFE					
	Diaphragm		EPDM					
Acces	sories	Ele	ectro-pneumatic positioner (4-20 mA DC)					
Acces	301103		Air regulator					

*1 Valve opens when the value of input signal increases.

· Available with ASME or EN flanged.

*2 Please apply air pressure between 0.4-1.0MPa for air regulator.

Cv value

Nominal size	15A	20A	25A	32A	40A	50A	65A	80A	100A
Cv	6	9	14	25	33	50	85	106	175

Dimensions (mm) and Weights (kg)



Size	L	HA	HB	D	Stroke	Weight
15A	184	276	100	220	20	13
20A	184	276	100	220	20	13
25A	184	276	100	220	20	16
32A	222	320	111	270	25	22
40A	222	320	111	270	25	22
50A	254	320	124	270	25	28
65A	276	394	122	350	30	48
80A	298	394	162	350	30	61
100A	352	394	182	350	30	76

Positioner

Available with 2 types of positioners



- Malfunction preventive structure with high tolerance for vibration.
- · Quick and accurate response.
- · Good efficiency with small air consumption.
- · Easy zero/span adjustment.

It is next generation positioner and micro processor equipped providing with various functions such as autocalibration and the optimum control PID etc.



- · LCD monitor shows positioner's condition.
- Excellent performance even under conditions of frequent vibrations.
- \cdot With feedback analog signal output terminal.
- \cdot Good efficiency with small air consumption.
- \cdot Auto-calibration with easy operation.

Air Operated Valve/Control Valve – Annex

Warning Be sure to install safety device for such as blocking or opening when failure or malfunction of solenoid valve may violate human life, body, or property.
 CAUTION Please refer to the manual attached to the product for procedures for installation and operation.

Disassembly and maintenance, inspection

Air operated valve

PD-1, PD-2

Disassembly

PD-2

- 1. Remove diaphragm cover on operation part and remove diaphragm.
- Since valve and diaphragm plate are connected by bolt, pass a bar through hole for fixing valve, loosen bolt by bar spanner, and remove plate. In this occasion, be careful that spring rebounds with strong force.
- After removing diaphragm plate and spring plate, frame can be removed by removing lock nut and set screw holding frame.
- 4. Next, remove upper cover of body (gland part Ass'y). Loosen gland nut in advance. Remove bottom cover.
- 5. After removing upper part, get out valve from bottom straightly. By above procedure, the product can be disassembled from upper part in order. Also, assembly is the reverse order of disassembly.

Maintenance and inspection

- 1. Make periodical inspection to check that diaphragm is not damaged.
- Be careful for damage on contact surface of valve and valve seat. It becomes cause of fluid leakage. If contact surface is damaged by dirt entry, make lapping with mixed sand.
- 3. Packing is consumable supply. If getting old, replace with new one.
- 4. Conduct inspection for spring buckling and stem bending, etc.

Troubleshooting	Air operated valve

Trouble		Cause	Remedy
Fluid does not flow (Valve disc is kept closing and does not open).		 Pilot pressure is not supplied. Pilot pressure is low. Sealing failure of outer lip seal. 	Check air supply piping. Apply pilot pressure as specified in "Specifications". Replace the actuator assembly.
Fluid keeps flowing and does not stop (Valve disc is kept opening and does not close). Or, there is valve leakage.	•	Leakage from stop valve on bypass piping. ····· Pilot pressure exists inside. ······ Pilot pressure exists inside. ······ part between valve disc and body. There is damage on the seat part ······ between valve disc and body. Spring failure inside actuator. ·····	Close stop valve. Or, in case that leakage still occurs even if closing stop valve, replace stop valve. Release pilot pressure from pilot port. Clean the seat part between valve disc and body. If there is damage on valve disc, replace the actuator assembly. If there is damage on the seat part of body, replace the product. Replace the actuator set.
Fluid leaks from the connection part of packing case and body.		Leakage from gasket due to loose of packing case. Leakage from gasket due to deterioration	Tighten packing case by the specified tightening torque. Replace gasket.
Fluid leaks from the leak detection port.		Leakage due to deterioration or wear of O ring or packing, etc. inside the actuator set.	Replace the actuator set.
Pilot pressure leaks from position indicator part.		Leakage due to deterioration or wear of O ring or packing, etc. inside the actuator assembly.	Replace the actuator assembly.

Air Operated Valve/Control Valve – Annex





▲ Warning

Warning before disassembly

- (1) Be sure not to remove circlip @
 - * Failure to follow this notice makes inner spring (2) fly out and result in injury.
- (2) To remove actuator set from body ①, supply pilot pressure to pilot port, and rise valve disc ⑤. Then loose and remove actuator set by grasping hexagonal part of packing case ②. Also, be sure not to stop pilot pressure during supply till the work finished.

* Actuator set cannot be removed when pilot pressure is not supplied to pilot port. Also, it is very dangerous to stop pilot pressure during supply at work because actuator set files out from body ① and result in injury.

(3) Before disassembly, be sure to discharge the pressure inside of the product, piping and equipment completely (after cooling down the product in case of high-temperature fluid). Also do not touch it with bare hands directly till it is closed.

Air Operated Valve/Control Valve – Annex

Recommended torque for actuator

To install actuator set on body, tighten so that appropriate pressure can be applied on gasket (3), with torque wrench. In this case, use tightening torque as follows.

Nominal Size	Tightening torque
15A	60Nm
20A	90Nm
25A	120Nm
32A	150Nm
40A	190Nm
50A	230Nm

\land Warning	Be sure to install safety device for such as blocking or opening when failure or malfunction of solenoid valve may violate human life, body, or property.
A CAUTION	Please refer to the manual attached to the product for procedures for installation and operation.

Troubleshooting

Control valve

CT-1			
Trouble		Cause	Remedy
The product does not operate.		 Pilot pressure or external signal is not supplied 	Check existence of pilot pressure (0.35 MPa or more) by device such as pressure gauge. Check existence of external signal by device such as tester.
	•	• Air supply piping is clogged or leaks	In case of clogging, clean air supply piping. In case of leakage, replace the piping.
		Diaphragm bolt is loosened.	Retighten diaphragm bolt.
		 Leakage occurs between lower diaphragm case and diaphragm rod. 	Replace actuator.
	•	Failure occurs in accessory positioner or regulator	Inspect or replace positioner or regulator.
		Failure occurs in body part or actuator Sensitivity of positioner is not appropriate	Inspect or replace body part or actuator. Replace positioner.
Operation is unstable (Hunting occurs).		Abnormal signal is sent from controller, Pilot pressure is not stable,	Regulate controller and check signal system. Check air supply piping and replace it with one of larger nominal size.
Leakage from plug.		• Valve does not descend to the position of full close.	Readjust zero point by controller.
		There is damage on plug of seat hing.	heplace body part.
Leakage from gland packing		Gland nut or bonnet nut is loosened	Retighten the nut. In case the leakage is still found, replace packing.
and bonnet gasket.		 Hardening of gland packing or bonnet gasket. ···· 	Replace gland packing or bonnet gasket.