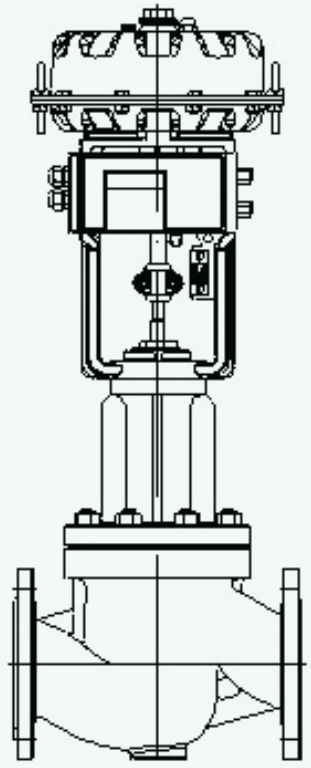
GEKO
CONTROL-VALVES

INSTRUCTION MANUAL

PNEUMATIC DIAPHRAGM OPERATED
TOP GUIDED GLOBE VALVE
PD30LA/GKV1 Series



Instructions
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SAFETY PRECAUTIONS

Proper handling and regular maintenance of the Diaphragm Operated Top Guided Globe Valve are essential for the safe performance of its receiving, hoisting, storage, installation, preparations for operation, and operation. Before you actually handle and operate this control valve, please carefully read and understand the safety precautions given in this manual.

The safety precautions provided in this manual for the operation and safety are intended to be observed only when the Diaphragm Operated Top Guided Globe Valve is used to regulate the flow rate of a process fluid for the purpose of controlling the flow rate, pressure, temperature and liquid level in the process system. The users of this control valve are responsible for all safety cautions and care required for operations not covered under this manual.

In this manual, the "cautions" that need to be exercised with particularly careful attention are noted, where applicable, in a frame containing the heading WARNING or CAUTIONS followed by its respective, specific description.

WARNING

Addresses cautions non-observance of which can lead to injury or death of person.

CAUTIONS

Addresses cautions non-observance of which can lead to failure or damage to this control valve or other equipment.

CONTENTS

1. Receiving, Handling and Storage

1-1. Receiving and Handling

⚠ WARNING

This control valve is heavy and therefore needs to be handled carefully and properly, following the instructions given below. Failure to observe these instructions may cause serious injuries on persons.

- For hoisting up and down the package containing this control valve, use a suitable hoisting machine conforming to the requirements of the labor safety and hygiene acts. Do not allow any person to beneath the package being hoisted up, nor operate the hoisting machine beneath the package being hoisted up.

  The weight of this control valve is indicated on a surface of the package.
- For a small-sized control valve contained in a cardboard box, the strength of The cardboard box will be reduced as it is wetted.. When the cardboard box is wetted, carefully handle it accordingly.

1-2. Storage

(1) It is recommended that the control valve be stored in an as-received packed state until the work to install it in a piping is started.

(2) Do not store it in a place:

(a) exposed to rainwater;

(b) where ambient temperature is higher than 60℃;

(c) in a dusty environment; and/or

(d) in a humid at1nosphere.

(3) Even when the received control valve has been unpacked and inspected for acceptance, it is recommended that the control valve be repacked as received and stored.

(4) Do not remove the air pipe and electric conduit connection plugs and covers until the air pipe connecting and electric wiring works are commenced.

(5) If the received, as-packed control valve is going to be stored for one year or more, the gland packing may be hardened and degraded during the storage. To prevent the degradation, open the Top of the package, loosen the gland flange locking hexagon nuts by about two turns, and store the valve, repacked. Before using the control valve that has been long stored as above, tighten the hexagon nuts to a torque value shown in Tables 10-3. and 10-4. Apply then an air pressure or hydraulic pressure equivalent to the operating fluid pressure (or apply nitrogen gas pressure if the fluid pressure is higher than 0.95 MPa) into the control valve through the pipe connection f1ange, and check the gland packing for leakage. If leakage should be detected, replace the gland packing with a new one. For the replacement, follow the procedure described in Section 10, Disassembly and Reassembly.

(6) To store the control valve after use, treat the control valve as follows.
(a) Clean the inside of the control valve by washing with water, and then dry it.
(b) Protect the gasket mounting surfaces of the connection flanges, denoted by arrows in Fig.2-1, against damage.
(c) Apply rust preventive treatment to control valve parts that are liable to rust.
(d) Protect the air pipe and electric conduit connections of the control valve with water resisting treatment.

2. Unpacking

Follow the unpacking instructions stated on the surface of the package.

⚠ WARNING

- When hoisting up this control valve out of its package, use standardized hoisting belts suited for the weight of this control valve, to ensure damage-free handling of the control valve. Also, use hoisting fittings, arranged on both sides to equally carry the load, as illustrated in Fig. 2-2. However, if the weight stated on the surface of the package exceeds the hoisting fittings limiting mass (weight) listed below, do not use hoisting fittings, but hoist the control valve as illustrated in Fig. 2-3. Failure to observe these instructions may allow the hoisted control valve to drop and injure persons.

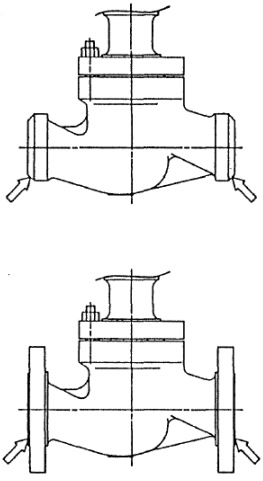
Actuator size	Model	Hoisting fittings limiting mass
270	PD3027	250 Kg
350	PD3035	400 Kg
450	PD3045	600 Kg

⚠ CAUTIONS

When and after the control valve is unpacked, take care to protect the control valve against its performance deterioration, as follows.

- Keep the gasket mounting surfaces or prepared surfaces for welding of the flanges (for connection to the piping) from being injured. See Fig. 1 Injured flange surface can be a cause of fluid leakage from the flange connection with the piping.

- If your control valve is a model having an actuator fitted with appurtenances such as a positioner, a booster relay and a solenoid vale or with a manual operation mechanism, make sure to keep these attachments from directly contacting the floor so that the load of the control valve may not be applied to them.



Protect the surfaces, pointed by arrows，from damage.
Fig.1

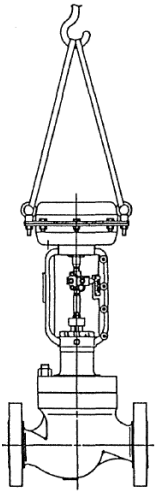


Fig.2-1

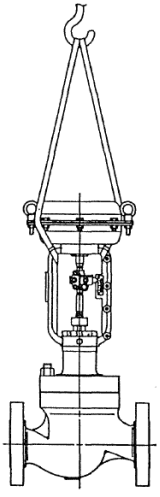


Fig.2-2

3. Installation

WARNING

This control valve is heavy and therefore needs to be handled carefully and properly, following the instructions given below. Failure to observe these instructions may cause serious injuries on persons.

- For installing this control valve in your process piping, hoist it using a hoisting machine conforming to the requirements of the labor safety and hygiene acts. Do not allow any person to be beneath the package being hoisted up, nor operate the hoisting machine beneath the package being hoisted up. The weight of this control valve is indicated on a surface of the package.

⚠ CAUTIONS

To maintain the performance of this control valve, exercise cautions as follows.

- Keep the gasket mounting surfaces of the flanges (for connection to the piping) from being injured. See Fig. 1 on page 3. Injured flange surface can be a cause of fluid leakage from the flange connection with the piping.
- When hoisting up this control valve out of its package, use standardized hoisting belts suited for the weight of this control valve, to ensure damage-free handling of the control valve. Observe the WARNING and CAUTIONS given in item 2, Unpacking.
- Prior to the connection of the control valve to a process piping, clean the inside of the piping to remove dust, sand, welding spatter and other foreign inclusions from the piping.
  Foreign inclusions, if left in the piping, may be caught between the plug and the seat ring to cause leakage. Foreign inclusions, if allowed to enter the guide of the plug, may disturb its operation.
- Do not remove the plugs at the air pipe and electric conduit connections of this control valve until the connection of this control valve to the process piping is completed and until the piping and the wiring works are started.
- When installing this control valve in the process piping, avoid applying such hard impacts to it as dropping it or bumping it hard.
- Keep a sufficient space for the maintenance of this control valve.
- If the actuator of the control valve is fitted with a manual operation mechanism, provide a sufficient space to permit safe and easy operation of the manual operation mechanism.
- Do not install this control valve in a place where the control valve may be subject to hard vibration or heavy loading.
- Do not attempt to ease the maintenance of the control valve by installing it in such a manner as causing the actuator to be positioned upside down.
- Maintain the ambient temperatures of the installed control valve within the range specified in Subsection 3-1， Allowable Ambient Temperatures for Installation.

3-1. Allowable Ambient Temperature for Installation

In the actuator specification of our Specification for Control Valve that has been submitted to you after our receipt of your order placement for the control valve, the three ambient temperature ranges of "Standard", "High Temperature" and "Low Temperature" are specified, according to one of which your control valve is manufactured. Referring to the temperature ranges shown below *， select a suitable place for installation where the specified ambient temperatures for your control valve could be met.

If the ambient temperatures around the selected place for installation may possibly exceed the specified range on account of the direct sun or solar radiation, provide an adequate sunshade or protect the control valve with heat insulation.

* Standard range : -10 to + 70℃
* Low-temperature range : -40 to +40℃
* High-temperature range : 0 to +100℃

3-2. Space for Maintenance

Above the control valve installed, maintain a space necessary for replacement of the actuator as well as for inspection of the inside of the control valve. Actually, add the chain block hook dimension to the dimension H shown below.

Actuator size / model	H
218,270 / PD3021,PD3027	500 mm minimum
350 / PD3035	600 mm minimum
460 / PD3046	750 mm minimum

3-3. Installation Position

- As a rule, the position of the installed control valve should be vertical as illustrated in Fig. 3.

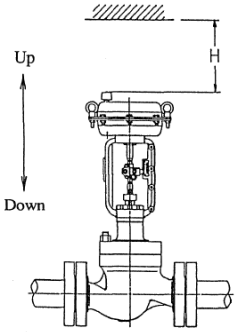


Fig. 3.

- Only when the vertical installation is impracticable, the control valve may be installed in a position within the range shown in Fig.4 , provided that the attached exhaust port of the actuator is not directed up. If the installed control valve is liable to external vibration or forces, an appropriate support should be provided for the control valve or the piping.

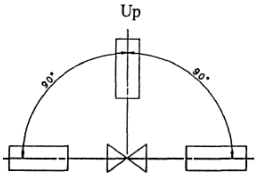


Fig. 4.

- If your control valve is fitted with a manual operation mechanism, the control valve should be installed in a position to ensure safe and easy operation of the mechanism.

3-4. Piping and Wiring

⚠ CAUTIONS

- For air pipe connections to the instruments such as the positioner and the booster relay, use pipes having a diameter that may not cause pressure drop in the piping.
- For a control valve factory-equipped with a positioner, booster relay and solenoid valve as standard accessories, the air piping from these accessories to the actuator have been already completed. Be careful not to damage these air pipes.
- Do not use sealing tape for instrument air supply pipe connections to the accessories because a sealing tape, if used there, may be jammed in to cause malfunction of the instruments.
- Do not perform wiring work on a rainy day or in an environment where the control valve is exposed to drops or splashes of water, in order to avoid possible electric leakage and subsequent damage to the instruments.
- For wiring, use wires having an enough capacity for the performance of the instruments.
- Make certain that the wires connected to the instruments may not allow rain water and other water to run from the lead-in wires into the instruments.

(1) For direct connection of signals (20 -100 Kpa) from controller to this control valve
Connect an air piping to the instrument air inlet shown in the structural drawing in Section 5.
(2) For control valve fitted with accessories
Connect pipes and wires to the instruments, referring to the furnished manuals for the accessories to the control valve.

4. Preparations for Operation, and Operation

4-1. Preparations for Operation

All adjustments based on your order specifications received by GEKO are completed before the control valve is shipped from the factory. However, in view of possible shocks or impacts on the control valve during its transportation and installation work, check its performance in combination with the controller after completion of the installation work.

> ⚠ **CAUTIONS**
>
> - If the actuator of your control valve is fitted with accessories, do not prepare for operations on a rainy day or in an environment where the control valve is exposed to drops or splashes of water, to avoid possible electric leakage and performance degradation.
> - For accessories that require power supply, check the voltage specified on their nameplates for conformance to your power source before connecting them to the power source. If your power supply do not meet the voltage specified on the nameplates, adjust your power supply to meet the specified voltage.
> - The operating source of the actuator should be dry, clean air. Make sure that the air pressure does not exceed the set pressure shown in the specifications. When it needs to be changed, contact GEKO for advice.
> - Make sure that air is not leaking from the instrument air pipe connections and from the diaphragm joints (around the actuator).
> their nameplates for conformance to your power source before connecting
> If air is leaking, disassemble the actuator (see Item 10-2) and stop the air leakage.

(1) Adjustment of accessories
When an adjustment is needed for an accessory, follow the instructions given in the manual for that accessory. To check the strokes of the valve for adjusting the positioner, use a dial gauge or a stroke detector equivalent to a dial gauge.

(2) Adjustment of off-balance actuator (The encircled part numbers correspond to the numbers used in the structural drawings in Section 5)
During transportation, storage or installation, the actuator off-balance will not get out of order. If, however, the actuator was separated from the valve assembly during the installation work of the control valve by some reason or other, perform adjustment by the procedure as follows.

- Prepare an air pressure reducing valve, and a pressure gauge of JIS 1.0 class.
- Make sure of the spring range and the supply air pressure by the nameplate of the control valve.
- Keep the hexagon socket head bolt **131** and the yoke connector **112** in a disassembled state.
- Allow the valve stem in closed condition.
- Using the air pressure reducing valve and the pressure gauge of JIS 1.0 class, apply

air pressure at the specified level to the instrument air inlet as follows.

(a) Direct action (valve closed under increased instrument air pressure)

★ Apply air pressure at a spring range upper limit level.

★ Engage the yoke connector with the thread of the actuator rod **106** and the thread of the valve stem, and then securely tighten them with the hexagon socket head bolt **131**. If it is not easy to engage them properly with each other, slightly reduce the air pressure from the spring range upper limit level and try again to engage them.

★ By varying the air pressure to the extent of the spring range, check to see if movement at specified strokes is performed. If your control valve is fitted with a positioner, adjust and check it as stated in Item (1) above.

(b) Reverse action (valve open under increased instrument air pressure)

★ Apply air pressure at a spring range lower limit level.

★ Engage the yoke connector with the thread of the actuator rod and **106** the thread of the valve stem, and then securely tighten them with the hexagon socket head bolt **131** . If it is not easy to engage them properly with each other, slightly increase the air pressure from the spring range lower limit level and try again to engage them.

★ By varying the air pressure to the extent of the spring range, check to see if movement at specified strokes is performed. If your control valve is fitted with a positioner, adjust and check it as stated in Item (1) above.

4-2. Operation

⚠ **CAUTIONS**

- During operation, keep the covers of the accessories and the wiring terminal box securely closed. If the control valve is operated with those covers left open, rain water or liquids from the immediate vicinities may enter it to cause electric leakage or shocks, or failure of the accessories.

(1) Manual operation

Manual operation is available for opening or closing the valve when operating air pressure is not available. (Option)

⚠ CAUTIONS

- At the completion of manual operation, be sure to return the handle shaft to the given position (where the c1earance between the handle shaft and the end of the slot in the MO cover shown in Fig. 4-1,4-2 is 0 to approximately 1 mm). If the handle shaft is not returned to its original position, the number of strokes during automatic operation will become insufficient. Also if an undue force is given after it passes the given position, it may damage the manual operation mechanism.

- Turning the handle clockwise moves the valve stem to close the valve, and turning the handle counterclockwise moves the valve stem to open the valve.
- During automatic operation, be sure to always keep the handle in its proper position.

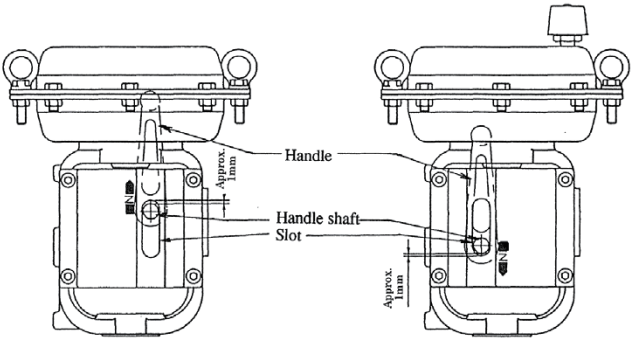


Fig.4-1 Direct action (DA) type

Fig. 4-2 Reverse action (RA) type

5. Structure

5-1A . Actuator

The actuator receives air pressure signals from the controller or air pressure output from the positioner by its diaphragm, and determines its output and position by means of force balancing with the spring. The actuator comprises mainly of a steel plate diaphragm case, a rolling diaphragm, multiple (4 to 8) springs, and an output shaft. Each model of the actuator is divided into two types: a direct action type (having a valve arranged to be closed when air pressure to the diaphragm chamber is increased),and a reverse action type (having a valve arranged to be opened when air pressure to the diaphragm chamber is increased).

(1)PD3021LA,PD3027LA(stroke less than 30mm)

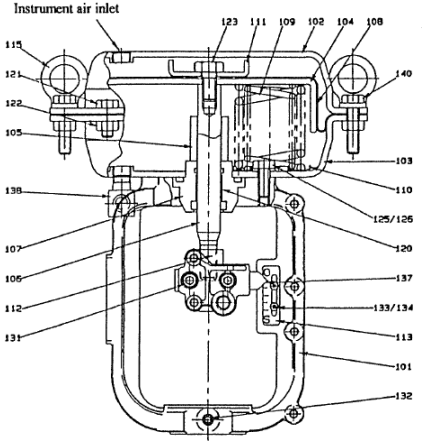


Fig.6-1A Direct action type(PD3021,3027)

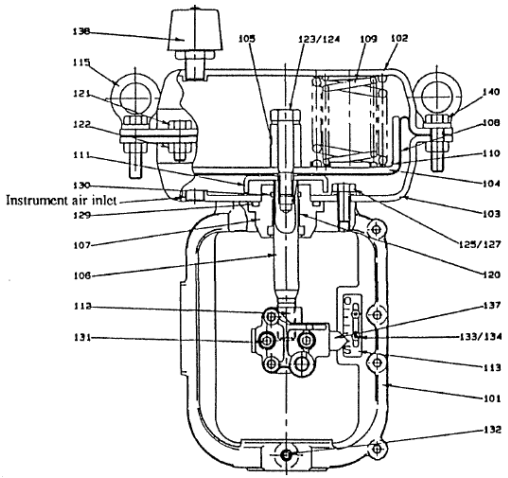


Fig.6-1B Reverse action type(PD3021,3027)

NO.	Designation
101	Yoke
102	Diaphragm case-Upper
103	Diaphragm case-Lower
104	Diaphragm plate
105	Stopper
106	Actuator rod
107	Guide holder
108	Diaphragm
109	Spring
110	Spring seat
111	Center plate
112	Yoke connector
113	Scale board
115	Eye metal
120	Dry bearing
121	Hexagon bolt
122	Hexagon nut
123	Hexagon bolt
124	Spring washer
125	Hexagon bolt
126	Spring washer
127	Seal washer
129	O-ring
130	O-ring
131	Hexagon socket head bolt
132	Hexagon bolt
133	Pan head machine screw
134	Speed nut
137	Pointer
138	Exhaust plug
140	Hexagon bolt

Fig.5-2 Reverse action type(PD3021,3027)

(2)PD3035LA,PD304SLA(stroke less than 40mm)

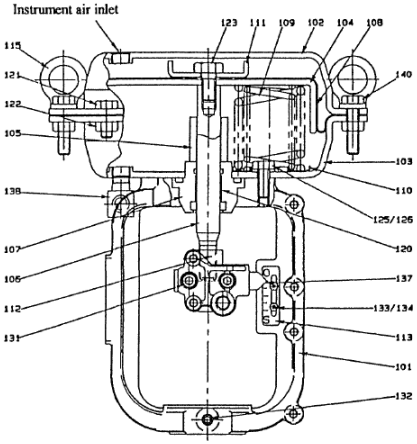


Fig.5-3 Direct action type(PD3035,304S)

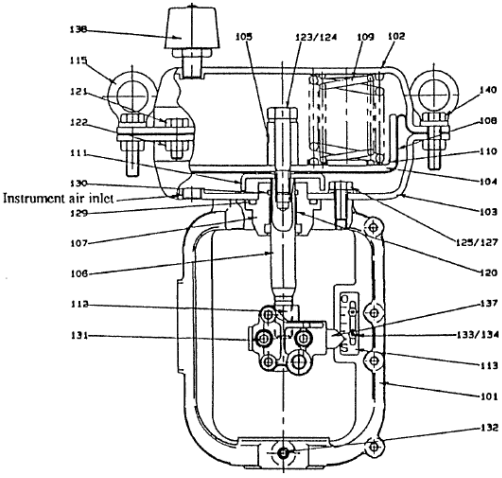


Fig.5-4 Reverse action type(PD3035,304S)

NO.	Designation
101	Yoke
102	Diaphragm case-Upper
103	Diaphragm case-Lower
104	Diaphragm plate
105	Stopper
106	Actuator rod
107	Guide holder
108	Diaphragm
109	Spring
110	Spring seat
111	Center plate
112	Yoke connector
113	Scale board
115	Eye metal
120	Dry bearing
121	Hexagon bolt
122	Hexagon nut
123	Hexagon bolt
124	Spring washer
125	Hexagon bolt
126	Spring washer
127	Seal washer
129	O-ring
130	O-ring
131	Hexagon socket head bolt
132	Hexagon bolt
133	Pan head machine screw
134	Speed nut
137	Pointer
138	Exhaust plug
140	Hexagon bolt

(3) PD304LLA,PD304ELA(stroke 50~80mm)

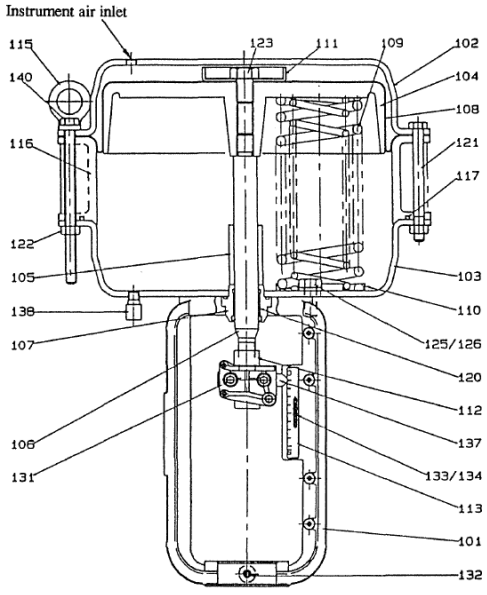


Fig.5-5 Direct action type(PD304L,304E)

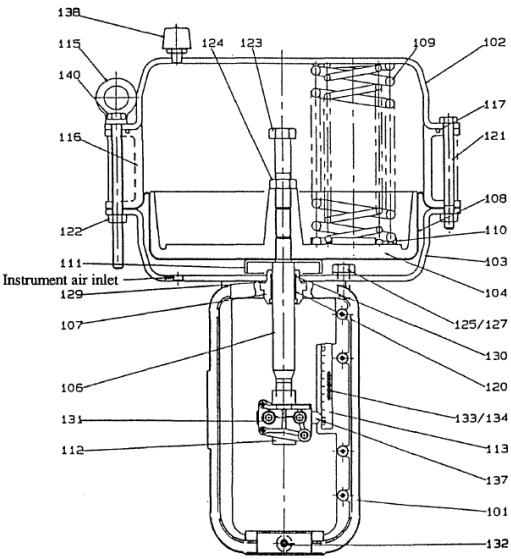


Fig.5-6 Reverse action type(PD304L,304E)

NO.	Designation
101	Yoke
102	Diaphragm case-Upper
103	Diaphragm case-Lower
104	Diaphragm plate
105	Stopper
106	Actuator rod
107	Guide holder
108	Diaphragm
109	Spring
110	Spring seat
111	Center plate
112	Yoke connector
113	Scale board
115	Eye metal
116	Spacer
117	O-ring
120	Dry bearing
121	Hexagon bolt
122	Hexagon nut
123	Hexagon bolt
124	Spring washer
125	Hexagon bolt
126	Spring washer
127	Seal washer
129	O-ring
130	O-ring
131	Hexagon socket head bolt
132	Hexagon bolt
133	Pan head machine screw
134	Speed nut
137	Pointer
138	Exhaust plug
140	Hexagon bolt

5-2. Manual Operation Mechanism

The manual operation mechanism to open or close this control valve, optionally available for applications where no operating pneumatic source is available, has a structure shown in Figs. 5-7 through 5-10.

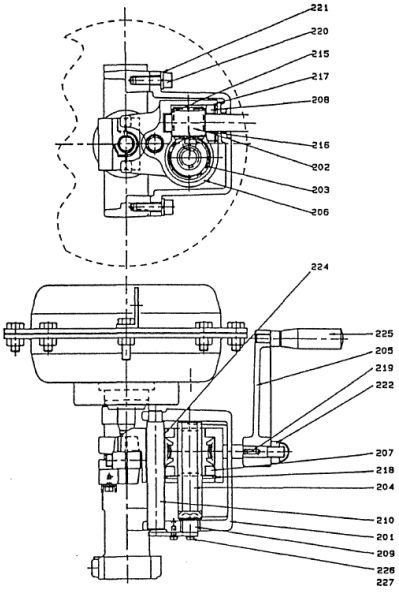


Fig.5-7 Direct action type
(PD3021LA,3027LA,3035LA,304SLA)

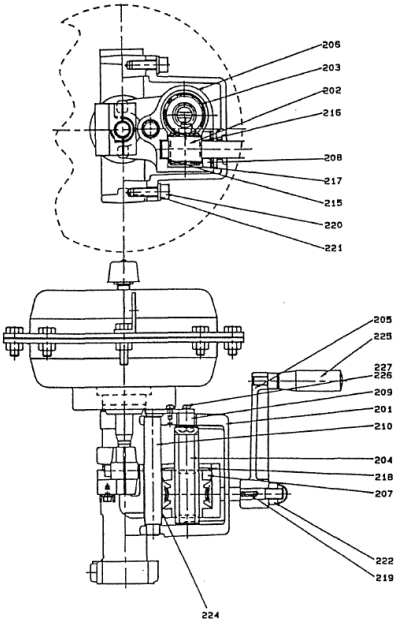


Fig. 5-8 Reverse action type
(PD3021LA,3027LA,3035LA,304SLA)

NO.	Designation	NO.	Designation	NO.	Designation
201	MO Unit cover	209	Whirl stopper	221	Countersunk head washer for hexagon socket head bolt
202	Worm (Handle shaft)	210	Guide shaft	222	U-nut with cap
203	Worm wheel	215	DU bush	224	DU bush
204	Screw rod	216	DU bush	225	Plastic grip
205	Crank handle	217	C-ring	226	Cross recessed head machine screw
206	Slide nut	218	C-ring	227	Spring washer
207	Worm wheel guide	219	C-ring		
208	Worm guide holder	220	Hexagon socket head bolt		

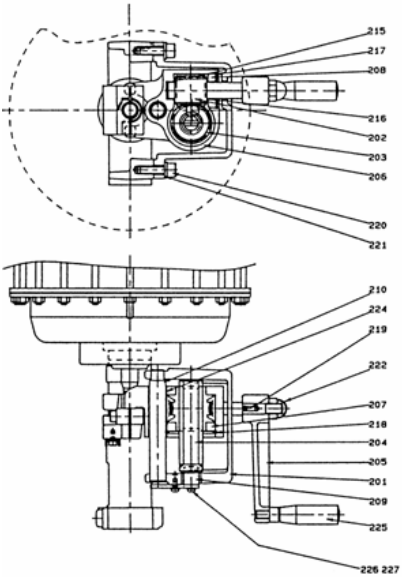


Fig.5-9 Direct action type
(PD304LLA,304ELA)

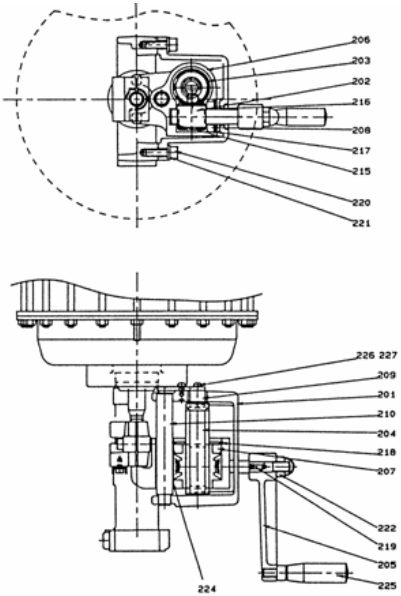
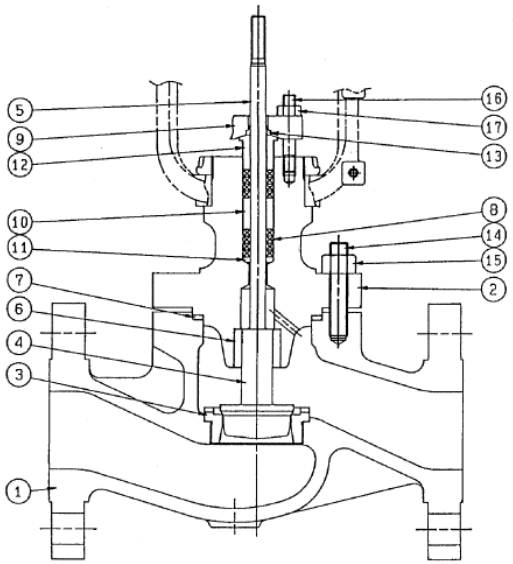


Fig. 5-10 Reverse action type
(PD304LLA,304ELA)

NO.	Designation	NO.	Designation	NO.	Designation
201	MO Unit cover	209	Whirl stopper	221	Countersunk head washer for hexagon socket head bolt
202	Worm (Handle shaft)	210	Guide shaft	222	U-nut with cap
203	Worm wheel	215	DU bush	224	DU bush
204	Screw rod	216	DU bush	225	Plastic grip
205	Crank handle	217	C-ring	226	Cross recessed head machine screw
206	Slide nut	218	C-ring	227	Spring washer
207	Worm wheel guide	219	C-ring		
208	Worm guide holder	220	Hexagon socket head bolt		

5-3. Valve Assembly

The Series-GKV1 Series Top guided globe has a structure as illustrated in Fig.5-11;the seat ring is fitted in the globe valve body for centering the plug with the bonnet by means of the guide which is pressure fitted in the bonnet. The bonnet and body are very simple in structure for centering with the spigot.



NO.	Designation
1	Body
2	Bonnet
3	Seat ring
4	Plug
5	Stem
6	Guide
7	Gasket
8	Gland packing
9	Gland flange
10	Lantern ring
11	Packing seat
12	Gland ring
13	Wiper
14	Body stud bolt
15	Hexagon nut
16	Gland stud bolt
17	Hexagon nut
23	Gland spring
24	TV seat

Fig.5-11 Internal structure and parts name

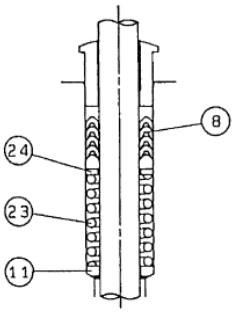


Fig.5-12 Gland packing structure detail
(Teflon V Packing)

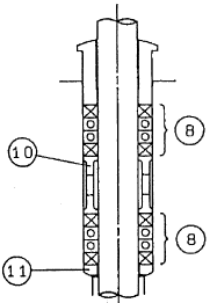


Fig.5 Gland packing structure detail
(Square Packing)

6. Principle of Operation

6-1. Direct Action Type

(For the construction and the encircled part numbers, please refer to Figs. 5-1， 5-3 and 5-5.)

The Direct Action Type designates the action to close the valve by increasing air pressure into the diaphragm chamber.

When air pressure is supplied through the instrument air inlet of the diaphragm case-Upper **102** into the diaphragm chamber, which is formed by the diaphragm case-upper and the diaphragm **108** , the force generated by the action of the diaphragm and the diaphragm plate **104** tightly fixed to the diaphragm compresses the spring **109** downwards. The compressed spring moves down the actuator rod **106** fixed to the diaphragm chamber is reduced, the reaction force of the spring against the compression moves up the diaphragm, the diaphragm plate, and the actuator rod.

6-2.Reverse Action Type

(For the construction and the encircled part numbers, please refer to Figs. 5-2， 5-4 and 5-6.)

The Reverse Action Type designates the action to open the valve by increasing air pressure into the diaphragm chamber.

When air pressure is supplied through the instrument air inlet of the diaphragm case-lower **103** into the diaphragm chamber, which is formed by the diaphragm case-lower and the diaphragm **108** , the force generated by the action of the diaphragm and the diaphragm plate **104** tightly fixed to the diaphragm compresses the spring **109** upwards. The compressed spring moves up the actuator rod **106** fixed to the diaphragm and the diaphragm and the diaphragm plate. Thereafter, when the supply air pressure to the diaphragm chamber is reduced, the reaction force of the spring against the compression moves down the diaphragm, the diaphragm plate, and the actuator rod.

7. Daily Inspection and Periodic Inspection

7-1. Daily Inspection

> **CAUTIONS**
>
> When carrying out daily inspection of this control valve, observe the cautions given in 4-1, Preparations for Operation.

If your control valve is important for the operation of your pipeline in which it is installed, carry out daily inspection as follows.

- For prevention of malfunctions, check the instrument air inlet pipe connection for air leakage.
- Check the gland packing and the gasket for fluid leakage. If fluid leakage from any of them is detected, check the valve stem for injuries. If the valve stem is found intact, retighten the gland packing while checking the operating condition.
- If your control valve is equipped with a positioner, check to see if the valve operates without hunting, and to see if the valve stem operates smoothly.
- When the control valve is operating, check to see if the control valve and its piping are free of vibration.

If any defect not repairable soon on the spot should be detected by daily inspection, repair it later when the plant can be shutdown, or contact GEKO Services. 7-2. Periodic Inspection

> **WARNING**
>
> - When carrying out periodic inspection, follow the warnings given in:
>
> 4-2. Operation 10. Disassembly and Reassembly

> **CAUTIONS**
>
> - When carrying out periodic inspection, observe the cautions given in:
>
> 3-4. Piping and Wiring 4-1. Preparations for Operation
> 4-2. Operation 10. Disassembly and Reassembly

7-2-1. Monthly or Bimonthly Inspection

Inspect all your control valves as follows.

- For prevention of malfunctions, check the instrument air inlet pipe connection for air leakage.
- Check the gland packing and the gasket for fluid leakage. If fluid leakage from any of them is detected, check the valve stem for injuries. If the valve stem is found intact, retighten the gland packing while checking the operating condition.
- If your control valve is equipped with a positioner, check to see if the valve operates without hunting, and to see if the valve stem operates smoothly.
- When the control valve is operating, check to see if the control valve and its piping are free of vibration.

If any defect not repairable soon on the spot should be detected by this periodic inspection, repair it later when the plant can be shutdown, or contact GEKO Services.

7-2-2. Annual or Biannual Inspection

Inspect, confirm, lubricate and/or replace the following parts.

* This inspection should advisably be carried out by experienced GEKO service engineers.

(1) Actuator

- Lubricate the inside of the cylinder and the guide of the piston rod.

  GEKO recommended oil:

Standard use	:	Molybdenum Grease No.2(IDEMITSU Daphne)
High-temperature use	:	Molybdenum Grease No.2(IDEMITSU Daphne)
Low-temperature use	:	Super CoronexNo.1 (IDEMITSU Daphne)

- Check the diaphragm for cracks and ply breaks
- Check the bolts and nuts for injuries and dimensional loss by corrosion. Replace defective parts, if any, with new ones.

(2) Valve Assembly

- Dismount the bonnet from the body in accordance with the valve disassembling procedure. Check the vales part of wear, tear and other damage. Replace damaged parts, if any, with new ones.

8. Troubleshooting and Remedies

Symptom	Possible Cause	Remedy
• No operation (Operation too slow)	• Air pressure supply too low	• Supply air pressure at a specified level.
	• Air supply piping clogged or leaking	• Clean piping inside, further tighten pipe connections, or replace defective pipe.
	• Air leakage from between cylinder and cylinder cover	• Retighten, or disassemble and correct (or replace).
	• Air leakage from upper and lower portions of actuator output shaft	• Disassemble and replace O-ring.
	• Defective accessories: Positioner, booster relay, solenoid valve, lock valve, etc.	• Try to apply air pressure directly to the instrument air inlet of the actuator instead of applying it through the accessories. If this operates the control valve normally, inspect, and readjust or replace defective accessories (positioner, booster relay, etc.).
	• Valve assembly or actuator out of order	• Remove the connector, and check the operation of the actuator only. If the actuator does not function properly, disassemble and correct the actuator. If the actuator is properly functional, disassemble and correct the valve assembly.
	• Manual operation handle is in a manual operation position.	• Return it to its original position shown in Figs.5 in 4-2(1)
	• Improper sensitivity of the positioner	• Replace the capacitance spring, following the instructions given in the manual for the positioner.
• Unstable operation (Accompanied by hunting)	• Load fluctuations by controlling fluid (Insufficient actuator output)	• Use a larger actuator.
	• Fluctuations of signals from the controller	• Change controller setups, or check the signaling system.
	• Fluctuations in supply air pressure	• Recheck the pressure air supply pipe diameter or replace.
	• Defective reducing valve	• Repair or replace the reducing valve.
• Leak from valve seat	• Insufficient output from the actuator, or injured valve seat.	• Check and adjust the actuator for off-balance condition as described in 4-1(2) • Disassemble and correct the valve seat (or replace parts if necessary).
• Leak from gland packing/gasket	• Loosened nut, injured valve stem, or degraded or hardened packing gasket.	• Tighten loose nuts, or replace packing gasket. Repair valve stem surface, or replace.

9. Preparations for Disassembly

WARNING

- Before disconnecting this control valve from the process piping for disassembly and inspection purpose, disassemble the valve bonnet with the valve body kept connected with the piping. Before setting about inspecting and repairing the inside of the control valve, make certain that the pressure in the control valve is the atmospheric pressure and that the temperature is not higher than 45°C.
- If your control valve is used for controlling a fluid powerfully poisonous to persons, make certain that the inside of the control valve has been thoroughly cleaned, and then proceed to disassemble it.

10. Disassembly and Reassembly

10-1.Separation of Actuator from Valve Assembly

WARNING

This control valve is heavy and therefore needs to be handled carefully and properly, following the instructions given below. Failure to observe these instructions may causeserious injuries on persons.

- For hoisting up this control valve, use a suitable hoisting machine conforming to the requirements of the labor safety and hygiene acts. After hoisting it up, securely mount the valve assembly on a metal rest, following the instructions given below.

(1) Place the valve assembly on a metal rest that supports the valve assembly stably. Use a spacer to prevent the metal rest from directly contacting the gasket face of the flange.

(2) If the control valve is small-sized, use copper, aluminum or other soft metal plate pads to protect the gasket face of the flange against injuries, and fix the valve assembly using a vice.

- When cleaning disassmbled part, wear protective glasses. Do not expose your bare hands directly to the cleaning solution, but wear rubber gloves.

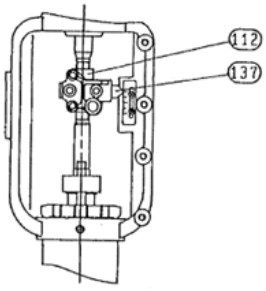


Fig.11

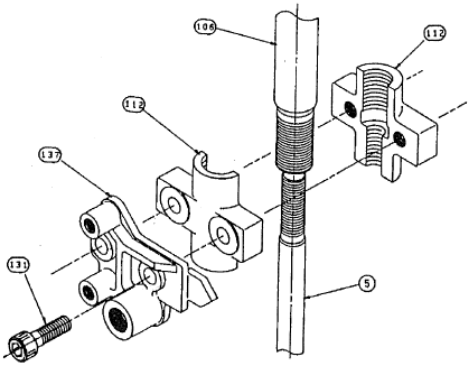


Fig.12

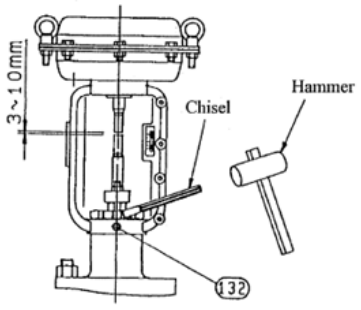


Fig.13

To separate the actuator from the valve assembly, follow the procedure given below.

- For the purpose of protecting the valve seat surfaces against damage during the work of separating the actuator from the valve assembly:

  For Direct Action Type-Keep the pressure in the diaphragm chamber at zero (i.e., keep the valve open).

  For Reverse Action Type-Apply air pressure into the diaphragm chamber, and keep the valve 10% to20% open.

- Loosen the hexagon socket head bolt **131** that is clamping the yoke connector **112** as shown in Figs.11 and 12, and remove the yoke connector. The valve assemble now is as shown in Figs.13.

•Apply the end, having a rectangular form, of a chisel into the recession of the yoke nut as shown in Fig. 13, and hit the chisel with a hammer to loosen the yoke nut. Note, however, that the direction of the chisel application shown in Fig. 13 is the direction to tighten the yoke nut. Since the yoke nut has a right-hand thread, turn the yoke nut counterclockwise as viewed from the actuator side, to loosen it.

•Loosen the hexagon bolt **132** shown in Fig.13, and the actuator will be ready for separation from the valve assembly.

10-2 Disassembly of Actuator

For the encircled numbers used in this subsection, refer to Fig.6-1,6-2,7-1 and 7-2.

WARNING

- Before starting this disassembling work, ensure that the inside of the diaphragm chamber is at the atmospheric pressure. Faliure to observe this warning can cause injuries to persons induced by compressed air.
- Use of incorrect procedure will cause the spring to pop out which may lead to a hazard of injury. Be sure to follow the disassembling procedure.

CAUTIONS

- Carefully perform the disassembling work to avoid injuring the outside and inside surfaces of the diaphragm and the surfaces of the actuator rods.
- Visually inspect the following surfaces of the diaphragm and actuator rod assembly, and do not disassemble it into parts if any faults should be detectde by the visual inspection:

  Outside and inside surface or the diaphragm

  Actuator rod surfaces

(1) Disassembly of actuator - Direct action type

- Without loosening the hexagon nut **122** holding the hosting fixture, loosen the other hexagon nut **122** and remove the hexagon bolt **121** .
- Evenly loosen the hexagon nuts **122** that are fastening the two long hexagon-head hanger bolts, and remove the long hexagon bolts.

The initial load of the springs is preset by these two long hexagon bolts and nuts. With these bolts and nuts now removed, the springs are let to elongate to their free length.

- Remove the diaphragm case-upper **102** .

- Pull off, then, the diaphragm and actrator rod assembly (the diaphragm 1**08** ,diaphragm plate **104** ,actrator rod **106** , center plate **111** ,and hexagon bolt **123** from the guide holder **107** .

To disassemble the diaphragm/actuator rod assembly, follow the procedure given below. The jointed portion is coated with locking cement to prevent loosening.

★ Type PD3021LA,PD3027LA: Joint between the hexagon bolt **123** and the actuator rod.

★ Type PD3035LA,PD304SLA,PD304LLA,PD304ELA:Joint between the diaphragm plate **104** and the actuator rod.

- Type PD3021LA,PD3027LA: When loosening the hexagon bolt **123** , tighten the double-hexagon nut at the yoke connector mounting screw of the actuator rod and hold it with a spanner. In this way, the hexagon bolt **123** can be loosened for disassembly.
- Type PD3035LA,PD304SLA,PD304LLA,PD304ELA: Loosen and remove the hexagon bolt **123**, then remove the center plate and diaphragm. Hold the projection(actuator rod side) of the diaphragm plate with a vice and tighten the double-hexagon nut at the yoke connector mounting screw of the actuator rod, and attach a spanner to the double-hexagon nut. In this way, the actuator rod can be disassembled.
- Loosen the hexagon bolt **125** . The diaphragm case-lower **103** ,spring washer **126** and guide holder **107** can be disassembled.
  The above completes the disassembled. Check all the parts and replace damaged parts with new ones.

(1) Disassembly of actuator-Reverse action type

- Without loosening the hexagon nut **122** that is fastening the bolt having an eye for hoisting, loosen the other hexagon nut **122** and remove the hexagon bolt **121** .
- Evenly loosen the hexagon nuts **122** that are fastening the two long hexagon-head hanger bolts, and remove the long hexagon bolts.

  The initial load of the springs is preset by these two long hexagon bolts and nuts.

  With these bolts and nuts now removed, the springs are let to elongate to their free length.
- Remove the diaphragm case-upper **102** .

  For Models PD304LLA and PD304ELA, also remove the spacer **116** .
- Remove the spring **109** and the spring seat **110** .
- Pull off, then the diaphragm and actuator rod assembly the diaphragm **108** , diaphragm plate **104** , actuator rod **106** , center plate **111** , stopper **105** and hexagon bolt **123** from the guide holder **107** .

  However in Models PD3035LA, PD304SLA, PD304LLA and PD304ELA, a stopper mechanism consisting of a hexagon bolt **123** and a spring washer **124** is employed instead of the stopper **105** .

To disassemble the diaphragm and actuator rod assembly, follow the procedure given below. Note that the following threaded joints are coated with thread locker for prevention of the loosening of the joints:

★ For Models PD3021LA and PD3027LA-Threaded joint of the hexagon bolt **123** and the actuator rod.

★ For Models PD3035LA, PD304SLA and PD304ELA-Threaded joint of the diaphragm plate **104** and the actuator rod.

- For the Model PD3021LA or PD3027LA, fasten the yoke connector locking thread of the actuator rod with double nuts and, while holding the double nuts with a spanner, loosen the hexagon bolt **123** ,and then remove the spring washer **124** and the stopper **105** .
- For the model PD3035LA, PD304SLA, PD304LLA, PD304ELA, loosen the hexagon nut **124** and remove the hexagon bolt **123** .While holding by a vice the diaphragm plate protrusion from which the hexagon nut has been removed, fasten the yoke connector locking thread of the actuator rod with double hexagon nuts and, by utilizing the double hexagon nuts, disassemble the assembly into parts.
- Loosen and remove the hexagon bolt **125** , and the seal washer **127** , the diaphragm case-lower **103** , and the guide holder **107** will be ready for removal.

The control valve is now disassembled. Check each part of the valve. Damaged parts should be replaced with new ones.

(2) Disassembly of manual operation mechanism

- Remove the hexagon socket head bolt **220** ,and the manual operation mechanism will be easily separable as an assembly from the yoke **101** .

  In this state of the manual operation mechanism as a separated assembly, its internal parts can be inspected for wear and tear. If the whole assembly are free of fault, it need not be disassembled. If any part of it is found faulty, we recommend you to have the manual operation mechanism repaired by GEKO Services, or to replace it, preferably as an assembly.
- Remove the U-nut with cap **222** , and the crank handle **205** will be easily dismountable.
- Remove the cross recessed head machine screw **226** , the whirl stopper **209** , and the guide shaft **210** in this order, from the MO unit cover **201** .
- The slide nut assembly is ready to be removed.
- Remove the C-ring **217** of the slide nut assembly, and the worm guide holder **208** and the worm **202** will be easily removable.
- Remove the C-ring **218** of the slide nut assembly, and the worm wheel guide **207** and the worm wheel **203** will be easily removable.

The control valve is now disassembled. Check each part of the valve. Damaged parts should be replaced with new ones.

10-3. Disassembly of Valve Assembly

WARNING

- If your valve assembly is large-sized, its body and bonnet are heavy, and use sufficient care so as not to allow the body or bonnet slip your hands when you handle it. The body or the bonnet, if allowed to slip off down your hands, may injure your hands and feet or break their bones.
- Always wear protective glasses whenever you work on the valve assembly to remove its rust or repair its damaged parts by grinding.

CAUTIONS

- Care should be taken not to damage the gasket on the flange.
- Do not put disassembled parts directly on a concrete, tiled or other hard floor.

To disassemble the valve assembly, use the following procedure.

- Remove the hexagon nut **19** , and dismount the bonnet **2** from the valve body **1** .
  In case of a small-sized valve, the plug **5** , the stem **6** , the balance cylinder **8** and the cage **4** may be dismounted together with the bonnet, be careful not to drop them as they are lifted up.
- Remove the plug assembly **5** and **6** . If the plug assembly has been dismounted together with the bonnet in the preceding step, pull out the plug assembly in the direction opposite to the gland packing. The plug and the stem are welded together, and do not separate them from each other.
- Pull out the balance cylinder **8** , balance seal **7** , cage **4** , seat ring **3** and seat gasket **9** in this order from the valve body.

Do not damage the cage inside surface and the plug outside surface.

- Remove the hexagon nut **21** and then the gland flange **17** , wiper **16** and gland ring **15** to separate the gland packing.

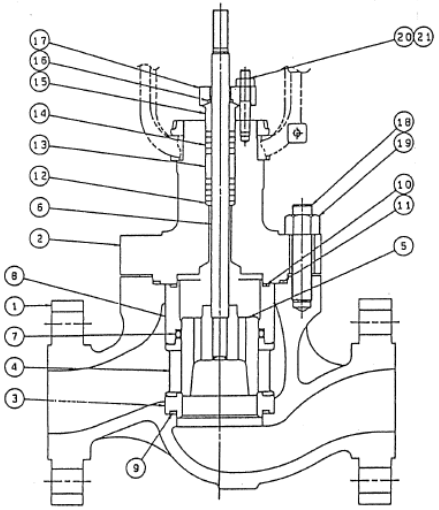


Fig.14

(2) Example of seat ring disassembling(tightening) procedure

Disassemble the seat ring by following the procedure given below.

As shown in Fig.10-4, attach the guide flange to the position from which the bonnet has been removed. Remove the seat ring using an air pressure impact wrench or a spanner at the corner of the disassembling jig. The screw of the seat ring can be loosened by turning the jig counterclockwise. Turn the jig 1 to 2 times and remove the guide flange, then the seat ring can be loosened without loosening the guide flange. The tightening torque of the impact wrench should be 1.3-1.5 times the tightening torque for the seat ring shown in Table 10-1.

Fig.10-5 shows an example of assembling the T-type disassembling jig and the guide flange.

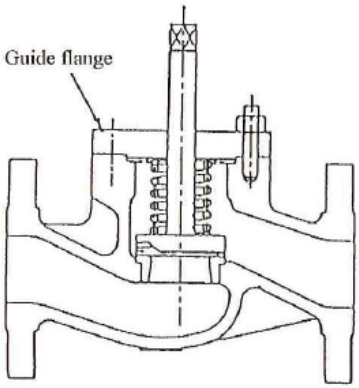


Fig.10-4

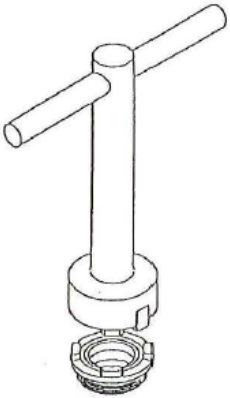


Fig.10-5

Valve size	Tightening torque
DN20,DN25(0.75B,1B)	150 N.m
DN40,DN50(1.5B,2B)	275 N.m
DN65,DN80(2.5B,3B)	365N.m
DN100(4B)	470 N.m

(2) Mounint the balance seal

•Material: Tefron/SUS316

Mount the balance seal **7** on the balance cylinder **8** in the direction shown in Fig.17-1.

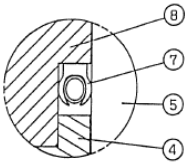


Fig.17-1 Tefron/SUS316

• Material: Grafoil

Mount the Grafoil on the balance cylinder 8 as shown in Fig.17-2 and 17-3. Note that the number of spacers varies with plug size.

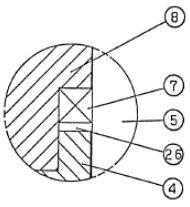


Fig.17-2
Plug size: 4B and under

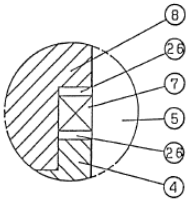


Fig.17-3
Plug size: 6B and above

(3) Tightening the Gasket

> ⚠ **CAUTIONS**
>
> • Fasten the bonnet evenly till reaching a torque value listed in Table 1 .

After mounting the bonnet **2** in position, and while holding it in a condition evenly and lightened by the hexagon nuts **19**, tentatively repeat moving up and down the plug assembly **5** and **6** to come into and out of contact with the valve seat several times.
This tentative operation will complete centering the seat ring, the plug assembly, and the bonnet. Then, using a torque wrench, permanently and evenly tighten the hexagon nuts **19** to a torque value specified in Table 1, in a manner of tightening one nut and then its diagonal nut.

Table 1. Gasket tightening torque

Valve size	Body rating		
	JIS 10K ANSI (JPI) 150#	JIS 20K , 30K ANSI (JPI) 300#	JIS 40K ANSI (JPI) 600#
1.5B(40A)	72N • m	72N • m	120N • m
2B(50A)	72N • m	72N • m	170N • m
3B(80A)	170N • m	170N • m	330N • m
4B(100A)	170N • m	170N • m	450N • m
6B(150A)	450N • m	450N • m	840N • m
8B(200A)	570N • m	570N • m	840N • m
10B(250A)	1200N • m	1200N • m	2100N • m
12B(300A)	1200N • m	1200N • m	2100N • m

(4) Mounting the gland packing

> **CAUTIONS**
>
> - Pay attention to the mounting procedure of the gland packing. It should be mounted in the order shown in Fig.18 and 19.
> - Care should be taken not to damage the surfaces (inside and outside, and Cage and bottom) of the gland packing.
> - When the gland packing is a Teflon V packing, make sure that the mounting direction is correct.
> - When tightening the gland packing, refer to Table 2 and 3.

When mounting the square type molded gland packing, the cut portion of each ring should be shifted by 90 degrees as shown in Fig.10-6.

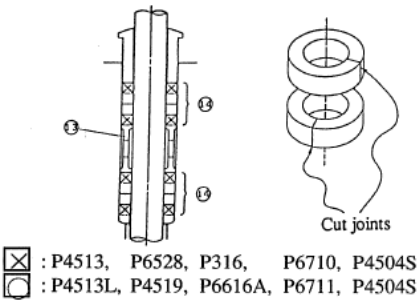


Fig. 18

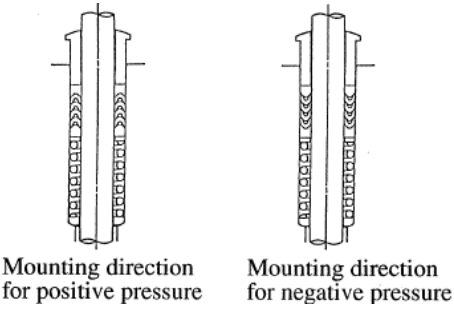


Fig. 19

Table 2. Square type mold gland packing tightening torque(Unit: N.m)

Check the packing material to be used against the corresponding packing symbol shown below and select the tightening torque.

Body rating	Stem diameter (mm)	Packing material				
		P4513 P4513L	P6528 P4519	P316 P6616A	P6710 P6711	P4504S P4504S
ANSI 150#	14	2.3	2.3	2.5	2.5	2.3
	17	2.8	2.8	3.0	3.0	2.8
	25	7.0	7.0	7.5	7.5	7.0
	38	23.0	23.0	25.0	25.0	23.0
ANSI 300#	14	3.0	3.0	3.5	3.5	3.0
	17	3.5	3.5	4.0	4.0	3.5
	25	9.0	9.0	10.0	10.0	9.0
	38	31.0	31.0	34.0	34.0	31.0
ANSI 600#	14	4.0	4.0	4.5	4.5	4.0
	17	4.5	4.5	5.0	5.0	4.5
	25	11.5	11.5	12.5	12.5	11.5
	38	38.0	38.0	42.0	42.0	38.0

Table 3. Teflon packing

Tighten the hexagon nut **21** using the following table as a standard.

Stem diameter (mm)	Tightening quantity
14	5 pitch (approx5. mm)
17	6 pitch (approx7. mm)
25	6 pitch (approx10. mm)

10-5. Reassembly of Actuator

Before reassembling the disassembled actuator, replace worn or otherwise damaged parts with new ones, and add a grease, recommend in 7-2-2, Annual or Biannual Inspection, to the friction parts of the actuator rod and the manual operation mechanism.

⚠ CAUTIONS

- When reassembling the diaphragm, take care to ensure that the side of the diaphragm to which air pressure is applied is the side having the rubber (GEKO-marked side).
- For replacement of the following parts, use brand-new ones.

Actuator Model	O ring	Seal washer
PD3021LA	P-16, P-44	W8
PD3027LA	P-20, P-44	W10
PD3035LA	P-22A, P-50A	W12
PD304SLA,PD304LLA,PD304ELA	P-28, P-50A	W16

10-6. Reassembly of Actuator and Valve Assembly

For reassembling the actuator and the valve assembly, follow the procedure stated below.

- Set the yoke in its original position before its disassembly, and fix it with the hexagon nut **132** , fully tighten the yoke nut as shown in Fig.10-3 using tools with same care as excercised when disassembling it.
- Push down the stem, and make certain that the plug is in contact with the seat ring.
- Repeat the off-balance adjusting procedure in 4-1(2).

11. Adjustment after Reassembly

On completion of the reassembly, check the performance as follows. If the performance is defective, re-disassemble the unit, find the cause of the defect, and reassemble it again.

- While applying air pressure at a specified level to the actuator, check for smooth operation.
- Perform the leak tests on the gasket and gland packing (it should be free from leak).
- Check to see if the leak rate of the valve seat is within the specified limit.
- Check to see if the hysteresis and the linearity are within the respective specified limit.

For reinstallation of the reassembled control valve in the piping, follow the procedure in Section 3, Installation.

12. Disposal of Product or Parts

In districts where the disposal of products or parts is undertaken in accordance with an act for the “disposal and cleanup of wastes” by a local public body or by industrial waste disposers authorized by the local governor, the disposal of this unit or its parts must be entrusted to such body.

⚠ CAUTIONS

- Do not incinerate the tetrafluoro-resin gland packing and the seat ring.
  If incinerated, they will be decomposed at high temperatures to emit poisonous fluoride gases, the inhalation of which is harmful to health.

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