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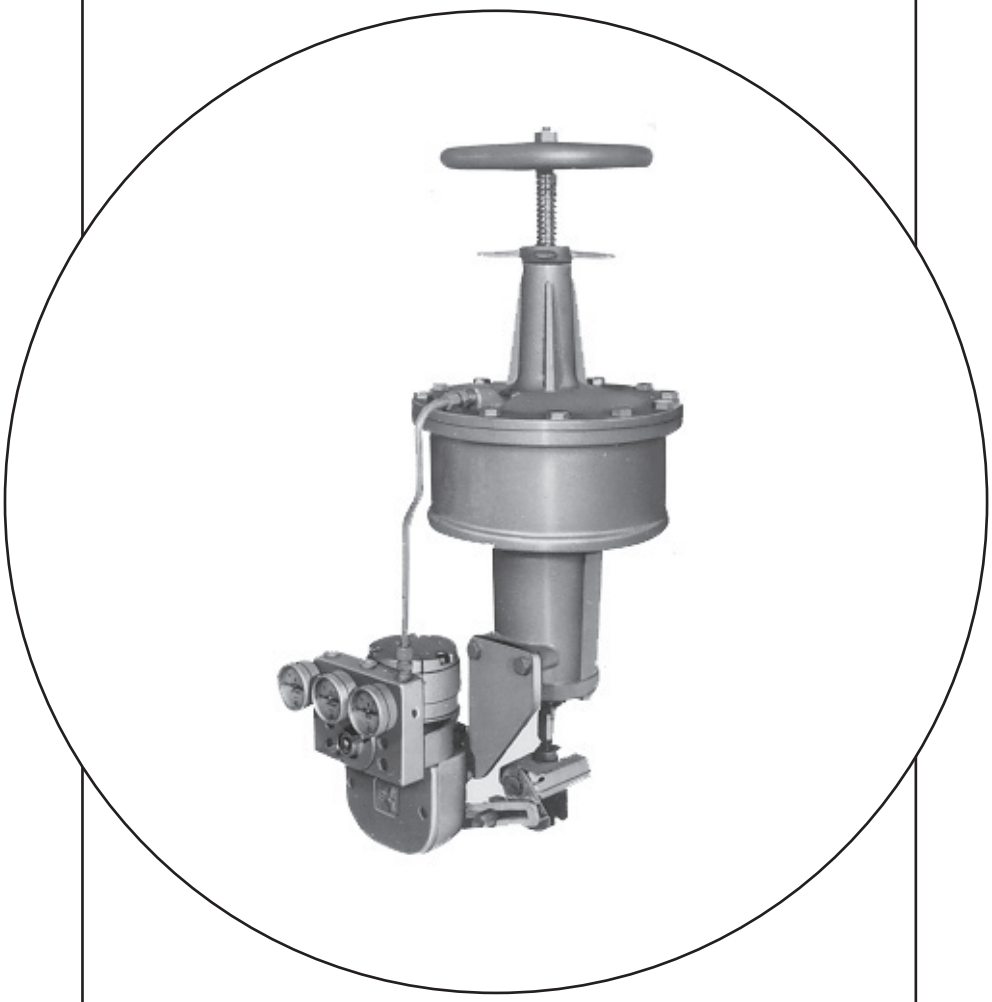
OM2-8210-0200

Pneumatic Cylinder Actuator (G-O-Moter)

Model : GOM

User's Manual



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1 Springless GOM (See Figures 1 and 2.)

The Springless GOM is a springless air piston cylinder which operates by a 4-way pilot valve. Air pressure applied to both sides of the piston plate causes the piston to move, and the position of the piston is maintained proportionally to the signal from a controller.

There are three types of piston, varing in cylinder diameter (100, 150, 250mm).

GOM can be used for the following applications:

- flue dampers, air and gas tube through valves, rotating dampers, butterfly valves, trough valves (liquid tube), high pressure valves, large control valves, single seated control valves, Saunders control valves, vane controls for blowers, small Bolton waterwheel pin valves, small Frances waterwheel gate rings, drum or linear adjustable resistors, transmissions, and mechanical controllers requiring proportional action. Without replacing any parts, up to approximately 70% of the rated stroke can be set by adjustment.

- Cautions -

GOM includes no anti-rotation fitting on the piston rod. Therefore, when it is used to generate forced rotation, you must install an external anti-rotation fitting.

1.1 Structure and Function

The GOM consists of a cylinder, pilot valve, and feedback mechanism. The cylinder causes the piston rod to move by an air pressure signal from the pilot valve. The pilot valve outputs an air pressure corresponding to the air signal pressure from the controller and maintains the piston rod at a position corresponding to the air signal pressure. The feedback mechanism transmits the piston stroke position to the pilot valve. This feedback action is achieved by inclination of a cam.

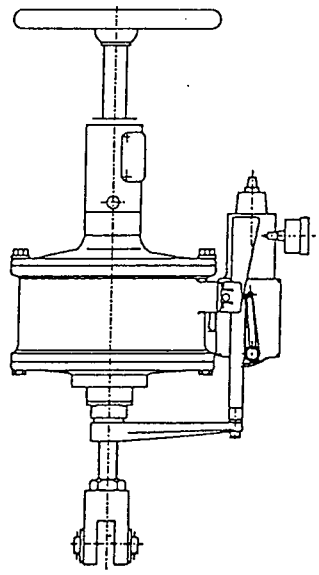


Figure 1. Vertical G-O-Motor with plate cam feedback mechanism

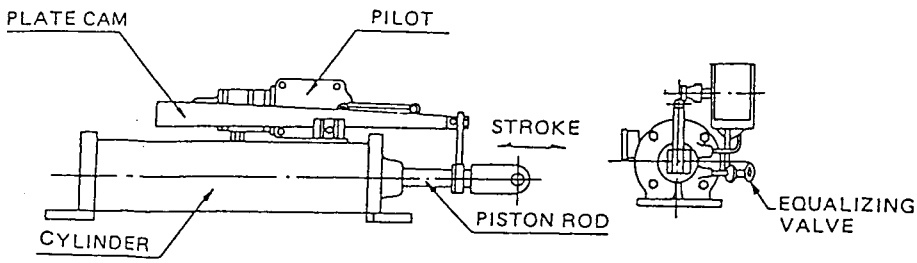


Figure 2. Horizontal G-O-Motor with plate cam feedback mechanism

Cylinder

The piston plate is inserted into the cast iron and cylinder case connected to the piston rod. Air pressure is applied to both chambers of the piston plate and causes the piston plate and piston rod to move. Each chamber features air-tight O-rings.

If a handwheel is provided, an equalizing valve is mounted to equalize the chamber pressure and reduce the actuating force.

The cylinder mounting position is selectable. The handwheel is described in this manual.

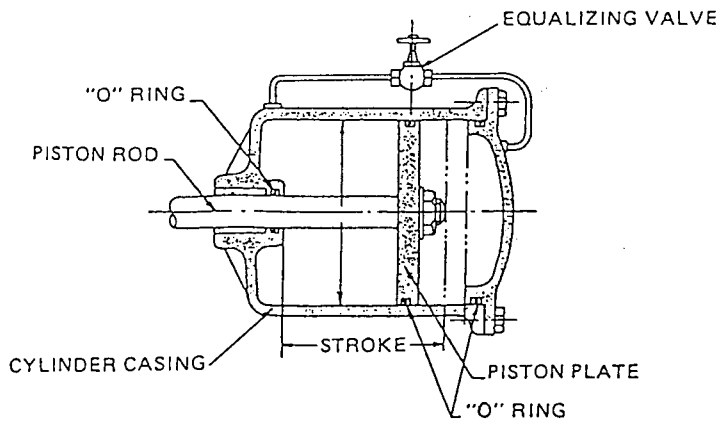


Figure 3. Cylinder

G-O-Pilot Valve (See Figure 4.)

The G-O-Pilot Valve consists of a pilot section and a feedback mechanism. The pilot section consists of several aluminum alloy rings, diaphragms inserted between these rings, and holes through the rings and diaphragms which form air passages. The feedback mechanism consists of a cast iron housing in which a balance spring, a primary beam, a secondary beam, and a rider are provided, together with a roller assembly, a cam plate and a piston rod lever. The cylinder and pilot section are connected only by copper tubing. The air signal pressure and air supply ports, as well as output ports to both cylinder chambers, are provided on the center ring. In the standard model, two pressure gauges show an air signal pressure and air supply pressure.

1.2 Operation (See Figure 4.)

G-O-Pilot

The air pressure signal from a controller is fed to the bottom-most air pressure chamber to achieve equilibrium with the balance spring by building up the downward force of the connection rod. This movement is transferred to the upper flapper to open and close the nozzle hole. The reduced supply air pressure fed through the restriction is applied to the back pressure chamber to increase or decrease the back pressure chamber pressure according to the movement of the flapper, which in turn opens or closes the upper pilot valve (B). When the lower pilot valve (A) is open, the supply air fills the upper chamber and primary back pressure chamber of the cylinder to the supply air pressure. When valve (A) is closed, the supply air exhausts from the exhaust hole through the exhaust chamber, and the pressure lowers to zero. The air pressure fed to the primary back pressure chamber opens or closes the lower pilot valve (B) against the force of the set spring. When valve (B) is open, the supply air is fed to the lower chamber of the cylinder. When closed, it exhausts to atmospheric pressure through the bonnet.

Feedback Mechanism

The tension of the spring generated by the stroke of the piston rod is fed back to the pilot valve through the primary beam, rider and secondary beam. The stroke of the piston rod can be controlled by changing the rider position, which changes the force transmitted to the pilot section. The zero adjustment screw changes the initial spring tension and determines the air signal pressure at which the piston rod begins to move. Since the air signal pressure ranges from 20 to 100 kPa {0.2 to 1.0 kg/cm^2}, adjust he zero adjustment so that the piston rod will start to move at 20 kPa {0.2 kgf/cm^2}.

Operation by air signal pressure

a) When the air pressure signal is zero

The initial tension of the balance spring results in the flapper closing the nozzle, the pilot valve (A) is opened by raising the back pressure chamber pressure, the supply air is fed to the primary pressure back pressure chamber and the upper chamber of the cylinder, and reaches the same pressure as the supply air. The set spring is forced upward by the air pressure fed to the primary backup pressure chamber to close the pilot valve (B), thus the secondary back pressure and the lower cylinder chamber pressure drop to zero. This forces the piston plate downward, and it stops at the lower stopper position.

b) When air pressure exceeds 20 kPa {0.2 kgf/cm^2}

When the air pressure signal exceeds 20 kPa {0.2 kgf/cm^2}, the downward force becomes stronger than the initial tension of the balance spring, and the connection rod moves downward. The nozzle hole opens to reduce the back pressure chamber pressure and the pilot valve (A) closes to start lower the upper cylinder chamber pressure and the primary back pressure chamber pressure. As the primary back pressure chamber pressure is reduced, the pilot valve (B) opens by the force of the set spring to feed the supply air to the lower cylinder chamber, increasing the pressure. When the lower cylinder chamber pressure becomes enough higher than the upper cylinder chamber pressure, this pressure difference forces the piston plate upward. At the same time, this movement is transferred to the balance spring by the feedback lever to increase the spring tension. When this force becomes equal to the pressure in the air signal pressure chamber, the connection rod closes the upper flapper to stop the piston plate.

c) When an external force is applied to the piston rod

When an external force is applied to the piston rod and the rod moves, the balance spring tension is increased or decreased by the feedback lever, and it becomes out of balance with the air pressure signal. In this case, the pilot valve is activated to generate a differential pressure on both the upper and lower sides of the cylinder so that the external force is cancelled out to restore the rod to its original position. So, the piston rod position is balanced by the air signal pressure and the balance spring force.

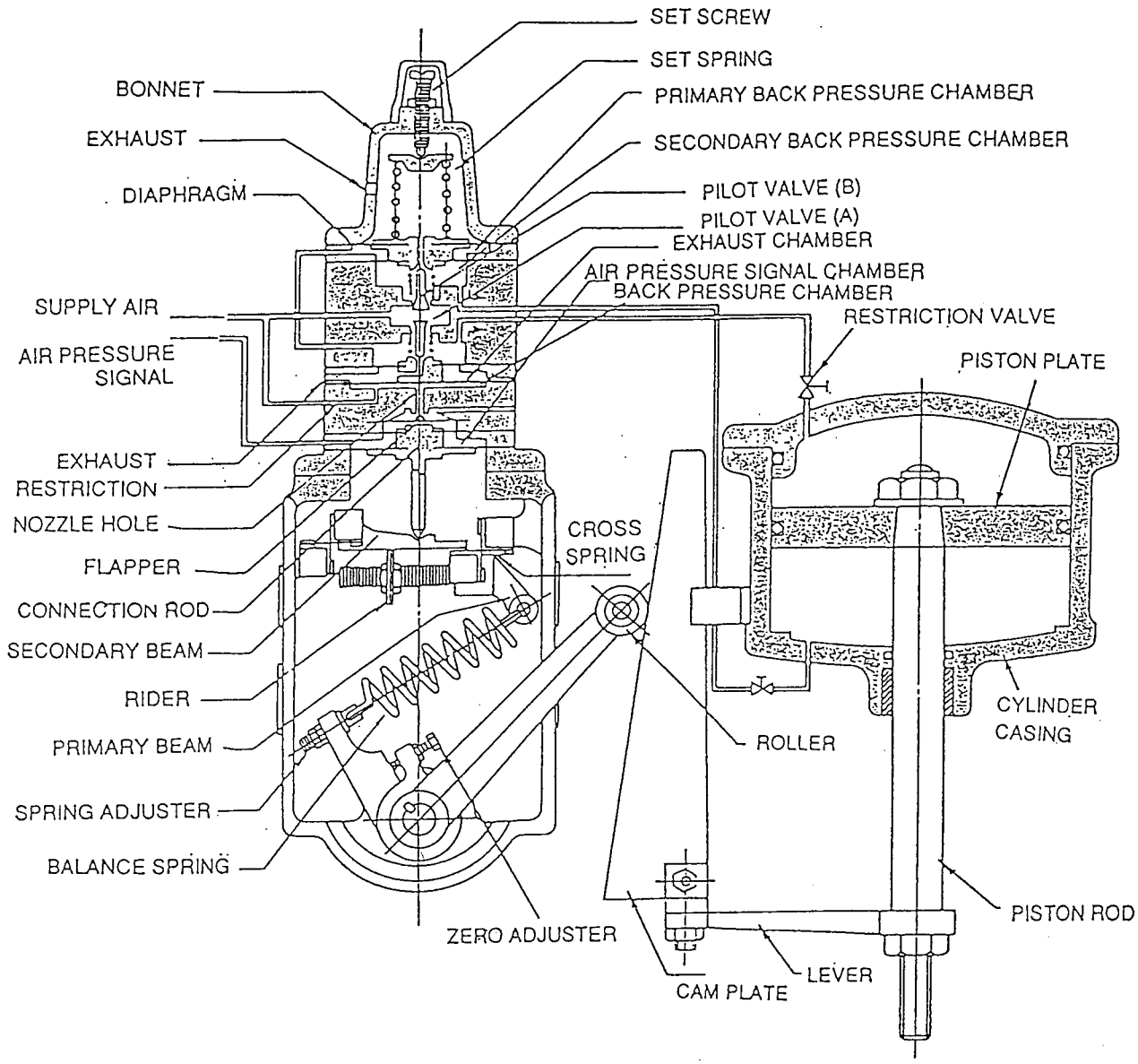


Figure 4. Operational diagram or G-O-Motor and G-O-Pilot Valve

Calibration

(1) Apply a supply air pressure of 200 kPa {2 kgf/cm^2} to the G-O-Pilot.

(2) Raise the air signal pressure so that the piston is positioned at the center of the cylinder and maintain that pressure. Adjust the set screw on the upper part of the G-O-Pilot so that the pressure in the upper and lower chambers of the cylinder becomes approximately half (100 kPa {1 kgf/cm^2}) the supply pressure.

(3) If the piston movement obtained by changing the supply air pressure signal shows overshooting or hunting, adjust the restriction valve on the air piping joint. However, too large a restriction effect may cause slow operation.

(4) Set the air signal pressure to 20 kPa {0.2 kgf/cm^2} and turn the zero adjustment screw so that the piston just touches the upper or bottom end of the cylinder.

(5) When the piston starts moving at a pressure lower than 20 kPa {0.2 kgf/cm^2}, turn the zero adjustment screw clockwise, and when it starts moving at a pressure higher than 20 kPa {0.2 kgf/cm^2}, turn the zero adjustment screw counterclockwise.

(6) Raise the air signal pressure to 100 kPa {1 kgf/cm^2}.

(7) Perform the adjustment so that the piston rod moves over a specified stroke and stops.

(8) If the movement of the piston is less than the specified stroke, turn the rider clockwise, and if it is larger than the stroke, turn the rider counterclockwise.

(9) Finally, make sue that the pressure in the upper and lower chambers of the cylinder becomes approximately zero and the supply air pressure when setting the air pressure signal to 19 kPa {0.19 kgf/cm^2} and 105 kPa {1.05 kg/cm^2}, respectively. If not, you may obtain insufficient output. Check the O-ring for leakage. If the O-ring is not defective, replace the pilot section.

Troubleshooting

If the G-O-Motor does not operate properly after performing the above adjustments, check the following items.

(1) Clogged air piping

(2) Leakages in air pipings

(3) Clogged restrictions and nozzles

(4) Damaged diaphragm in G-O-Pilot

(5) Damaged O-ring

If any of the items above is found, perform inspection, repair or replacement as necessary.

1.3 Handwheel

The handwheel is provided as an option with the horizontal G-O-Motor as. All vertical G-O-Motors features the handwheel as standard.

Handwheel for vertical G-O-Motor

The handwheel shown in Figure 5 is used for the vertical G-O-Motor.

Switching from MAN to AUTO

a) Shut off the equalizing valve.
b) Switch the handle to the downward (AUTO) position.
c) Turn the handle counterclockwise until it stops.

Switching from AUTO to MAN

a) Open the equalizing valve.
b) Turn the handle clockwise until it stops.
c) Switch the handle to the upward (MAN) position.

Clockwise rotation of the handle moves the rod downward.
Counterclockwise rotation of the handle moves the rod upward.

Handwheel for horizontal G-O-Motor

The handwheel shown in Figure 6 is used for the horizontal G-O-Motor with a long stroke of 100mm or more. Switch from AUTO to MAN or vice versa by changing the connection of the piston rod and the screw guide.

Switching from MAN to AUTO

a) Move the screw guide to a control position which is obtained when switching to AUTO operation. If switching is performed forcefully, it may cause sudden movement of the piston rod, so perform the operation described above.

b) Shut off the equalizing valve.

c) Remove the stopper of the screw guide from the groove provided on the piston rod by turning it 180 degrees. If the stopper cannot be removed, adjust the position of the screw guide by turning the handle clockwise or counterclockwise to free the stopper.

d) Move the screw guide by turning the handle clockwise or counterclockwise so that the gap between the screw guide and the bonnet is approximately 5mm.

Switching from AUTO to MAN

a) Move the screw guide to the groove of the piston rod by turning the handle counterclockwise.

b) Hook the stopper of the screw guide on the groove of the piston rod by turning the stopper 180 degrees.

c) Open the equalizing valve.

d) Clockwise rotation of the handle extends the piston rod. Counterclockwise rotation of the handle withdraw it.

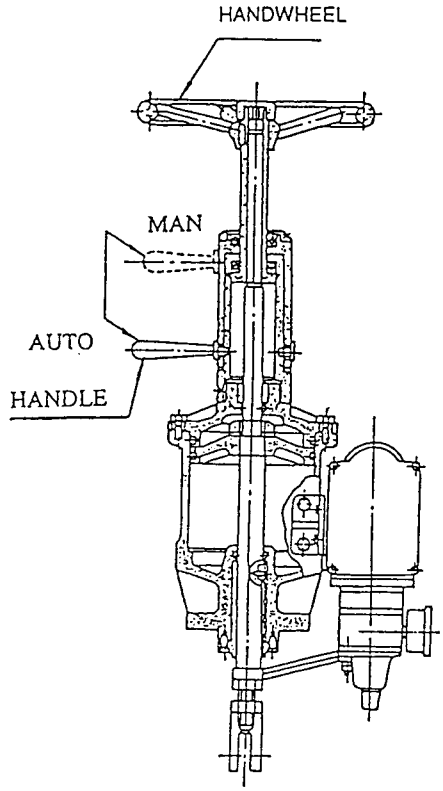


Figure 5. Vertical model handwheel

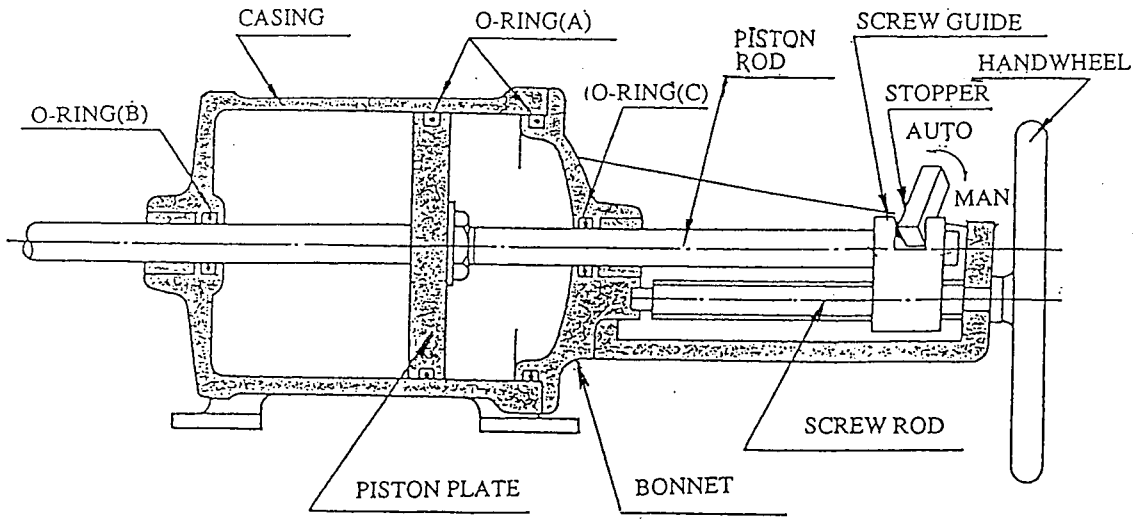


Figure 6. Horizontal model handwheel

1.4 Specification

Supply air pressure	: 200 kPa {2 kgf/cm^2}
Linearity	: +/- 2.0% (with G-O-Pilot)
Hysteresis	: 2.0% or less (with G-O-Pilot)
Action	: Direct/reverse action
Ambient temperature	: 0 to 70 degrees centigrade

Table 1. O-ring list

GOM M	O-ring (A)		O-ring (B)		O-ring (C)	
	AN6227	Q'ty	AN6227	Q'ty	AN6227	Q'ty
- 44LL (M)	〃 - 45	3	〃 - 19	1	〃 - 16	1
- 41OL (M)	〃 - 45	3	〃 - 19	1	〃 - 16	1
* - 64LM	〃 - 60	2	〃 - 22	1	〃 - 18	1
- 64L (M)	〃 - 60	2	〃 - 22	1	〃 - 19	1
- 66L (M)	〃 - 60	3	〃 - 22	1	〃 - 19	1
- 61OL (M)	〃 - 60	3	〃 - 22	1	〃 - 19	1
* - 84LM	〃 - 70	2	〃 - 22	1	〃 - 18	1
- 84L (M)	〃 - 70	3	〃 - 22	1	〃 - 19	1
- 86L (M)	〃 - 70	3	〃 - 22	1	〃 - 19	1
- 81OL (M)	〃 - 70	3	〃 - 22	1	〃 - 19	1
* - 124LM	〃 - 79	3	〃 - 22	1	〃 - 18	1
- 121OL (M)	〃 - 79	3	〃 - 31	1	〃 - 27	1
* - 154LM	〃 - 85	2	〃 - 29	1	〃 - 21	1
- 151OL (M)	〃 - 85	3	〃 - 33	1	〃 - 30	1

Notes:

1) Material : nitrile rubber
2) Q'ty (1) in O-ring column (C) is the number required for a GOM including the handwheel.
3) GOM with "*"mark is a vertical model with handwheel used for butterfly valves manufactured by Yamatake Corporation.
4) AN6227: Navy Air Force Aeronautical Specification.

2. Spring G-O-Motor

The spring G-O-Motor has a cylinder and piston in place of the diaphragm of an Air-O-Motor, and provides a compact design and larger stroke than the Air-O-Motor.

The spring G-O-Motor is used for butterfly control valves, large control valves, dampers and control elements requiring proportional position action.

The spring G-O-Motor has a larger sliding friction than the Air-O-Motor type and a positioner must be used.

- Cautions -

The GOM includes no anti-rotation fitting on the piston rod. Therefore, when is used for to generate forced rotation, provide an external anti-rotation fitting.

2.1 Structure

The spring G-O-Motor consists of a cylinder section and positioner. The cylinder section consists of a cylinder casing, piston plate, piston rod and spring. The cylinder casing is made of cast iron, and its inner surface is finished with molybdenum disulfide. The piston plate is made of cast iron, and an O-ring is used for sealing the sliding section. The piston rod is made of SUS 403.
For the details of the positioner, refer to manual no. OM28310-0200 (HTP Valve Positioner) or OM2-8313-0100 (HEP Valve Positioner).

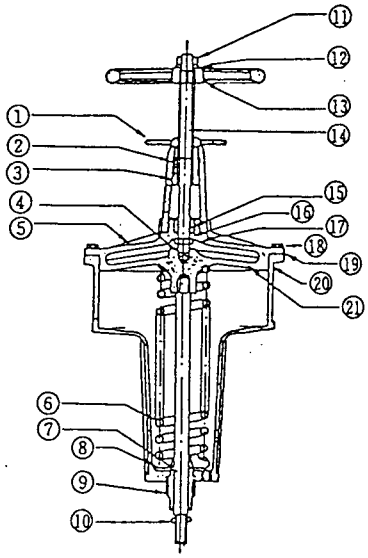
2.2 Operation

The air signal pressure from a controller is fed to the positioner to move the piston plate to a position corresponding to the air signal pressure. When the position of the piston plate shifts from that corresponding to the air signal pressure due to load or other reasons, the positioner changes the air pressure applied to the cylinder in the range 0 to 140 kPa {1.4 kgf/cm^2}, to bring the piston back to a correct position.

If the supply air pressure becomes zero due to failure of the air supply source, the piston moves upward by the spring force.

2.3 Handwheel

All the spring G-O-Motors include a handwheel. When manual operation is required, turn the locking nut counterclockwise and turn the handle. Clockwise rotation of the handle extends the piston rod from the cylinder. When automatic operation is performed, turn the handle counterclockwise until it stops, and fasten the locking nut firmly.



1 Lock Nut
2 Slide Cover
3 Screw Guide
4 Pivot
5 Bonnet
6 Spring
7 Piston Rod
8 Spring Seat
9 Stem Guide
10 Lock Nut
11 Nut
12 Washer
13 Handwheel
14 Screwed Rod
15 Guide
16 "O" Ring
17 Stopper
18 Bolt
19 Packing
20 "O" Ring
21 Piston Plate
22 Cylinder Casing

Figure 7. Spring G-O-Motor

2.4 Specification

Supply air pressure : 140 kPa {1.4 kgf/cm^2}
Linearity : +/- 1.0% (with G-O-Pilot)
Hysteresis : 1.0% or less (with G-O-Pilot)
Action : Direct action
Ambient temperature : 0 to 70 degrees centigrade

2.5 Disassembly

(1) Remove the air piping.

(2) Turn the handle counterclockwise, turn the spring adjuster counterclockwise to loose the spring, and remove the bolts which mount the casing and the bonnet.

(3) Remove the piston plate from the casing by pushing it upward after removing the nuts.

(4) After reassembly, turn the spring adjuster until it starts operation at a cylinder pressure of 20 kPa {0.2 kgf/cm^2}.

For the adjustment, refer to manual no. OM2-8310-0200 (HTP Valve Positioner) or OM2-8313-0100 (HEP Valve Positioner).

Table 2. O-ring list

GOM	O-ring (A)	O-ring (B)
- 83S	AN6227 - 70	AN6227 - 12
- 84S	〃 - 70	〃 - 12
- 103S	〃 - 75	〃 - 15
- 124S	〃 - 79	〃 - 17

Material: Nitrile rubber
Quantity: 1 each

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