



Operation Manual

PRODUCT NAME

V Cylinder

MODEL / Series / Product Number

CVS1 * N40 & 100 — * — *

SMC Corporation

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Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “**Caution**,” “**Warning**” or “**Danger**.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)*1), and other safety regulations.

*1) ISO 4414: Pneumatic fluid power - General rules and safety requirements for systems and their components
ISO 4413: Hydraulic fluid power - General rules and safety requirements for systems and their components
IEC 60204-1: Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots
etc.



Danger

Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.



Warning

Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.



Caution

Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

Warning

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

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

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

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Our products cannot be used beyond their specifications. Our products are not developed, designed, and manufactured to be used under the following conditions or environments. Use under such conditions or environments is not covered.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Use for nuclear power, railways, aviation, space equipment, ships, vehicles, military application, equipment affecting human life, body, and property, fuel equipment, entertainment equipment, emergency shut-off circuits, press clutches, brake circuits, safety equipment, etc., and use for applications that do not conform to standard specifications such as catalogs and operation manuals.
3. Use for interlock circuits, except for use with double interlock such as installing a mechanical protection function in case of failure. Please periodically inspect the product to confirm that the product is operating properly.



Safety Instructions

Caution

We develop, design, and manufacture our products to be used for automatic control equipment, and provide them for peaceful use in manufacturing industries.

Use in non-manufacturing industries is not covered.

Products we manufacture and sell cannot be used for the purpose of transactions or certification specified in the Measurement Act.

The new Measurement Act prohibits use of any unit other than SI units in Japan.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”. Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

1. Specifications

1-1 Specifications

table 1. Specifications

Fluid	Air
Proof pressure	1.5MPa
Max. operating pressure	1.0MPa
Min. operating pressure	0.05MPa
Ambient and fluid temperature	-10 to +60°C. -10 to +60°C with built-in magnet (No freezing)
Lubrication	Not required (non-lube)
Stroke length tolerance	to 250st $^{+1.0}_0$ mm 251 to 1000st $^{+1.4}_0$ mm
Cushion	Air cushion or Rubber bumper
Piston speed	50 to 500mm/sec
Action	Double acting
Solenoid valve	Single VS4124-00※(Coil)※(Lead wire)-X46 Double VS4224-00※(Coil)※(Lead wire) 3 Positions, closed center VS4334-02※(Coil)※(Lead wire) 3 positions, closed center B port used VS4424-02※(Coil)※(Lead wire)
Port size	Rc1/4
Voltage	AC100,110,200,220,24V(50/60Hz) DC12,24,32,48,100,110V
Leads entry	Grommet , DIN type terminal
Manual override	Provided
Insulation	Equivalent to class B
Allowable voltage variation	-15% to +10% of rating.

1-2. Power consumption

Table 2. Apparent power

AC			Apparent power
			(VA) 100V・200V
AC	Inrush	50Hz	100
		60Hz	90
	Holding	50Hz	20
		60Hz	14

Table 3. Power consumption

DC	Voltage(V)	Power consumption(W)
	12	13.2
24		
32		
48		
100		
110		

Use the actuator with allowable kinetic energy or less.

{Refer to 2-6. Allowable kinetic energy (Page 11)}

Warning

- **Confirm the specifications.**

These product are designed only for use in compressed air systems (including vacuum). Do not operate at pressures or temperatures, etc., beyond the range of specifications, as this can cause damage or malfunction. (Refer to the specifications.)

Please contact SMC when using a fluid other than compressed air made by pneumatic equipment (including vacuum).

We do not guarantee against any damage if the product is used outside of the specification range.

- **Confirm the applicable specification range.**

These product specification apply to standard strokes, including intermediate strokes. Please consult with SMC for specifications on long strokes. There are also some made-to-order products (-XB□/-XC□) for which product specifications do not apply.

2. Installation and Handling

2-1. Air supply

The compressed air supplied to the cylinder should be filtered by SMC AF series air filter and regulated to the specified set pressure by SMC AR series regulator.

Warning

- **Type of fluids**
Please consult with SMC when using the product in applications other than compressed air.
- **When there is a large amount of drainage.**
Compressed air containing a large amount of drainage can cause malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.
- **Drain flushing**
If condensation in the drain bowl is not emptied on a regular basis, the bowl will overflow and allow the condensation to enter the compressed air lines. It causes malfunction of pneumatic equipment.
If the drain bowl is difficult to check and remove, installation of a drain bowl with an auto drain option is recommended.
- **Use clean air.**
Do not use compressed air that contains chemicals, synthetic oils including organic solvents, salt or corrosive gases, etc, as it can cause damage or malfunction.

Caution

- **Install an air filter.**
Install an air filter upstream near the valve. Select an air filter with a filtration size of 5 µm or smaller.
- **Take measures to ensure air quality, such as by installing an aftercooler, air dryer, or water separator.**
Compressed air that contains a large amount of drainage can cause malfunction of pneumatic equipment such as valves.
Therefore, take appropriate measures to ensure air quality, such as by providing an aftercooler, air dryer, or water separator.
- **Ensure that the fluid and ambient temperature are within the specified range.**
When operating at temperatures below 5°C, water in the circuit may freeze and cause breakage of seals or malfunction. Corrective measures should be taken to prevent freezing.
- **Lubricating the non-lube type 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 additionally lubricated, be sure to use class 1 turbine oil (with no additive) ISO VG32. Do not use machine oil or spindle oil.
Stopping lubrication later may lead to malfunction because the new lubricant will displace the original lubricant. Therefore, lubrication must be continued once it has been started.
If turbine oil is used, refer to the corresponding Material Safety Data Sheet (MSDS).

For compressed air quality, refer to Best Pneumatics No. 5.

2-2. Design

The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Warning

- **There is a danger of sudden action by cylinders if sliding parts of machinery are twisted, etc., and changes in forces occur.**
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 designed to operate smoothly and to avoid such dangers.
- **If there is a chance that the product will pose a hazard to humans, install a protective cover.**
If the moving portion of the product will pose a hazard to humans or will damage machinery or equipment, provide a construction that prevents direct contact with those areas.
- **Be certain that the secured portions will not loosen.**
Be certain to adopt a reliable connecting method if the cylinder is used very frequently or if it is used in a location that is exposed to a large amount of vibration.
- **There may be cases in which a speed reduction circuit or a shock absorber is required.**
If the driven object moves at high speeds or is heavy, it will be unfeasible for only the cylinder's cushion to absorb the shock.
Therefore, provide a speed-reduction circuit to reduce the cylinder's speed before the thrust is applied to the cushion, or an external shock absorber to dampen the shock. If these countermeasures are taken, make sure to take the rigidity of the mechanical equipment into consideration.
- **Design the system so that it will not apply an external force over the maximum force to the product.**
The product can break, causing a risk of injury or damage to equipment.
- **The product generates a large force. Install on a sufficiently rigid mounting base, taking this force into consideration.**
There is a risk of injury or damage to equipment.
- **Consider the possibility of a reduction in the circuit air pressure caused by a power failure.**
When a cylinder is used in a clamping mechanism, the work piece may come off due to a decrease in clamping force because of a decrease in the circuit pressure caused by a power failure, etc. Therefore, safety equipment should be installed to prevent damage to machinery and injury. Suspension equipment and lifting devices also require measures to prevent dropping.
- **Consider the possibility of power source related malfunction that could occur.**
For the equipment that rely on power sources such as compressed air, electricity, or hydraulic pressure, adopt a countermeasure to prevent the equipment from causing a hazard to humans or damage to the equipment in the event of malfunction.
- **Consider the behavior of the rotary actuator in the event of an emergency stop.**
Devise a safety system so that if a person engages the emergency stop, or if a safety device is tripped during a system malfunction such as a power outage, the movement of the cylinder will not cause a hazard to humans or damage the equipment.
- **Avoid synchronized operation using cylinders only.**
Even if multiple pneumatic cylinders are initially set to the same speed, their speed may vary due to changes in operating conditions. Therefore, avoid designs where a single load is moved by synchronizing multiple cylinder operations.
- **Consider the action when operation is restarted after an emergency stop or abnormal stop.**
Design the machinery so that 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.
- **Intermediate stop**
It is difficult for this product to make a piston stop at the required intermediate position accurately and precisely using a 3 position closed center type directional control valve, due to the compressibility of air. Furthermore, since valves and cylinders are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for extended periods of time. Contact SMC if it is necessary to hold the stopped position for extended periods of time.

Caution

- **Avoid having a large gap between the clevis and mating bushing, as this exposes the pin to a bending load.**
- **Do not touch the cylinder during high speed and high frequency operation of the cylinder.**

When the cylinder is operating at a high speed and high frequency, the cylinder tube surface temperature increases, and may cause a burn.

- **Do not use the air cylinder as an air-hydro cylinder.**
If working fluid of the air cylinder is turbine oil, oil leakage can result.
- **Grease is applied to cylinder.**
- **The base oil of grease may seep out.**

The base oil of grease in the cylinder may seep out of the tube, cover, crimped part or rod bushing depending on the operating conditions (ambient temperature 40 °C or more, pressurized condition, low frequency operation). Please consult with SMC in cases where a particular clean environment is required.

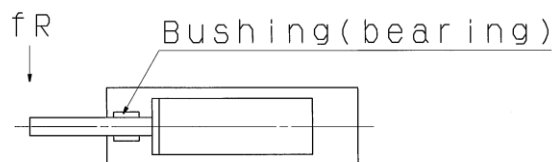
2-3. Mounting and Installation

The foot mounting cylinder has a hole in the foot to drive a pin into for accurate positioning and fixing.

Caution

- **Do not apply excessive lateral load to the piston rod.**
The bold solid lines in Fig. 1 show the allowable lateral load on the cylinder for a certain stroke length.

Refer to Table 4 Maximum Allowable Kinetic Energy.(Page 11)



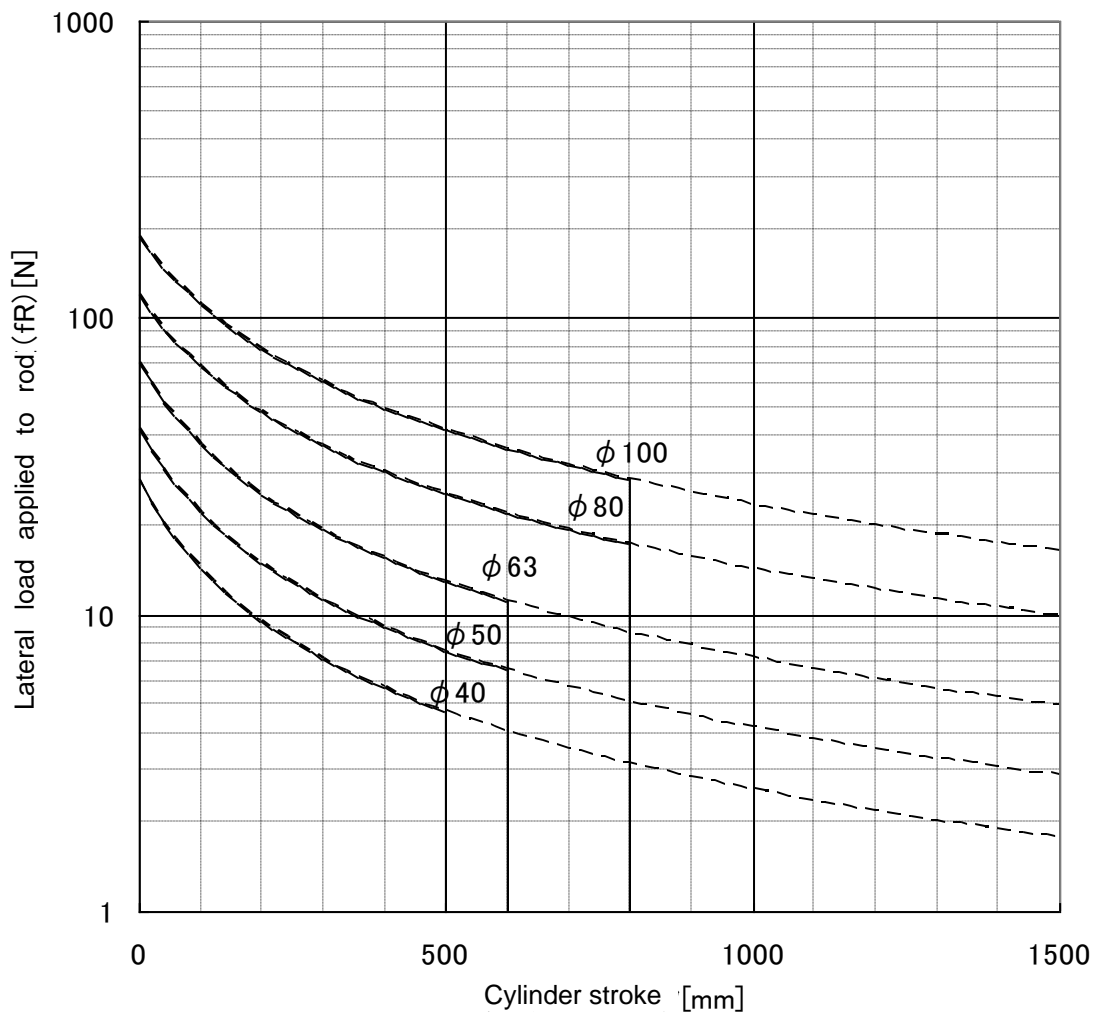


Fig 1. Allowable lateral load applied to rod end

⚠ Caution

- **Be certain to align the rod axis with the load and direction of movement when connecting.**
 When not properly aligned, the rod and tube may be twisted, and damage may be caused due to wear on areas such as the inner tube surface, bushings, rod surface and seals.
- **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.**
- **Do not scratch or gouge the sliding parts of the cylinder tube or piston rod, etc., by striking or grasping them with other objects.**
 Cylinder bores are manufactured to precise tolerances, so that even a slight deformation may cause malfunction. Also, scratches or gouges, etc., in the piston rod may lead to damaged seals and cause air leakage.
- **Prevent the seizure of rotating parts.**
 Prevent the seizure of rotating parts (pins, etc.) by applying grease.
- **Do not use until you can verify that equipment can operate properly.**
 Verify correct mounting by function and leak tests properly after compressed air and power are connected following mounting or repair.
- **Cantilever fastening**
 If a cylinder is actuated at high speed when mounted with one side fastened and one side free (basic type, flange type, direct mount type), the bending moment may act on the cylinder due to vibration at the stroke end, causing damage to the cylinder. In such cases, install a mounting bracket to suppress vibration of the cylinder body, or reduce piston speed until the cylinder body does not vibrate at the stroke end. Also, use a mounting bracket when moving the cylinder body, or mounting a long stroke cylinder horizontally with one-sided fastening.

- **Do not apply excessive lateral load to the piston rod.**

Calculation for excessive lateral load:

Minimum operating pressure value after the device is mounted (MPa) = Cylinder's minimum operating pressure(MPa) + {Load weight(kg)

× Guide friction coefficient / Cylinder's cross section (mm²)}

If the product is found to operate smoothly with the calculated pressure, it has been determined that the alignment of the guides have not created additional loading on the cylinder.

- **Do not let foreign matter such as cutting chips get into the product from the supply port.**

When the product is installed on a machine on site, the debris from drilled mounting holes can get in the supply port of the product. Take sufficient care to prevent this.

- **Double solenoid or 3 position solenoid valve**

Place the cylinder so that the solenoid valve is horizontal. Do not place the cylinder with the solenoid valve vertical.

- **Others**

For manual operation, press the center of the manual override button with a blunt object.

The valve is operable even if the rubber part is torn. The rubber covers do not need to be removed.

Voltage fluctuation of -15 to +10% of the rated voltage is allowed.

Simultaneous power supply to the double solenoid is not allowed, as it can result in the burnout of the solenoids.

2-4. Environment

Warning

- **Do not use in an atmosphere having corrosive gases, chemicals, sea water, water, water steam, or where there is direct contact with any of these.**
- **Do not expose the product to direct sunlight for an extended period of time.**
- **Do not use in a place subject to heavy vibration and/or shock.**
- **Do not mount the product in locations where it is exposed to radiant heat.**
- **Do not use in dusty locations or where water or oil, etc., splash on the equipment.**
- **When using auto switches, do not operate in an environment with strong magnetic fields.**
- **A decrease in grease base oil may be accelerated by the properties of compressed air used in pneumatic equipment, the external environment, or operating conditions, etc., and the resulting drop in lubricating performance may have an effect on equipment service life.**
- **Avoid storing the product in humid conditions.**

Store the product with the piston rod retracted and avoid humidity, in order to prevent generation of rust.

Caution

- Machined part of the piston rod and tie rod are not plated. If the generation of rust during usage or storage is not acceptable, please consult SMC.
- **Preparation before piping**
Before piping, perform air blow (flushing) or cleaning to remove any cutting chips, cutting oil, dust, etc. from the piping and fitting.
- **Wrapping of pipe tape**
When screwing piping or fittings into ports, ensure that chips from the pipe threads or sealing material do not enter the piping.
Also, if pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.

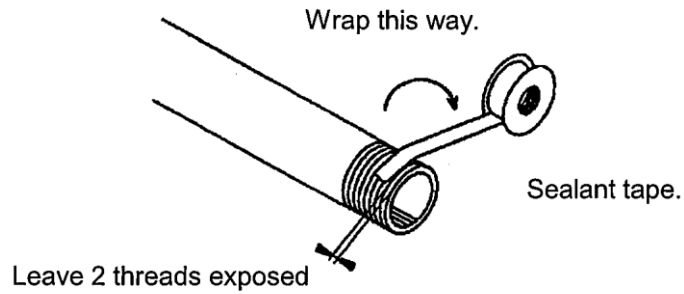
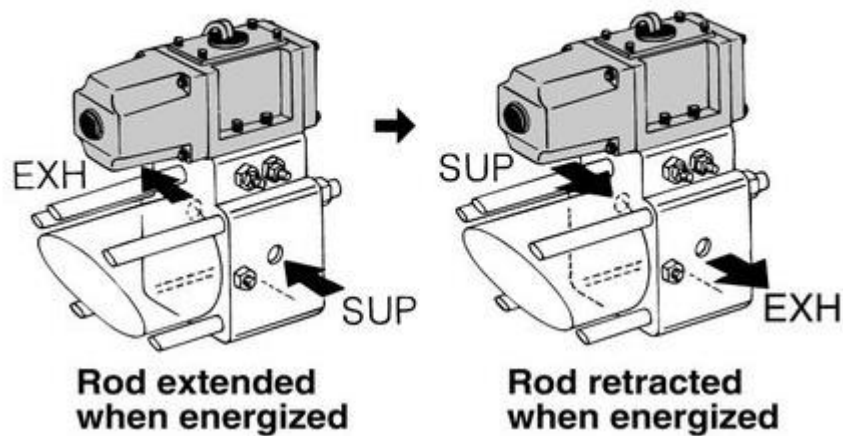


Fig. 2 Sealant tape

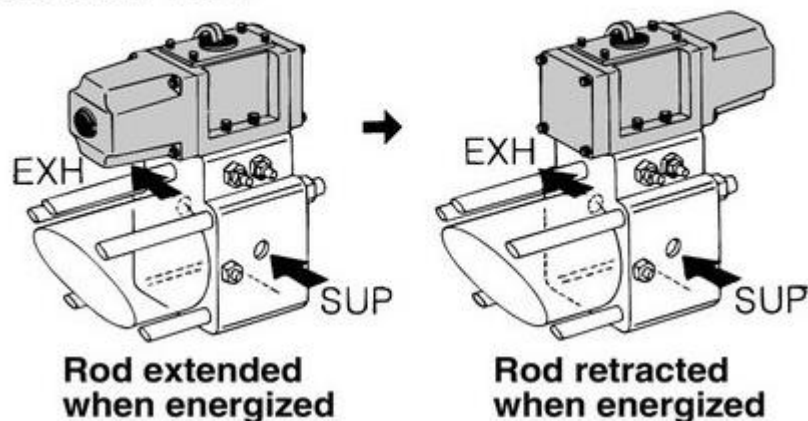
2-5. Changing between Rod Extended when Energized and Rod Retracted when Energized

How to change
 Rod extends when energized, and air is supplied to port A, and exhausted through port B.
 Rod retracts when energized, and air is supplied to port B and exhausted through port A.

1. This is possible by reversing the SUP port and EXH port piping.



2. This is possible by inverting the solenoid valve direction 180°.



2-6. Allowable kinetic energy

Warning

- **Use the actuator with allowable kinetic energy (Table 4) or less.**
Operation with a kinetic energy over the allowable value can break the product and cause injury or damage to equipment. If excessive kinetic energy is expected, install an external absorber to prevent impact to the body of the product. In this case, please verify the rigidity of the equipment carefully.

Table 4. Allowable kinetic energy

		φ 40	φ 50	φ 63	φ 80	φ 100
Allowable kinetic energy (J)	Air cushion	2.8	4.6	7.8	16	29
	Non cushion	0.33	0.56	0.91	1.50	2.68
	Rubber bumper	1.8	3.6	6.0	12.0	12.0

Caution

- **When the product is equipped with a rubber bumper, note that there will be a slight bounce at the stroke end.**

2-7. Air cushion

Caution

- Cylinder cushions are adjusted properly at the time of shipment. However, readjust the cushion valve on the cover when the cylinder is put into service based upon working load and operating speed.
- When the cushion valve is turned clockwise, the cushion contracts and its effectiveness is increased, and when the cushion valve is turned counterclockwise, the cushion expands and its effectiveness is decreased.
- If the cushion valve is fully closed throughout operation, the piston may bounce at the stroke end, not move full stroke, or the cushion seal may be damaged due to excessive pressure. Therefore, do not use the cushion cover in such manner.
- Check that the screw of the cushion valve is screwed in. Although the snap ring is attached, the cushion valve may lurch if the screw is not fitted properly.
- Activate the air cushion when operating the cylinder. If this is not done, the piston rod assembly or the tie-rods will be damaged when the allowable kinetic energy exceeds the values shown in the table 4.

Warning

- **Do not open the cushion valve beyond the stopper.**
A snap ring is installed as a cushion valve retention mechanism. Do not open the cushion valve beyond it. If not operated in accordance with the above precautions, the cushion valve may be ejected from the cover when air pressure is supplied.

Table 5. Hexagon wrench of cushion valve

Bore size (mm)	Width across flats	Hexagon wrench
40,50,63	3	JIS 4648 Hexagon wrench key 3
80,100	4	JIS 4648 Hexagon wrench key 4

Caution

- **Use the air cushion at the end of cylinder stroke.**
Select the cylinder with bumper if the cushion valve is to be fully opened. Otherwise, tie-rods or piston assembly may be damaged.

2-8. Control of direction

To switch the operating direction of the cylinder, mount an applicable solenoid valve selected from SMC's range of solenoid valves.

Warning

- **Design a circuit to prevent sudden action of a driven object.**

When the product is actuated by an exhaust center type directional control valve or when one side of the piston is pressurized with air exhaust, such as when the product is started after the exhaust of the residual pressure from the circuit, driven objects may act suddenly at high speed. In such cases, injury may occur, such as hands or feet getting caught in the machinery, or damage to the machinery itself may occur. Design the machinery to avoid such dangers.

2-9. Mounting bracket

- Mounting nut should be tightened while keeping all the tension equal.
- When they are tightened, please use proper tightening torque.
{Refer to Table 6 (P14)}
- Before mounting a support bracket, make sure the product is aligned by placing on the leveled surface.
It is recommended to secure the mounting screws temporarily to insure alignment before tightening with the specified torque.

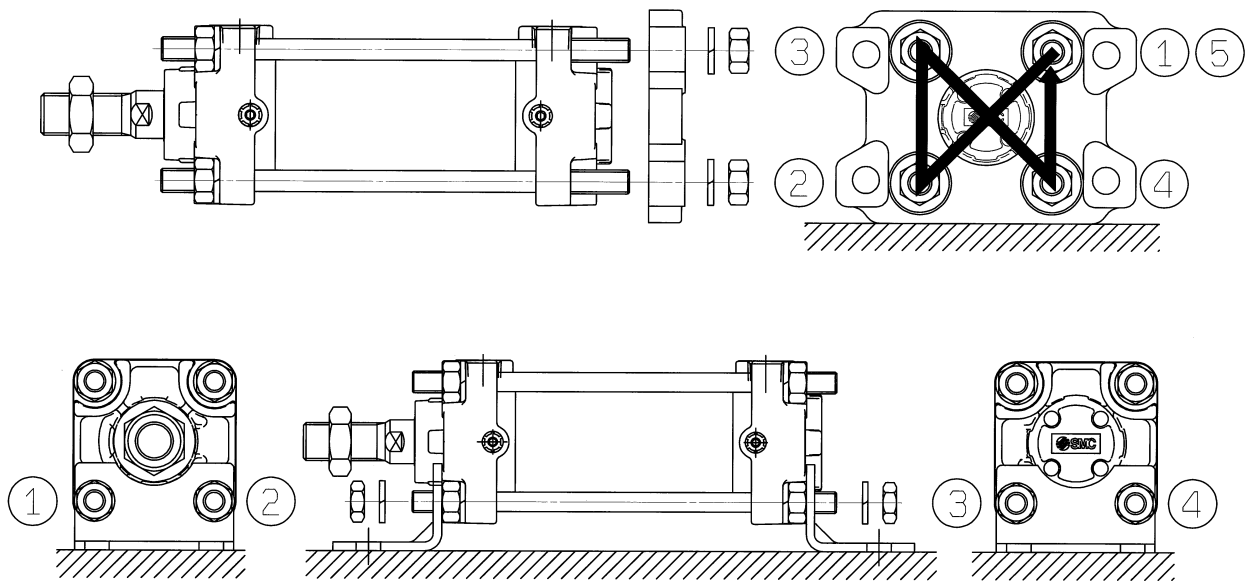


Fig 3. Order for tightening mounting screws

3. Maintenance

3-1. Checks

The following checks are required for proper cylinder operation.

- 1) Smooth operation
- 2) Changes in piston speed and cycle time
- 3) Abnormal stroke
- 4) Looseness of mounting bolt and rod end nuts
- 5) Looseness of mounting frame and excessive deflection
- 6) Internal and external leakage (Change in output)
- 7) Damage to the piston rod sliding surface
- 8) Clogging and discharge drainage of the air filter
- 9) Lubrication of rotating parts (double knuckle joint, clevis pin, etc.)
- 10) Position of auto switches

When any abnormality is found as a result of checking the points above, eliminate causes and take necessary measures such as retightening screws and the application of grease. Contact SMC sales if it is necessary to repair the cylinder.

Warning

- **As a minimum, maintenance should be performed according to the above items. Perform additional maintenance as necessary.**
Improper handling can cause damage and malfunction of equipment and machinery.
- **Removal of equipment, and supply/exhaust of compressed air.**
Ensure that drop prevention measures and safe lock out of the moving parts are taken, the power of the facility and supply air is shut off and the compressed air in the system is exhausted before removing the equipment.
Before restarting the equipment, confirm that measures are taken to prevent sudden action.

3-2. Replacement of seals

It is possible to replace the rod seal, cushion seal, piston seal, cylinder tube gasket and wear ring.

Contact SMC sales if it is necessary to replace parts other than those mentioned above.

Warning

- **Only people who have sufficient knowledge and experience are allowed to replace seals.**
The person who disassembles and reassembles the cylinder is responsible for the safety of the product.

Caution

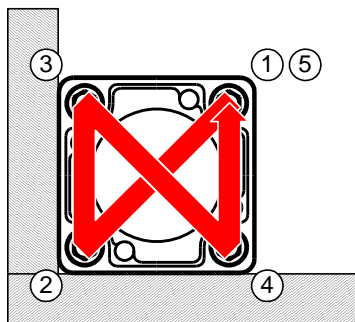
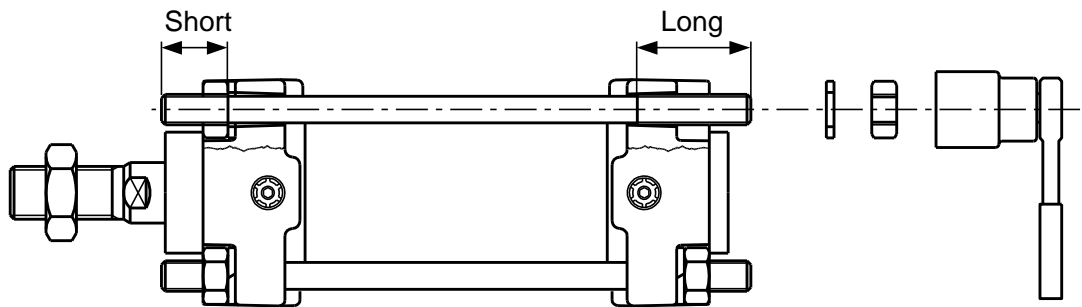
- **When replacing seals, carefully handle parts to prevent injury to your hands or fingers on the corners of parts.**

3-2-1. Disassembly / Reassembly

Caution

- Disassemble and assemble the cylinder on a clean cloth in a clean location. Perform on a clean cloth.
- Make sure no particles are present. Do not scratch the seals.
- A tie-rod nut should be fitted on the shorter thread to the end of tie-rod by hand. And affix to the cylinder.
- Another tie-rod nut should be mounted on the cover at the opposite side of the first tie-rod nut, and tightened so that the tensile force is even.
- When they are tightened, please use proper tightening torque. (Refer to Table 6).

It same for mounting bracket



Tie rod tightening order.

Table 6. Tightening torque

Bore size	Socket	Tightening torque[N·m]
40,50	13 (M8)	7.4
63	17 (M10)	20
80,100	19 (M12)	29

3-2-2. Removal of seals

1) Rod seal

Insert a precision screwdriver from the front of the cover to pull out the seal as shown in Fig. 4.

Caution

- Take care not to damage the seal groove of the cover at this time.

2) Piston seal

Wipe off grease around piston seal first to make seal removal easier.

As shown in Fig. 5, hold the piston seal with one hand and push it into the groove so that the piston seal can be lifted off and pulled out without using a precision screwdriver.

The groove of the rod cover is deep, so if the rod seal is removed with a precision screwdriver, it might be damaged.

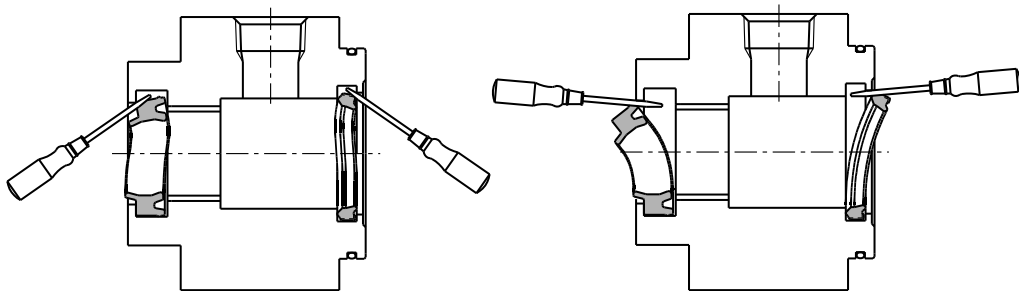


Fig 4. Remove rod seal

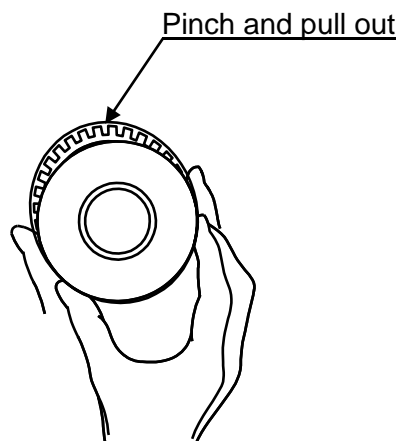


Fig 5. Remove piston seal

3) Tube gasket

Pull out with the precision screwdriver.

3-2-3. Grease

⚠ Caution

- Use SMC's recommended grease.

Grease pack part number: GR-S-010 (10g), GR-S-020 (20g)

1) ① Rod seal

Apply a thin layer of grease to all surfaces of the new seal to make it easy to mount the rod seal and improve sealing.

Fill the groove of the seal with grease, which is necessary for operation.

2) ② Piston seal

Apply a thin layer of grease to the all surfaces of the piston seal to make it easy to mount the seal.

3) ⑤ Cushion seal ⑦ Tube gasket

Apply a thin layer of grease to all surfaces of the tube gasket to make it easy to mount the gasket.

4) Parts of cylinder

Grease is applied to the locations shown in Fig. 6. The amount of grease per cylinder of 100 stroke is shown in attached table 7. Roughly, one scoop with a forefinger is approximately 3g.

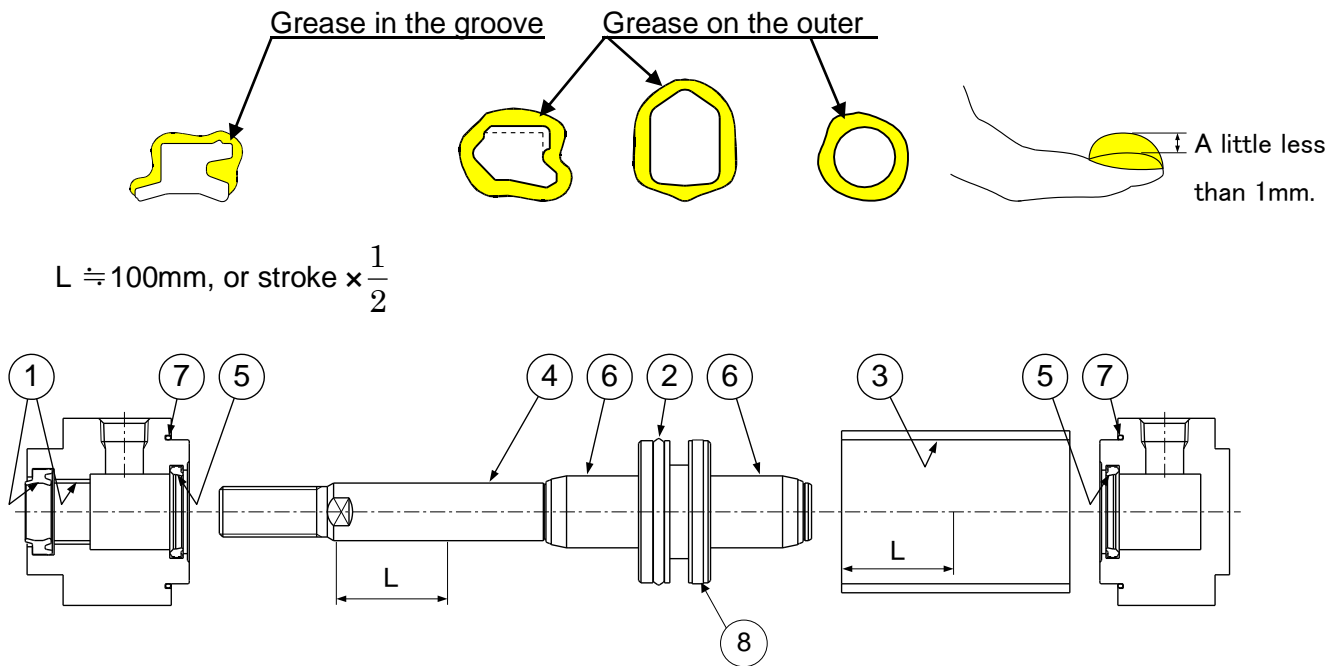


Fig 6. Position for application of grease

Table 7. Amount of grease

units: g

Stroke	Bore	Φ40	Φ50	Φ63	Φ80	Φ100	Position for grease
	At 100st		3 to 4	3 to 5	4 to 5	6 to 8	8 to 10
50st added		1	1	1.5	2	3	③ ④

3-2-4. Mounting of seals

1) Rod seal, Cushion seal (Fig 6, ① ⑤)

Pay attention to the mounting direction of the seal.

Apply grease all over the seal and inner surface of the bushing as shown in Fig. 7. If it is difficult to apply grease, for example to a small bore diameter, use a precision screwdriver. Do not scratch any surface with the screwdriver.

2) Piston seal, Wear ring (Fig 6, ② ⑧)

Mount with care not to twist the piston seal. Apply grease to the seal groove and outer circumference of wear ring by rubbing grease into them as shown in Fig. 8.

3) Tube gasket (Fig 6, ⑦)

Mount with care not to twist the tube gasket.

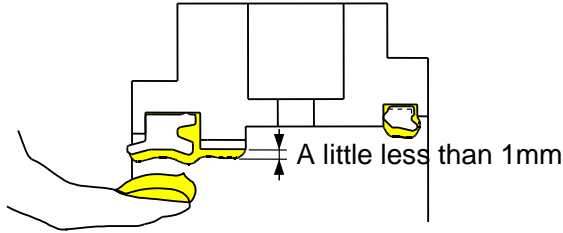


Fig 7. Rod seal

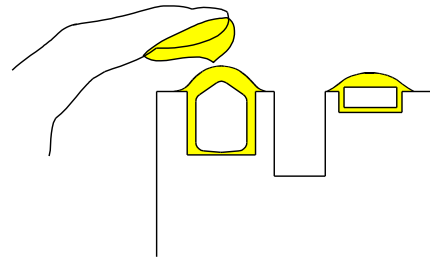
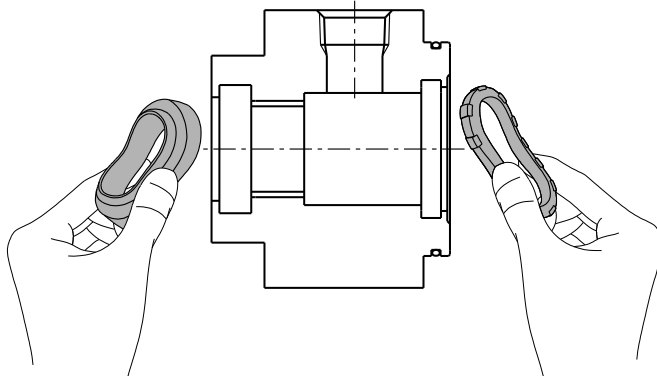
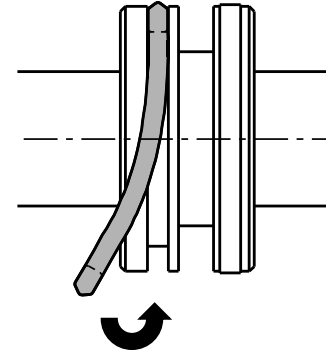


Fig 8. Piston seal, wear ring



Mount rod seal and cushion seal



Mount piston seal

4) Use a socket wrench when the bracket is replaced.

If other tools are used, the nut or other parts may be deformed or the work efficiency may decrease. For applicable sockets, please refer to the table 8.

Table 8. Mounting nut

Bore size(mm)	Nut	Width across flats	Tightening torque(N·m)
40,50	JIS B1181 class 3 IntermediateM8X1.25	13	7.4
63	JIS B1181 class 3 IntermediateM10X1.25	17	20
80,100	JIS B1181 class 3 IntermediateM12X1.75	19	29

5)When replacing mounting brackets, tie-rod nuts on the cylinder body become loosened.

Mount the mounting bracket after tightening the tie-rod nut with the appropriate tightening torque again.

6) The trunnion type cylinder requires mounting accuracy.

The trunnion type cylinder may lose dimensional accuracy and malfunction when it is disassembled and reassembled because the axial center of the trunnion and that of the cylinder will not be aligned easily.

! Caution

- Confirm that there is no problem with operation and air tightness after assembly.

3-3. Consumable parts

3-3-1. Replacement parts

Table 9. Seal kit no.

	ϕ 40	ϕ 50	ϕ 63	ϕ 80	ϕ 100
Seal kit no.	CVS1N40-PS	CVS1N50-PS	CVS1N63-PS	CVS1N80-PS	CVS1N100-PS
Contents of the seal kit	Rod seal 1 pc Piston seal 1 pc Pipe gasket 2 pcs Valve port gasket 2 pcs Cylinder tube gasket 2 pcs				

Note) Seal kits include grease pack.(ϕ 40,50:10g, ϕ 63,80:20g, ϕ 100:30g)

Grease pack part number: GR-S-010(10g) , GR-S-020 (20g)

Table 10. Wear ring number

	Wear ring number
ϕ 40	C1A040-07-305B
ϕ 50	C1A050-07-306B
ϕ 63	C1A063-07-307B
ϕ 80	C1A080-07-308B
ϕ 100	C1A100-07-309B

Caution

- The seal is not delivered in sealed packaging for storage independently, so it must be used within 1 year.

3-3-2. Storage of seals

Caution

- Store seals in sealed packaging such as polyethylene bag and place it in a box.
- Avoid locations exposed to direct sunlight and high temperature and humidity. In particular, isolate from equipment that can generate heat, radiation and ozone.
- Do not stack a lot of seals, or deform or damage seals by putting a heavy object on top of them.
- White particles can emerge from the surface of the seal during storage, but they do not affect its performance.

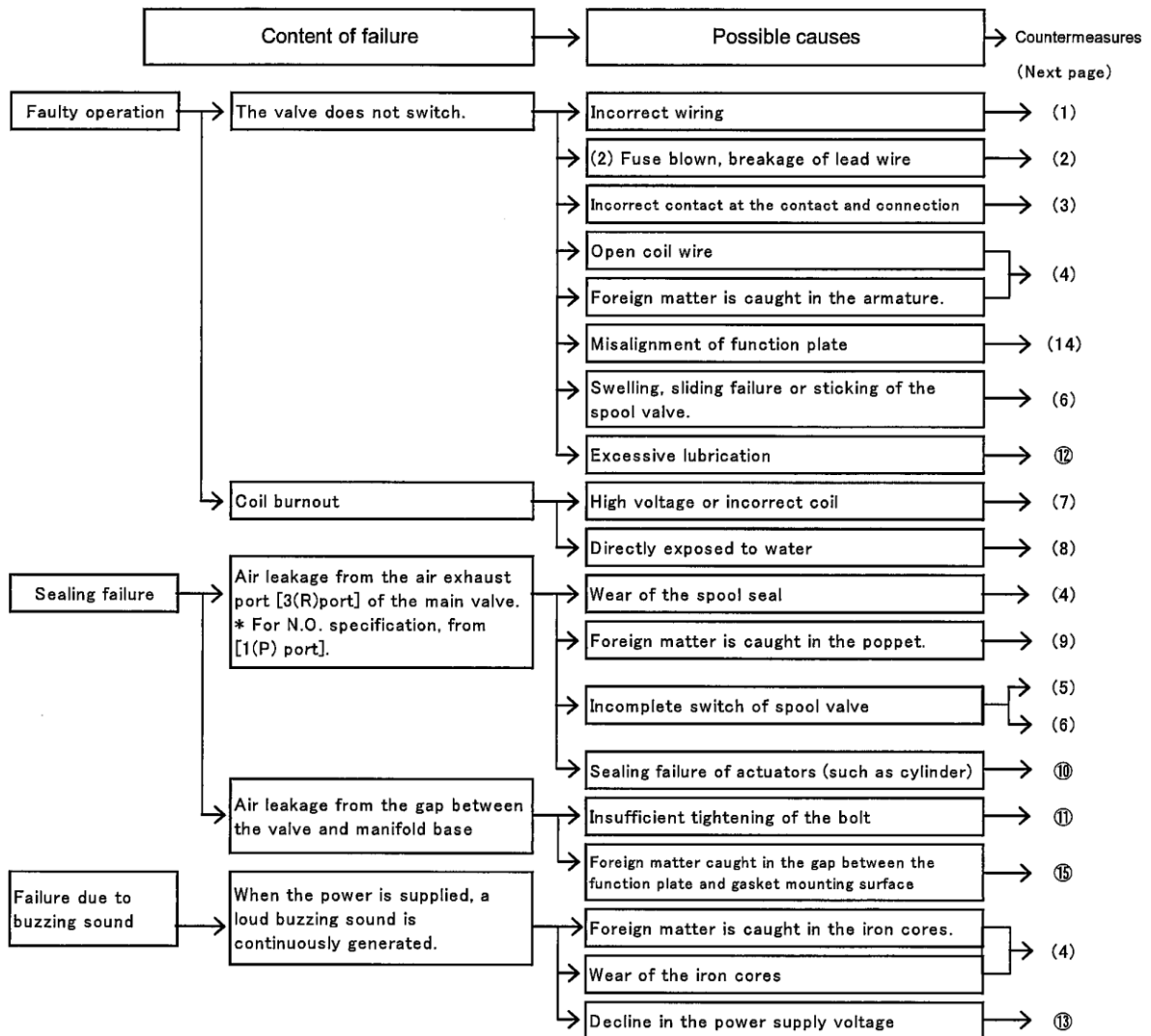
3-4. Troubleshooting

Table 11. Troubleshooting of cylinder parts

Failure	Cause	Countermeasures
The piston rod does not operate smoothly.	Improper alignment at mounting	- Alignment and adjustment at mounting
	Lateral load is applied.	- Provide a proper guide. - Modify the mounting.
	Operated below the lower speed limit	- Remove factors to change load.
	High load factor	- Increase pressure. - Use larger cylinders.
	The cushion valve is tightened too much or completely closed.	- Readjust the cushion valve.
Damage/ Deformation	Impact force by high speed operation.	- Adjust the cushion. - Lower speed. - Reduce load. - Provide shock absorbing mechanism externally. (Consider using shock absorbers etc.)
	Lateral load is applied.	- Provide a proper guide. - Modify the mounting.

Troubleshooting

Should any trouble occur during operation, trace the source of the problem in the following list and take appropriate countermeasures.



Countermeasures

No.	Countermeasures
(1)	Connect wires correctly.
(2)	Replace the part.
(3)	Replace the part or connect wires correctly.
(4)	Replace the valve.
(5)	Adjust the pressure so that the pilot pressure stays within the specification range at the time of operation.
(6)	If incorrect oil has been used for lubrication, remove the oil using a pneumatic blow gun, and replace the valve with a new one. If a lubricant is used in the system after the replacing the valve, use turbine oil Class 1 (with no additive) ISO VG32. If there is a large amount of condensation or condensate cannot be removed completely, mount an auto drain or install a dryer and replace the valve.
(7)	Check the voltage and replace the valve.
(8)	Protect the valve especially the coil to prevent it from being exposed to water.
(9)	If air leakage is caused by foreign matter, remove the foreign matter in the piping using a pneumatic blow gun and replace the valve.
⑩	Repair or replace the actuators.
⑪	Stop the air and additionally tighten the bolt.
⑫	Reduce the amount of lubrication to the amount at which the oil does not splash from the exhaust port [3(R) port]. * For N.O. specification, from [1(P) port].
⑬	Adjust the voltage so that voltage during operation will satisfy the specification.
⑭	Align the function plate.
⑮	Remove foreign matter.

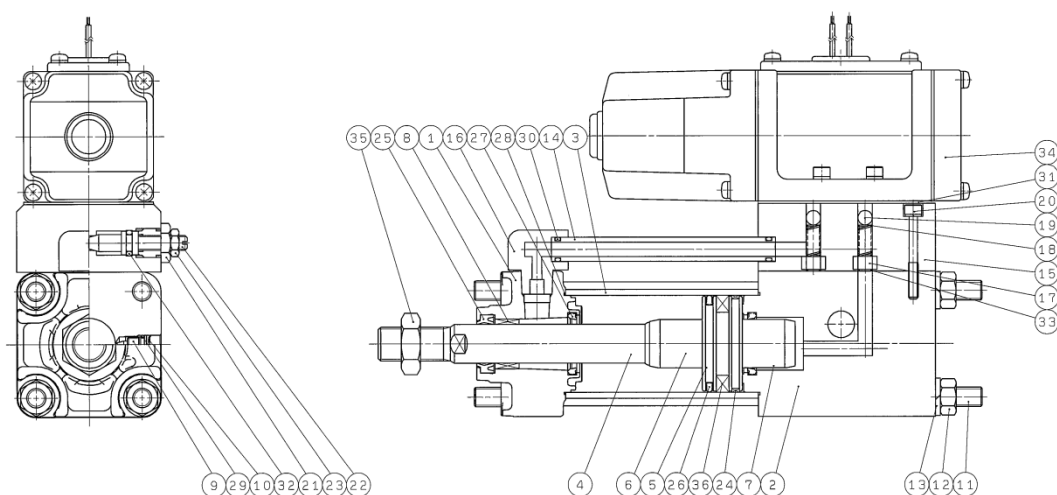
If the countermeasures above are not effective, there may be a problem with the valve. In that case, stop using the valve immediately.

If any of the examples below are applicable, there may be an internal problem in the valve. In that case, stop using the valve immediately.

1. Voltage was outside of the rated voltage.
2. Oils other than specified were supplied.
3. Lubrication was stopped in the middle of lubrication. Or, lubrication was interrupted temporarily
4. Directly exposed to water
5. Severe impact was applied.
6. Foreign matter such as condensate or rubber entered.
7. Other than those specified, if precautions on the operation manual apply.

If the product malfunctions, please return the valve as it is.

4. Construction



Standard product: Double acting/single rod

Table 12. Parts list

No.	Description	Qty	No.	Description	Qty
1	Rod cover	1	19	Check ball	2
2	Head cover	1	20	Hexagon socket head bolts	4
3	Cylinder tube	1	21	Needle guide head bolts	2
4	Piston rod	1	22	Speed control needle	2
5	Piston	1	23	Lock nut	2
6	Cushion ring	1	24	Wear ring	1
7	Cushion ring B	1	25	Rod seal	1
8	Bushing	1	26	Piston seal	1
9	Cushion valve	2	27	Cushion seal	2
10	Snap ring	2	28	Cylinder tube gasket	2
11	Tie rod	4	29	Cushion valve seal	2
12	Tie rod nut	8	30	Pipe gasket	2
13	Spring washer	8	31	Gasket	1
14	Pipe	1	32	Speed control needle seal	2
15	Sub plate	1	33	Valve port gasket	4
16	Pipe fitting	1	34	Solenoid valve	1
17	Valve port	2	35	Rod end nut	1
18	Check spring	2	36	Magnet	(1)

Revision history

A : Addition of allowable kinetic energy when using rubber cushion	Jan.24.2017
B : Voltage change due to discontinuation of some specifications of VS series	Jul.9.2021
3 : "Safety Precautions" revised	Mar.12.2024

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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.
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