SMC

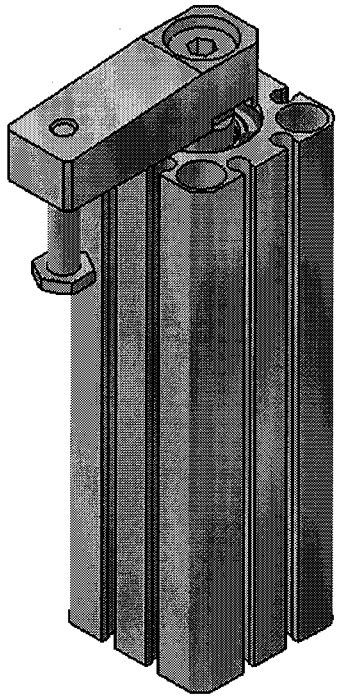
No.	MK2T−OM0002K

OPERATION MANUAL

ROTARY CLAMP CYLINDER

【MK2T Series】

Φ20, Φ25, Φ32, Φ40, Φ50, Φ63



☆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 "Danger ", "Warning" or "Caution ". To ensure safety, be sure to observe ISO 4414[*1)], JIS B 8370[*2)] and other safety practices.

■Indications

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

*1) ISO4414: 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

①The 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.

②Only 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.

(A trained and experienced operator is required to have understanding of JIS B 8370 "General Rules for Pneumatic Equipments" and other safety regulations.)

③Do not service machinery/equipment of attempt to remove components until saferyty 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 and relieve all energy (liquid pressure, spring force, capacitor, gravity).
3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc.

④Contact 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 or placed where direct sunshine strikes.
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.
4. Interlock circuit. In this case, provide double interlock circuit by providing a mechanical protective function for possible failure of either of them. Also, perform periodical checks to ensure it works properly.

■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

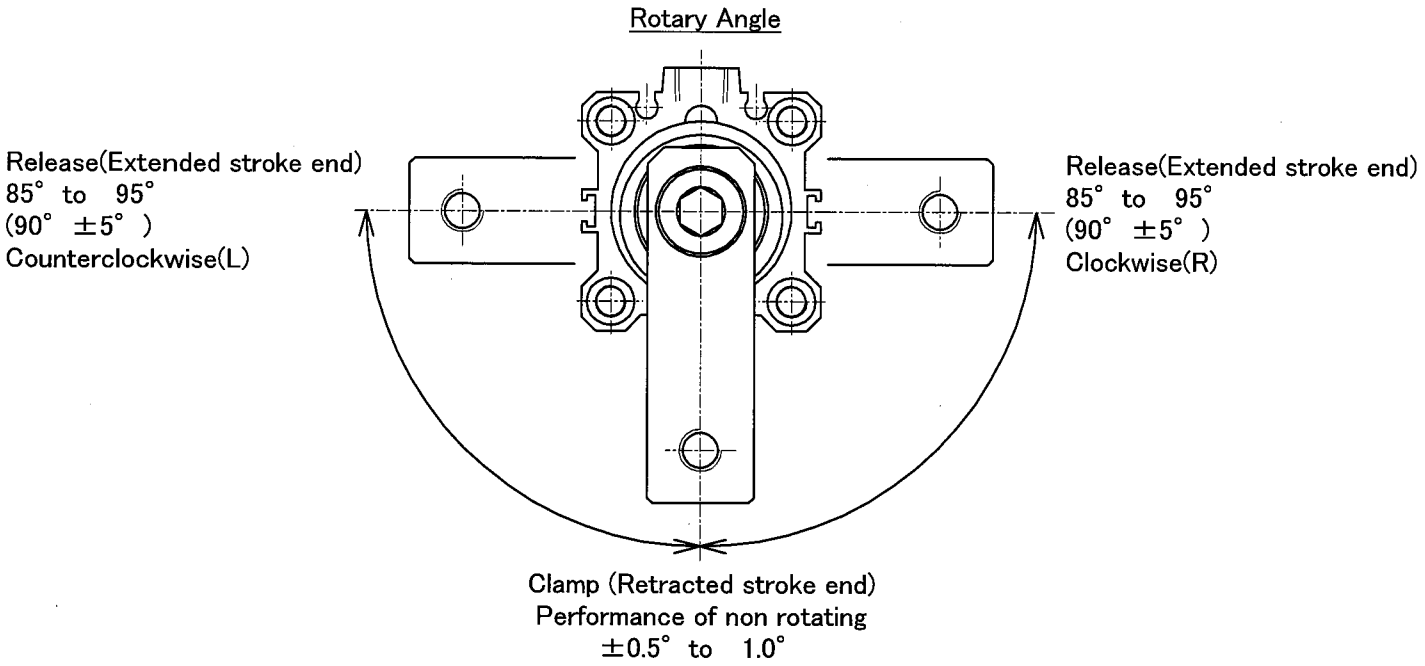
2-1. Specifications

Bore size (mm)	20	25	32	40	50	63
Action	Double acting					
Rotary angle note 1)	90° ±5°					
Rotary direction note 2)	R: Clockwise L: Counterclockwise					
Rotary stroke (mm)	19		29		33	
Clamp stroke (mm)	10・20				20・50	
Theoretical clamp force (N) note 3)	100	185	300	525	825	1300
Fluid	Air					
Proof pressure	1.5MPa					
Operating pressure range	0.1 to 1MPa					
Ambient and fluid temperature	Without auto switch −10 to 70℃ (No freezing) With auto switch −10 to 60℃ (No freezing)					
Lubrication	Non-lube					
Piping port size	M5×0.8		1/8(Rc・NPT・G)		1/4(Rc・NPT・G)	
Mounting	Through-hole/Both ends tapped common, Head side flange					
Cushion	Rubber bumper					
Storke length tolerance	$^{+1.0}_{0}$					
Piston speed	50 to 200mm/s					
Non-rotating accuracy	±1.0°		±0.5°			

Note 1) Refer to "Rotary Angle" diagram.

Note 2) Direction of rotation viewed from the rod side when the piston rod is retracting.

Note 3) At 0.5MPa



3. 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 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.

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.

⑩ **Make sure to connect a speed controller to the cylinder and adjust it so that the cylinder speed will be within a range of 50 to 200mm/s.**

If a clamp arm other than the available option is used, make sure to select an appropriate arm after calculating the inertial moment of the arm.

To operate a speed controller, make sure that the valve is fully closed, and gradually open the valve to adjust the speed.

⚠ Caution

① **Do not wipe off the grease attached on the sliding face of the cylinder.**

If the grease is removed from the sliding part of the cylinder forcibly, a malfunction could occur.

When the cylinder has been in operation for a long distance, the sliding parts become discolored black.

In such cases, to prolong cylinder life, wipe off the grease from the sliding parts, and add new grease.

(When the grease is wiped off, use water. If it is wiped off with alcohol or special solvent, the seal could be damaged.)

② **Avoid giving external force over maximum output to the cylinder.**

A pieces of cylinder broken by the force may damage the human and the device.

③ **Don't use plural cylinders synchronously without guide.**

It is difficult to control speed of the cylinder using air, whitch is compressive fluid, because speed is given an effect by change of supplied pressure, load, temperature, lubrication and each part, and difference of the performance of each cylinder.

For a short time, it is possible to adjust speed of plural cylinders by speed controller, but for a long time, above mentioned factors may break synchronisum of those cylinders. If synchronism is broken, lateral load caused by difference of position is given to piston rod and may wear seal and bearing, and make galling to cylinder tube and piston.

If it is necessary to use plural cylinders synchronously, use the guide with hardness and high accuracy not to make difference to speed of each cylinder which has individual output.

④ **Prevent intrusion of obstruction such as cutting chip from supply port into inside of the cylinder.**

If the cylinder is put on the floor at field during positioning for installation, cutting chip made by the drill for mounting hole may intrude from supply port of the cylinder and cause failure.

⑤ **Cut the length of piping short.**

Too long cylinder piping makes volume of mist in the cylinder (the mist is caused by adiabatic expansion) less than one in the piping tube, and prevent the mist from being released to air.

Residual mist in the tube becomes pooled by repeating actuation, and may leads to occurrence of water which removes the grease of the cylinder. As the result of it, the condition of lubrication becomes worse and air leakage caused by wear of seal and malfunction by increase of friction resistance occure.

In order to solve this issue, following countermeasure is necessary.

(1) Cut piping tube from solenoid valve to cylinder short as much as possible and make mist release to atmosphere properly. Following formula is eferred.

Converted value of content volume of cylinder to atmospheric pressure × 0.7 ≧ Content volume of piping tube

(2) Make exhaust pressure discharge directly to atmosphere by installing speed exhaust controller ASV or quick exhaust valve.

(3) Direct piping port downwardly so that moisture occurring in piping wouldn't return to cylinder.

⑥ Ensuring safety

If one side of the piston is pressurized by supplying air with the clamp arm attached, the piston will move vertically while the clamp arm rotates.

This operation could be hazardous to personnel, as their hands or feet could get caught by the clamp arm, or could lead to equipment damage.

Therefore, it is important to secure as a danger zone a cylindrical area with the length of the clamp arm as its radius, and the stroke plus 20mm as its height.

3-2. Selection

Speed control

When cylinder is adjusted to desired speed, install speed controller such as SMC's AS series near supply port of air.

For this adjustment, either of supply air or exhaust air is squeezed, generally exhaust air is done.

Direction control

When actuatig direction of cylinder is changed, install adequate solenoid valve selected among SMC's various models.

⚠ Warning

① Confirm the specifications.

The preducts featured in this catalog 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 center of a valve, it is difficult to make a piston stop at the required position as acurately 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 in the case it is necessary to hold a stopped pssition for an extended period.

⚠ Caution

① Use a speed controller to adjust the cylinder drive speed, gradually increasing from a low speed to the desired speed setting

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 **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.

③ **Prevent the seizure of rotating parts.**

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

④ **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.

⑤ **Instruction manual**

Install the preducts 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.

⑥ **Set the mounting base suitable to large force given by the cylinder.**

If the mounting base doesn't have enough hardness, the human and the device may be damaged.

⑦ **Mounting of clamp arm**

Use a clamp arm that is available as an option.

To fabricate a clamp arm, make sure that the allowable bending moment and the inertial moment will be within the specified range.

If a clamp arm that exceeds the specified value is installed, the internal mechanism in the cylinder could become damaged.

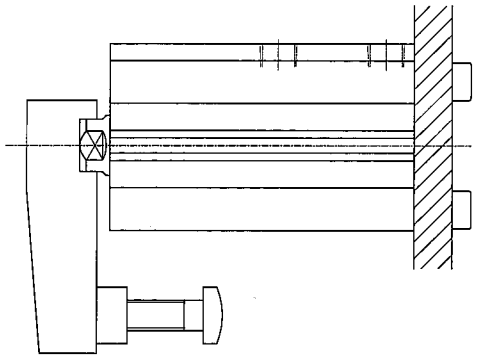
⑧ **Please go in the following tightening torque when you install the cylinder and the flange metal fittings.**

When both ends tap flange is installed

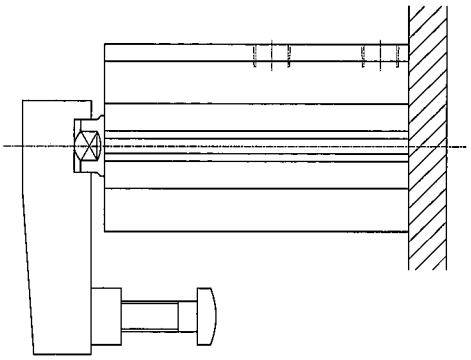
Application dia	Thread size	Tighting torque (N・m)
Φ20	M6×1	8.98～12.0
Φ25		
Φ32		
Φ40		
Φ50	M8×1.25	11.4～22.4
Φ63	M10×1.5	25.0～44.9

When passing hole is installed

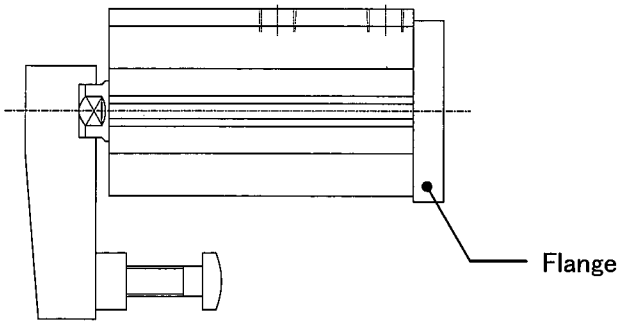
Application dia	Thread size	Tighting torque (N・m)
Φ20	M5×0.8	2.8～5.1
Φ25		
Φ32		
Φ40		
Φ50	M6×1	8.98～12.0
Φ63	M8×1.25	11.4～22.4



Both ends tap installation



Passing hole installation



Flange installation

⑨ **To remove and reinstall the arm on the piston rod, instead of securing the cylinder body, use a wrench to secure the arm to loosen or to tighten the bolt.**

An excessive amount of rotational force will be applied to the piston rod if the bolt is tightened by securing the cylinder body, which could damage the internal parts.

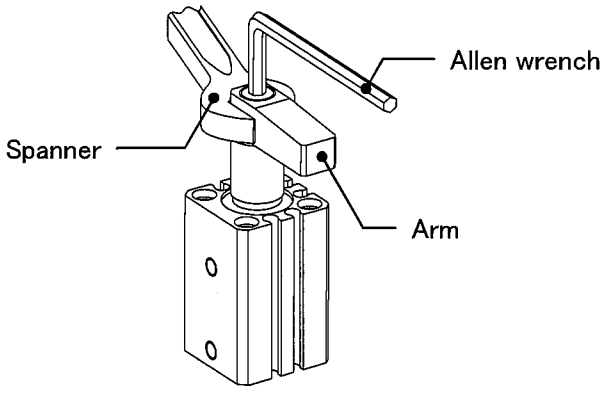
To fabricate an arm, make sure to machine a detect portion that corresponds to the parallel section at the rod end.

When arm is installed

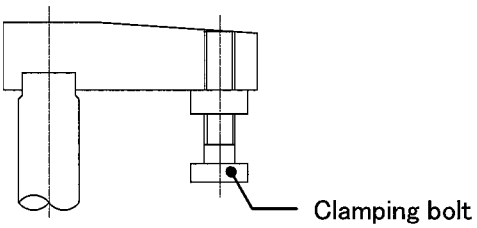
Application dia	Thread size	Tighting torque (N・m)
Φ20・Φ25	M8×1.25	4～6
Φ32・Φ40	M10×1.5	8～10
Φ50	M12×1.75	14～16
Φ63	M16×2	106～127

When clamping bolt is installed

Application dia	Thread size	Tighting torque (N・m)
Φ20・Φ25	M6×1	2～3
Φ32・Φ40	M8×1.25	4～6
Φ50・Φ63	M10×1.5	8～10



When arm is installed

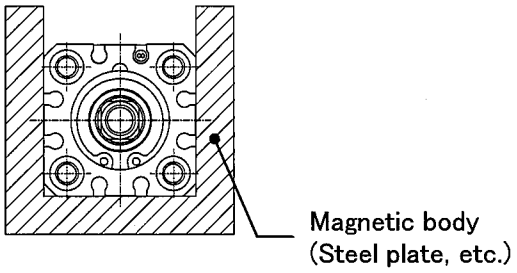


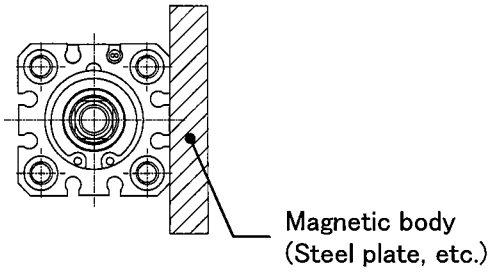
When clamping bolt is installed

⑩ **Mounting**

As shown in the figure below, when a magnetic body is in close contact with the cylinder body periphery (including the case where only one side is in contact), the function of the auto switch may be unstable.

Please contact SMC if this occurs.





⑪ Magnetic field resistant auto switch

If welding cables or welding gun electrodes are in the vichnity of the cylinder, the magnets in the cylinder could be affected by the external magnetic fields.

(Please contact SMC if the welding amperage exceeds 16,000 A.)

If the source of strong magnetism comes in contact with the cylinder or an auto switch, make sure to install the away from the source of the magnetism.

If the cylinder is to be used in an environment in which spatter will come in direct contact with the lead wires, cover the lead wires with a protective tube.

For the protective tube, use a tube with a bore of Φ7 or more, which excels in heat resistance and flexibility.

Please contact SMC if an inverter welder or a DC welder will be used.

3-4. Piping

⚠ Caution

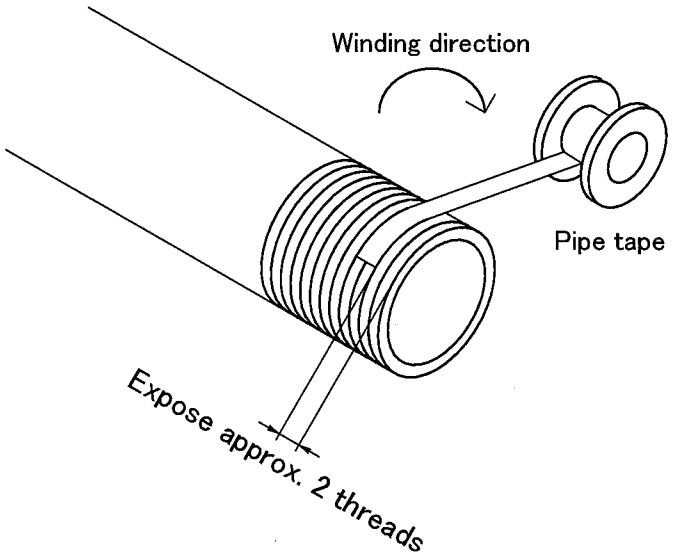
① Before piping

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 fittings 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.



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 Class 1 turbine oil (with no additive) ISO VG32.

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.

3-6.Air Supply

For compressed air supplied to the cylinder, use the air which is filtrated by SMC's filter such as AF series and adjust to specified setting pressure by SMC's regulator such as AR series.

⚠ 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

① **Install air filters.**

Install air filters close to valves at their upstream side.

A filtration degree of 5 μm or less should be selected.

② **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.

③ **Use the product within the specified range of fluid and ambient temperature.**

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

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

3-7.Operating Environment

⚠ Warning

① **Do not use the cylinder under following environments:**

1. An area in which fluids such as cutting oil splash on the piston rod.
2. An area in which foreign matter such as particles, cutting chips, dust, or spatter is present.
3. An area in which the ambient temperature exceeds the operating range.
4. An area exposed to direct sunlight.
5. An environment that poses the risk of corrosion.

② **The cylinder could malfunction or the non-rotating accuracy could be affected if a rotational force is applied to the piston rod.**

Therefore, observe the particulars given below before operating the cylinder.

1. Do not absolutely perform any work (such as clamping or acting as a stopper, etc.) in the rotary direction (Fig 1).
2. To clamp, make sure to do so within the clamp stroke (straight-line stroke) range (Fig 2).
3. Make sure that the clamping surface of the workpiece is perpendicular to the cylinder' s axial line (Fig 3).
4. Do not operate the cylinder in such a way that an external force causes the workpiece to move while being clamped (Fig 4).
5. Furthermore, do not operate the cylinder in an application in which a rotational force will be applied to the piston rod.

Fig 1

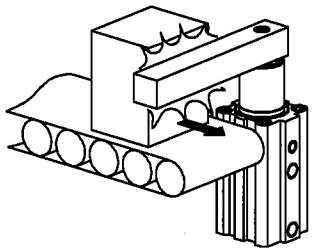


Fig 2

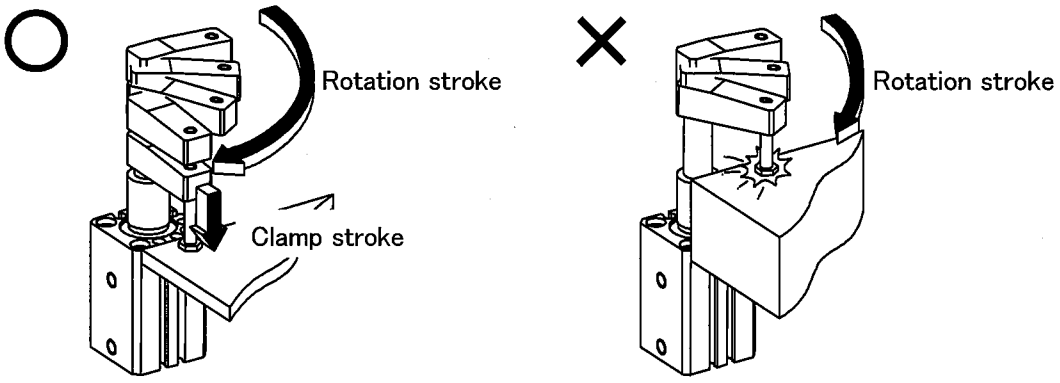


Fig 3

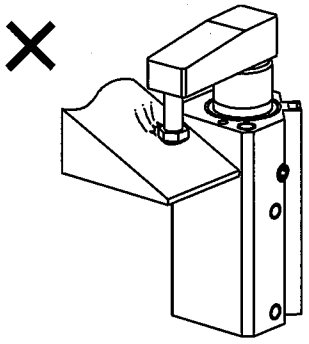
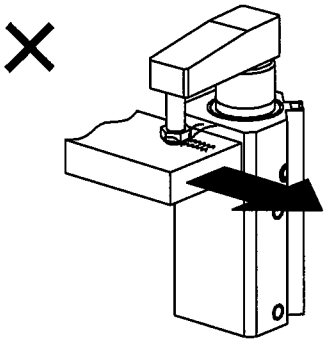


Fig 4



③ **When using auto switches, do not operate in an environment with strong magnetic fields.**

④ **Avoid much humidity for storage of cylinder.**

Store the cylinder with piston rod retracted under the environment with little humidity and countermeasure for rusty.

3-8. Maintenance

⚠ Warning

① **Perform maintenance procedures as shown in the instruction manual.**

If they are handled improperly, malfunction or damage of machinery or equipment may occur.

② **Removal of equipment, and supply/exhaust of compressed air**

Before any machinery or equipment is removed, first ensure that the appropriate measures are in place to prevent the falling or erratic movement of driven objects and equipment, then cut off the electric power and reduce the pressure in the system to zero. Only then should you proceed with the removal of any machinery and equipment.

When machinery is restarted, proceed with caution after confirming that appropriate measures are in place to prevent cylinders from suddenly moving.

⚠ Caution

① **Drain flushing**

Remove drainage from air filters regularly.

3-9. Auto switches

An auto switch basically becomes bundled shipment, and install it, please after referring to the following.

The type and specifications of applicable auto switch and the cautions for handling them can be found in the catalogue and operation manual respectively.

Direct mounting

【Application auto switch】

Reed switch ・・・D-A90・D-A93・D-A96・D-A90V・D-A93V・D-A96V

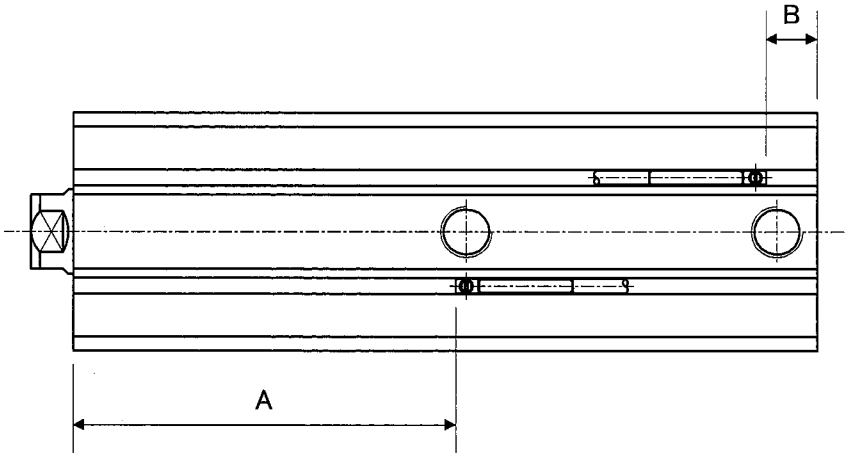
Solid state switch・・・D-M9N・D-M9P・D-M9B・D-M9NV・D-M9PV・D-M9BV・D-F9G・D-F9H
D-M9NW・D-M9PW・D-M9BW・D-M9NWV・D-M9PWV・D-M9BWV
D-M9NA・D-M9PA・D-M9BA・D-M9NAV・D-M9PAV・D-M9BAV

<Auto switch mounting position>

Install an auto switch on the position surely done on-off on the stroke edge.

The auto switch installation shows the proper installation position in the stroke detection in the table below risking as shown in the figure below, and referring.

The position where an auto switch is installed is a standard (No one to specify the position where it is installed to ship the installation) in the table below though it depends.

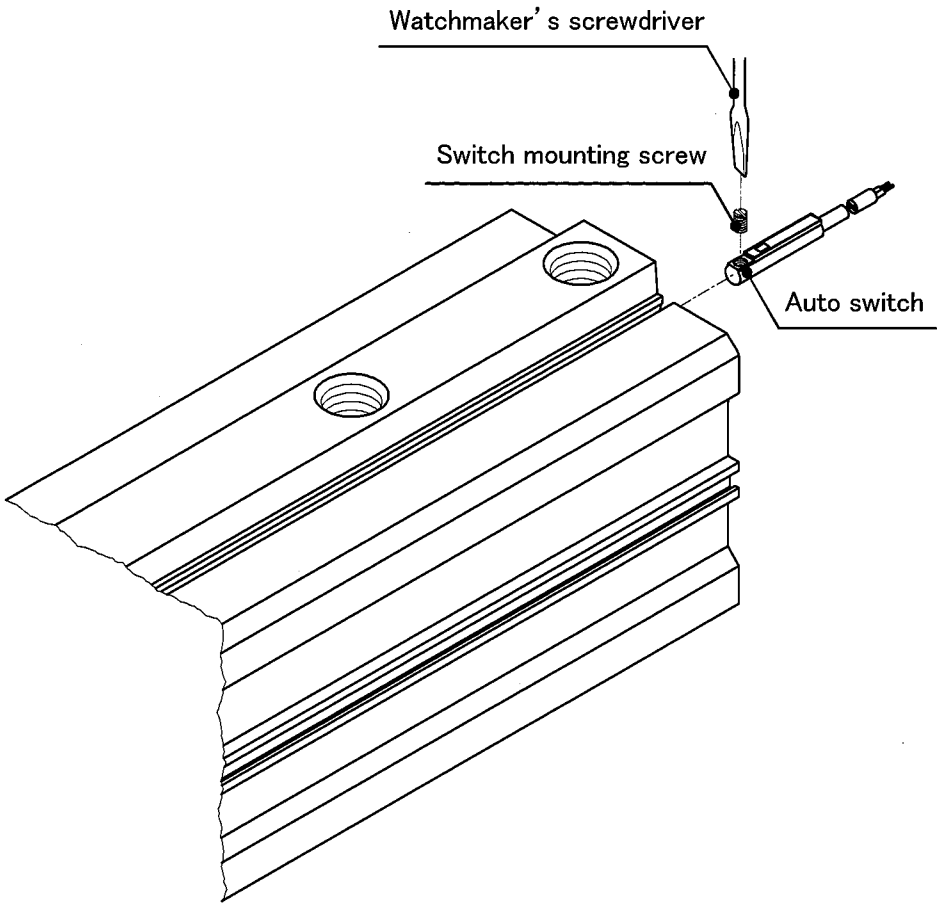


Unit: mm

		Application auto switch			
		D-M9□(W)(V) D-M9□A(V) D-F9□		D-A9□(V)	
Bore	Stroke	A	B	A	B
Φ20	10, 20	60.5	9	56.5	5
Φ25	10, 20	61	11	57	7
Φ32	10, 20	76	13.5	72	9.5
Φ40	10, 20	77	16	73	12
Φ50	20	92.5	21.5	88.5	17.5
	50	122.5	25	118.5	21
Φ63	20	94.5	22.5	90.5	18.5
	50	124.5	26.5	120.5	22.5

※A: Unclamp side B: Clamp side

<How to mount the auto switch>



Insert the front of the auto switch into the auto switch groove and slide the switch to the desired detection position.
Securely tighten the mounting screw, use a watchmaker' s screwdirver with a 5 to 6 mm handle diameter and tighten with a torque of 0.1 to 0.15 N・m.
As a guide, an acceptable tightening level is reached by tightening the screw an additional 90 degrees (1/4 turn) from the point at which the screw is snug.

Rail mounting

【Application auto switch】

Reed switch ・・・D-A72・D-A73・D-A80・D-A72H・D-A73H・D-A76H・D-A80H・D-A73C・D-A80C
D-A79W

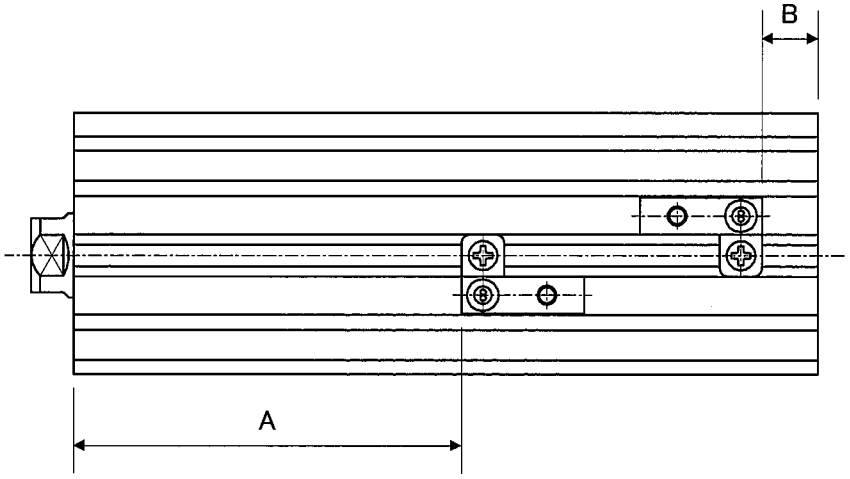
Solid state switch ・・・D-F79・D-F7P・D-J79・D-J79C・D-F7NV・D-F7PV・D-F7BV・D-F79W・D-F7PW
D-J79W・D-F7NWV・D-F7BWV・D-F79F・D-F7BA・D-F7BAV・D-F7NT

< Auto switch mounting position>

Install an auto switch on the position surely done on-off on the stroke edge.

The auto switch installation shows the proper installation position in the stroke detection in the table below risking as shown in the figure below, and referring.

The position where an auto switch is installed is a standard (No one to specify the position where it is installed to ship the installation) in the table below though it depends.

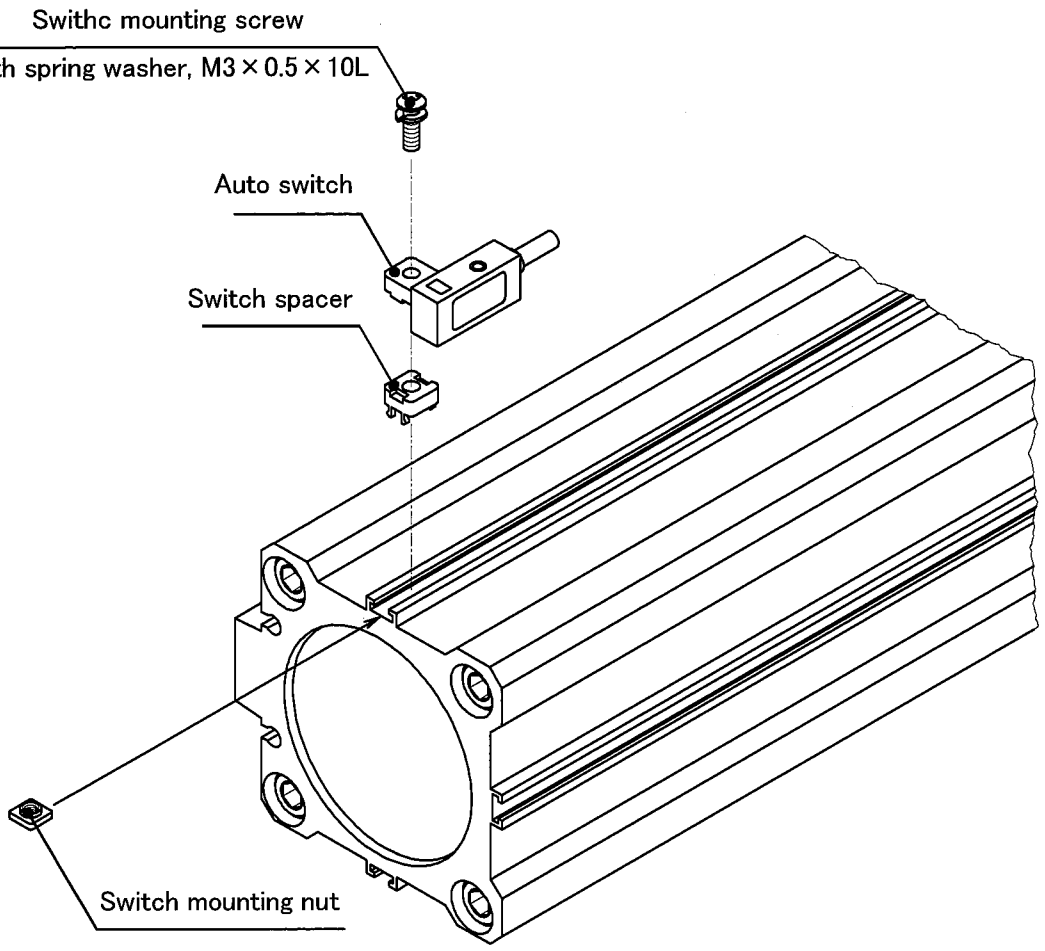


Unit:mm

		Application auto switch							
		D-F7NT		D-A72 D-A7(8)□H D-A7(8)□C D-F(J)7□(W)(V) D-J79C D-F79F D-F7BA(V)		D-A73 D-A80		D-A79W	
Bore	Stroke	A	B	A	B	A	B	A	B
Φ32	10, 20	78.5	16	73.5	11	73	10.5	70.5	8
Φ40	10, 20	79.5	18.5	74.5	13.5	74	13	71.5	10.5
Φ50	20	95	24	90	19	89.5	18.5	87	16
	50	125	27.5	120	22.5	119.5	22	117	19.5
Φ63	20	97	25	92	20	91.5	19.5	89	17
	50	127	29	122	24	121.5	23.5	119	21

※A:Unclamp side B:Clamp side

< How to mount the auto switch>



①Slide the auto switch mounting nut inserted into the mounting rail and set it at the auto switch mounting position

②Fit the convex part of auto switch mounting arm into the concave part of auto switch mounting rail. Then slide the switch over the nut.

③Push the suto switch mounting screw lightly into the mounting nut through the hole of auto switch mounting arm.

④After reconfirming the detecting position, tighten the mounting screw to secure the auto switch. (Tighening torque of M3 screw should be 0.5 to 0.7 N・m.)

⑤Modification of the detecting position should be made in the condition of 3.

Mounting bracket kit number

Bore	Kit number	Description	Qty.
Φ32・Φ40 Φ50・Φ63	BQ-2	Switch mounting screw	1
		Switch spacer	1
		Switch mounting nut	1

※Mounting screws set made of stainless steel

The set of satainless steel mounting screws (with nuts) described below is available and can be used depending on the operating environment.

(Please order the auto switch spacer, since it is not included.)

BBA2: For D-A7/A8/F7/J7

When only a switch is shipped independently, "BBA2" screws are attached.

【Application auto switch】

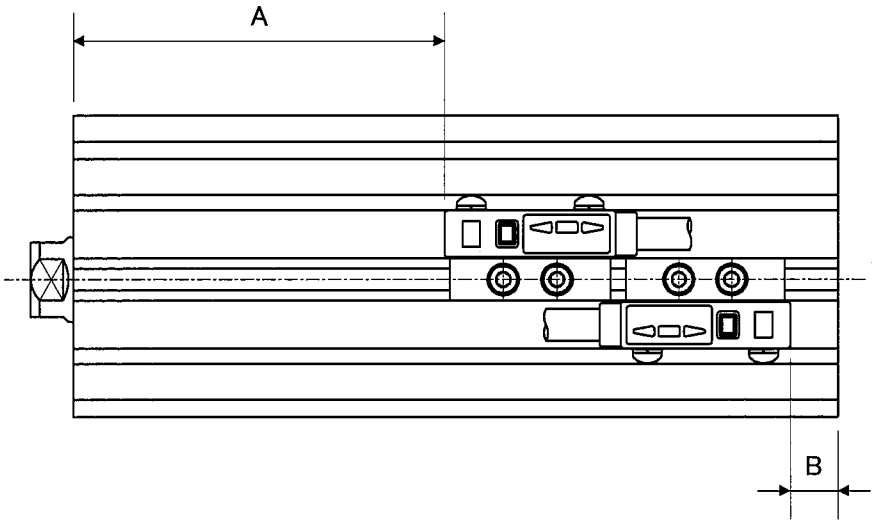
Solid state switch・・・D-P4DW・D-P4DWSC・D-P5DW・D-P5DWB・D-P5DWSC・D-P5DWL-298

< Auto switch mounting position>

Install an auto switch on the position surely done on-off on the stroke edge.

The auto switch installation shows the proper installation position in the stroke detection in the table below risking as shown in the figure below, and referring.

The position where an auto switch is installed is a standard (No one to specify the position where it is installed to ship the installation) in the table below though it depends.



Unit:mm

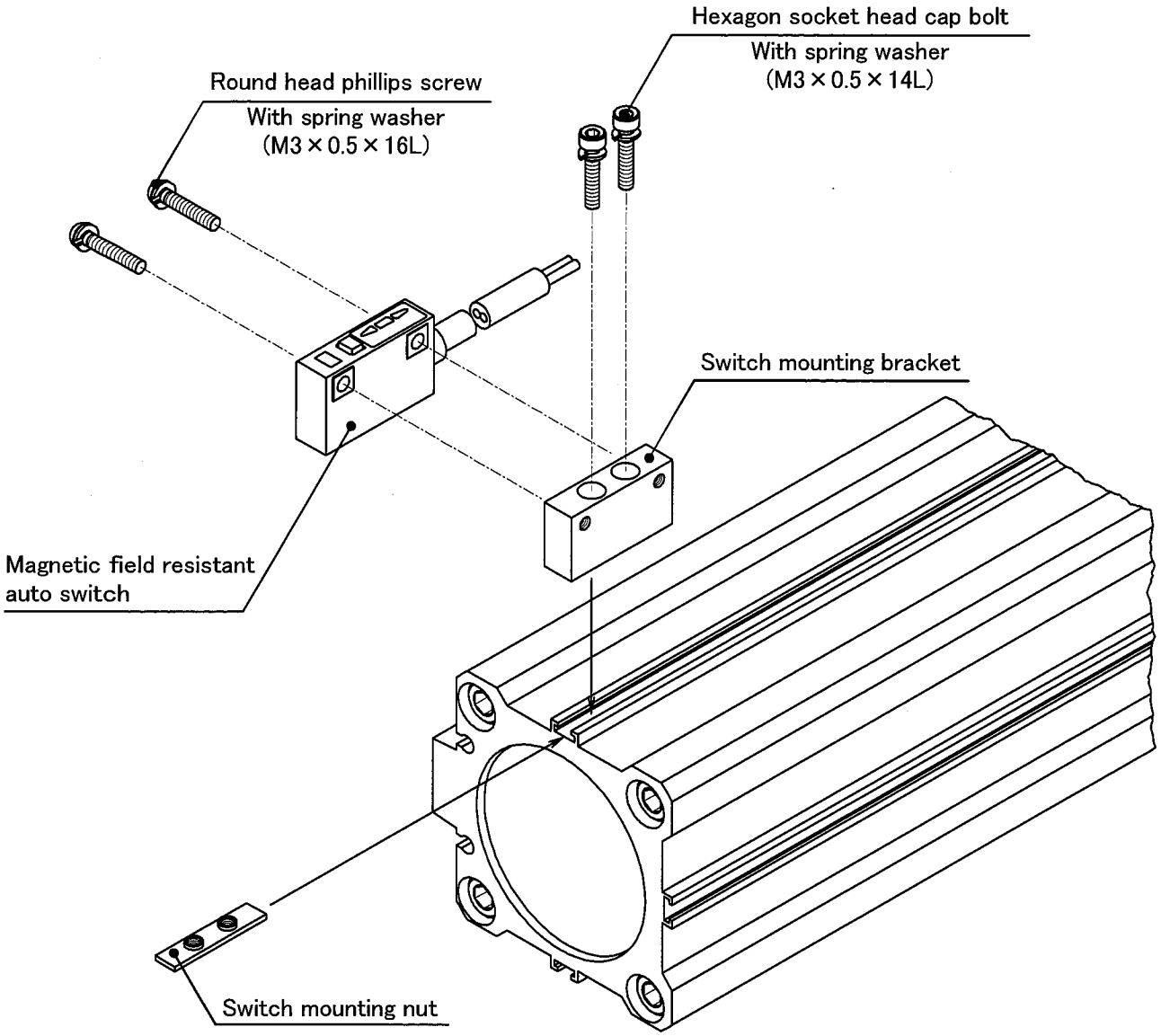
		Application auto switch D-P4DW D-P4DWSC D-P5DW D-P5DWB D-P5DWSC D-P5DWL-298	
Bore	Stroke	A	B
Φ40	10, 20	70	9
Φ50	20	85.5	14.5
	50	115.5	18
Φ63	20	87.5	15.5
	50	117.5	19.5

※A:Unclamp side B:Clamp side

< How to mount the auto switch>

【Application auto switch】

Solid state switch・・・D-P4DW・D-P5DW・D-P5DWB



①Mount the mounting bracket onto the mounting nut by tightening bracket fixing screw lightly through the mounting hole on the top of bracket.

②Insert the mounting bracket assembly (bracket + nut) into the mounting groove and set it at the auto switch mounting position.

③Push the suto switch mounting screw lightly into the auto switch through the mounting hole secure.

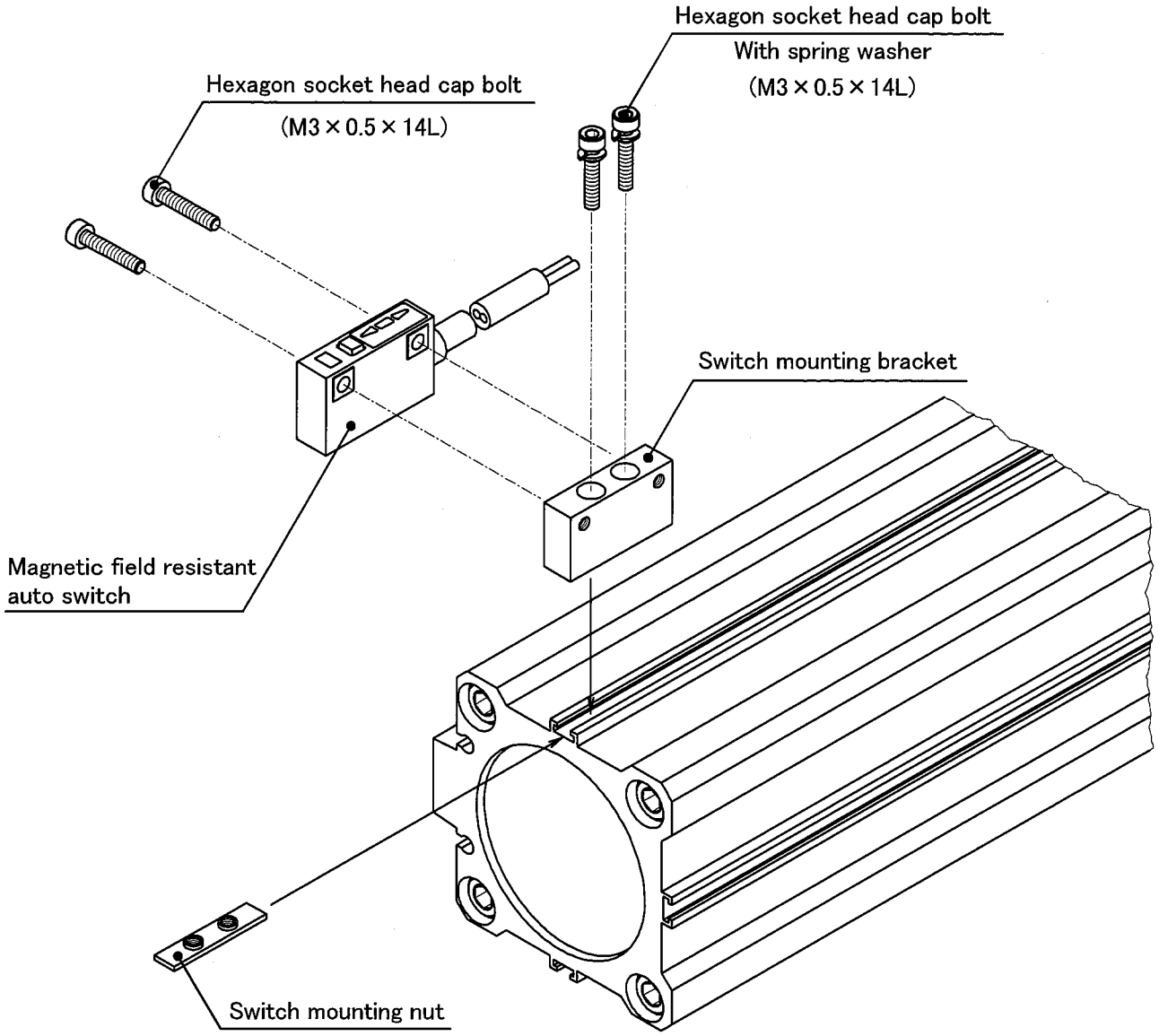
④After reconfirming the detecting position, tighten the mounting screw to secure the mounting bracket and the auto switch.(Tightening torque should be 0.5 to 0.7N・m.)

Auto switch mounting bracket part No.

Bore	Kit number	Description	Qty.
Φ40・Φ50・Φ63	BQP1-050	Switch mounting bracket	1
		Swtich mounting nut	1
		Round head phillips screw (with spring washer)	2
		Hexagon socket head cap bolt (with spring washer)	2

【Application auto switch】

Solid state switch・・・D-P4DWSC・D-P5DWSC・D-P5DWL-298



①Mount the mounting bracket onto the mounting nut by tightening hexagon socket head cap bolt (with spring washer) lightly through the mounting hole on the top of bracket.

②Insert the mounting bracket assembly (bracket + nut) into the mounting groove and set it at the auto switch mounting position.

③Push the suto switch mounting screw lightly into the auto switch through the mounting hole secure.

④After reconfirming the detecting position, tighten the mounting screw to secure the mounting bracket and the auto switch.(Tightening torque should be 0.5 to 0.7N・m.)

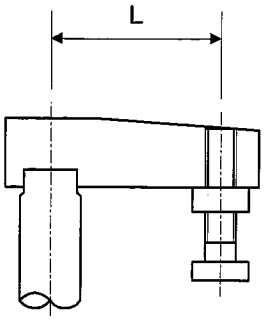
Auto switch mounting bracket part No.

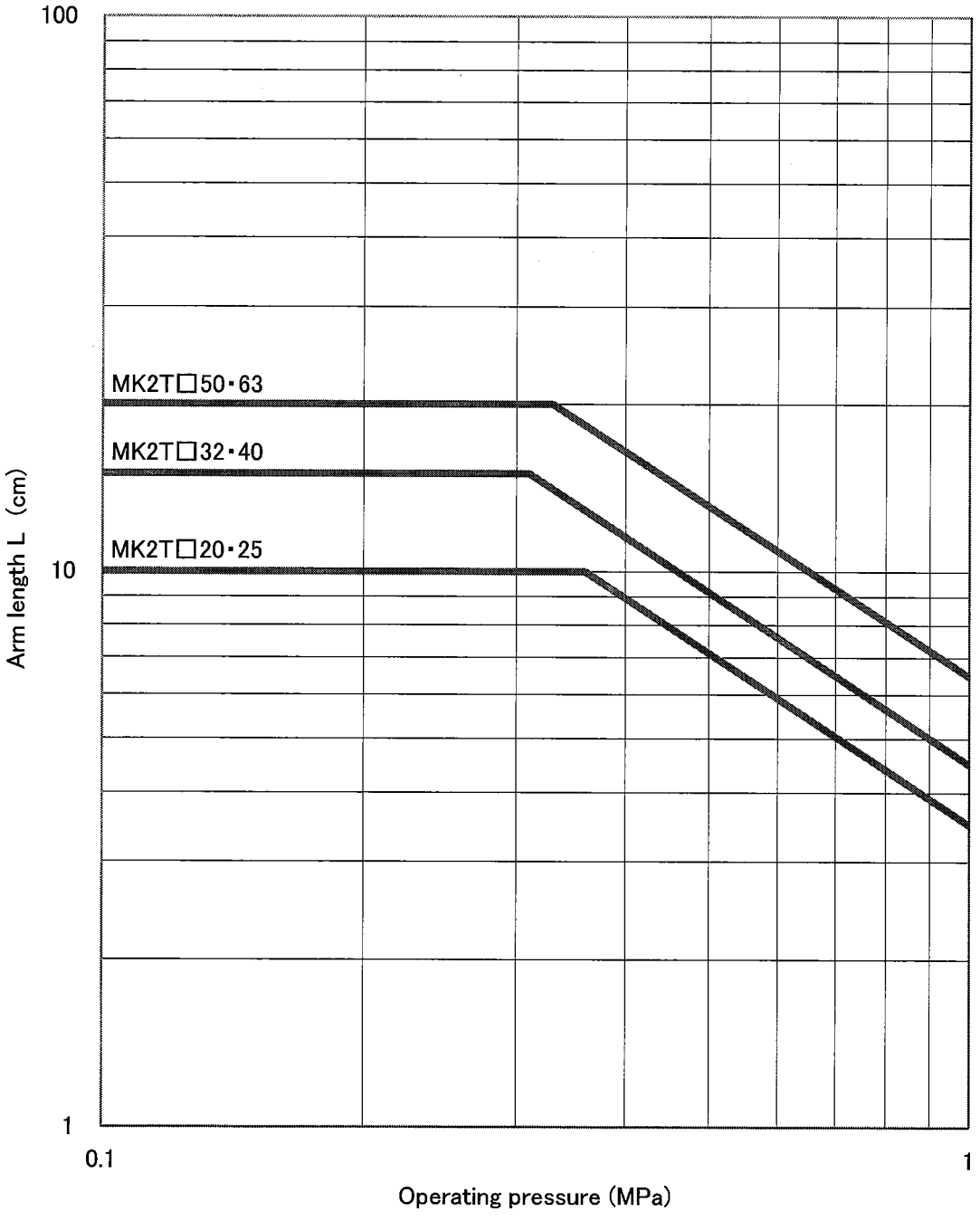
Bore	Kit number	Description	Qty.
Φ40・Φ50・Φ63	BQP1T-050	Switch mounting bracket	1
		Swtich mounting nut	1
		Hexagon socket head cap bolt (with spring washer)	2
		Hexagon socket head cap bolt	2

4. Model selection

4-1. Allowable bending moment

Use the arm length and operating pressure within below fig for allowable bending moment loaded piston rod.

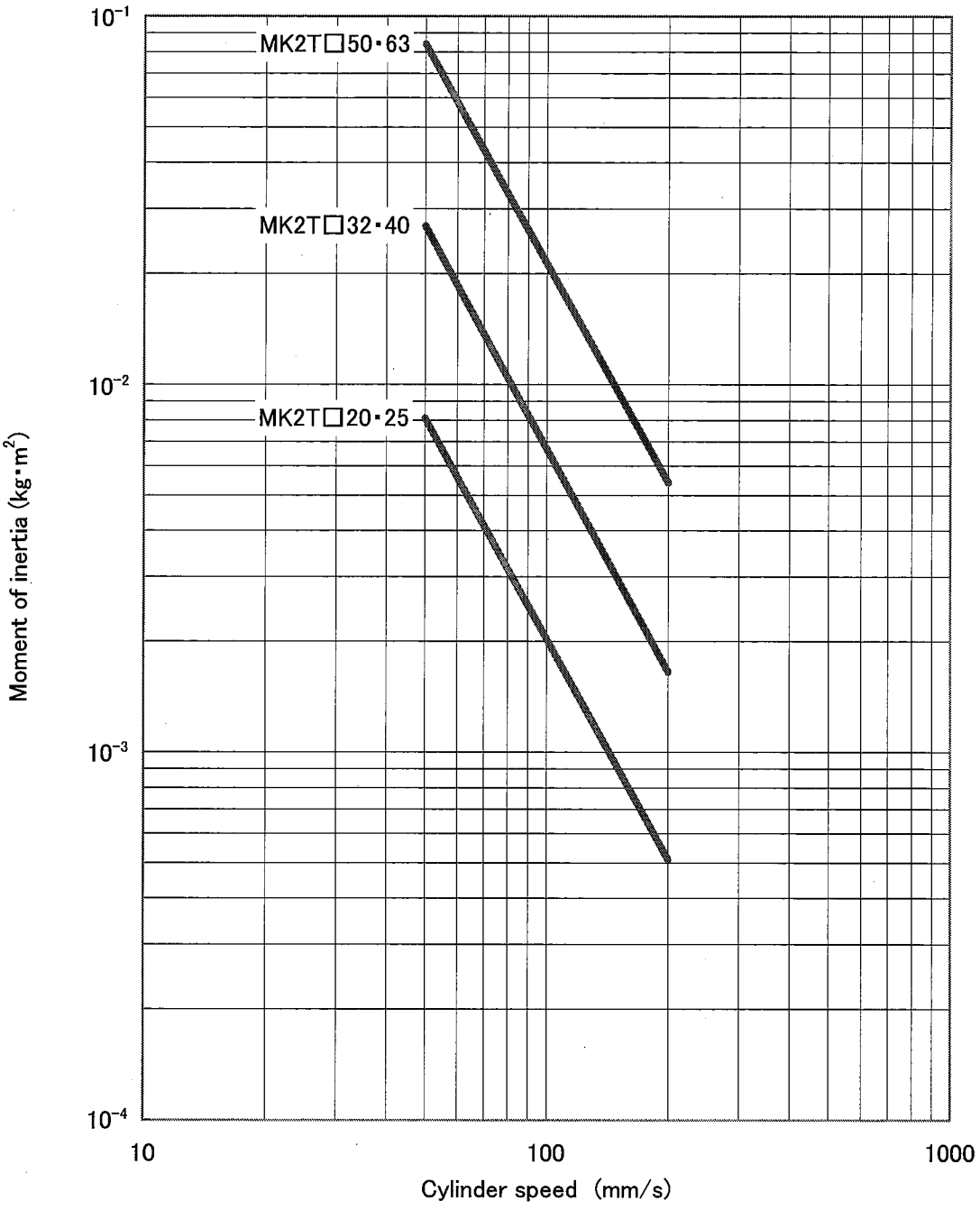




4-2. Moment of inertia

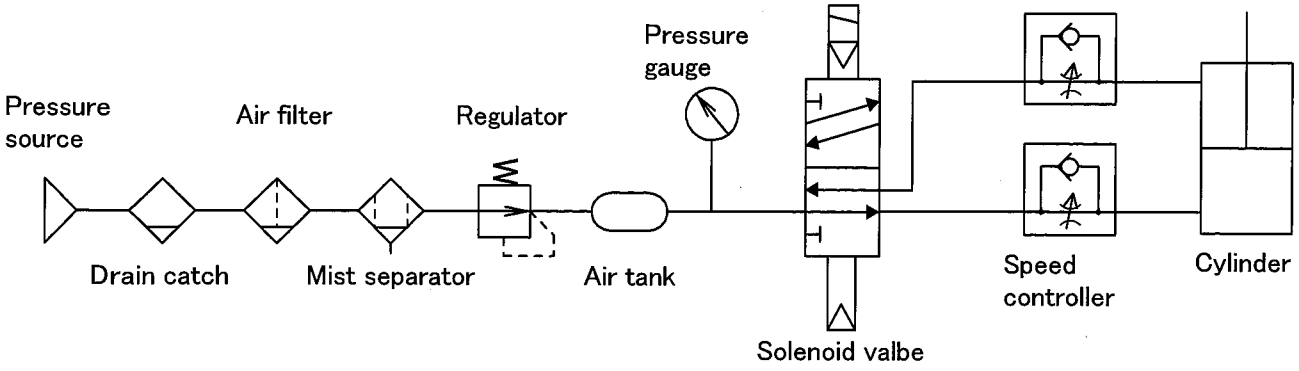
When the arm is long and heavy, damage of internal parts may be caused due to inertia.

Use the inertia moment and cylinder speed within below fig based on armrequirements.



5. Pneumatic pressure circuit

The following is an example of a basic meter-out control circuit for operating a cylinder using an air filter, a regulator, a solenoid valve and a speed controller.



6. Maintenance and Check

6-1. Daily check

①Is the operation smooth?

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

③Is there any abnormality in the stroke?

6-2. Periodic check

①Are the cylinder mounting bolts and workpieces firmly fixed?

②Is the operation smooth?

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

④Is there any external leakage?

⑤Is there any abnormality in the stroke?

⑥Are there any flaws on the piston rod.

⑦Is the drainage of the air filter removed periodically?

Check the above-mentioned items, and if any defects are found, take appropriate measures.

If there are any unclear points, consult SMC's sales separtment.

6-3. How to replace the seal

Disassembly of the cylinder

Procedure 1 : Cleaning

Prior to disassembly, wipe off any dirt from the outside of the actuator.

This will prevent the intrusion of dust and foreign materials during disassembly.

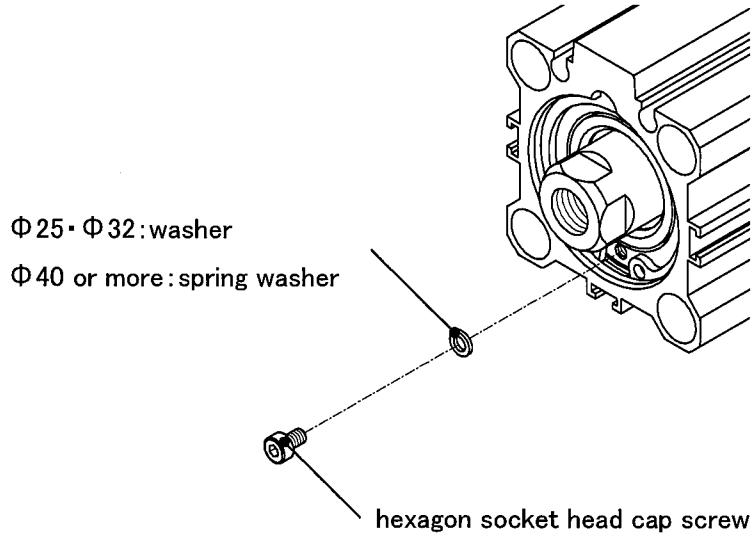
Take particular care on the surface of the piston rod.

Procedure 2 : Removal of arm

Remove the arm with rod point.

Procedure 3 : Removal of hexagon socket head cap screw [only Φ25 or more]

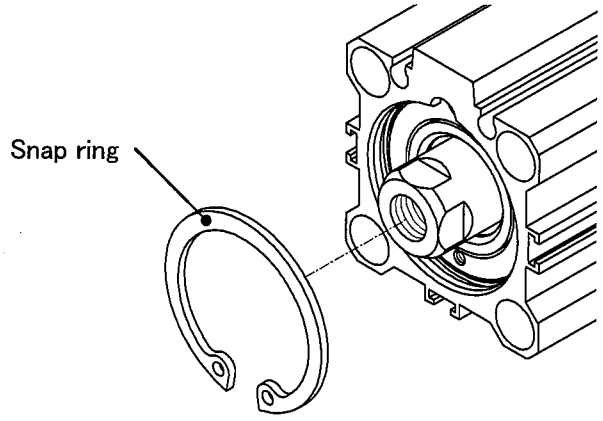
Remove the hexagon socket head cap screw (with washer or spring washer).



Procedure 4 : Removal of snap ring

Please go with proper pliers (tool for C type stop circle for the hole).

Moreover, please note that the snap ring comes off from pliers when detaching it, it flies, and the human body and peripherals might be disadvantaged.



Procedure 5 : Decomposition

Please install the bolt etc. in the point part of the piston rod, and pull it out with rod cover assembly and the key.

In that case, please note that neither the inside diameter of the tube nor the rod cover bearing are damaged.

Removal of the seal

Procedure 1 : Removal of the coil scraper

Insert a precision driver etc. from front the rod cover assembly and prise the seal out.

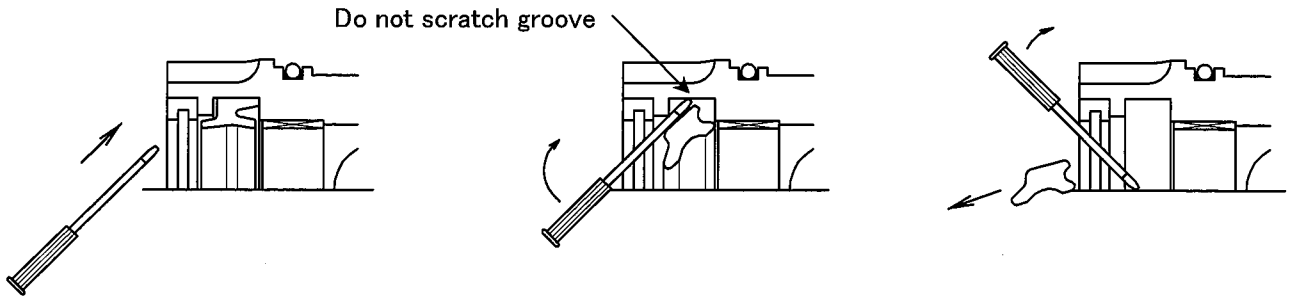
From front rod cover assembly and prise the coil scraper out.

Take care not to scratch or score the coil scraper groove in the rod cover assembly.

Procedure 2 : Removal of the rod seal

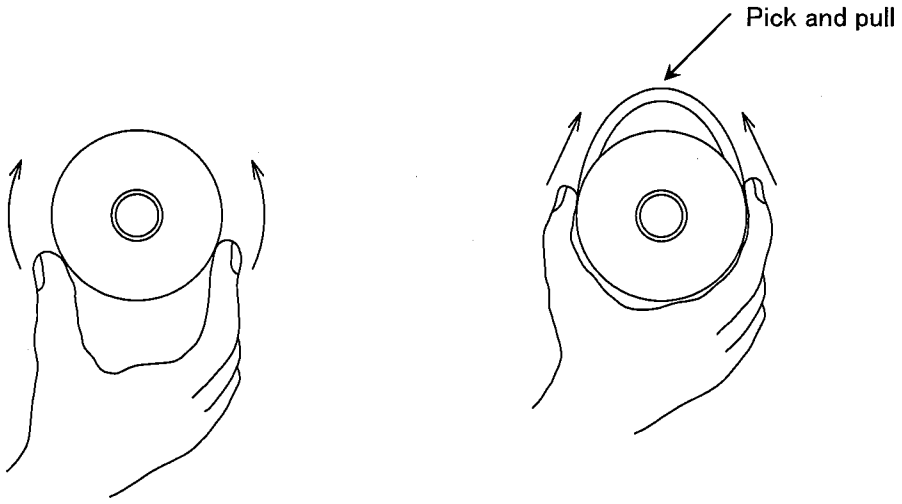
Insert a precision driver etc. from front the rod cover assembly and prise the seal out.

Take care not to scratch or score the seal groove in the rod cover assembly.



Procedure 3 : Removal of the piston seal

Push the tube gasket partially to make it come off and pull it out manually.



Procedure 4 : Removal of the tube gasket

Please make it push out of one side with the hand, and pull out the place where it came up (Refer to the above figure).

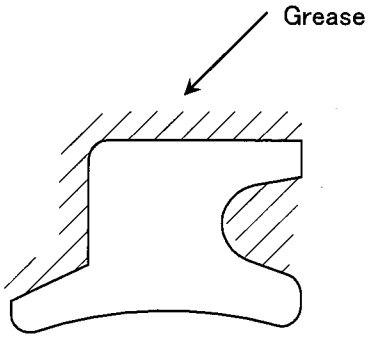
Spreading of grease

Procedure 1 : Grease spreading of rod seal and piston seal

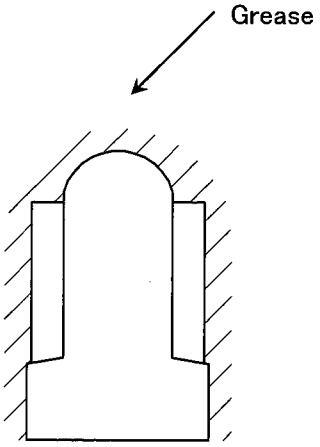
There is thinly no irregularity and lithium system grease * is spread on all surroundings of rod seal and piston seal for the exchange.

※SMC recommendation grease : It is possible to arrange.

(The arrangement product number is 6-4. Please refer to the articles of consumption.)



Rod seal



Piston seal

Procedure 2 : Grease spreading of tube gasket

There is thinly no irregularity and lithium system grease * is spread on the whole of the tube gasket for the exchange.

※SMC recommendation grease : It is possible to arrange.

(The arrangement product number is 6-4. Please refer to the articles of consumption.)

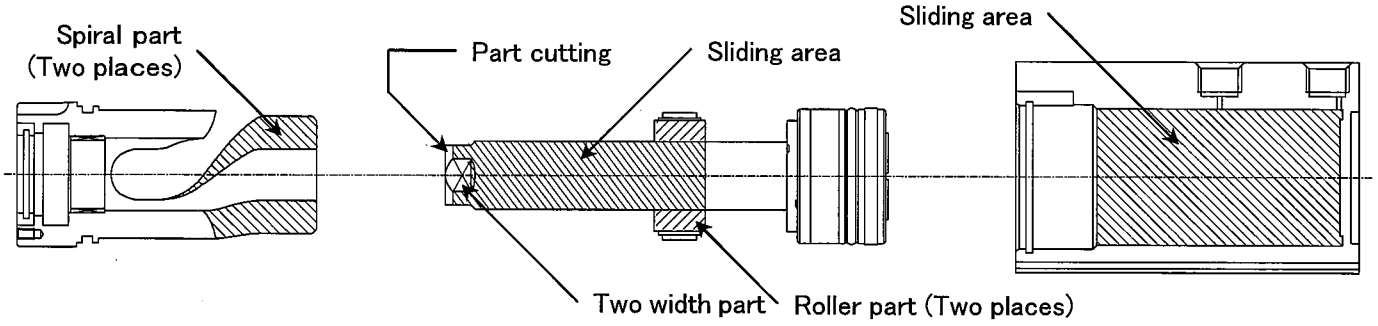
Procedure 3 : Grease spreading of each part

There is thinly no irregularity and lithium system grease * is spread on a specified part of rod cover assembly, piston rod assembly and cylinder tube assembly.

Please give it.

※SMC recommendation grease : It is possible to arrange.

(The arrangement product number is 6-4. Please refer to the articles of consumption.)



Rod cover assembly

Piston rod assembly

Cylindr tube assembly

Installation of seal and Coil scraper

Procedure 1 : Installation of rod seal and tube gasket

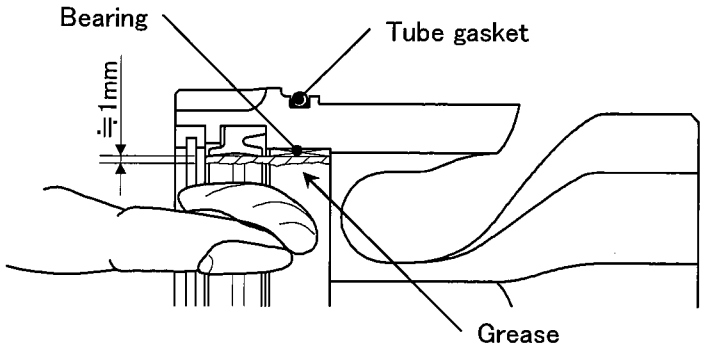
Please install the direction of rod seal so as not to make a mistake.

Please install the tube gasket so as not to drop out of rod cover assembly.

After it installs it, there is no irregularity and lithium system grease * is spread on rod seal and the bearing.

※SMC recommendation grease : It is possible to arrange.

(The arrangement product number is 6-4. Please refer to the articles of consumption.)



Procedure 2 : Installation of Coil scraper

Please install Coil scraper for the exchange in the Coil scraper ditch surely.

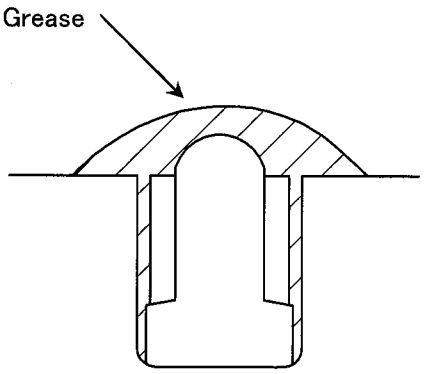
Procedure 3 : Installation of piston seal

Please install it so that piston seal should not twist.

Please spread it to rub lithium system grease * into between piston seal outer part and the ditch after it installs it.

※SMC recommendation grease : It is possible to arrange.

(The arrangement product number is 6-4. Please refer to the articles of consumption.)



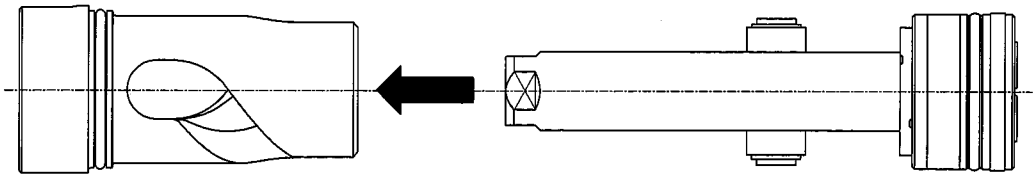
Procedure 4 : Installation of tube gasket

Please note the dropout, and install it.

Assembly of cylinder

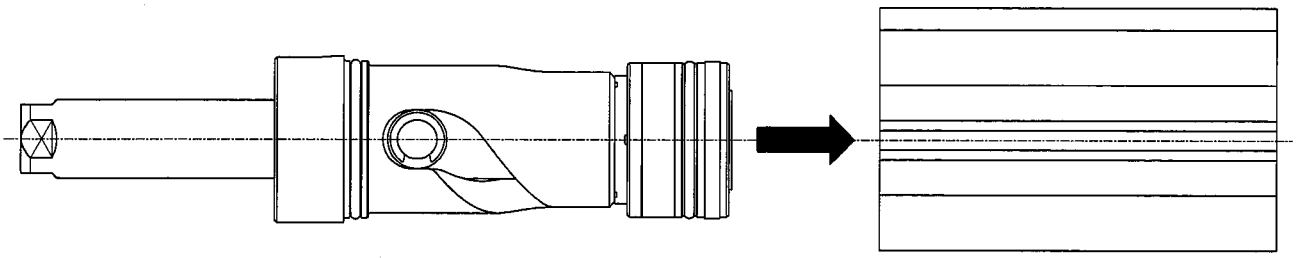
Procedure 1 : Insertion of rod cover assembly

Please insert it politely slowly so as not to damage rod seal in corner part piston rod assembly.



Procedure 2 : Insertion of piston rod assembly

Please insert it politely slowly to damage neither piston seal nor the tube gasket in corner part cylinder tube assembly.



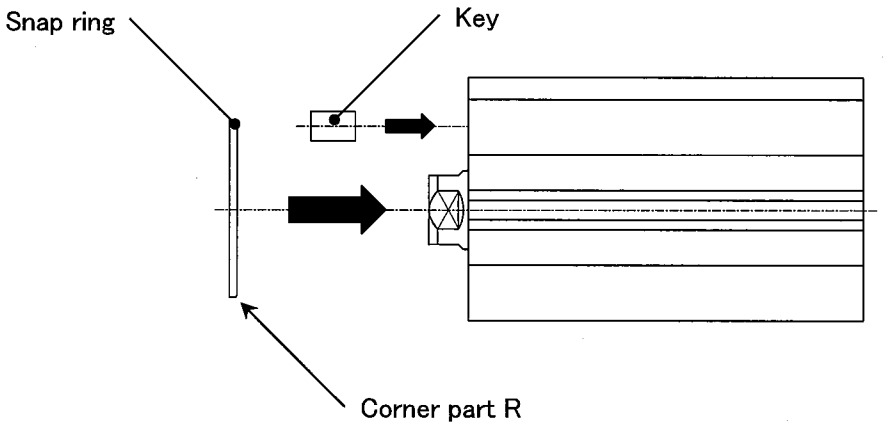
Procedure 3 : Installation of key and snap ring

Please insert the key in the key ditch, and install the snap ring with proper pliers (tool for C type snap ring for the hole).

In that case, please install the direction of the snap ring so as not to make a mistake.

Because the snap ring comes off from pliers when it installs it, it flies, and the human body and peripherals might be disadvantaged.Please note it.

Moreover, please confirm whether in the snap ring ditch surely.



Procedure 4 : Installation of hexagon socket head cap screw [only Φ25 or more]

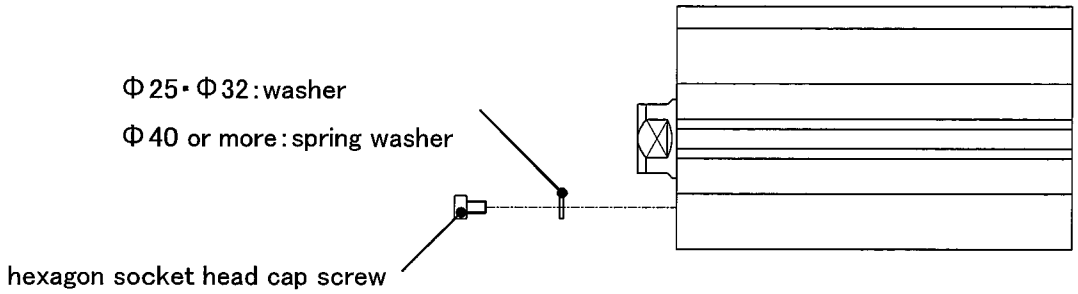
The adhesive in screw hole part screw and rod cover assembyl of the bolt with a hexagon socket head cap screw hole after it is possible to be done alcohol etc. of the drop to being.

Please spread the adhesive (SMC recommendation adhesive: Loctite Corp. 242 [Blue]) for loose stop on screw hole part rod cover assembly.

Please tighten with the hexagon socket head cap screw (※Φ25・Φ32 : with washer／Φ40 or more : with spring washer).

Please confirm whether the adhesive has overflowed after it concludes it.

Please wipe an extra adhesive off when overflowing.



Tightening torque

Bore	Size of screw	Tightening torque (N・m)
Φ25・Φ32	M2.5×0.45	0.36±10% (0.324～0.396)
Φ40・Φ50・Φ63	M3×0.5	0.63±10% (0.570～0.690)

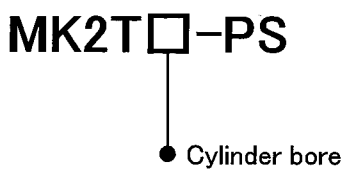
Procedure 5 : Assembly confirmation

Please confirm whether not to cause the air leakage from the packing seal or to operate by the minimum operating pressure smoothly.

6-4. Consumable parts

In this product, seal kit and the grease package were prepared.

①Seal kit



Cyliner bore (mm)	Kit no.	Content and qty.			
		Rod seal	Piston seal	Tube gasket	Coil scraper
20	MK2T20-PS	1	1	1	1
25	MK2T25-PS	1	1	1	1
32	MK2T32-PS	1	1	1	1
40	MK2T40-PS	1	1	1	1
50	MK2T50-PS	1	1	1	1
63	MK2T63-PS	1	1	1	1

Storage of seal (for extended period)

1) Put the seal into an enclosed package for storage.
2) Avoid exposure to direct sunlight, high temp. and humidity.
   Especially, shut off the equipment which possibly causes heat, radiation and ozone from the package.
3) Do not deform or damage the seal by crushing.
4) The seal may have white powder on the surface during storage. This will not effect the performance of the seal.

②Grease package

When the grease is added during replacement of the seal and maintenance of the cylinder, use the grease package.

Kit no.	Net
GR-S-010	10g

6-5. Bracket

In this product, the flange metal fittings were prepared.

①Flange

Cylinder bore(mm)	Kit no.	Net
20	CQS-F020	・Flange (1 pc.) ・Hexagon socket head cap screw (4 pcs.)
25	CQS-F025	
32	MK2T-F032	
40	MK2T-F040	
50	MK2T-F050	
63	MK2T-F063	

※The material of the flange metal fittings is steel.

6-6. Accessory Bracket

In this product, the arm and the installation bolt were prepared.

①Arm

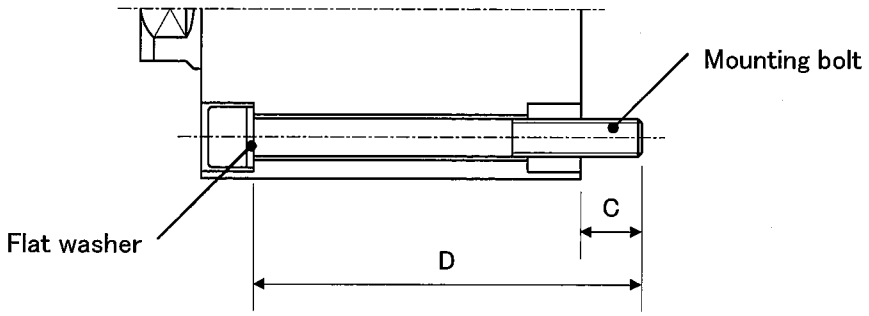
Cylinder bore(mm)	Kit no.	Net
20	MK-A020	・Arm (1 pc.) ・Clamping bolt (1 pc.) ・Hexagon socket head cap screw (1 pc.) ・Hexagon nut (1 pc.) ・Spring washer (1 pc.)
25		
32	MK-A032	
40		
50	MK-A050	
63	MK2T-A063	

※The material of the arm is steel.

②Mounting bolt: The mounting bolt for the through- hole type.

Ordering: Add the word "MK2TB" in front of the bolts to be used.

Example) M5 × 115L 4 pcs. (MK2TB)



Note) Be sure to use a flat washer to mount cylinders via through-holes.

Model	C	D	Mounting bolt
MK2TB20-10	11	115	M5 × 115L
MK2TB20-20	11	135	M5 × 135L
MK2TB25-10	8.5	115	M5 × 115L
MK2TB25-20	8.5	135	M5 × 135L
MK2TB32-10	11.5	145	M5 × 145L
MK2TB32-20	11.5	165	M5 × 165L
MK2TB40-10	7.5	145	M5 × 145L
MK2TB40-20	7.5	165	M5 × 165L
MK2TB50-20	13.5	185	M6 × 185L
MK2TB50-50	10	245	M6 × 245L
MK2TB63-20	13	185	M8 × 185L
MK2TB63-50	14	250	M8 × 250L

※The material of the bolt is steel.

6-7. Made to order specifications

In this product, (X1859) with the head side pin hole was prepared.

How to order

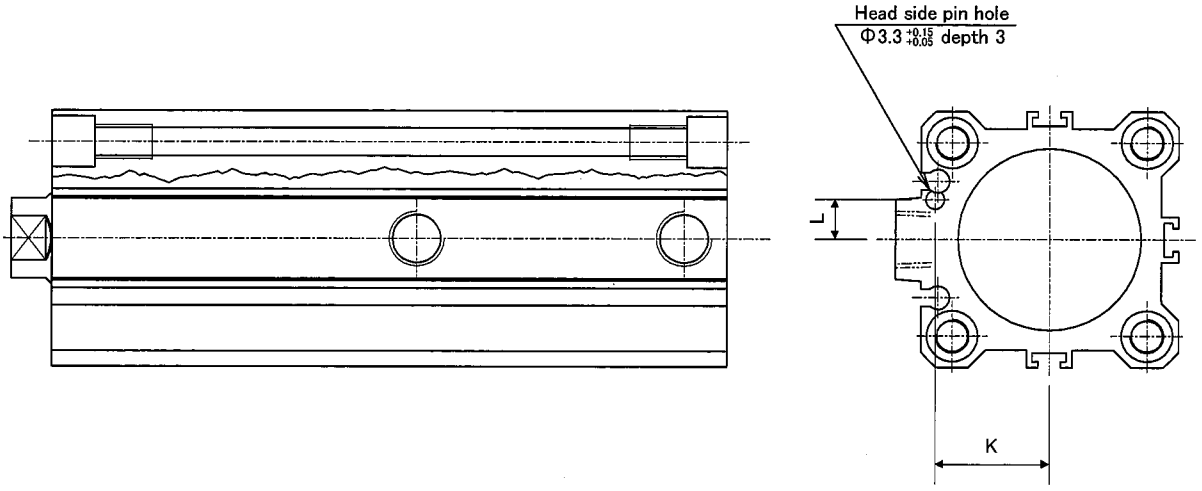
Standard model no.	-X1859

Specifications

Series	MK2T
Bore size	Φ32, Φ40, Φ50, Φ63

Additional specifications	Same as standard type

Dimensions



Bore size (mm)	K	L
32	20±0.15	7±0.15
40	24±0.15	7±0.15
50	30±0.15	8±0.15
63	35±0.15	9±0.15

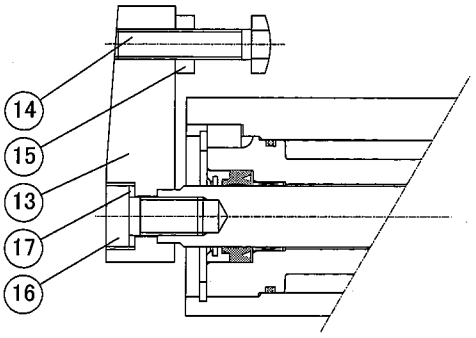
※Dimensions except mentioned above are the same as standard type.

7. Troubleshooting

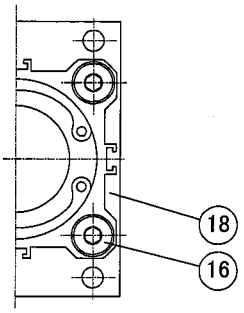
Trouble	Phenomenon	Possible cause	Remedy	Related section
・The operation is not smooth. ・The force output is reduced. ・The cylinder doesn't operate.	Air leakage (external)	1. The rod seal is damaged by flaws on the piston rod.	1. Replace piston rod and rod seal.	
		2. The rod seal is damaged by use at temp out of the specified range.	2. Apply the grease on piston rod and replace rod seal.	2-1
		3. The rod seal is damaged by use at temp out of the specified range.	3. Keep operating temp. range and replace rod seal.	6-3
		4. Shortage of grease	4. Add grease.	
		5. Foreign materials are allowed to enter.	5. Remove foreign materials from rod seal.	
	Air leakage (internal)	1. The piston seal is worn due to grease washed away by water including drain.	1. Install air cleaning equipments including air filter in the piping and replace piston seal.	6-3
	A lack of pneumatic pressure	1. The pressure from factory source lowers.	1. Supply adequate pressure.	3-4
		2. The setting of regulator is displaced.	2. Set regulator properly.	3-6
		3. The piping is clogged.	3. Perform flashing to the piping.	
	Overload	1. The bending moment has been exceeded.	1. Use within the allowable value.	4-1
		2. The moment of inertia has been exceeded.	2. Use within the allowable value.	4-2
	Low operating speed	1. The speed is lower than specified piston speed.	1. Use within specifications.	2-1
	Improper pneumatic circuit design.	1. The system construction is not suitable.	1. Select adequate size of tube, fitting, directional control valve, speed controller etc.	
・A part is damaged.	Breakage of Bumper, Piston rod, Rod cover and Cylinder tube	1. Directional control valve falls in trouble.	1. Use within the allowable value.	
		2. The bending moment has been exceeded.	2. Use within the allowable value.	2-1
		3. The moment of inertia has been exceeded.	3. Use within the allowable value.	4-1
		4. The abnormal external force is applied.	4. Mechanism interference, eccentric load and overload could cause deformation and damage of the cylinder. Remove these factors.	4-2

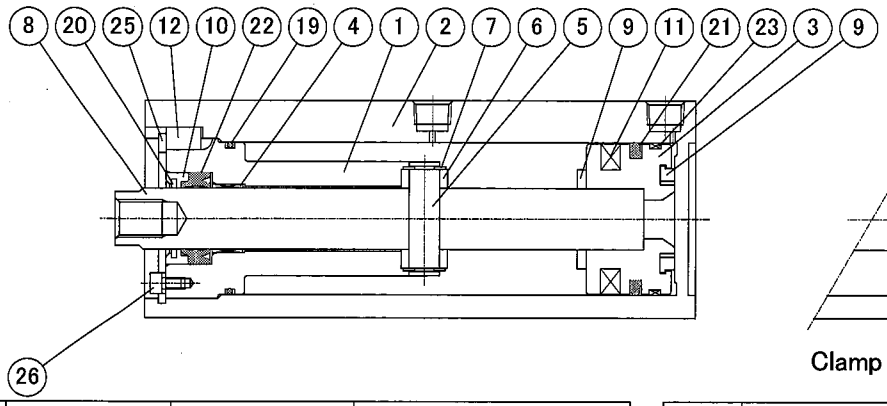
8. Basic construction

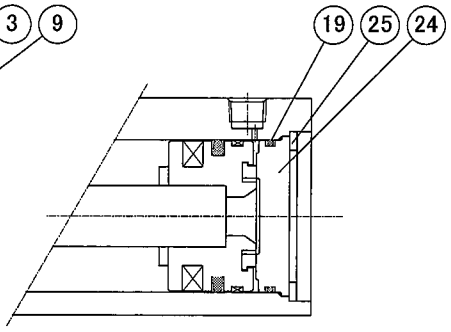
With arm (N)



Head side flange style (G)







Clamp stroke : only 50mm

No	Description	Material	Note
12	Key	Construction steel	Zinc trivalent chromate treatment
11	Magnet	—	
10	Seal retainer	Aluminum alloy	Trivalent chromate treatment
9	Bumper	Urethane	
8	Piston rod	Construction steel	Φ32 to Φ63 Hard chromium plated
		Stainless steel	Φ20 and Φ25 Hard chromium plated
7	Snap ring	Special-purpose steel	Φ32 to Φ63 Zinc trivalent chromate treatment
			Φ20 and Φ25 Phosphate coated
6	Guide roller	Construction steel	
5	Guide shaft	Construction steel	Φ32 to Φ63 Hard chromium plated
		Stainless steel	Φ20 and Φ25 Hard chromium plated
4	Bushing	lead-bronze casting	Φ32 to Φ63
		Sintered oil-impregnated	Φ20 and Φ25
3	Piston	Aluminum alloy	Trivalent chromate treatment
2	Cylinder tube	Aluminum alloy	Hard anodized
1	Rod cover	Construction steel	Electroless nickel plated

No	Description	Material	Note
26	Hexagon socket head cap screw (with spring washer)	Construction steel	Φ40 to Φ63 Nickel plated
	Washer	Stainless steel	Φ25 and Φ32
	Hexagon socket head cap screw	Construction steel	Φ25 and Φ32 Nickel plated
25	Snap ring	Special-purpose	Phosphate coated
24	End plate	Aluminum alloy	Hard anodized
23	Wearing	Resin	
22	Rod seal	NBR	
21	Piston seal	NBR	
20	Coil scraper	Bronze	
19	Gasket	NBR	
18	Flange	Construction steel	Nickel plated
17	Spring washer	Steel wire	Nickel plated
16	Hexagon socket head cap screw	Construction steel	Nickel plated
15	Hexagon nut	Construction steel	Nickel plated
14	Clamp bolt	Construction steel	Electroless nickel plated
13	Arm	Construction steel	Electroless nickel plated