NIPPON VALVE CONTROLS, INC.

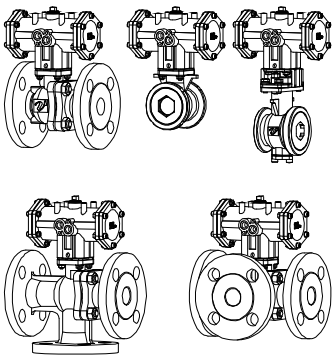
Instruction manual

Pneumatic Actuated Ball Valve BR BS GS VR TR LR T3 L3 SP-1500

Please read this manual before installation and use.

GENERAL

Flanged ball valve with pneumatic actuator.



Actuator
- Double-acting typ
  - PND / TAD
- Single-acting type
  - PSO / TAO (Airless SHUT)
  - PSC / TAC (Airless OPEN)

Valve
- BR Type For various fluids and general use.
- BS type For Wafer.
- VR type For control.
- GS type For Wafer. (JIS 10K / 20K)
- TR type For mixing / dividing.
- LR type For mixing / dividing.
- T3 Type Trunnion structure. (with flow paths)
- L3 type Trunnion structure.

PRODUCT CODE

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
BR type	(JIS 10K)		B R	9		1				-	-	
	(JIS 20K)		B R	9		3	T	T		-	-	
BS type	(Full port)		B S	9		1				-	-	
	(Standard port)		B S	9		1				R	-	
VR type	(V-port)		V R	9		1	U	U		-	-	-
	(Reduced port)		V R	9		1	U	U		R 0 1 5	-	-
GS type	(V-port)		G S	9		3	U	U		V	-	-
	(Full port)		G S	9		3	U	U		-	-	-
	(Standard port)		G S	9		3	U	U		R	-	-
TR type			T R	9		1	T	T	P	-	-	-
LR type			L R	9		1	T	T	P	-	-	-
T3 type			T 3	9		1	T	T	G	-	-	-
L3 type			L 3	9		1	T	T	G	-	-	-

(1) Actuator
- PND TAD
- PSO TAO
- PSC TAC

(2) Valve
- BR BS VR
- GS
- TR LR
- T3 L3

(3) Voltage
- 9 : Air

(4) Sizing code
- 0 : Standard
- 1 : Light
- 2 : Heavy

(5) Connection
- 1 : JIS 10K
- 3 : JIS 20K

(6) Body material
- T : SCS13A
- U : SCS14A

(7) Ball material
- T : SUS304 / SCS13A
- U : SCS14A

(8) Seat material
- F : F-PTFE
- G : R-PTFE
- R : R-F-PTFE
- K : PEEK
- I : API
- C : R-PEEK
- M : SUS316 + Stellite
- P : R-PTFE

(9) Size [mm]
- ex. 25 A → 025

(10) Option
- FR : Filter Regulator Unit
- LB : Limit Switch Box
- EN : Positioner
- EP : Positioner
- EX : Smart Positioner
- ES : Smart Positioner
- ER : Smart Positioner

(11) Positioner control pattern (TAD)
- A : SHUT by 4 mA ↔ OPEN by 20 mA
- B : SHUT by 20 mA ↔ OPEN by 4 mA

(11) Positioner control pattern (PSO / TAO)
- C : OPEN by 20 mA ↔ SHUT by 4 mA (Airless SHUT)
- D : OPEN by 4 mA ↔ SHUT by 20 mA (Airless SHUT)

(11) Positioner control pattern (PSC / TAC)
- E : SHUT by 4 mA ↔ OPEN by 20 mA (Airless OPEN)
- T : SHUT by 20 mA ↔ OPEN by 4 mA (Airless OPEN)

(11) Flow paths (T3 valve)
- a to d : 3 way valve flow

VALVES SPECIFICATIONS

Water Oil Air, Gas Steam Chemicals Sea water Slurry Negative pressure

BR BS VR type

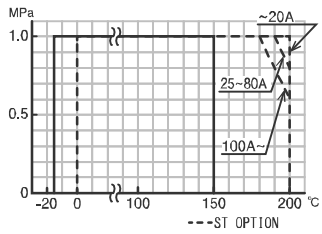
Valve type		BR			BS		VR
Design		2-way, Full port			2-way, Wafer		2-way, V-port
Connection		JIS10K Flanged-end		JIS20K Flanged-end	JIS Flanges 10K		JIS10K Flanged-end
Fluid							
Max pressure		1 MPa		2 MPa	1 MPa		1 MPa
Size [mm]		015 to 100	015 to 150	015 to 080	015 to 150		015 to 080
Material	Body	SCS14A	SCS13A	SCS13A	SCS13A	SCS14A	SCS14A
	Ball	SCS14A	SCS13A	SCS13A	SCS13A	SCS14A	SUS316 / SCS14A
	Seat	F-PTFE R-PTFE R-F-PTFE			F-PTFE R-PTFE R-F-PTFE		R-PTFE R-F-PTFE
Stem seal	Packing	R-PTFE			R-PTFE		R-PTFE
	O-ring	FKM			FKM		FKM

The optional for steam fluids.

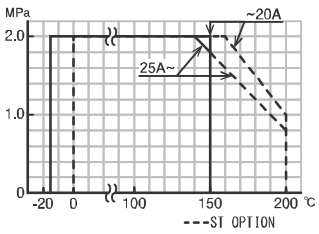
Valve type	Option code	O-ring
BR BS VR	ST	Replace (Steam resistant FKM)

PRESSURE & TEMPERATURE RATING

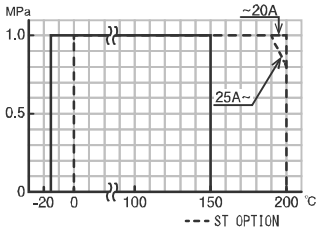
BR (JIS 10K)



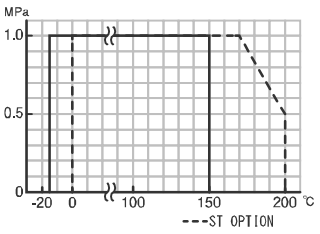
BR (JIS 20K)



BS



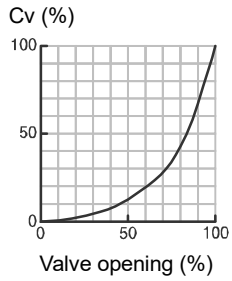
VR



Note) Insulation options are required for use with fluids more than 150 °C.

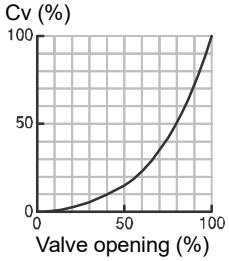
INHERENT FLOW CHARACTERISTIC (BS)

100 to 150 mm



Range ability
30:1

INHERENT FLOW CHARACTERISTIC (VR)



	Range ability
VR-1UUG - 015 to 080	50:1
VR-1UUG R 015	100:1

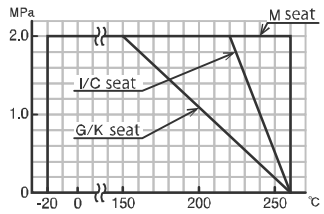
VALVES SPECIFICATIONS

Water Oil Air, Gas Steam Chemicals Sea water Slurry Negative pressure

GS type

Valve type		GS
Design		2-way, Wafer
Connection		JIS Flanges 10K / 20K
Fluid		
Max pressure		2 MPa
Size [mm]		015 to 150
Material	Body	SCS14A
	Ball	SCS14A (HCr PLTD)
	Seat	R-PTFE PEEK API R-PEEK SUS316 + Stellite
Stem seal	Packing	R-PTFE

PRESSURE & TEMPERATURE RATING



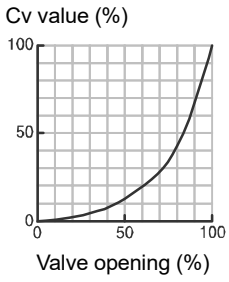
Note) Option for use in fluid temperature more than 170 °C.

SEAT LEAKAGE VOLUME

	Seat material	Leakage rate	Remarks
G	R-PTFE	Bubble-tight	We prefer to K seat depends on pressure or environmental conditions. please consult us for your specifications. API cannot be used with steam fluid.
K	PEEK		
I	API		
C	R-PEEK	Less than 0.00001 % of rated Cv. (V-ported type is 5 to 8 times the above.)	1/1000 of ANSI B16.104 Class IV.
M	SUS316 + Stellite	Less than 0.01 % of rated Cv. (V-ported type is 5 to 8 times the above.)	ANSI B16.104 Class IV.

Note) M seat can also be manufactured at ANSI B16.104 Class V.

INHERENT FLOW CHARACTERISTIC



	Range ability
GS-3UU□ V 015 to 032	50:1
GS-3UU□ - 015 to 080	200:1
GS-3UU□ R 040 to 150	100:1

VALVES SPECIFICATIONS

Water Oil Air, Gas Steam Chemicals Sea water Slurry Negative pressure

TR LR T3 L3 type

Valve type		TR / LR		T3 / L3
Design		3-way, Full port		3-way, Full port
Connection		JIS10K Flanged-end		JIS10K Flanged-end
Fluid				
Max pressure		1 MPa		1 MPa
Size [mm]		020 to 040	050 to 100	025 to 150
Material	Body	SCS13A		SCS13A
	Ball	SUS304	SCS13A	SCS13A
	Seat	R-PTFE		R-PTFE
Stem seal	Packing	R-PTFE		PTFE
	O-ring	FKM		-

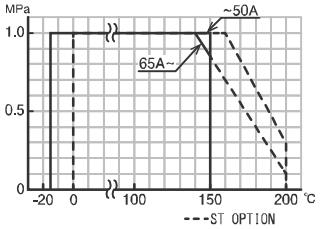
The optional for steam fluids.

Valve type	Option code	O-ring
TR LR	ST	Replace
T3 L3	ST-VF	Add

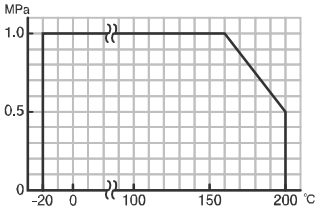
O-ring: Steam resistant FKM

PRESSURE & TEMPERATURE RATING

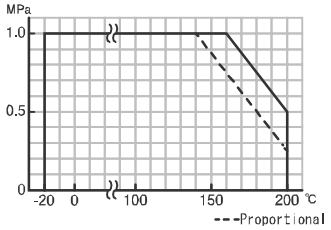
TR / LR



T3



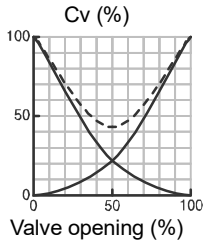
L3



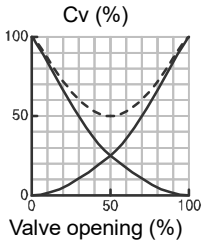
Note) Insulation options are required for use with fluids more than 150 °C. (T3 / L3: 170 °C)

INHERENT FLOW CHARACTERISTIC (TR / LR)

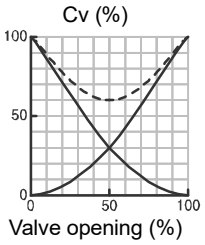
020 mm



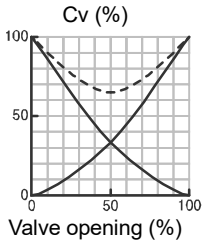
025 mm



040 mm



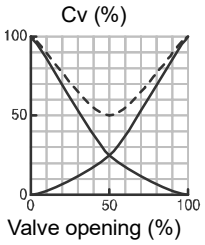
050 to 100 mm



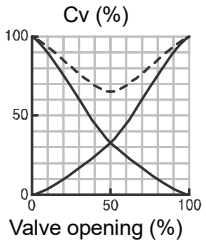
Range ability 20:1

INHERENT FLOW CHARACTERISTIC (L3)

025 mm



040 to 150 mm



Range ability 30:1

FLOW PATHS (Position① / P1) (Position② / P2)

TR LR L3		T3							
		Form: a		Form: b		Form: c		Form: d	
P1	P2	P1	P2	P1	P2	P1	P2	P1	P2
									
B-C ⇔ A-C		A-B ⇔ B-C		A-C ⇔ A-B		B-C ⇔ A-B-C		A-B-C ⇔ A-C	

Note) When a closed path is exposed to high pressure, it may leak slightly to an open path. (TR / LR)

PNEUMATIC ACTUATOR SPECIFICATIONS

3 way valve: SHUT / Position①, OPEN / Position②

PND type

Classification	Double-acting type			
Actuator type	PND-03S	PND-03D	PND-04D	PND-05D
Weight [kg]	0.2	0.3	0.5	0.8
Air consumption [ℓ] (round-trip)	0.05	0.08	0.19	0.35
Operation time [s]	Less than 1.			
Operation	SHUT by air to port A. ↔ OPEN by air to port B.			
Air pressure	0.4 to 0.7 MPa			
Piping connection	Rc 1/8			
Method of operation	Scotch yoke			
Housing material	PPS resin			
Ambient temperature	-10 to 50 °C (Please be careful when you use in 5 °C or less, so that there no freeze.)			
Manual operation	Operates the upper shaft of the actuator directly.			

PSO PSC type

Classification	Single-acting type (Spring-return)				
Actuator type	PSO - 03S PSC - 03S	PSO - 03D PSC - 03D	PSO - 04D PSC - 04D	PSO - 05D PSC - 05D	PSO - 05W PSC - 05W
Weight [kg]	0.2	0.4	0.6	1.2	1.8
Air consumption [ℓ] (round-trip)	0.03	0.04	0.1	0.2	0.53
Air exit	One side	Both sides			
Operation time [s]	Less than 1.				
Operation	PSO : OPEN by air to intake port. ↔ SHUT by spring-return. (Airless SHUT) PSC : SHUT by air to intake port. ↔ OPEN by spring-return. (Airless OPEN)				
Air pressure	0.4 to 0.7 MPa				
Piping connection	Rc 1/8				
Method of operation	Scotch yoke				
Housing material	PPS resin				
Ambient temperature	-10 to 50 °C (Please be careful when you use in 5 °C or less, so that there no freeze.)				
Manual operation	No manual operation.				

PNEUMATIC ACTUATOR SPECIFICATIONS

3 way valve: SHUT / Position①, OPEN / Position②

TAD type

Classification	Double-acting type						
Actuator type	TAD-040	TAD-050	TAD-063	TAD-080	TAD-100	TAD-125	TAD-160
Weight [kg]	0.9	1.3	2.1	3.4	6.1	9.8	18.2
Air consumption [ℓ] (round-trip)	0.11	0.18	0.34	0.66	1.36	2.72	5.56
Operation	SHUT by air to port A. ↔ OPEN by air to port B.						
Air pressure	0.4 to 0.7 MPa						
Piping connection	Rc 1/8	Rc 1/4					
Method of operation	Rack-and-pinion	Scotch yoke					
Housing material	Aluminum alloy						
Ambient temperature	-10 to 50 °C (Please be careful when you use in 5 °C or less, so that there no freeze.)						
Manual operation	Operates the upper shaft of the actuator directly.						

TAO TAC type

Classification	Single-acting type (Spring-return)						
Actuator type	TAO-040 TAC-040	TAO-050 TAC-050	TAO-063 TAC-063	TAO-080 TAC-080	TAO-100 TAC-100	TAO-125 TAC-125	TAO-160 TAC-160
Weight [kg]	2.3	3	4.9	8.5	16.4	27.6	51.2
Air consumption [ℓ] (round-trip)	0.23	0.34	0.67	1.26	2.62	4.44	8.77
Operation	TAO : OPEN by air to intake port. ↔ SHUT by spring-return. (Airless SHUT) TAC : SHUT by air to intake port. ↔ OPEN by spring-return. (Airless OPEN)						
Air pressure	0.4 to 0.7 MPa						
Piping connection	Rc 1/4						
Method of operation	Rack-and-pinion	Scotch yoke					
Housing material	Aluminum alloy						
Ambient temperature	-10 to 50 °C (Please be careful when you use in 5 °C or less, so that there no freeze.)						
Manual operation	No manual operation.	Option: MT (Manual handle unit)					

PNEUMATIC ACTUATOR SPECIFICATIONS

3 way valve: SHUT / Position①, OPEN / Position②

OPTIONAL PARTS

Classification			Code	PND	PSO	PSC	TAD	TAO	TAC
Speed Controller with bypass valve (Housing material: PPS)			BS				○		
FR Unit (Regulator with Filter) TA2-FR (KONAN)			FR	○	○	○	○	○	○
Limit Switch Box (Standard load signal)			LB	○	○	○	○	○	○
Explosion Proof Limit Switch / VCX7001 (azbil) Ex d e II C T6			LR				○	○	○
Speed Controller (with One-touch Fitting) One set			SE	○	○	○	○	○	○
Speed Controller (with One-touch Fitting) Two sets			SS	○			○		
Speed Controller (with One-touch Fitting) Dual Speed Controller			SF		○	○		○	○
Manual handle unit (for TAO-050 to 160 / TAC-050 to 160)			MT					○	○
Sealing the spring unit. (Oil-free)			92					○	○
Smart positioner for PSO / PSC (Except 03S)			EX		○	○			
Explosion Proof Electro-Pneumatic Positioner EXd II BT5 (TIIS)			EN				○	○	○
Explosion Proof Electro-Pneumatic Positioner Ex dmb II B T5 (TIIS)			EP				○	○	○
Smart positioner			ES				○		
			ER					○	○
Smart positioner (with 4 to 20mA output)			ET				○		
			EU					○	○
Positioner operation	SHUT by 4 mA. ↔ OPEN by 20 mA.		A				○		
	SHUT by 20 mA. ↔ OPEN by 4 mA.		B				○		
	OPEN by 20 mA. ↔ SHUT by 4 mA. (Airless SHUT)		C		○			○	
	OPEN by 4 mA. ↔ SHUT by 20 mA. (Airless SHUT)		D		○			○	
	SHUT by 4 mA. ↔ OPEN by 20 mA. (Airless OPEN)		E			○			○
	SHUT by 20 mA. ↔ OPEN by 4 mA. (Airless OPEN)		T			○			○
Smart positioner SHUT by loss of signal	SHUT by 4 mA. ↔ OPEN by 20 mA.		A				○		
	SHUT by 20 mA. ↔ OPEN by 4 mA.		B				○		
	OPEN by 20 mA. ↔ SHUT by 4 mA. (Airless SHUT)		C					○	
	OPEN by 4 mA. ↔ SHUT by 20 mA. (Airless SHUT)		D					○	
	SHUT by 4 mA. ↔ OPEN by 20 mA. (Airless OPEN)		Y						○
Smart positioner OPEN by loss of signal	SHUT by 20 mA. ↔ OPEN by 4 mA.		W				○		
	OPEN by 4 mA. ↔ SHUT by 20 mA. (Airless SHUT)		X					○	
	SHUT by 4 mA. ↔ OPEN by 20 mA. (Airless OPEN)		E						○
	SHUT by 20 mA. ↔ OPEN by 4 mA. (Airless OPEN)		T						○
5-Port Solenoid Valve		Voltage: 100 V AC	1S	○	○	○			
(with speed controller, silencer, DIN connector)		Voltage: 200 V AC	2S	○	○	○			
		Voltage: 110 V AC	3S	○	○	○			
		Voltage: 220 V AC	4S	○	○	○			
VZ3190-□D-X213		Voltage: 24 V DC	5S	○	○	○			

PNEUMATIC ACTUATOR SPECIFICATIONS

3 way valve: SHUT / Position①, OPEN / Position②

SOLENOID VALVE (Applicable Pneumatic Actuators: PND-05D, TAD TAO TAC)

Classification (☐: Voltage code)			Code	
5-port Solenoid Valve Return (with bypass valve)	Lead wire	4N3S102K-L☐	N43SL☐	☐: Voltage 1 : 100V AC 3 : 200V AC 5 : 24V DC
	DIN Connector	4N3S102K-D☐	N43SD☐	
	DIN Connector (with lamp)	4N3S102K-N☐	N43SN☐	
	Watertight cover	4N3S102K-W☐	N43SW☐	
5-port Explosion proof solenoid valve Return (with bypass valve)	Conduit	4N4S102K-E01-H☐B0-R	4N4S01-☐B0, NO	
	Flame proof packing (Cable size Φ9.5 to 10.4 mm)	4N4S102K-E10-H☐B0-R	4N4S10-☐B0, NO	

Operate by solenoid valve (Normally Open)

PND / TAD	SHUT by solenoid off.	↔	OPEN by power to solenoid.
PSO / TAO (Airless SHUT)	OPEN by power to solenoid.	↔	SHUT by solenoid off. (Spring-return)
PSC / TAC (Airless OPEN)	SHUT by power to solenoid.	↔	OPEN by solenoid off. (Spring-return)

HANDLING & STORAGE

①HANDLING

Do not drop or throw the product as it may break.

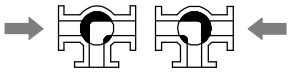
②STORAGE

- Store away from dust, moisture and direct sunlight. If possible, store in the original package.
- Do not remove a dust proof cap until the piping.
- ③CHECKING Check the product code before installation.
- Make sure that the bolts are not loose.

INSTALLATION

①PRECAUTIONS

- Flush the pipeline carefully before installing the valve. Foreign particles, such as sand or pieces of welding electrode, will damage the ball and seats.
- For valves with specified flow direction (GS / VR) or with ST / SC option, check the arrows on the product before piping.
- When the flow path is subjected to a high pressure from arrow, it may leak slightly to the low pressure port. (TR / LR)



②PIPING FLANGES

- Gasket should be selected appropriately to suit the fluid, pressure and temperature.
  Use spring washer to prevent from decreasing surface pressure gasket when the temperature change happens frequently.
- Tighten all bolts using crossover method to load the joint evenly.
- Wafer type ball valve is put between two seats of flanged-end and tightened with long bolts. (BS / GS)

③ENVIRONMENT

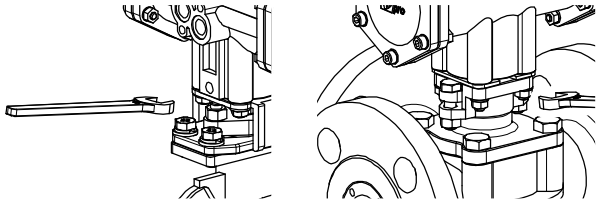
- Do not install in place where corrosive gas is present or where vibration is heavy (0.5 G or more).
- When radiant heat causes the surface temperature of the control unit to exceed 50 °C, provide an appropriate shielding plate.
- If there is a possibility that the fluid and drive part freeze, please take measures to prevent freezing.
- For single-acting type, prevent water and dust from coming into air exit.

④POSITIONING

Should be positioned through 90° upward from horizontal. Provide space around the product to allow manual operation, inspection and replacement work.

⑤CAUTIONS FOR MAINTENANCE (GS / T3 / L3)

Do not keep warm for maintenance of the valve gland.

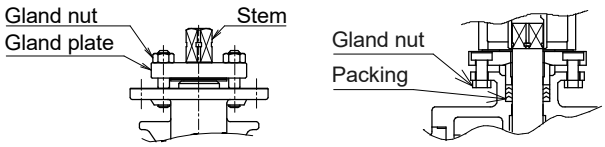


GS T3 L3

TIGHTEN THE GLAND NUTS (GS / T3 / L3)

- Check that there is no leakage from the gland packing.
- If it leakage, tighten gland nuts by alternately. Do not over-tighten the gland nuts.

GS T3 L3



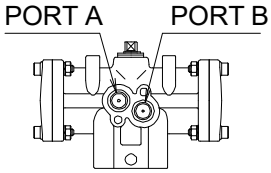
Recommended torques					
Valve size [mm]					Torque [N·m]
GS			T3	L3	
V-port	Full port	Standard port			
015 020	015 020	-	-	-	2
025 032	025 032	040	025	025	3.5
-	040 050	050 065	040	040 050	7
-	065 080	080 100	050 065	065 080	10
-	-	125 150	080 100	100 125	14
-	-	-	125 150	150	20

AIR PIPING

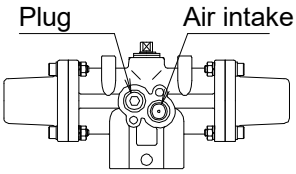
• Pneumatic actuator has an air supply ports to operate piston.

Double-acting type
PND : Rc 1/8
Coupling OD
less than 14.5 Φ

TAD-040 : Rc 1/8
TAD-050 to 160 : Rc 1/4



Single-acting type
PSO / PSC : Rc 1/8
TAO / TAC : Rc 1/4



• Piping of double-acting type is connected by seal tape on PORT A / B. Piping of single-acting type is put seal tape only on the air intake port.
• PND / PSO / PSC: PPS resin air supply port may be damaged if over tighten, please lightly tighten by hand.
• Never put anything on the actuator or make it into a foothold.

OPERATION

①AIR SOURCE
• Use the filtered dry air (less than 40 μ).
• Extra attention is needed where it's cold climate (below 5 °C).
• When air pressure is high, reduce it to standard pressure (0.4 to 0.7 MPa). Air pressure should not exceed 0.7 MPa during operation test.
• Capacity of compressor and air tank are to be calculated by capacity of piping and air consumption. A margin of 30% is required.

②TEST OPERATION
Check the operation of pneumatic actuator before fluid enters the piping.

Double-acting type	Stop the air from the air source. Release the residual pressure in the air cylinder. Open the air equalizer. Move the manual shaft of actuator with a wrench.
Single-acting type	Send the standard pressure air. Confirm the opening / closing operation by slowly moving the actuator.

③TESTING
After piping, check following points.
• Piping is correct.
• Air or fluid leakage from connection. Flow direction of air is correct.
• Air pressure is in the range.
• Nothing interferes with operation when limit switch or solenoid valve is attached.

④ATTENTION
The opening and closing operation of the pneumatic actuator is fast, which may affect the product life. Please adjust the operation time of pneumatic actuator using a speed controller.

Valve size [mm]	Adjustment of operation time.
Less than 040	More than 1 second
050 or more	More than 2 seconds

MANUAL OPERATION

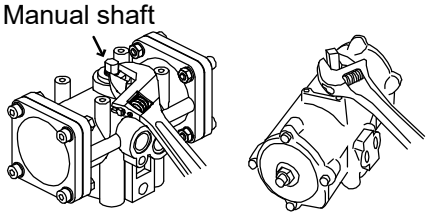
- Double-acting; stop the air supply and do not leave the air inside of cylinder.
- Single-acting; cannot be operated manually.

Optional code with the handle: TAO-MT / TAC-MT.

- Before automatic operation, be sure to remove wrench.

OPERATION (PND / TAD)

After turning air pressure to 0, turn manual shaft slowly with a smooth-jawed wrench to check the direction of OPEN/SHUT position.



PND TAD

MAINTENANCE

- Do the routine maintenance at least once in half a year.
- Do not set or take spring unit parts apart after installing the pneumatic single-acting actuator.

Can be used with no oil supply.

- Confirm the air leakage.
- Confirm the air supply pressure.
- Confirm the dirt or grit inside of cylinder.

Lubrication Procedure (TAD / TAO / TAC)
In case of lubricating, use turbine oil or the equivalent through a lubricator. (ISO VG 32.46).
Once lubricate, do the regularly.

Inspection items

- Confirm operation of opening and closing.
- Confirm whether screws are loose or not.
- Confirm the fluid temperature or pressure.
- Confirm the leak from valve stem.
- Confirm the bolt tightening torque.

TROUBLESHOOTING

Problem	Cause	Solution
Fail to operate.	Air doesn't come out.	Supply air.
	Air pressure is too low.	Adjust to standard pressure level.
Stop in the mid position.	• Biting of valve seat. • The scale has adhered to the valve ball.	Remove a foreign object.
Leakage from valve body	• Valve cap get loose. • Valve body is damaged.	Replace the valve.
Leakage from valve seat	Seat is worn or damaged.	Replace the valve.
		Replace the valve seat.
Leakage from valve stem	Stem packing is worn or distorted.	Replace the valve.
		Replace the packing.
Leakage from valve gland (GS) (T3 L3)	Gland packing is worn or distorted.	Tighten the gland nut.
		Replace the gland packing.

For more information contact
NIPPON VALVE CONTROLS, INC. for consultation.

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