Doc. no.CG1＊-OM0001G

Operation Manual

PRODUCT NAME

STAINLESS STEEL CYLINDER

MODEL / Series / Product Number

C*G5*N**SR / V-*
C*G5*A**SR / V-*

SMC Corporation

Contents

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 relating to systems.
ISO 4413: Hydraulic fluid power -- General rules relating to systems.
IEC 60204-1: Safety of machinery -- Electrical equipment of machines .(Part 1: General requirements)
ISO 10218: Manipulating industrial robots -Safety.
etc.

Caution	**Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
Warning	**Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
Danger	**Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious 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. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
4.Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

Safety Instructions

⚠ Caution

The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

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.∗2)
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.

∗2) Vacuum pads are excluded from this 1 year warranty.
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

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 regulation 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.**

⚠ Caution

SMC products are not intended for use as instruments for legal metrology.
Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country.
Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

Specific Product Precautions

Caution on Design

⚠ Warning

1. Note the weight of the stainless steel products.

Since the weight of stainless steel cylinders is approximately 1.5 to 3 times heavier than the standard products (with aluminum body), be careful when calculating weight estimates. Also, when mounting the cylinder on equipment where vibration is expected, avoid using single side brackets such as the flange type, and use double side brackets such as the foot type instead.

⚠ Caution

1.Adjust the speed control for the environment in which it will be used.

Speed adjustment may be changed depending on the environment.

2.Dust may accumulate on this product's mounting screws and brackets in some operating conditions.

Measures must be applied depending on the operating conditions when mounting.

Selection

⚠ Warning

1.Generally, use nitrile rubber (NBR) seals with liquids that do not contain chlorine and sulfur, and use fluoro rubber (FKM) seals with liquids that contain chlorine and sulfur.

However, depending on the type and the brand of liquid (such as cleaning solvent) that splashes on the cylinder, the operating life of seals may be reduced dramatically. In cases where special additives are used, or where liquid caused trouble with the current nitrile or fluoro rubber seals in the past, request an investigation or set up a test period for the use of the seals。

2.Even the fluoro rubber specification may not be applicable depending on the type of chemicals and the operating temperature. Therefore, be sure to verify the seal's applicability before use.

Mounting

⚠ Warning

1.Do not rotate the cover.

If a cover is rotated when installing a cylinder or screwing a fitting into the port, it is likely to damage the junction part with cover.

2. When using pins, apply grease, etc., in order to prevent them from degrading of shape and rusting.

Operating Precautions

⚠ Warning

1.For details about operating precautions, refer to for the CG1 series.

⚠ Caution

1.If cleaning the rotating part, grease may leak out, which shortens product service life. Thus, cleaning must be as infrequent as possible.

2.If excess water gets into mounting holes, unwanted bacteria may reproduce. Plug them with plug bolts or external covers to avoid this.

Operating Environment

⚠ Warning

1.Fully consider the compatibility of stainless steel.

The corrosion resistance of stainless steel is not effective against all media and corrosive environments. Corrosion proceeds rapidly with strong hydrochloric acid, hydrofluoric acid, and high temperature ammonium gas, etc. Therefore its compatibility to the environment must be considered carefully.

2.Do not operate cylinders with auto switches in environments where oil and chemicals are used.

Please contact SMC when operating in environments with coolants, cleaning solvents, various oils or chemicals, as it may cause adverse effects (faulty insulation, malfunction due to swelling of the potting resin, and hardening of lead wires, etc) to auto switches even in a short period of time. Even with the fluoro rubber seal specification, the auto switch related parts (switch body, mounting bracket, and built-in magnet) are identical to the standard specifications. Therefore, consult with SMC regarding the cylinder's compatibility (such as chemical resistance) with an environment (chemicals, etc.) before operating.

3. Do not immerse the cylinder in water or chemicals.

When the cylinder is operated in a condition with water pressure, the fluid leaks into the cylinder in the early stages. In the worst case, the fluid may back flow inside the piping and damage the solenoid valve.

⚠ Caution

1.Avoid installing and using a cylinder inside a food zone.

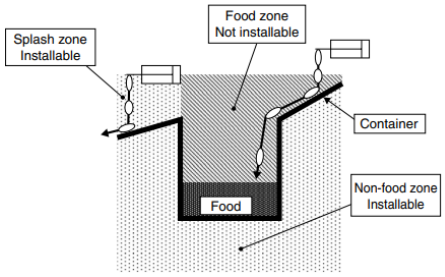
<Not installable>

Food zone・・・・・・・・・・An environment where food which will be sold as merchandize, directly touches the cylinder's components.

<Installable>

Splash zone・・・・・・・An environment where food which will not be sold as merchandize, directly touches the cylinder's components

Non-food zone・・・・・・An environment where there is no contact with food.



2. When cleaning solvent or chemicals splashes on a cylinder, the service life may be extremely shortened. Please contact SMC for details.

3.When cleaning cylinders with steam, do it as quickly as possible, keeping the cylinder's temperature range in mind.

4. When cleaning cylinders with a brush, etc., do not apply excessive force to the weaker parts, such as auto switch lead wire, etc.

Specific Product Precautions

Maintenance

⚠ Warning

1.If this cylinder is lubricated, it may cause malfunctions.

If grease other than designated is used, it may also cause malfunctions.

- Order with the following part number when only the grease for maintenance is needed.
  Grease pack part number for stainless steel cylinders
  Grease for food processing machines: GR-R-010 (10 g)

2. Do not wipe grease attached to the rotating part of the air cylinder.

If grease attached to the rotating part is forcibly wiped off, it may cause malfunctions.

If the cylinder is operated for a long period of time, the rotating part may become black. In such cases, wipe the grease attached to the rotating part and reapply fresh grease to enable the cylinder to operate for a long period of time.

(Wipe the grease with water. Using alcohol or solvents may damage seals.)

Precautions for the CG5-S series

⚠ Warning

1.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. Repeatedly disassem -bling and reassembling the product may cause wearing or deformation of the screws as well as a decline in screw tightening strength. When reassembling the product, be sure to check the cover and tubing screws for wear, deformities, or any other abnormalities. Operating the product with damaged screws may result in the cover or tubing coming off during operation, which could lead to a serious accident. Caution must be taken to avoid such incidents.

⚠ Caution

1.Sealant* is used on the threads of the connecting sections of the cover and the cylinder tube for airtight construction. When disassembling the cylinder, the old sealant must be completely removed, and new sealant must be applied before re-assembling.

*Loctite® 542 (medium strength) or equivalent

2.ø50 or larger bore size cylinders cannot be dis-as-sembled.

When disassembling cylinders with bore sizes of ø20 through ø40, grip the double flat part of either the head cover or the rod cover with a vise and loosen the other side with a wrench or a monkey wrench, etc., and then remove the cover. When re-tightening, tighten approximately 2 degrees more than the original position. (Cylinders with ø50 or larger bore sizes are tightened with a large tightening torque and cannot be disassembled. Please contact SMC when disassembly is required.)

3. When replacing seals, take care not to hurt your hand or finger on the corners of parts.

1. Specifications

1-1 Specifications

Fluid		Air
Proof pressure		1.5MPa
Max. operating pressure		1.0MPa
Min. operating pressure		0.05MPa
Ambient and fluid temperature		-10 to +70°C. -10 to +60°C with built-in magnet (No freezing)
Lubrication		Not required (non-lube)
Stroke length tolerance		1 to 1000st $^{+1.4}_{0}$mm 1001 to 1500st $^{+1.8}_{0}$mm
Cushion		Rubber bumper/ Air cushion
Piston speed	ø20 to ø63	50 to 1000mm/sec
	ø80 and ø100	50 to 700mm/sec
Action		Double acting, Single rod

Use the actuator with allowable kinetic energy or less.
(Refer to 2-6-3. Allowable kinetic energy (Page 14))

⚠ Warning

1.Confirm the specifications.

The product is designed only for use in industrial compressed air systems. Do not operate at pressures, temperatures or kinetic energy beyond the range of specifications, as this can cause damage to cylinder or malfunction.

(Refer to the specifications.)

Contact SMC in advance for non-industrial uses, or if using with a fluid other than compressed air.

2.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.

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

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 cylinder damage or malfunction.

2.When there is a large amount of drainage

Compressed air containing a large amount of drainage can cause the malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.

3.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. This causes the malfunction of pneumatic equipment.

If the drain bowl is difficult to check and remove, the installation of a drain bowl with an auto drain option is recommended.

For detailed information regarding the quality of the compressed air described above, refer to SMC's "Compressed Air Cleaning System."

⚠ Caution

1.Do not use ultra-dry air because the lubrication characteristics inside the equipment will deteriorate and this can affect the reliability (life) of the product.

If the operating fluid is ultra-dry air, consult SMC.

2.Install an air filter.

Install an air filter upstream near the valve. Select an air filter with a filtration size of 5μm or smaller.

3.Therefore, take appropriate measures to ensure good air quality, such as providing an after cooler, 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 providing an after cooler, air dryer, or water separator.

4.Ensure that the fluid and ambient temperature are within the specified range.

When operating at temperatures below 5^{o}C, water in the circuit may freeze and cause breakage of seals or malfunction. Corrective measures should be taken to prevent freezing. For detailed information regarding the quality of the compressed air described above, refer to SMC's "Compressed Air Cleaning System."

5.Precautionary measures against condensation

Moisture condensation can occur inside pneumatic systems due to a drop in temperatures caused by the piping or operating conditions. This can degrade or wash away grease, resulting in a shortened service life or a malfunction.

For details, refer to the catalog “Precautionary measures against condensation in a pneumatic system.”

6.Lubricating non-lube type cylinders

These cylinders have been lubricated for life at the factory and can be used without any further lubrication.

2-2. Design

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

⚠ 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, 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.A protective cover is recommended to minimize the risk of personal injury.

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.

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

Do not use the product where operation frequency is high or the product is exposed to vibration.

4.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.

5.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.

6.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.

7.Consider a possible loss of power source.

Measures should be taken to prevent injury and equipment damage in the event that there is a loss of power to equipment controlled by air pressure, electricity or hydraulics, etc.

8.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.

9.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.

10.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.

11.Avoid synchronized operation using cylinders only.

Even if multiple pneumatic cylinders are initially set to the same speed, their speeds may vary due to changes in operating conditions. Therefore, avoid designs where a single load is moved by synchronizing multiple cylinder operations.

12.Do not disassemble the product or make any modifications, including additional machining

Doing so may cause human injury and/or an accident.

13. Refer to the Auto Switches Precautions for using with an auto switch.

14.When a cylinder is used in a clamping, suspending, or lifting mechanism

There is a danger of workpieces dropping if there is a decrease of thrust 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/or human injury

⚠ Caution

1. Operate the cylinder component parts within a range such that collision damage will not occur at the stroke end.

For applications where a piston with inertial force strikes a cover and stops at the stroke end, follow the cylinder model selection procedure (the front matter), or select while taking into account the allowable kinetic energy indicated in each model's specifications.

2.Avoid having a large gap between the clevis and mating bushing, as this exposes the pin to a bending load.

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

4.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.

5.If pressure is applied to the external cylinder parts, there is a possibility that air will get inside the cylinder from the rod seal section.

(Example: inside a chamber, etc.)

6.Resumption after a long stop.

When resuming operation after a long stop, there are cases in which the starting pressure rises or there is a delay in the piston starting time due to adhesion.

Conducting several cycles of running-in operation will solve this problem. Please consider implementing this before resumption.

7.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.

2-3. Mounting and Installation

⚠ Warning

1.Ensure sufficient space for maintenance activities.

When installing the products, allow access for maintenance and inspection.

2.Tighten threads with the proper tightening torque.

When installing the products, follow the listed torque specifications.

3.Do not place a magnetic object near the product.

The auto switch is a magnetic sensing type. If a magnetic object is placed close to it, the actuator could operate suddenly, which could pose a hazard to humans or damage the machinery and equipment.

4.Do not perform additional machining on the product.

Performing additional machining on the product can result in insufficient strength and cause damage to the product. This can lead to possible human injury or damage to the surrounding equipment.

5.Risk to people with pacemakers

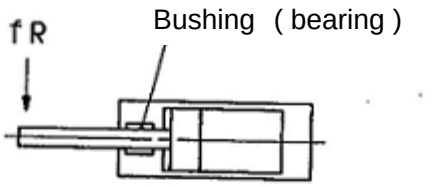
As coming into close proximity with strong magnets may interfere with the function of pacemakers, posing a life-threatening risk to those with pacemakers, they should stay away from products with built-in magnets or take safety measures to block their magnetic force. Failure to heed caution may result in the malfunction of electronic equipment such as pacemakers

⚠ Caution

1.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 2 Maximum Allowable Kinetic Energy. (Page 14)



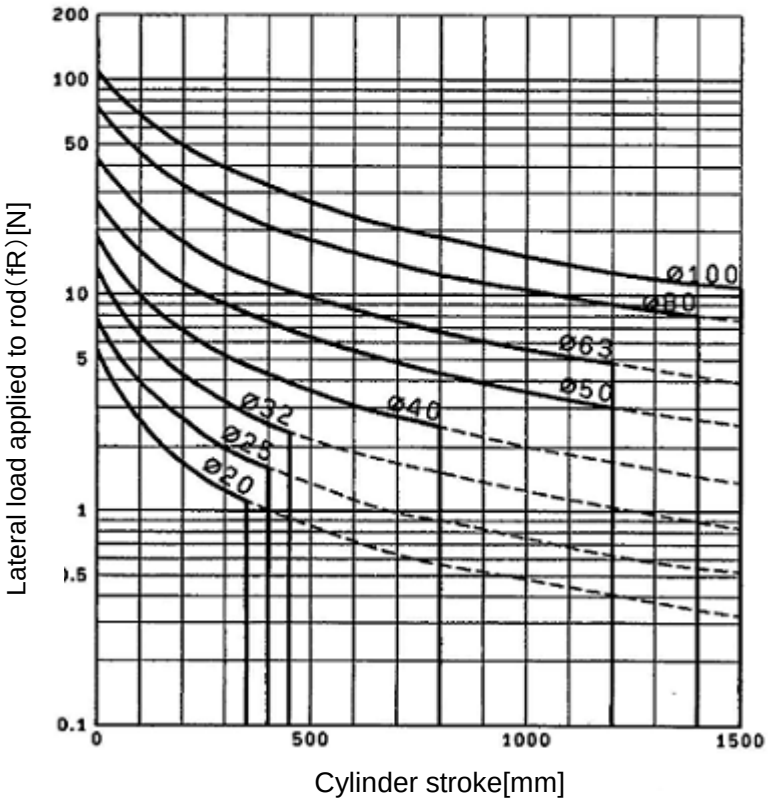


Fig. 1 Allowable lateral load applied to rod end

2.Cantilever fastening

If a cylinder is actuated at a high speed when mounted with one side fastened and one side free (basic type, flange 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 the 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.

3.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 certain areas, such as the inner tube surface, bushings, rod surface, or seals.

For off-center loads, we recommend using in combination with a floating joint, etc., for effective deviation absorption. Confirm the allowable eccentricity and rotating angle before selecting for use.

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

5.Refer to the torque in Table-1 when tightening the foot, flange and Plug bolt to the cylinder.

Table 1 Tightening torque (Unit: Nm)

Bore size (mm)	Foot Flange Plug bolt	Cushion valve (Valve retainer)	Cushion valve (Lock nut)
20	1.5	2.0	0.5
25	2.9	2.0	0.5
32	2.9	2.0	0.5
40	4.9	2.0	0.5
50	11.8	5.0	1.0
63	24.5	5.0	1.0
80	24.5	20.0	2.0
100	42.2	20.0	2.0

6. Do not scratch or gouge the sliding parts of the cylinder tube, piston rod, etc., by striking or grasping them with other objects.

Cylinder bores are manufactured to precise tolerances, so even a slight deformation may cause a malfunction. Also, scratches, gouges, etc., on the piston rod may lead to damaged seals or cause air leakage.

7.Prevent the stoppage of rotating parts.

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

8.Do not use the product until you have verified that the equipment can operate properly.

After installation or repair, apply air and power supplies to the equipment and perform appropriate functional and leakage inspections to make sure the equipment is mounted properly.

9.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.

2-4. Environment

⚠ Warning

1.Do not expose the product to direct sunlight for an extended period of time.

2.Do not use in a place subject to heavy vibration and/or shock.

3.Do not mount the product in locations where it is exposed to radiant heat.

4. When using the cylinder in a dusty environment, or one where it is exposed to water or oil, install a protective cover over the whole cylinder.

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

6.A decrease in the base oil of grease may be accelerated by the properties of the compressed air used in pneumatic equipment, the external environment, operating conditions, etc., and the resulting drop in lubricating performance may have an effect on the equipment's service life

7.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

1.Internal lubricant or the base oil of grease may seep out of the cylinder depending on the operating conditions. Take great care when a clean environment is required.

2.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.

3.Wrapping of sealant 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 sealant tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.

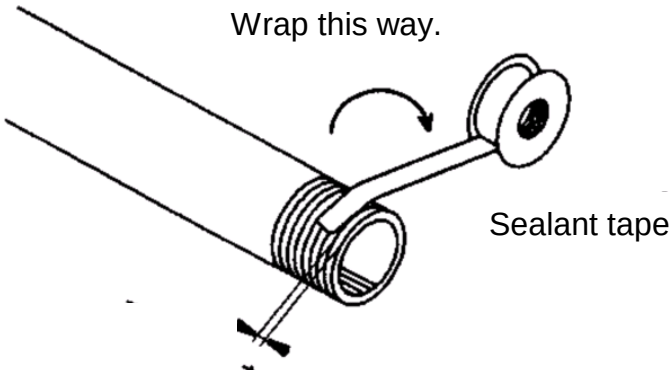


Fig. 2 Sealant tape

2-5. Speed control

When the piston speed is adjusted, install SMC AS series speed controller near the air supply port to adjust to the specified speed. There are two methods of speed adjustment, one is to restrict air supplied to the product (meter-in), and the other is to restrict air exhausted from the product (meter-out). Normally, the meter-out type should be adopted.

⚠ Caution

・Piston speed should be controlled gradually from low speed to the specifiedspeed with a speed controller fully closed.

2-6. Cushion

2-6-1. CG5*N Series/ Rubber bumper

The product has a rubber bumper at both ends of the piston or the cover, which can soften the shock at stroke end and reduce the noise created during operation and by the shock. This feature enables the use of the product at a high frequency or high speed operation.

⚠ Caution

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

2-6-2. CG5*A Series/ Air cushion

The kinetic energy generated by large loads and high speeds is absorbed at the stroke end using the compressed air, so the parts around the actuator are not affected by vibration.

⚠ Caution

1. When the product is shipped, the cushion needle of the cylinder is opened by 1-2 rotations from fully closed and then the lock nut is tightened. When using the product, readjust the cushion valve mounted on the cover according to the level of the operation load and operating speed.

2.When the cushion valve is turned in a clockwise direction, the orifice becomes smaller and the cushion effectiveness is increased. When the cushion valve is turned in a counter-clockwise direction, the orifice becomes larger and the cushion effectiveness is reduced.

3.Tighten the lock nut of the cushion valve according to the tightening torque in Table 1.

The effectiveness of the cushion will change from the initial setting when the lock nut becomes loose and the cushion valve rotates. Readjust the lock nut when such a condition is observed.

4.The cushion seal is subject to wear. The cushion effectiveness therefore changes in the product operation over an extended period of time. Readjust the cushion as necessary.

5.If the cushion valve is fully closed, the piston may bounce at the end of stroke and not move through the full stroke, or the cushion seal may become damaged due to excessive pressure. Do not fully close the cushion valve.

6.If the cushion valve is opened too much, the cylinder will operate like cylinders without an air cushion, and the impact force will be extremely large.

7.Air cushion is not for reducing the piston speed around the stroke end.

2-6-3. Allowable kinetic energy

The applied kinetic energy must be within the allowable value when an inertial load is actuated.

Please refer to "Fig.1 Allowable lateral load applied to rod end ". (Page 10)

Table 2 Allowable kinetic energy

CG5	N	A
Bore size(mm)	E max (J)	E max (J)
20	0.28	0.42
25	0.41	0.65
32	0.66	0.91
40	1.2	1.8
50	2.0	3.4
63	3.4	4.9
80	5.9	11.8
100	9.9	16.7

Formula

$E = (m / 2) \times v^2$

E : Kinetic energy (J)
m : Load mass (Kg)
v : Max. piston speed (m/s)

$E \leqq E$ max (J)
Should be satisfied.

⚠ Warning

・Use the actuator with allowable kinetic energy (Table 2) 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.

2-7. 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.

2-8. Auto switches

When an auto switch is mounted or its set position is changed, refer to Fig. 3.

⚠ Caution

1.Use a specific mounting bracket (Table 3) and mount the product so that the band of the bracket will be perpendicular to the stroke of the product.

2.Tighten mounting screws to the appropriate torque.

3.The auto switch can only be used for cylinders with a built-in magnet for auto switch (e.g. CDG5).

(1) Wind a band on the cylinder tube to roughly set the auto switch mounting position.
(2) Put the mounting part of the auto switch between the clasps of the band of the bracket, and match the mounting hole of the switch to the holes of the clasp
(3) Turn the mounting screw slightly into the threads of the band through the mounting hole.
(4) Confirm where the detecting position is, and tighten the mounting screw to fix the auto switch. (The tightening torque of the M4 screw must be 1 to 1.2Nm.)
(5) The detection position can be changed under the conditions in step 3.

Fig. 3 Mounting and movement of the auto switch

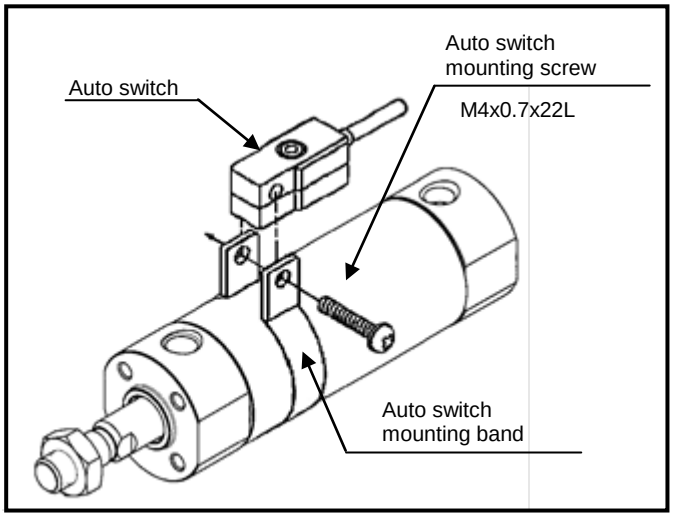
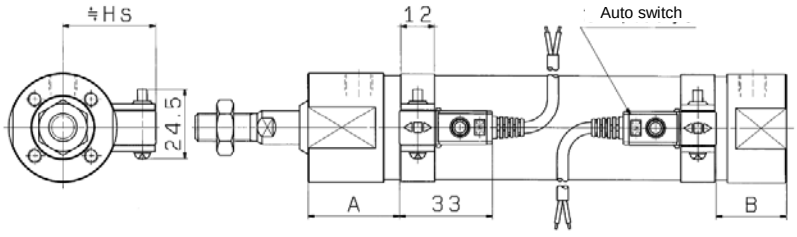


Table3 Auto Switch Mounting Bracket / Part No.

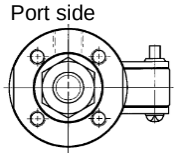
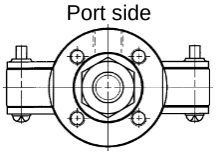
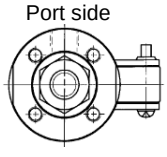
*With stainless steel mounting screws.

Applicable bore size (mm)	20	NBA-088S
	25	NBA-106S
	32	BGS1-032S
	40	BAF-04S
	50	BAF-05S
	63	BAF-06S
	80	BAF-08S
	100	BAF-10S

D-G5BA



Minimum Stroke for Auto Switch Mounting

Mounting bracket	Basic type, Foot type, Flange type, Clevis type		
Number of auto switches	1 (Rod cover side)	2 (Different sides)	2 (Same side)
Switch mounting side	Port side 	Port side 	Port side 
Minimum stroke (mm)	10	20	75

Operating Range (mm)

Auto switch model	Bore size (mm)							
	20	25	32	40	50	63	80	100
D-G5BA	5	5	5.5	6	7	7.5	7.5	8

* Since this is a guideline including hysteresis, not meant to be guaranteed. (Assuming approximately ±30% dispersion) There may be the case to change substantially depending on an ambient environment.

Proper Auto Switch Mounting Position and Its Mounting Height (mm)

Applicable bore size (mm) \ Auto switch model	D-G5BA		
	A	B	Hs
20	31.5	26	26
25	31.5	28.5	28.5
32	32.5	33	33
40	37	36.5	36.5
50	45.5	42	42
63	45.5	48.5	48.5
80	56	57.5	57.5
100	57	68	68

Note) Adjust the auto switch after confirming the operating condition in the actual setting.

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

1.As a minimum, maintenance should be performed according to the above items. Perform additional maintenance as necessary.

If handled improperly, human injury and/or malfunction or damage of machinery and equipment may occur

2.Maintenance work

If handled improperly, compressed air can be dangerous. Assembly, handling, repair, and element replacement of pneumatic systems should be performed by a knowledgeable and experienced person.

3.Drain flushing

Remove drainage from air filters regularly

4.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 and piston seal for ø20 to ø40.

Replacement of the rod seal may be difficult when the scraper remains attached since it has to be removed and inserted through the inside diameter area of the scraper.

⚠ 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.

For disassembling, hold the flats of the tube cover gently in a vice and hold the flats of the rod cover with a spanner or adjustable wrench to loosen and remove the rod cover. When reassembling, tighten 0 to 2 degrees more than the original position before disassembling.

Bore size of ø50 or more cannot be disassembled because they are tightened to a high torque. Contact your SMC Sales representative if you need to disassemble these products.

Sealant* is used on the threads of the connecting sections of the cover and the cylinder tube for airtight construction. When disassembling the cylinder, the old sealant must be completely removed, and new sealant must be applied before re-assembling.

* Loctite® 542 (medium strength) or equivalent

3-2-2. Removal of seals

1. Rod seal

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

⚠ Caution

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

2) When the water-resistant scraper is worn out, replace the entire rod cover assembly.
In such a case, contact your SMC sales representative.
(Only available for cylinders up to Ø40)

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.

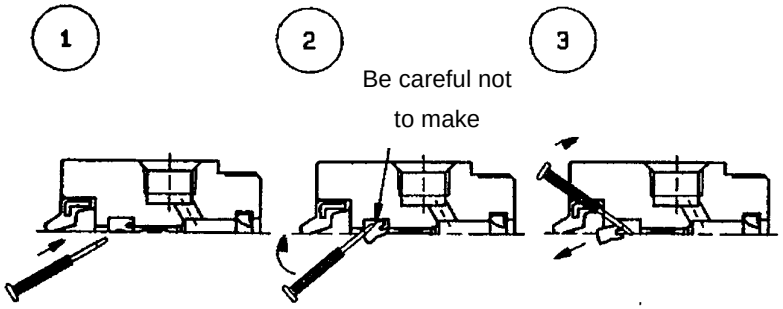


Fig. 4 How to remove rod seal

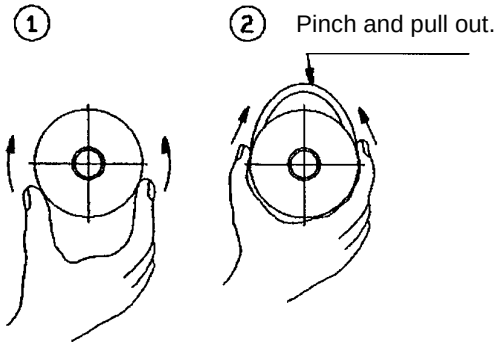


Fig. 5 How to remove piston seal

3.Valve seal and Valve retaining gasket (Only for air cushion type ）

Pry it with a miniature driver after disassembly.（Fig. 6）

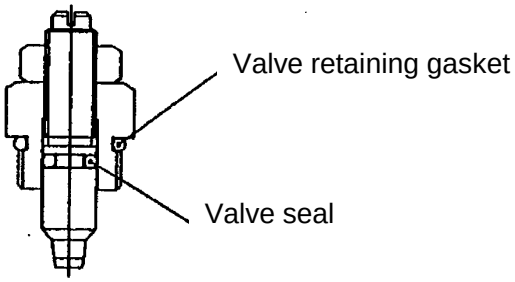


Fig. 6 Positions of Valve seal and Valve retaining gasket

3-2-3. Grease

⚠ Caution

・Use SMC's recommended grease.
Grease pack part number: GR-R-010 (10g)

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. 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. Valve seal and Valve retaining gasket (Air cushion type)

   Lightly apply grease to the entire surface.

4. Parts of cylinder

   Grease is applied to the locations shown in Fig. 4. The amount of grease per cylinder of 100 stroke is shown in attached table 4. Roughly, one scoop with a forefinger is approximately 3g.

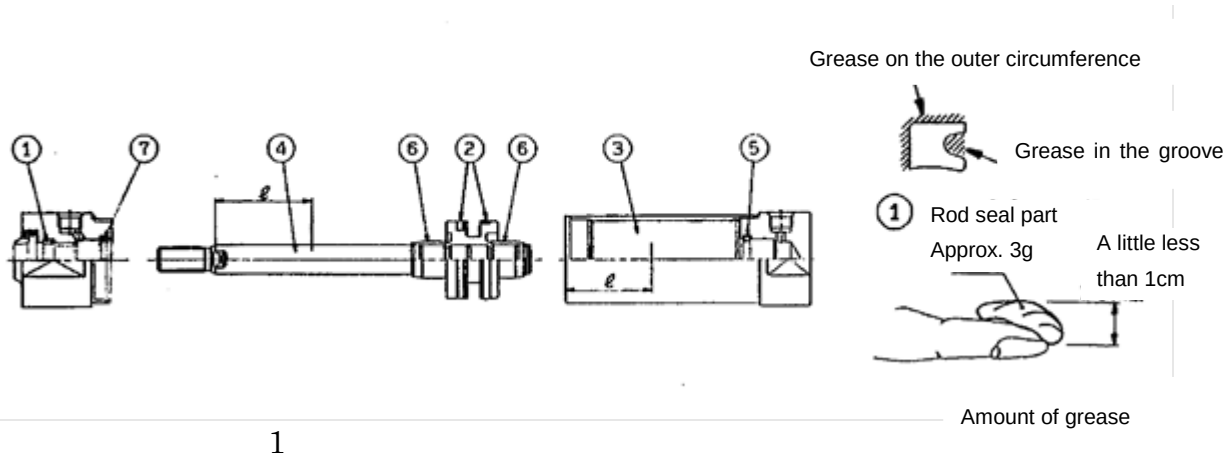


Fig. 7 Position for application of grease

Table 4 Amount of grease units: g

Bore size (mm) / Stroke		20	25	32	40	Position for grease
At 100st		2	3	3	3 to 4	1, 2, 3, 4, 5, 6, 7, 8
50st added		0.5	0.5	0.5	1	3, 4

5, 6 and 7 are not applicable for Rubber bumper type

3-2-4. Mounting of seals

1. Rod seal (Fig.8)

   Pay attention to the mounting direction of the seal.

   Apply grease to the scraper and the inner circumference of the rod seal as shown in Fig. 8.

2. Piston seal (Fig. 9)

   Mount with care not to twist the piston seal. Apply grease to the seal groove and outer circumference by rubbing grease into them as shown in Fig. 9.

3.Valve seal and Valve retaining gasket .(Air cushion type ）

   Mount them to the specified positions referring to Fig. 6.

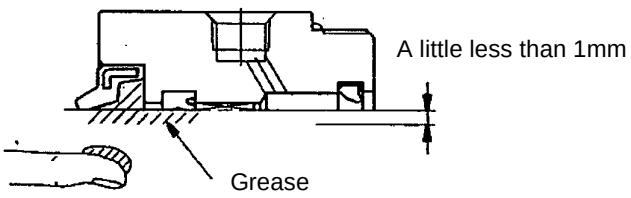


Fig. 8 Rod seal

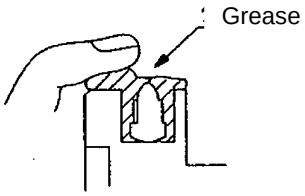


Fig. 9 Piston seal

⚠ Caution

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

3-3. Consumable parts

3-3-1. Replacement parts

Bore size (mm)	Rubber bumper		Air cushion	
	CG5*N*SR	CG5*N*SV	CG5*A*SR	CG5*A*SV
20	CG5N20SR-PS	CG5N20SV-PS	CG5A20SR-PS	CG5A20SV-PS
25	CG5N25SR-PS	CG5N25SV-PS	CG5A25SR-PS	CG5A25SV-PS
32	CG5N32SR-PS	CG5N32SV-PS	CG5A32SR-PS	CG5A32SV-PS
40	CG5N40SR-PS	CG5N40SV-PS	CG5A40SR-PS	CG5A40SV-PS
Seal material	NBR	FKM	NBR	FKM
Contents of the seal kit	Rod seal Piston seal		Rod seal Piston seal Valve seal Valve retainer gasket	
Grease pack	**GR-R-010 (10g)**			

3-3-2. Storage of seals

⚠ Caution

1. Although seals are packed, place them in a box or bag and store them in an area free of heat, direct sunlight, ozone, radiation etc.

2. After opening the package, pay attention not to get dirt or dust on the seal and store it in the original packing condition as much as possible.

3. Do not place an item on the product, bind a rubber product with a string, or hang on a nail or wire to prevent any deformation or scratch on the product.

4.White particles can emerge from the surface of the seal during storage, but they do not affect its performance.

3-4. Troubleshooting

Problem	Major causes	Countermeasures
Operation has lost smoothness.	1. Lubrication failure	- Apply the specified grease after cleaning of parts (Grease pack: GR-R-010 (10g))
	2. Deformation of piston rod	- Replace the cylinder with a new one. When reinstalling the product, adjust the load and mounting position.
	3. Insufficient pressure	- Supply appropriate pressure.
	4. Operation at a low speed outside of the limit.	- Use at 50 mm/s or faster.
Output force has decreased.	1. Air leakage from piston seal	- Replace the piston seal with a new one. See 3-2-2. Replacement of seals. (Page 18)
	2. Air leakage from rod seal	- Replace the rod seal with a new one. See 3-2-2. Replacement of seals. (Page 18)
	3. Insufficient air pressure	- Supply appropriate pressure.
	4. Insufficient flow rate	- The resistance in the fluid path may have increased due to deformation or foreign matter entering the product. Perform repair or cleaning.
	5. Incorrect mounting position of the product	- Mount in a proper position without any force applied to the product.
	6. Deformation of piston rod	- Replace the cylinder with a new one. When reinstalling the product, adjust the load and mounting position.
	7. Lubrication failure	- Refer to the countermeasure for the trouble “Operation has lost smoothness/ lubrication failure.”
Piston speed is too fast.	1. Speed controller is not used.	- Use a speed controller suitable for the size of the product. Refer to the catalog and operation manual of the speed controller for details.
	2. Insufficient fine adjustment of speed controller	- Select a speed controller, which can be adjusted to the required speed. Refer to the catalog and operation manual of the speed controller for details.
Piston speed is too slow.	1. Directional control valve is too small.	- Select directional control valves with suitable size. Refer to the catalog and operation manual of the directional control valve for details.
	2. Resistance of equipment in the piping route is too large	- Use components and equipment of an appropriate size. It affects the piping diameter and length. Equipment at the exhaust side should also be of an appropriate size. Refer to the catalog and operation manual of the components and equipment for details.
The product sometimes does not operate.	1. Operation at a very low speed	- Refer to Operation has lost smoothness/4.Operation at a low speed outside of the limit.
	2. Problem of equipment other than this product	- Check all items in the system one by one to find the cause. Refer to the catalog and operation manual of the components and equipment for details.
The product has become unable to operate.	1. Damage of piston seal	- If there is leakage from the piston seal, it will be exhausted from the exhaust port of the directional control valve all the time. Replace the piston seal. See 3-2-2. Replacement of seals. (Page 18)
	2. Problem of equipment other than this product	- Check all items in the system one by one to find the cause. Refer to the catalog and operation manual of the components and equipment for details.
	3. Insufficient pressure	- Supply appropriate pressure.

Problem	Major causes	Countermeasures
The piston rod has been deformed and broken.	1. Operation at high speed	- Replace the cylinder with a new one. Operation at a high speed can cause impact from the load, and deform and damage the product. Keep within the specified piston speed and allowable kinetic energy.
	2. Excessive external force	- Structural interference, eccentric load or over-load may cause damage and deformation of the cylinder. Eliminate the cause and replace the product with a new one.
Piston speed cannot be adjusted with the speed controller.	1. Incorrect speed controller selection	Use a speed controller suitable for the size of the product. Refer to the catalog and operation manual of the speed controller for details.
	2. Problem of the speed controller	- Replace the speed controller with a new one. Refer to the catalog and operation manual of the speed controller for details.
The product has stick and slip movement.	1. Speed too slow	- Use at 50 mm/s or faster.
	2. Insufficient margin of output	- Supply appropriate pressure. - Replace with a product of a larger bore size.
	3. Use of a meter-in circuit	- In case of the operation with low pressure or low speed, the operation may become stable if the product is used with meter-in. Use of a meter-out circuit.
The product jump out after being stopped for extended periods of time.	1. Fluctuation of residual pressure in the product between continuous operation and operation after stoppage for extended periods of time	- Consider the use of a suitable pneumatic circuit to prevent sudden action of the product.
The cushion does not work.	1. Allowable kinetic energy exceeded	-Keep your kinetic energy within acceptable cushioning or use an external cushion.
	2. Cushion valve adjustment failure	-Adjust again. Refer to 2-6-2. CG5*A Series / Air cushion on page 13.
Switch does not turn on (Switch sometimes does not turn on)	1. Power supply failure or connection failure	- Check the power supply. - Connect the product properly.
	2. Displacement of auto switch position	- Try to slide the auto switch over the product to check its ON position, and move it to a correct position.
	3. Reduction of magnetic force	- If there is a magnetic source near the product, move it away or install a shield plate to reduce the effect from the magnet. - When the product gets hot, adjust operating frequency to lower it to 60oC. - If the above measures do not resolve the problem, replace the product with a new one.
	4. Lowered sensitivity of auto switch	- Eliminate the problem of ambient temperature, vibration, or impact. Replace the switch with a new one if the problem is not solved.
Switch does not turn off (Switch sometimes does not turn off)	1.Fused contact of auto switch (reed type)	- Check the voltage and load are within the specified rated values, and replace the auto switch with a new one.
	2. External magnetic field keeping auto switch on.	- If there is a magnetic source near the product, move it away or install a shield plate to reduce the effect from the magnet.

4. Basic Circuit for Cylinder Operation

The basic circuit for operating the product with air filter, regulator, solenoid valve and speed controller (meter-out) is shown in the following figure.

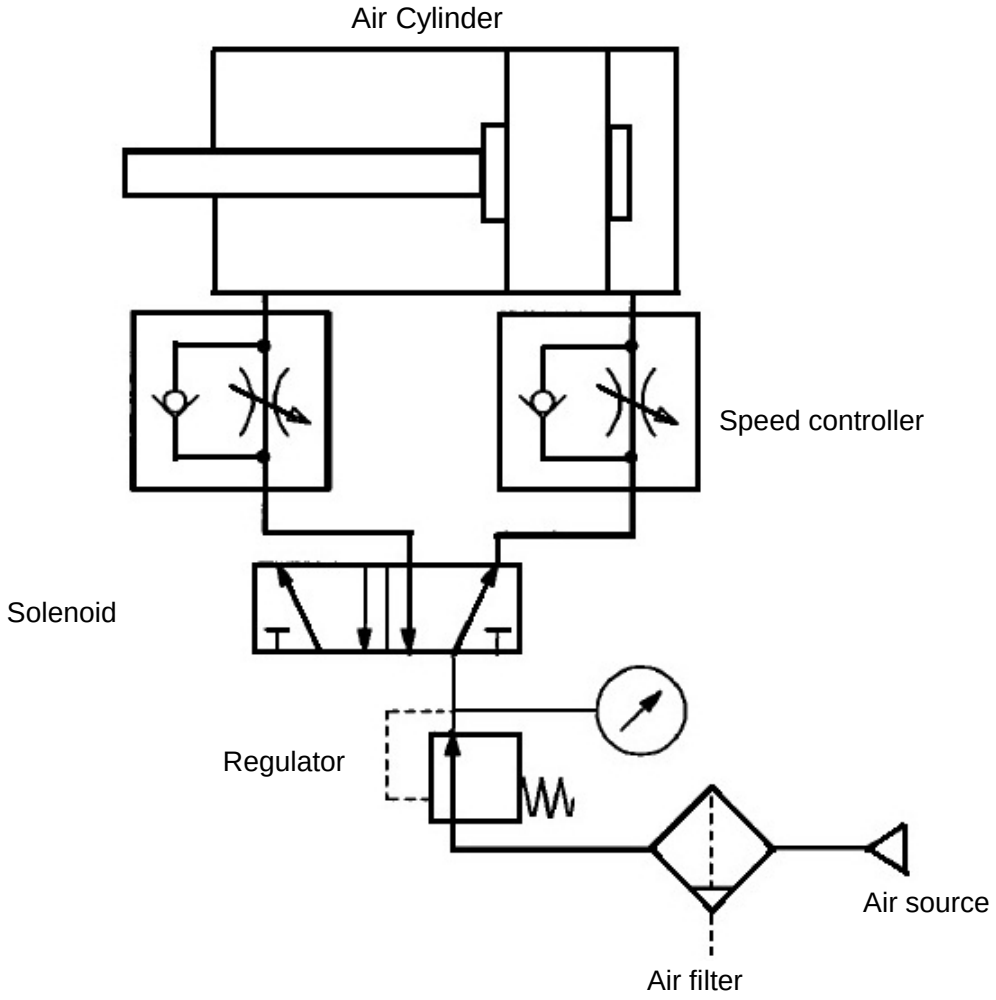
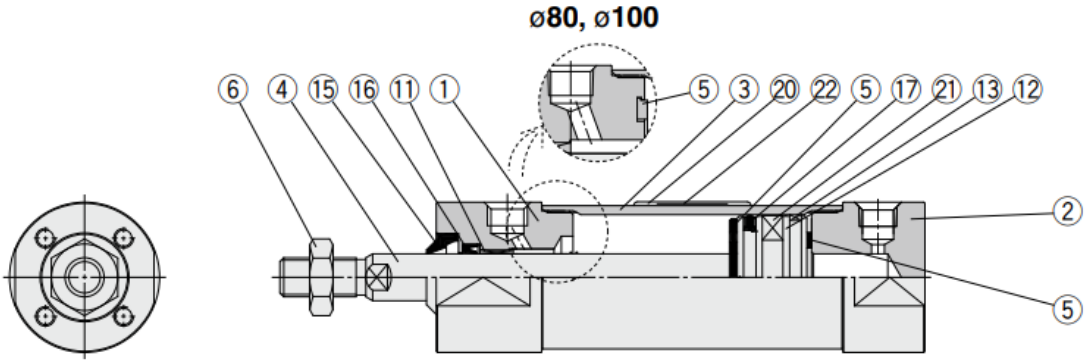


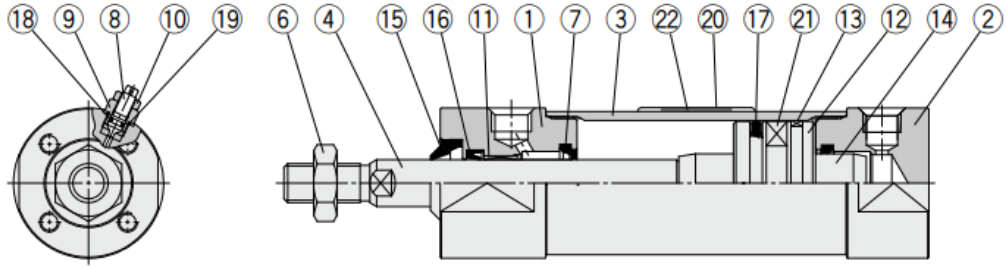
Fig. 10　Basic Circuit

5. Construction

With rubber bumper



With air cushion



Component Parts

No.	Description	Material	Note
1	Rod cover	Stainless steel	
2	Head cover	Stainless steel	
3	Cylinder tube	Stainless steel	
4	Piston rod	Stainless steel	Hard chrome plated
5	Bumper	Urethane	
6	Rod end nut	Stainless steel	
7	Cushion seal	Urethane	
8	Cushion valve	Stainless steel	
9	Valve retainer	Stainless steel	
10	Lock nut	Stainless steel	
11	Bushing	Bearing alloy	
12	Piston	Aluminum alloy	
13	Wearing	Resin	
14	Cushion ring	Aluminum alloy	

No.	Description	Material	
		CG5□□□SR	CG5□□□SV
15	Water resistant scraper	NBR	FKM
16	Rod seal		
17	Piston seal		
18	Valve seal		
19	Valve retainer gasket		
20	Label protector	PET	
21	Magnet	—	
22	Label	—	

Note 1) Component part material and surface treatment other than listed above are the same as the standard type of the CG1 series.
Note 2) For cylinders with an auto switch, the piston is fixed with a magnet.

Fig. 11 Double Acting, Single Rod : Construction/Construction

Revision history
2: All revised contents

SMC Corporation

4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021 JAPAN
Tel: + 81 3 5207 8249 Fax: +81 3 5298 5362
URL https://www.smcworld.com