SMC

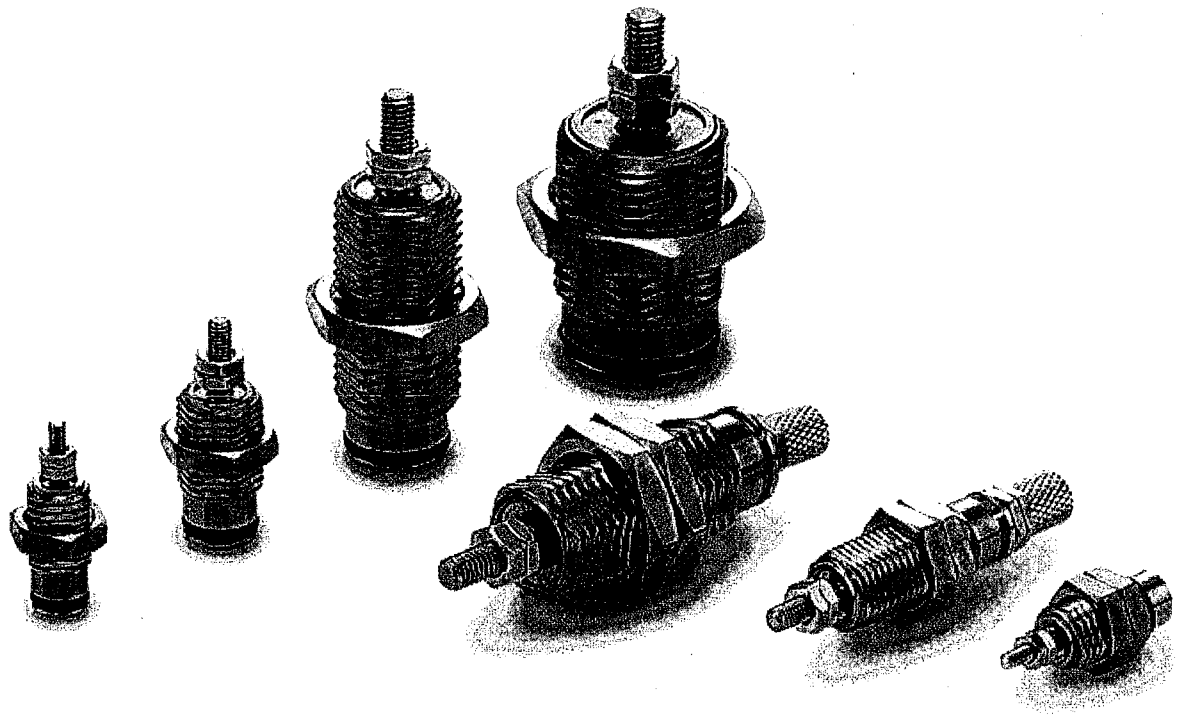
No.	CJP＊－OM0002C－A

OPERATION MANUAL

CJP CYLINDER

【Single acting spring return】

Φ4, Φ6, Φ10, Φ15



☆ Read this manual thoroughly before mounting and operating the actuator.

☆ Pay particular attention to the section concerning safety.

☆ Keep this manual in an accessible location.

SMC CORPORATION

Contents

1. Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by labels of "**Caution** ", "**Warning**" or "**Danger** ". To ensure safety, be sure to observe ISO 4414*1), JIS B 8370*2) and other safety practices.

■Indications

Indication	Indications
⚠ Caution :	Operator error could result in injury*3) or equipment damage*4).
⚠ Warning :	Operator error could result in serious injury or loss of life.
⚠ Danger :	In extreme conditions, there is a possible result of serious injury or loss of life.

※1) ISO 4414 : Pneumatic fluid power – General rules relating to systems

※2) JIS B 8370 : General Rules for Pneumatic Equipment

※3) An injury does not necessitate staying or going to a hospital for a long period of time to recover. This includes burns and electric shocks..

※4) Equipment damage is extensive damage related to equipment and machines.

■Selection/Handling/Application

① **The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.**

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements. The expected performance and safety assurance will be the responsibility of the person who has determined the compatibility of the system. This person should continuously review the suitability of all items specified, referring to the latest catalogue information with a view to giving due consideration to any possibility of equipment failure when configuring a system.

② **Only trained personnel should operate pneumatically operated machinery and equipment.**

Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

③ **Do not service machinery/equipment or attempt to remove components until safety is confirmed.**

1. Inspection and maintenance of machinery/equipment should only be performed once measures to prevent falling or runaway of the driver objects have been confirmed.
2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment, exhaust all residual compressed air in the system.
3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc.

④ **Contact SMC if the product is to be used in any of the following conditions:**

1. Conditions and environments beyond the given specifications, or if product is used outdoors.

2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, clutch and brake circuits in press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

■Exemption

①SMC doesn't take any responsibility for the damage resulting from an earthquake, fire due to other causes than our products, the third party behavior and the customer's intentional or unintentional fault, misuse and operation in other abnormal conditions.

②SMC doesn't take any responsibility for the damage associated with use of our product or out-of-service product (including loss of company profits, suspension of company activity).

③SMC doesn't take any responsibility for the damage resulting from the use in the manner other than specified in the catalogue or Operation Manual.

④SMC doesn't take any responsibility for the damage resulting from malfunction due to use of our product in combination with equipments or software from another manufacturer.

2. Specifications

2－1. Specifications

Bore Size (mm)		4	6	10	15
Action		Single acting, Spring return			
Maximum operating pressure		0.7MPa			
Minimum operating pressure		0.3MPa	0.2MPa	0.15Pa	
Proof pressure		1.05MPa			
Ambient and fluid temperature		−10～70℃(Non-freezing)			
Lubrication		Not required(Non-lube)			
Piston speed		50 to 500mm/s			
Cushion		None			
Stroke length tolerance		$^{+1.0}_{0}$			
Thread tolerance		JIS 2 class			
Rod end configuration		With thread / Without thread			
Mounting bracket		Panel mounting style		Plug mounting style	
Accessory	Standard equipment	Mounting nut(2) Rod end nut(2)※		Mounting nut(1) Gasket(1) Rod end nut(2)※	
	Option	Hose nipple (ϕ4 is excluded)			

※When rod end is threaded.

2－2. Standard Strokes

Bore size (mm)	4	6	10	15
Stroke (mm)	5、10、15			

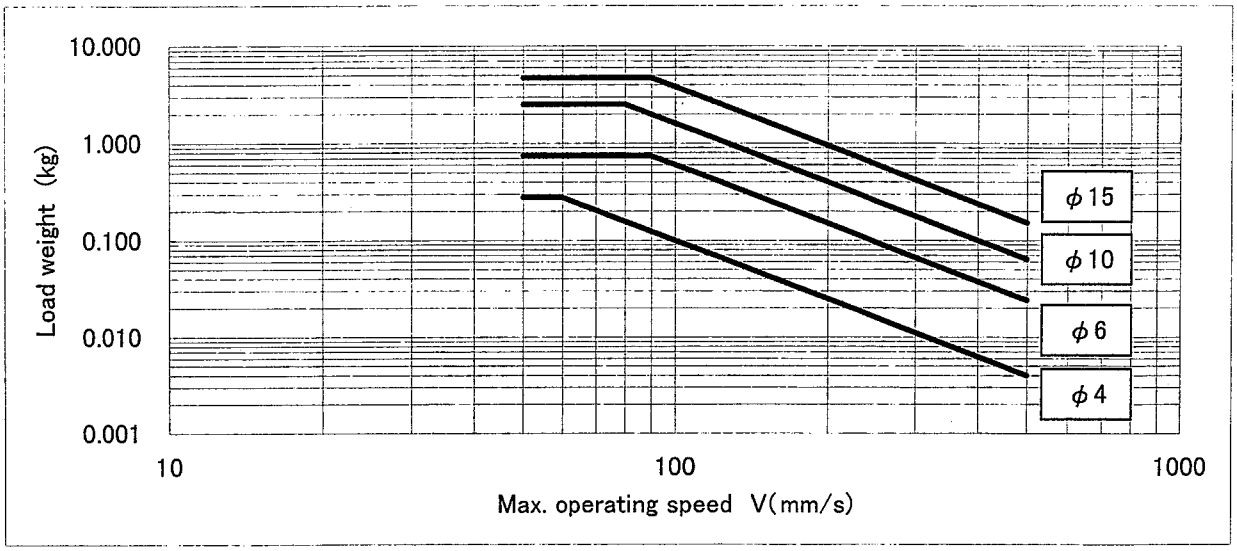
2－3. Spring Reaction Force

Bore size(mm)	4	6	10	15
Retracted side(N)	2.80	3.92	5.98	10.80
Extended side(N)	1.00	1.42	2.45	4.41

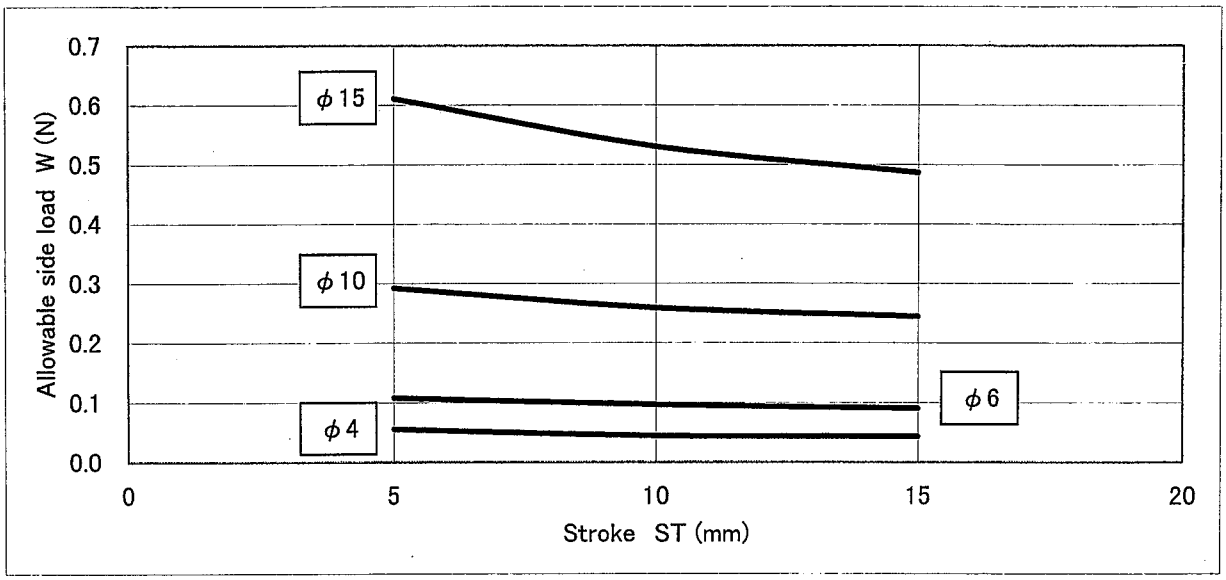
※Same spring force for each stroke.

2－4. Allowable Kinetic Energy

Bore size (mm)	4	6	10	15
Operating piston speed(m/s)	0.05～0.5			
Allowable kinetic energy (J)	$0.5X10^{-3}$	$3X10^{-3}$	$8X10^{-3}$	$19X10^{-3}$



2－5. Allowable Side Load



3. Actuator/Precautions

3－1. Caution on design

⚠ Warning

1) **There is a possibility of dangerous sudden action by air cylinders if sliding parts of machinery are twisted due to external forces, etc.**

In such cases, human injury may occur; e.g., by catching hands or feet in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be adjusted to operate smoothly and designed to avoid such dangers.

2) **A protective cover is recommended to minimize the risk of personal injury.**

If a stationary object and moving parts of a cylinder are in close proximity, personal injury may occur. Design the structure to avoid contact with the human body.

3) **Securely tighten all stationary parts and connected parts so that they will not become loose.**

Especially when a cylinder operates with high frequency or is installed where there is a lot of vibration, ensure that all parts remain secure.

4) **A deceleration circuit or shock absorber may be required.**

When a driven object is operated at high speed or the load is heavy, a cylinder's cushion will not be sufficient to absorb the impact. Install a deceleration circuit to reduce the speed before cushioning, or install an external shock absorber to relieve the impact.

In this case, the rigidity of the machinery should also be examined.

5) **Consider a possible drop in circuit pressure due to a power outage, etc.**

When a cylinder is used in a clamping mechanism, there is a danger of workpieces dropping if there is a decrease in clamping force due to a drop in circuit pressure caused by a power outage, etc. Therefore, safety equipment should be installed to prevent damage to machinery and human injury. Suspension mechanisms and lifting devices also require consideration for drop prevention.

6) **Consider a possible loss of power source.**

Measures should be taken to protect against bodily injury and equipment damage in the event that there is a loss of power to equipment conrtolled by pneumatics, electricity, or hydraulics.

7) **Design circuitry to prevent sudden lurching of driven objects.**

When a cylinder is driven by an exhaust centre type directional control valve or when starting up after residual pressure is exhausted from the circuit, etc., the piston and its driven object will lurch at high speed if pressure is applied to one side of the cylinder because of the absence of air pressure inside the cylinder. Therefore, equipment should be selected and circuits designed to prevent sudden lurching, because there is a danger of human injury and/or damage to equipment when this occurs.

8) **Consider emergency stops.**

Design so that human injury and/or damage to machinery and euqipment will not be caused when machinery is stopped by a safety device under abnormal conditions, a power outage or a manual emergency stop.

9) **Consider the action when operation is restarted after an emergency stop or abnormal stop.**

Design the machinery so that human injury or equipment damage will not occur upon restart of operation.

When the cylinder has to be reset at the starting position, install manual safety equipment.

3−2. Selection

⚠ Warning

1) **Confirm the specifications.**

The products are designed for use in industrial compressed air systems. If the products are used in conditions where pressure and/or temperature are outside the range of specifications, damage and/or malfunctions may occur. Do not use in these conditions. (Refer to the specifications.)

Please consult with SMC if you use a fluid other than compressed air.

2) **About intermediate stop**

In the case of 3 position closed centre of a valve, it is difficult to make a piston stop at the required position as accurately and precisely as with hydraulic pressure due to compressibility of air.

Furthermore, since valves and cylinders, etc. are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for an extended period of time. Please contact SMC if it is necessary to hold a stopped position for an extended period.

⚠ Caution

1) **Operate within the limits of the maximum usable storke.**

Refer to the selection procedures for the air cylinder to be used for the maximum usable stroke.

2) **Operate the piston within a range such that collision damage will not occur at the stroke end.**

The operation range should prevent damage from occurring when a piston, having inertial force, stops by striking the cover at the stroke end. Refer to the cylinder model selection procedure for the maximum usable stroke.

3) **Use a speed controller to adjust the cylinder drive speed, gradually increasing from a low speed to the desired speed setting.**

4) **Provide intermediate supports for long stroke cylinders.**

An intermediate support should be provided in order to prevent damage to a cylinder havindg a long stroke, due to problems such as sagging of the rod, deflection of the cylinder tube, vibration and external load.

3−3. Mounting

⚠ Caution

1) **Be certain to match the rod shaft center with the load and direction of movement when connecting.**

When not properly matched, problems may arise with the rod and tube, and damage may be caused due to friction on areas such as the inner tube surface, bushings, rod surface, and seals.

2) **When an external guide is used, connect the rod end and the load in such a way that there is no interference at any point within the stroke.**

3) **Do not scratch or gouge the sliding portion of the cylinder tube or the piston rod by striking it with an object, or squeezing it.**

The tube bore is manufactured under precise tolerances. Thus, even a slight deformation could lead to a malfunction.

Moreover, scratches or gouges, etc. in the piston rod may lead to damaged seals and cause air leakage.

4) **Prevent the seizure of rotating parts.**

Prevent the seizure of rotating parts (pins, etc.) by applying grease.

5) **Do not use until you verify that the equipment can operate properly.**

After mounting, repairs, or modification, etc., connect the air supply and electric power, and then confirm proper mounting by means of appropriate function and leak tests.

6) **Instruction manual.**

Install the products and operate them only after reading the instruction manual carefully and understanding its contents. Also keep the manual where it can be referred to as necessary.

3－4. Piping

⚠ Caution

1) **Before piping**

Before piping, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.

2) **Wrapping of pipe tape**

When screwing piping or fitting into ports, ensure that chips from the pipe threads or sealing material do not get inside the piping.

Also, when the pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.

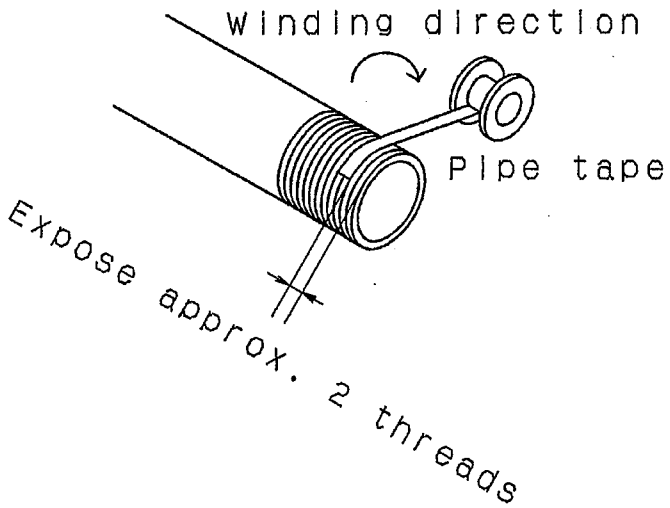


Fig 1

3－5. Lubrication

⚠ Caution

1） Lubrication of cylinder

The cylinder has been lubricated for life at the factory and can be used without any further lubrication. However, in the event that it is lubricated additionally, be sure to use the following one.

Stopping lubrication later may lead to malfunctions because the new lubricant will cancel out the original lubricant. Therefore, lubrication must be continued once it has been started.

Bore size(mm)	Kind of lubrication oil
4	Polyalphaolefin oil or equivalent oil
6、10、15	Turbine oil(non additive) ISO VG32

3－6. Air Supply

⚠ Warning

1） Use clean air.

Do not use compressed air which contains chemicals, synthetic oils containing organic solvents, salts or corrosive gases, etc., as this can cause damage or malfunction.

⚠ Caution

2） Install air filters.

Install air filters close to valves at their upstream side. A filtration degree of 5 μm or less should be selected.

3） Install an aftercooler, air dryer, or water separator (Drain Catch).

Air that includes excessive drainage may cause malfunction of valves and other pneumatic equipment. To prevent this, install an air dryer, aftercooler or water separator, etc.

4） Use the product within the specified range of fluid and ambient temperature.

Take measures to prevent freezing when below 5°C, since moisture in circuits can freeze and cause damage to seals and lead to malfunctions.

The allowable operating range for this product is between −10 to 70°C

If the cylinder is used at temp out of this range, the packing is hardened, the grease is lost and the packing is worn, resulting in air leakage.

For compressed air quality, refer to "Air Preparation Equipment" catalog.

3－7. Operating Environment

⚠ Warning

1） Do not use in atmospheres or locations where corrosion hazards exist.

Refer to the construction drawings regarding cylinder materials.

2） In dusty locations or where water or oil, etc., splash on the equipment, take suitable measures to protect the rod.

3－8. Maintenance

- Daily check

  1) Is the operation smooth?

  2) Is there any abnormal change in the piston speed and cycle time?

  3) Is there any abnormality in the stroke?

- Periodical check

  1) Are the cylinder mounting bolts and work, firmly fixed?

  2) Is the operation smooth?

  3) Are there any abnormal changes in the piston speed and cycle time?

  4) Is there any air leakage?

  5) Is there any abnormality in the stroke?

  6) Are there any flaws on the piston rod

  7) Is the drain of the air filter removed periodically?

⚠ Warning

1） Perform maintenance in above procedure.

If the cylinder is handled incorrectly, breakage and operating failure of the equipment around the cylinder may be caused.

2） Removal of equipment and supply and exhaust of compressed air

Before removing the equipment, make sure the load or work cannot drop or run away out of control. Cut off the air and power supply for the system and exhaust the compressed air from the system. Before the system is restarted, make sure the actuator cannot extend out of control.

⚠ Caution

1） Drain flushing.

Remove condensate from filters regularly.

4. Pin cylinder/Precautions

4－1. Required quality of air.

The air to be supplied to the cylinder shall be filtered through the AF series air filter of SMC and reduced in pressure to the specified setting level by the AR series regulator.

4－2. Speed control.

1) In applications where control of cylinder working speed is required, install the AS 1*11 series speed controller of SMC in the vicinity of the supply air port of the cylinder to control the opecating speed.
2) To control the operating speed, adjust the speed controller to throttle the air to be supplied to the cylinder.
3) To loosen impact, a fixed orifice is incorporated in the hose nipple. Be sure not to enlarge the inside diameter of this orifice, because if the hole is enlarged, the cylinder operating speed may exceed the allowable speed (500mm/sec at no-load), which will result in an increased impact force to damage the cylinder.

   In applications where a no-load operating speed of more than 500mm/sec is required, the manufacturer should be consulted.

4－3. Directional control

In applications where switching over of the actuating direction of the cylinder is required, install the most appropriate solenoid valve selected from the various available types of SMC to switch over the direction. It is recommended to use a 3-way solenoid valve.

4－4. Installation

1) Extreme care should be exercised in installing the cylinder so that the load exerting the piston rod of the cylinder may always be in the axial direction. The load in the radial direction may cause the twisted piston rod or damaged thread of the tip of the rod.
2) In applications where the cylinder is used to actuate an object that moves over the rails, connection between the coupler of the object and the piston rod of the stationary type cylinder should be performed in such a manner that it is made sure that the both are well aligned at both fully extended and retracted positions of the rod.

   If alignment is not properly established, the cylinder will be subjected to unreasonable force to such an extent that the connection between the two provides a misalignment even though the cylinder seems to operate smoothly from the outside, reducing the service life.
3) Before piping the cylinder, thoroughly flash the pipings. This is because dust and scales in the upstream line of the filter can be eliminated by the filter however, those in the downstream can not be removed but are forced into the solenoid valve and the cylinder, resulting in defective operation and reduced life.
4) When the cylinder is installed in the field, it likely occurs that chips of a drill used for making mountaing holes fall down into the supply port of the cylinder if it is placed underneath. Utmost care should be paid to prevent such chips from entering the inside of the cylinder.
5) Be careful not to hit and damage the piston rod, which is a finely finished sliding part, when it extends to the outside of the cylinder tube. If it is damaged, cylinder operation becomes worse even though it works properly.

   The bore of the cylinder cover is finished to precise tolerance and thus if the tube undergoes severe impact to such an extent that its out-of-roundness is affected, cylinder operation will also be adversely affected.
6) Avoid such an installation in which load is exerted to the cylinder when the rod is in the retraction stroke.

4－5. Piping

It is recommended that the following fitting should be used when connecting this cylinder.

Cylindre Bore size	Applicable tubing	Type of fitting	Port	Model
φ4	φ2/φ1.2	One-touch fitting	M3X0.5	KJ□02-M3
		Miniature fitting		M-3AU-2
φ6 φ10 φ15		One-touch fitting	M5X0.8	KJ□02-M5
		Miniature fitting		M-5AU-2
	φ4/φ2.5	Hose nipple (With fixed orifice)		CJ-5H-4
	φ6/φ4			CJ-5H-6

Please note that if the above One-touch fitting or miniature fitting is used for the cylinder bore size with φ15 , the retracting speed of the cylinder may decelerate.

4－6. Piping connection to the cylinder

Piping connection to the cylinder is as shown in the figure below,

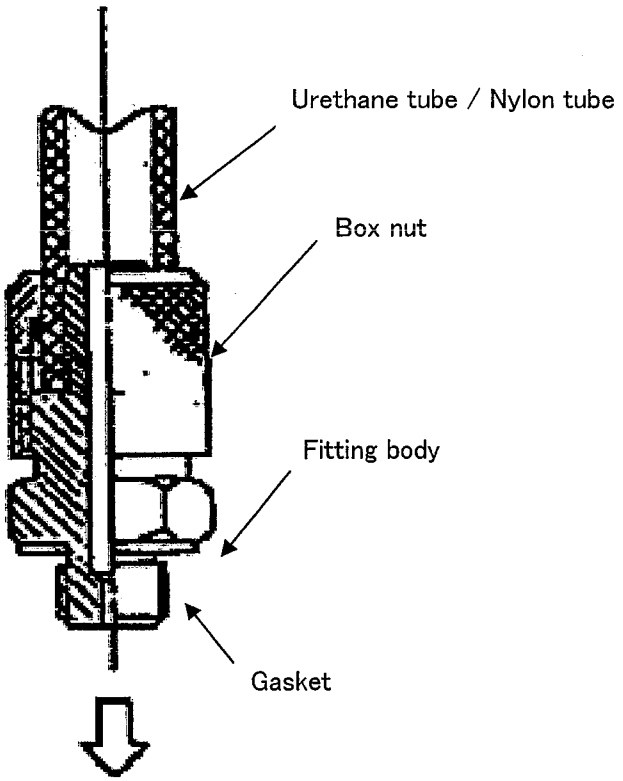


Fig2. CJ-5H-6 (Tube size of O.D.6/I.D.4)
CJ-5H-4 (Tube size of O.D.4/I.D.2.5)

A hose nipple consists of two parts: a fitting body and a box nut. There are two sizes, one is for O.D.4mm/I.D.2.5mm tube and the other is for O.D.6mm/I.D.4mm. This nipple fits both nylon tube and urethane tube. Connection process of nylon or urethane tube is as follows:

1) Remove the box nut, pass nylon tube or urethane tube through the nut.
2) Insert the tube into the fitting body.
3) Fasten the nut to the body.

4−7. Pneumatic circuit

Figure 3 shows a basic circuit involving the cylinder in which an air filter, a regulator, a solenoid valve and speed controller are incorporated.

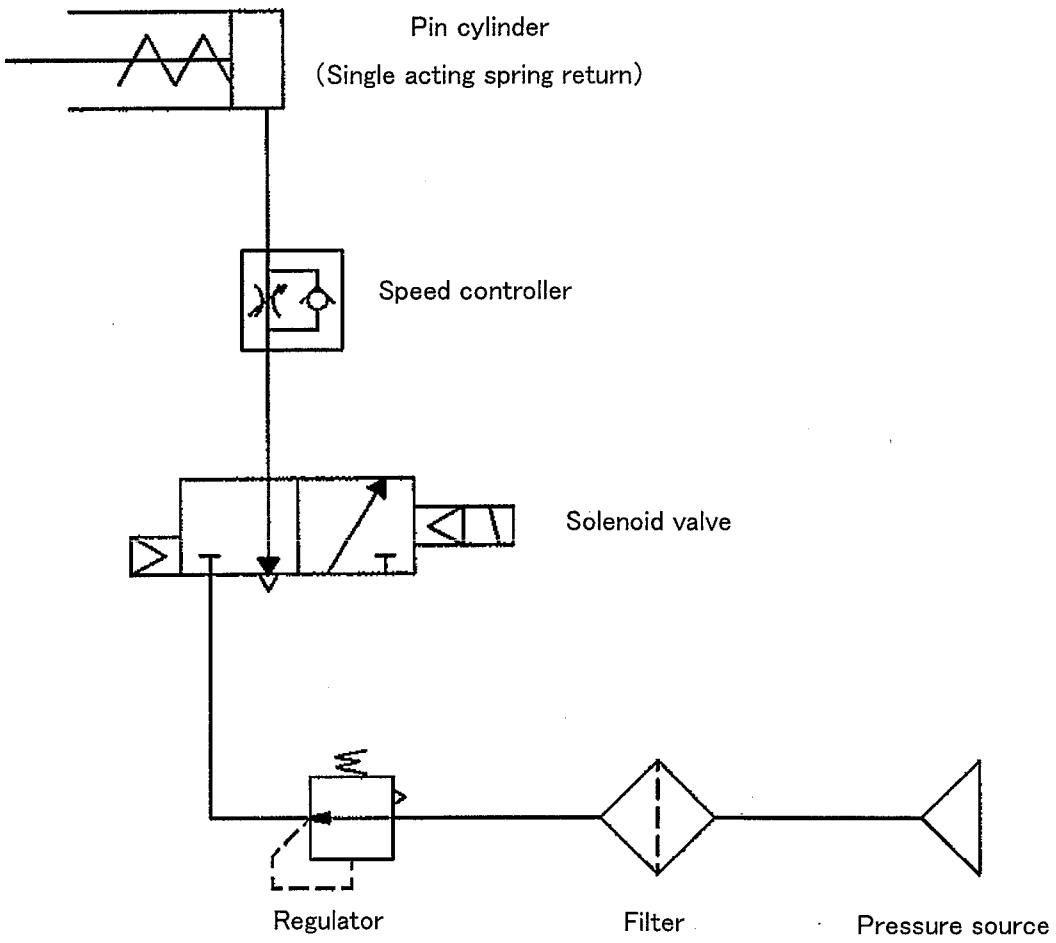


Fig. 3

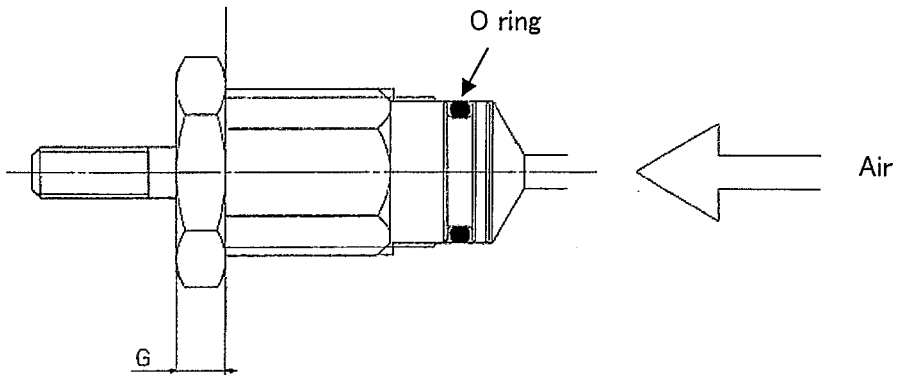
4−8. Recommended tightening torque of mounting nut.

Mounting nut recommended tightening torpue is follow:

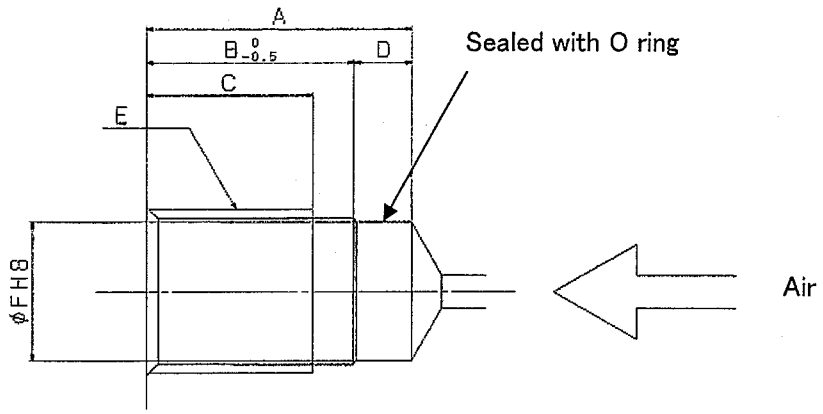
Bore size (mm)	Tightening torque (N・m)
4	2
6	2.5
10	6
15	7

4—9. Recommended mounting hole dimensions of plug mounting type cylinders.

When plug mounted



Machining dimensions for mounting



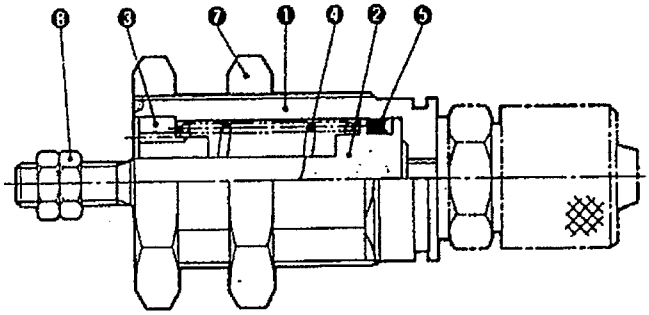
Bore size (mm)	Stroke	A	B	C	D	E	ϕF	G
4	5	12	8.5	6	3.5	M8X1.0	6.5	3
	10	20	16.5	14				
	15	28	24.5	22				
6	5	16	12.5	10	3.5	M10X1.0	8.5	3
	10	23	19.5	17				
	15	30	26.5	24				
10	5	17	13.5	10.5	3.5	M15X1.5	12	4
	10	23.5	20	17				
	15	30.5	27	24				
15	5	19	14.5	11.5	4.5	M22X1.5	19	5
	10	25	20.5	17.5				
	15	31.5	27	24				

Note: E and ϕF should be machined in a concentric manner.

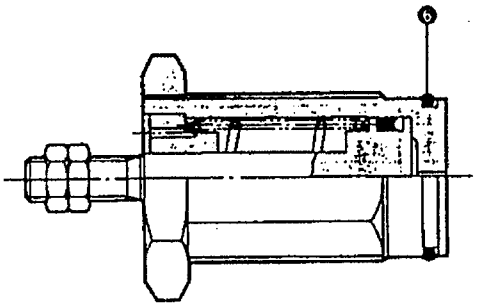
5. Construction

Not able to disassemble..

Panel mounting style



Plug mounting style



Component Parts

No.	Description	Material	Note
①	Cover	Brass	Electroless nickel plated
②	Piston	Stainless steel	
③	Collar	Oil-impregnated sintered alloy	ϕ4 : Brass with electroless nickel plated ϕ6, ϕ10 : Phosphor bronze
④	Return spring	Stell	Zinc chromate
⑤	Piston seal	NBR	
⑥	Gasket	NBR	Special product (O ring) Pulg mounting only
⑦	Mounting nut	Brass	Electroless nickel plated
⑧	Rod end nut	Stell	Nickel plated

6. Troubleshooting

Trouble	Phenomenon	Possible cause	Remedy	Related section
・The operation is not smooth. ・The force output is reduced. ・The cylinder doesn't operate.	Air leakage	The piston packing is worn due to grease washed away by water.	Install air cleaning equipment, in the line.	3-6 4-1
	A lack of pneumatic pressure	① The pressure from the factory source is reduced. ②The regulator setting has been displaced. ③The piping is clogged.	①Supply adequate pressure. ②Set regulator properly. ③Flush the piping.	2-1 3-4 4-1
	Overload	The lateral load has been exceeded.	Use within the allowable value.	2-5
	Low operating speed	The speed is lower than specified piston speed.	Use within specifications.	2-1
	Improper pneumatic circuit design.	The system construction is not suitable.	Select adequate size of tube, fitting, directional control valve, speed controller etc.	4-2 4-3 4-5
・A part is damaged.	Breakage of piston, cover.	①The speed is too high due to insufficient adjustment of the speed controller. ②The kinetic energy exceeds the allowable value. ③The lateral load exceeds the allowable value. ④An abnormal external force is applied.	①Adjust the speed with the speed controller again so that the speed will decrease within the specifications. ②Use within the allowable value. ③Use within the allowable value. ④Mechanism interference, eccentric load and overload could cause deformation and damage of the cylinder. Remove these factors.	2-1 2-4 2-5 3-3 4-4