



Operation Manual

PRODUCT NAME

Guide Cylinder

MODEL / Series / Product Number

MGC Series

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 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

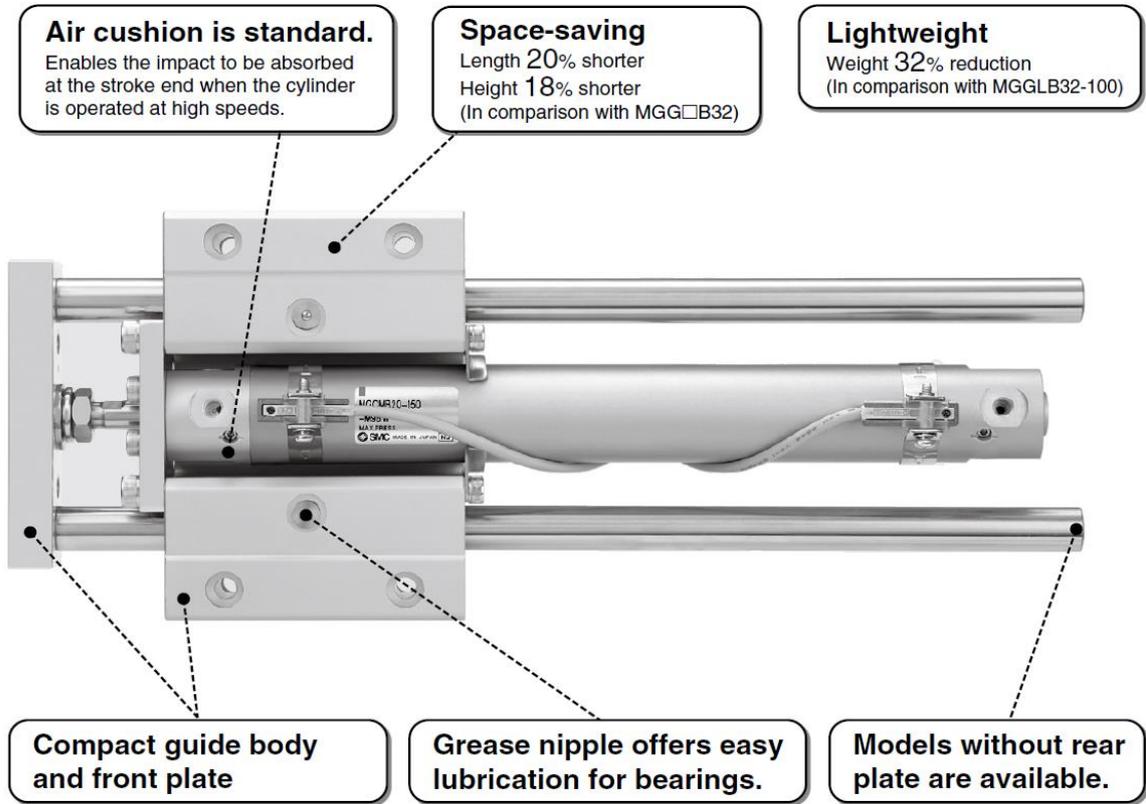
SMC products are not intended for use as instruments for legal metrology.

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.

Product Features

Guide Cylinder/Compact Type MGC Series $\phi 20, \phi 25, \phi 32, \phi 40, \phi 50$

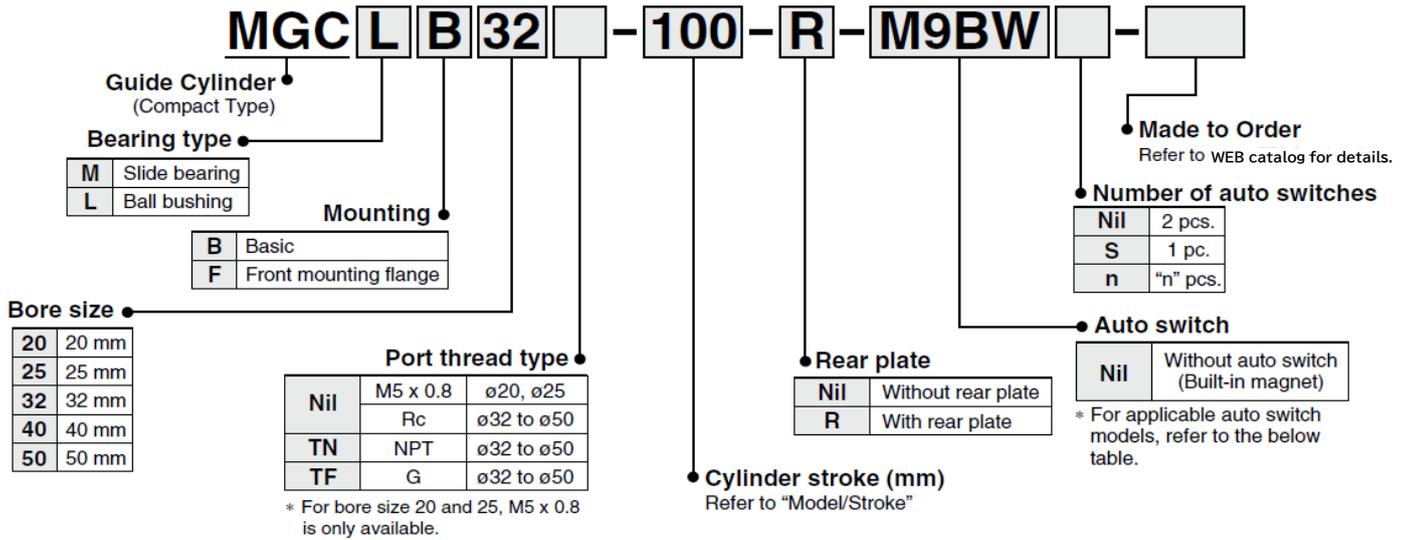


Variations

Bore size (mm)	Standard stroke (mm)						
	75	100	125	150	200	250	300
20	●	●	●	●	●	●	●
25	●	●	●	●	●	●	●
32	●	●	●	●	●	●	●
40	●	●	●	●	●	●	●
50	●	●	●	●	●	●	●

Bore size (mm)	Long stroke (mm)										
	250	300	350	400	450	500	600	700	800	900	1000
20	●	●	●	●	●	●	●	●	●	●	●
25	●	●	●	●	●	●	●	●	●	●	●
32	●	●	●	●	●	●	●	●	●	●	●
40	●	●	●	●	●	●	●	●	●	●	●
50	●	●	●	●	●	●	●	●	●	●	●

1. How to Order



Applicable Auto Switches/Refer to WEB catalog for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage		Auto switch model				Lead wire length (m)					Pre-wired connector	Applicable load	
					DC	AC	Applicable bore size				0.5 (Nil)	1 (M)	3 (L)	5 (Z)	None (N)			
							ø20 to ø50	ø20, ø25	ø32	ø40, ø50								
Solid state auto switch	—	Grommet	—	3-wire (NPN)	5 V, 12 V	—	M9NV	M9N	●	●	●	○	—	○	IC circuit			
				3-wire (PNP)			M9PV	M9P	●	●	●	○	—	○				
		Connector		2-wire	12 V	—	M9BV	M9B	●	●	●	○	—	○	—	—		
				—		H7C	●	—	●	●	—	—	—					
	Diagnostic indication (2-color indicator)	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	M9NV	M9N	●	●	●	○	—	○	IC circuit		
				3-wire (PNP)				M9PV	M9P	●	●	●	○	—	○			
	Water resistant (2-color indicator)	Grommet	—	2-wire	12 V	—	—	M9BW	M9B	●	●	●	○	—	○	—		
				—				H7C	●	—	●	●	—	—	—			
	With diagnostic output (2-color indicator)	Grommet	—	3-wire (NPN)	24 V	5 V, 12 V	—	M9NAV*1	M9NA*1	○	○	●	○	—	○	IC circuit		
				3-wire (PNP)				M9PAV*1	M9PA*1	○	○	●	○	—	○			
—	Grommet	—	2-wire	12 V	—	—	M9BAV*1	M9BA*1	○	○	●	○	—	○	—			
			—				H7NF	●	—	●	○	—	○	—	○	IC circuit		
Reed auto switch	—	Grommet	Yes	3-wire (NPN equivalent)	24 V	5 V	—	A96V	A96	●	—	●	—	—	—	IC circuit		
				None				2-wire	100 V	A93V*2	A93	●	●	●	—	—	—	—
									100 V or less	A90V	A90	●	—	●	—	—	—	—
		Yes		2-wire	100 V, 200 V	—	(B54)	B54	●	—	●	●	—	—	—	—		
					200 V or less	—	(B64)	B64	●	—	●	—	—	—				
		Connector		—	—	—	—	—	—	C73C	●	—	●	●	—	—	—	
						24 V or less	—	C80C	●	—	●	●	—	—	—	IC circuit		
Diagnostic indication (2-color indicator)	Grommet	Yes	—	—	—	—	(B59W)	B59W	●	—	●	—	—	—	—			

*1 Water resistant type auto switches can be mounted on the above models, but in such case SMC cannot guarantee water resistance.

Consult with SMC regarding water resistant types with the above model numbers.

*2 1 m type lead wire is only applicable to D-A93.

* Lead wire length symbols: 0.5 m Nil (Example) M9NW
 1 m M (Example) M9NWM
 3 m L (Example) M9NWL
 5 m Z (Example) M9NWX
 None N (Example) H7CN

* Solid state auto switches marked with "○" are produced upon receipt of order.

* Since there are other applicable auto switches than listed, refer to WEB catalog.

* For details about auto switches with pre-wired connector, refer to WEB catalog.

* The D-A9□(V)/M9□(V)/M9□W(V)/M9□A(V) are shipped together, (but not assembled).
 (Only switch mounting brackets are assembled at the time of shipment.)

Caution

When using auto switches shown inside (), stroke end detection may not be possible depending on the One-touch fitting or speed controller model. Please contact SMC in this case.

2. Model/Stroke

Model (Bearing type)	Bore size (mm)	Standard stroke (mm)	Long stroke (mm)
MGCM (Slide bearing) MGCL (Ball bushing)	20	75, 100, 125, 150, 200	250, 300, 350, 400
	25	75, 100, 125, 150 200, 250, 300	350, 400, 450, 500
	32		350, 400, 450, 500, 600
	40		350, 400, 450, 500, 600 700, 800
	50		350, 400, 450, 500, 600 700, 800, 900, 1000

* Intermediate strokes and short strokes other than the above are produced upon receipt of order.

3. Specifications

Model	MGC□□20	MGC□□25	MGC□□32	MGC□□40	MGC□□50	
Base cylinder	CDG1ZA	Bore size	Port thread type	Stroke	Z	Auto switch
Bore size (mm)	20	25	32	40	50	
Action	Double acting					
Fluid	Air					
Proof pressure	1.5 MPa					
Maximum operating pressure	1.0 MPa					
Minimum operating pressure	0.15 MPa (Horizontal, No load)					
Ambient and fluid temperature	-10 to 60°C					
Piston speed	50 to 750 mm/s					
Cushion	Air cushion					
Base cylinder lubrication	Non-lube					
Stroke length tolerance	+1.9 +0.2 mm					
Non-rotating accuracy ^{*1}	Slide bearing	±0.07°	±0.06°	±0.06°	±0.05°	±0.04°
	Ball bushing	±0.06°	±0.05°	±0.04°	±0.04°	±0.04°
Piping port size (Rc, NPT, G) ^{*2}	M5 x 0.8		1/8		1/4	

*1 When the cylinder is retracted (initial value), the non-rotating accuracy without loads or deflection of the guide rods will be below the values shown in the above table as a guideline.

*2 For bore sizes 20 and 25, M5 x 0.8 is only available.

4. Theoretical Output



Bore size (mm)	Rod size (mm)	Operating direction	Piston area (mm ²)	Operating pressure (MPa)								
				0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
20	8	OUT	314	62.8	94.2	126	157	188	220	251	283	314
		IN	264	52.8	79.2	106	132	158	185	211	238	264
25	10	OUT	491	98.2	147	196	246	295	344	393	442	491
		IN	412	82.4	124	165	206	247	288	330	371	412
32	12	OUT	804	161	241	322	402	482	563	643	724	804
		IN	691	138	207	276	346	415	484	553	622	691
40	16	OUT	1260	252	378	504	630	756	882	1010	1130	1260
		IN	1060	212	318	424	530	636	742	848	954	1060
50	20	OUT	1960	392	588	784	980	1180	1370	1570	1760	1960
		IN	1650	330	495	660	825	990	1160	1320	1490	1650

Note) Theoretical output (N) = Pressure (MPa) x Piston area (mm²)

5. Weight

Bore size (mm)		20	25	32	40	50
Basic weight	LB type (Ball bushing bearing/Basic)	1.04	1.55	2.07	3.32	6.45
	LF type (Ball bushing bearing/Front mounting flange)	1.7	2.35	3.02	5.02	8.58
	MB type (Slide bearing/Basic)	1.02	1.51	2.03	3.26	6.35
	MF type (Slide bearing/Front mounting flange)	1.69	2.32	2.98	4.96	8.48
Additional weight with rear plate		0.2	0.25	0.34	0.58	1.04
Additional weight per each 50 mm of stroke		0.14	0.17	0.25	0.4	0.61
Additional weight for long stroke		0.01	0.01	0.02	0.03	0.06
Additional weight with bracket		0.011	0.018	0.019	0.031	0.061

Calculation: (Example)

MGCLB32-500-R

(Ball bushing bearing/Basic, ø32/500 st., with rear plate, with bracket)

- Basic weight 2.07 (LB type)
- Additional weight with rear plate 0.34
- Additional stroke weight 0.25/50 st
- Stroke 500 st
- Additional weight for long stroke 0.02
- Additional weight with bracket 0.019

$$2.07 + 0.34 + 0.25 \times 500/50 + 0.02 + 0.019 = 4.95 \text{ kg}$$

6. Moving Parts Weight

Bore size (mm)	20	25	32	40	50
Moving parts basic weight	0.34	0.53	0.69	1.2	2.45
Additional weight with rear plate	0.2	0.25	0.34	0.58	1.04
Additional weight per each 50 mm of stroke	0.11	0.14	0.2	0.33	0.51

Calculation: (Example)

MGCLB32-500-R

- Moving parts basic weight 0.69
- Additional weight with rear plate 0.34
- Additional stroke weight 0.2/50 st.
- Stroke 500 st.

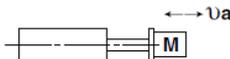
$$0.69 + 0.34 + 0.2 \times 500/50 = 3.03 \text{ kg}$$

7. Allowable Kinetic Energy by Air Cushion Mechanism

R: Rod end, H: Head end

Bore size (mm)	Effective cushion length (mm)	Allowable kinetic energy (J)
20	R: 7, H: 7.5	R: 0.35, H: 0.42
25	R: 7, H: 7.5	R: 0.56, H: 0.65
32	7.5	0.91
40	8.7	1.8
50	11.8	3.4

High kinetic energy generated by large loads and high speed operations can be absorbed by compressing air at the stroke end thus preventing shock and vibration being transmitted to the machine. The air cushion has not been designed to control the piston speed in the end regions of the stroke. The load kinetic energy can be obtained by the following equation:



$$E_k = \frac{M + m}{2} v^2 \quad v = 1.4 v_a$$

E_k : Kinetic energy (J)

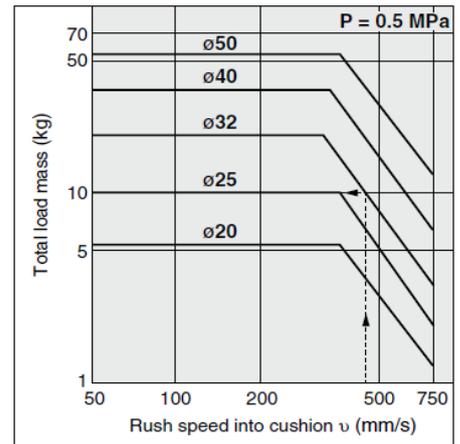
M : Weight of the driven object (kg)

m : Weight of moving parts of cylinder (kg)

v : Maximum speed (m/s)

v_a : Average speed (m/s)

Note) Set v_a so that rush speed into cushion v should not exceed 0.75 m/s.



Also, selection can be made by using the graph above.

Example)

Find the maximum load mass when using a cylinder with ø32, stroke 500 mm, with rear plate as a lifter at an average speed of v_a 300 mm/s.

Rush speed into cushion v is as follows:

$$v = 1.4 \times 300 = 420 \text{ mm/s.}$$

Extend upward from 420 mm/s on the abscissa in the graph until crossing at the line of bore size 32. Extend leftward from the intersection to find the total load weight 10 kg.

Subtract the moving parts weight of 3.08 kg from this. (For moving parts, refer to "Moving Parts Weight".) 6.92 kg will be obtained, which is equal to the maximum load weight.

⚠ Caution

In a horizontal application, pay attention to that the load weight should not exceed the allowable end load given on WEB catalog.

8. Design/Selection

Warning

1) Confirm the specifications.

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

2) Confirm the applicable specification range.

The cylinder specifications listed in the catalog 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.

3) There is a danger of sudden action by cylinders if the sliding parts of machinery are twisted, etc., or changes in forces occur.

In such cases, human injury may occur, e.g. by hands or feet getting caught 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.

4) 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.

5) 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.

6) Consider the possibility of a power source related malfunction.

For equipment that relies 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 a malfunction.

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

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

8) Consider the action of the cylinder in the event of an emergency stop.

Devise a safe 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) 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.

10) Consider the action of the cylinder when restarting after an emergency stop.

Devise a safe design so that the restarting of the cylinder will not pose a hazard to humans or damage the equipment. Install manually controlled equipment for safety when the actuator has to be reset to the starting position.

11) Intermediate stops

When an intermediate stopped position is performed with a 3position closed center type/double check valve type directional control valve, it is difficult to achieve accurate and precise stopped positions 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 an extended period of time. Please contact SMC in case it is necessary to hold a stopped position for an extended period of time.

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.

15) Do not use the product as a shock absorber.

If abnormal pressure or an air leakage occurs, the rotary actuator's speed reduction capability could become severely affected, which could pose a hazard to humans or damage the machinery and equipment.

16) Do not stop or hold the product at midpoint by keeping air pressure in the product.

For a product lacking an external stopping mechanism, if the directional control valve is closed to keep the air pressure in the product in an attempt to stop the product at midpoint, it might not be possible to maintain that stopped position due to an air leakage. As a result, it could pose a hazard to humans or cause damage to machinery and equipment.

⚠ Caution

1) Use the product within the limits of the maximum usable stroke.

The piston rod will be damaged if operated beyond the maximum stroke.

2) 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, or select while taking into account the allowable kinetic energy indicated in each model's specifications.

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

4) 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.)

5) Do not use the product as a stopper.

Also when water, cutting oil, etc., directly splashes on a cylinder, please contact SMC for details.

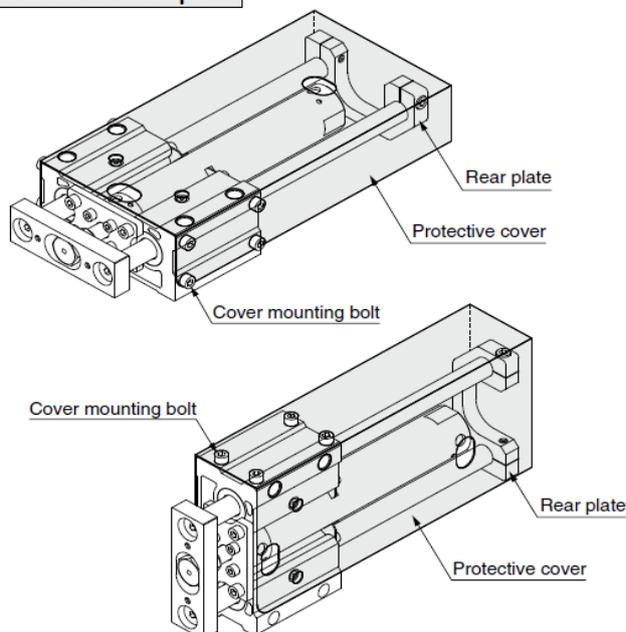
9. Installations/Adjustment

⚠ Warning

1) Installing a protective cover (In the case of rear plate)

During mounting, handling and operation, the rear plate makes reciprocating movements. Therefore, pay careful attention not to insert your hand, etc., between the cylinder and the rear plate. When you are going to fit this product to the outside of your equipment, take preventative measures such as installing a protective cover.

MGC Protective cover installation example



1) Operation manual

Install the product and operate it only after reading the operation manual carefully and understanding its contents. Also, keep the manual in a location where it can be referred to as necessary.

2) Ensure sufficient space for maintenance activities.

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

3) Tighten threads with the proper tightening torque.

When installing the products, follow the listed torque specifications.

4) 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.

5) 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.

6) Do not enlarge the fixed throttle by modifying the pipe connectors

If the hole diameter is enlarged, the product's rotation speed will increase, causing the shock force to increase and damage the product. As a result, it could pose a hazard to humans or damage the machinery and equipment.

7) Do not open the cushion valve after rotating it numerous times in a row. Though uncommon, there are cases in which the cushion valve may leak air.

The cushion valve should be adjusted by gradually opening it while checking the operation of the cylinder cushion.

Caution

1) 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.

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

3) Do not scratch or gouge the sliding 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.

4) Do not use until you can confirm that equipment can operate properly.

Confirm correct mounting by performing function and leak tests properly after compressed air and power are connected following mounting or repair.

5) 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, 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 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.

6) Be very careful when handling the product.

Depending on the handling method, there is a risk that the corners of the product will injure your hands, fingers, etc.

7) Use caution that no scratch or dent will be given to the slide part of the guide rod.

Because the outer circumference of the guide rod is manufactured with precise tolerances, even a slight deformation, scratch, or gouge can lead to faulty operation or reduced durability.

8) When fitting the guide body, use the guide body which has high flatness of the fitting surface.

If the guide rod has twisted, operation resistance will become abnormally higher and the bearing will wear at an early stage, thereby resulting in poor performance.

9) When mounting a workpiece to the plate, do so only when the piston rod is retracted.

Otherwise, the guide parts has twisted and lead to a malfunction.

10) Mount in locations where maintenance will be easy.

Ensure enough clearance around the cylinder to allow for unobstructed maintenance and inspection work.

11) Do not adjust the rod stroke by moving the rear plates,

as doing so will cause the rear plates to come into direct contact with the guide body or the bracket mounting bolt. The resulting impact cannot be absorbed easily, the stroke position cannot be maintained, and faulty operation may result.

12) Lubrication

When you are going to oil the bearings, do so by using a nipple so that no foreign matter will be mixed. For the grease, we recommended using high-quality lithium soap based grease no. 2

13) Mounting orientation (In the case of rear plate)

If the guide body is mounted so that it is inclined more than 90°, the rear plate may interfere with the basic cylinder head end due to the deflection of guide rods. Please consult with SMC.

14) Fixing of base cylinder

When the product is mounted and operated in a location with low rigidity, bending moment may be applied to the base cylinder by vibrations generated at the stroke end, causing damage to the cylinder. In such cases, install a support bracket to suppress the vibration of the body of the base cylinder or reduce the piston speed until the body does not vibrate at the stroke end.

10. Piping

⚠ Caution

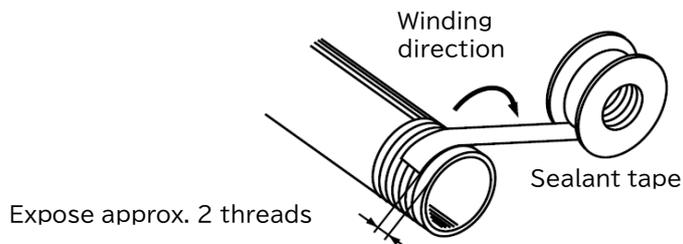
1) Refer to the Fittings and Tubing Precautions for handling One-touch fittings.

2) Preparation before piping

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

3) Winding 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.



11. Lubrication

Warning

1) Lubricating lube type cylinders

Install a lubricator in the circuit, and use class 1 turbine oil (with no additives) ISO VG32. Do not use machine oil or spindle oil. If turbine oil is used, refer to the Safety Data Sheet (MSDS) of the oil.

2) Lubricating non-lube type cylinders

These cylinders have 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 additives) ISO VG32. Do not use machine oil or spindle oil.

Stopping lubrication later on may lead to a 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 Safety Data Sheet (MSDS).

12. Air Supply

Warning

1) Type of fluids

Please consult with SMC when using the product in applications other than compressed air.

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.

4) Use clean air.

Do not use compressed air that contains chemicals, synthetic oils that include organic solvents, salt, corrosive gases, etc., as it can cause damage or malfunction.

Caution

1) When extremely dry air is used as the fluid, degradation of the lubrication properties inside the equipment may occur, resulting in reduced reliability (or reduced service life) of the equipment. Please consult with SMC.

2) 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.

3) 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 the 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.

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

If the fluid temperature is 5°C or less, the moisture in the circuit could freeze, causing damage to the seals or equipment malfunction. Therefore, take appropriate measures to prevent freezing.

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.

13. Operating Environment

Warning

- 1) Do not use in an atmosphere containing corrosive gases, chemicals, sea water, water, or water vapor as the generation of rust, corrosion, etc., may occur as a result. Direct contact with the above must also be avoided.

About plated carbon steel machining

The long machined parts (end threads of piston rods, double-sided chamfer portions, tie rod threads, etc.) are not plated. Consider a made-to-order product (-XC6□) if the product is to be used in an environment where the generation of rust or corrosion will be a problem.

- 2) Do not expose the product to direct sunlight for an extended period of time.
- 3) Do not use in a place subject to heavy vibration and/or shock.
- 4) Do not mount the product in locations where it is exposed to radiant heat
- 5) Do not use in dusty locations or where water, oil, etc., splash on the equipment.

Use the heavy duty scraper type (-XC4) in situations where there is a lot of dust.

Use a water-resistant cylinder when there is splashing or spraying of a liquid. (Available as a special.)

- 6) When using auto switches, do not operate in an environment with strong magnetic fields.
- 7) 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.

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.

14. Maintenance

Warning

- 1) Perform maintenance and inspection according to the procedures indicated in the operation manual.

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**

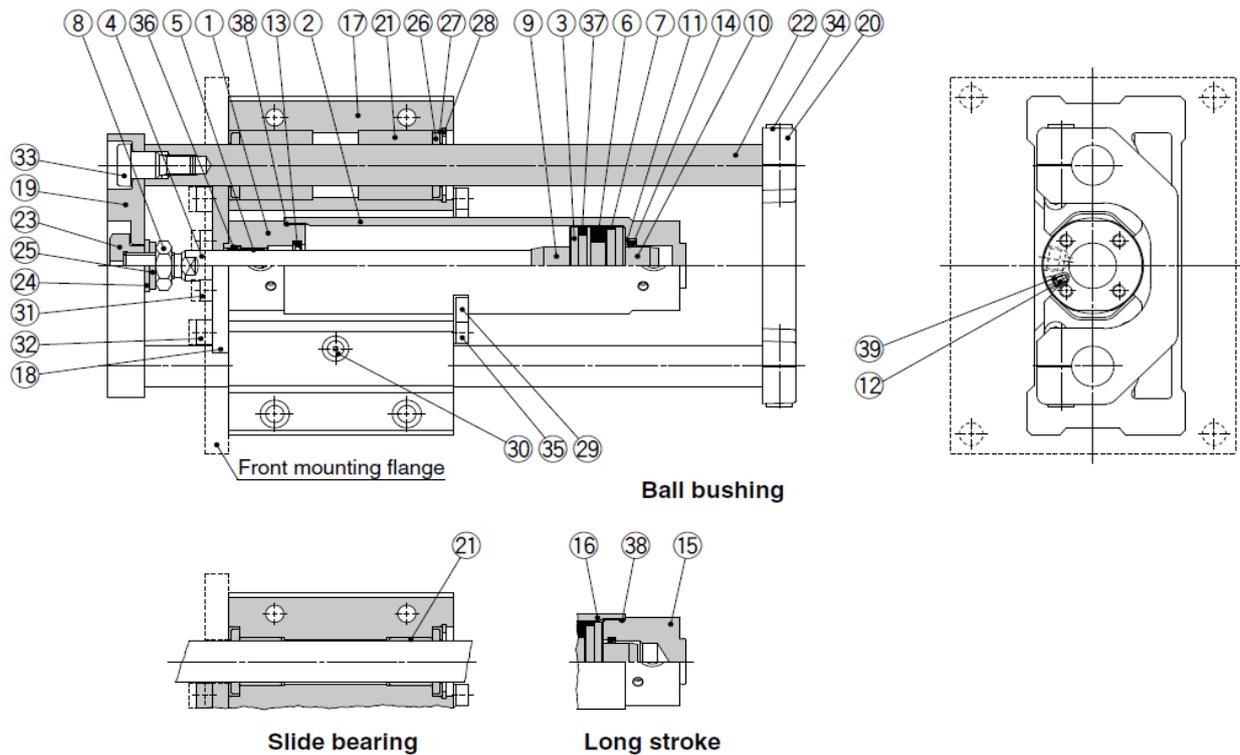
Before components are removed, first confirm that measures are in place to prevent workpieces from dropping, run-away equipment, etc. Then, cut off the supply pressure and electric power, and exhaust all compressed air from the system using the residual pressure release function.

When machinery is restarted, proceed with caution after confirming that appropriate measures are in place to prevent sudden movement.

15. Troubleshooting

Nonconformity	Causes	Countermeasures
No smooth operation	Lower operating speed than the limit	Consider providing low speed specification.
	High load factor	Increase Pressure.
		Use larger cylinder.
Meter-in speed controller	Change it to meter-out.	
Air leak Malfunction	High ambient temperature	Use heat resistant cylinder.
	Low ambient temperature	Use cold resistant cylinder. (Available as a special.)
	Soiled tube	Put a cover over cylinder.
	Water from exhaust air of valve	Shorten piping.
	Vibration	Review where to install the cylinder so as not to receive external force.
	Splashes of water/coolant	Put a cover over cylinder.
		Use cylinder improved in water resistant. (Available as a special.)
	Excessive eccentric load	Check the WEB catalog.
	Excessive lateral load	Check the WEB catalog.
Dust	Set a cover over cylinder.	
	Use cylinder with scraper.	
Parts Breakage Malfunction	Impact force from high speed operation	Check allowable kinetic energy.
		Lower speed.
		Reduce load.
	Excessive eccentric load	Check the WEB catalog.
Excessive lateral load	Check the WEB catalog.	

16. Construction: With Rear Plate



Component Parts

No.	Description	Material	Note
1	Rod cover	Aluminum alloy	Hard anodized
2	Tube cover	Aluminum alloy	Hard anodized
3	Piston	Aluminum alloy	
4	Piston rod	Stainless steel	For $\phi 20$, $\phi 25$
		Carbon steel	Hard chrome plating For $\phi 32$ to $\phi 50$
5	Bushing	Bearing alloy	
6	Magnet	—	
7	Wear ring	Resin	
8	Rod end nut	Carbon steel	Zinc chromated
9	Cushion ring A	Aluminum alloy	
10	Cushion ring B	Aluminum alloy	
11	Seal retainer	Carbon steel	Zinc chromated
12	Cushion valve	Carbon steel	Electroless nickel plating For $\phi 20$ to $\phi 40$
		Carbon steel	Zinc chromated For $\phi 50$
13	Cushion seal A	Urethane	$\phi 32$ or larger is common.
14	Cushion seal B	Urethane	
15	Head cover	Aluminum alloy	Hard anodized For long stroke
16	Cylinder tube	Aluminum alloy	Hard anodized
17	Guide body	Aluminum alloy	Anodized
18	Small flange	Carbon steel	Nickel plating For basic
	Large flange	Carbon steel	Nickel plating For front mounting flange
19	Front plate	Carbon steel	Nickel plating
20	Rear plate	Cast iron	Painted
21	Slide bearing	Bearing alloy	For slide bearing
	Ball bushing	—	For ball bushing
22	Guide rod	Carbon steel	Hard chrome plating For slide bearing
		Carbon steel	Quenched, hard chrome plating For ball bushing
23	End bracket	Carbon steel	Nickel plating
24	Flat washer	Carbon steel	Zinc chromated
25	Spring washer	Carbon steel	Zinc chromated
26	Felt	Felt	
27	Holder	Stainless steel	
28	Type C retaining ring for hole	Carbon tool steel	Phosphate coated
29	Bracket	Stainless steel	
30	Nipple	—	Nickel plating
31	Hexagon socket head cap screw	Carbon steel	Zinc chromated For cylinder mounting
32	Hexagon socket head cap screw	Carbon steel	Zinc chromated For large/small flange mounting

Component Parts

No.	Description	Material	Note
33	Guide bolt	Carbon steel	Nickel plating For front plate mounting
34	Hexagon socket head cap screw	Carbon steel	Zinc chromated For rear plate mounting
35	Hexagon socket head cap screw	Carbon steel	Zinc chromated For bracket mounting
36	Rod seal	NBR	
37	Piston seal	NBR	
38	Tube gasket	NBR	
39	Valve seal	NBR	

Replacement Parts/Seal Kit

Bore size (mm)	Kit no.	Contents
20	CG1N20Z-PS	Set of nos. above 36, 37, 38
25	CG1N25Z-PS	
32	CG1N32Z-PS	
40	CG1N40Z-PS	

Note) Refer to the following precautions for disassembly/replacement. Order with the kit number according to the bore size.

* Seal kit includes a grease pack (10 g). Order with the following part number when only the grease pack is needed.

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

⚠ Caution

- Do not replace the bushings.
- To replace a seal, apply grease to the new seal before installing it. If the cylinder is put into operation without applying grease to the seal, it could cause the seal to wear significantly, leading to premature air leakage.
- Basic cylinders with a bore size of $\phi 50$ cannot be disassembled. When disassembling cylinders with bore sizes of $\phi 20$ through $\phi 40$, grip the double flat part of either the tube 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 retightening, tighten approximately 2 degrees more than the original position. (Cylinders with bore size $\phi 50$ are tightened with a large tightening torque and cannot be disassembled. If disassembly is required, please contact SMC.)

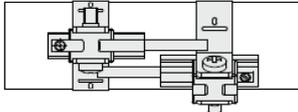
17. Auto switch Mounting

17-1. Minimum Auto Switch Mounting Stroke

n: No. of auto switches (mm)

Auto switch model	No. of auto switches mounted		
	1 pc.	2 pcs. Same surface	"n" pcs. Same surface
D-M9□	5	40 Note 1)	55 + 35 (n-2) (n = 2, 3, 4, 5...)
D-M9□W	10	40 Note 1)	55 + 35 (n-2) (n = 2, 3, 4, 5...)
D-M9□A	10	40 Note 1)	60 + 35 (n-2) (n = 2, 3, 4, 5...)
D-A9□	5	30 Note 1)	50 + 35 (n-2) (n = 2, 3, 4, 5...)
D-M9□V	5	35	35 + 35 (n-2) (n = 2, 3, 4, 5...)
D-A9□V	5	25	25 + 35 (n-2) (n = 2, 3, 4, 5...)
D-M9□WV D-M9□AV	10	35	35 + 35 (n-2) (n = 2, 3, 4, 5...)
D-C7□ D-C80	5	50	50 + 45 (n-2) (n = 2, 3, 4, 5...)
D-H7□ D-H7□W D-H7BA/H7NF	10	60	60 + 45 (n-2) (n = 2, 3, 4, 5...)
D-C73C/C80C D-H7C	5	65	65 + 50 (n-2) (n = 2, 3, 4, 5...)
D-B5□/B64 D-G5□/K59□	5	75	75 + 55 (n-2) (n = 2, 3, 4, 5...)
D-B59W	10		

Note 1) Auto switch mounting

Auto switch model	With 2 auto switches Same surface	
	 <p>The auto switch is mounted by slightly displacing it in a direction (cylinder tube circumferential exterior) so that the auto switch and lead wire do not interfere with each other.</p>	
D-M9□ D-M9□W	Less than 55 stroke Note 2)	
D-M9□A	Less than 60 stroke Note 2)	
D-A9□	Less than 50 stroke Note 2)	

Note 2) Minimum stroke for mounting auto switches in the other mounting types mentioned in note 1.

17-2. Operating Range

Auto switch model	Bore size				
	20	25	32	40	50
D-M9□(V)/M9□W(V) D-M9□A	4.5	5	4.5	5.5	5
D-A9□	7	6	8	8	8
D-C7□/C80 D-C73C/C80C	8	10	9	10	10
D-B5□/B64	8	10	9	10	10
D-B59W	13	13	14	14	14

Auto switch model	Bore size (mm)				
	20	25	32	40	50
D-H7□/H7□W D-H7BA/H7NF	4	4	4.5	5	6
D-H7C	7	8.5	9	10	9.5
D-G5□/K59 D-G5□W/K59W D-G5NT/G5BA	4	4	4.5	5	6
D-G59F	5	5	5.5	6	7

* 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.

17-3. Auto Switch Mounting Bracket: Part No.

Auto switch model	Bore size(mm)				
	20	25	32	40	50
D-M9□(V) D-M9□W(V) D-A9□(V)	Note 1) BMA3-020 (A set of a,b,c,d)	Note 1) BMA3-025 (A set of a,b,c,d)	Note 1) BMA3-032 (A set of a,b,c,d)	Note 1) BMA3-040 (A set of a,b,c,d)	Note 1) BMA3-050 (A set of a,b,c,d)
D-M9□A(V) Note 2)	BMA3-020S (A set of b,c,d,e)	BMA3-025S (A set of b,c,d,e)	BMA3-032S (A set of b,c,d,e)	BMA3-040S (A set of b,c,d,e)	BMA3-050S (A set of b,c,d,e)

Switch bracket

a Transparent (Nylon) Note 1)

e White (PBT)

b Switch holder

c Auto switch mounting band

d Auto switch mounting screw

Auto switch

(With switch installed)

*Band (c) is mounted so that the projected part is on the internal side (contact side with the tube).

D-H7□ D-H7□W D-H7NF D-C7□/C80 D-C73C/C80C	BMA2-020A (A set of band and screw)	BMA2-025A (A set of band and screw)	BMA2-032A (A set of band and screw)	BMA2-040A (A set of band and screw)	BMA2-050A (A set of band and screw)
D-H7BA	BMA2-020AS (A set of band and screw)	BMA2-025AS (A set of band and screw)	BMA2-032AS (A set of band and screw)	BMA2-040AS (A set of band and screw)	BMA2-050AS (A set of band and screw)
D-B5□/B64 D-B59W D-G5□/K59 D-G5□W/K59W D-G5BA/G59F D-G5NT	BA-01 (A set of band and screw)	BA-02 (A set of band and screw)	BA-32 (A set of band and screw)	BA-04 (A set of band and screw)	BA-05 (A set of band and screw)

Note 1) Since the switch bracket (made from nylon) are affected in an environment where alcohol, chloroform, methylamines, hydrochloric acid or sulfuric acid is splashed over, so it cannot be used. Please contact SMC regarding other chemicals.

Note 2) For the D-M9□A(V) type auto switch, mounting the switch bracket on the indicator light may damage the auto switch. Please install the switch bracket avoiding on the indicator light.

Band Mounting Brackets Set Part No.

Set part no.	Contents
BMA2-□□□A(S) * S: Stainless steel screw	<ul style="list-style-type: none"> • Auto switch mounting band (c) • Auto switch mounting screw (d)
BJ4-1	<ul style="list-style-type: none"> • Switch bracket (White/PBT) (e) • Switch holder (b)
BJ5-1	<ul style="list-style-type: none"> • Switch bracket (Transparent/Nylon)(a) • Switch holder (b)

[Stainless Steel Mounting Screw]

The following stainless steel mounting screw kit is available. Use it in accordance with the operating environment. (Since the auto switch mounting bracket is not included, order it separately.)

BBA3: D-B5/B6/G5/K5 types

Note 3) For details about the BBA3, refer to WEB catalog. When the D-G5BA type auto switch is shipped independently, the BBA3 is attached.

Revision history	
Initial release	1998.8.26
Revision 1	2023.1.20

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