



Operation Manual

PRODUCT NAME

Compact Guide Cylinder

MODEL / Series / Product Number

Series ¹²⁻
¹³⁻ **MGPL-Z**

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.

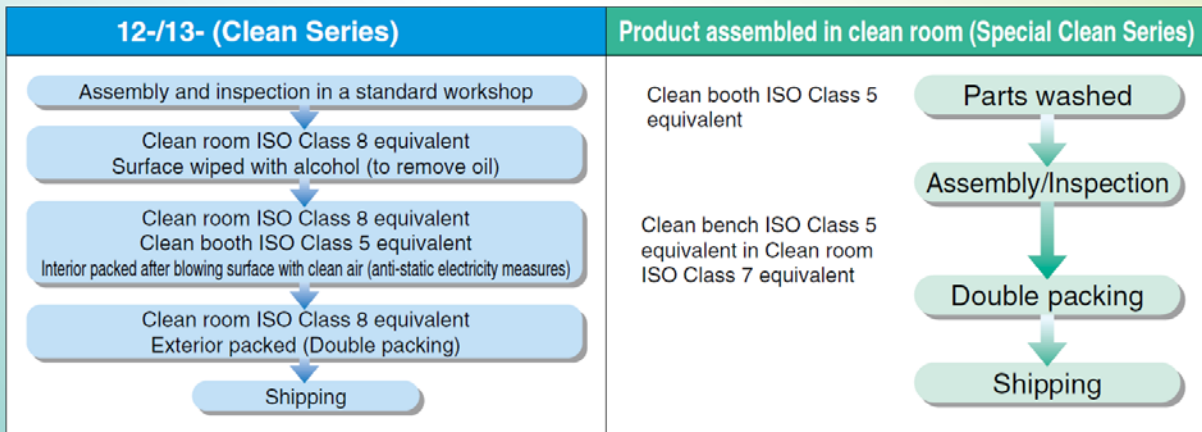
SMC Pneumatic Clean Room Equipment

Clean Series Series 12-/13-

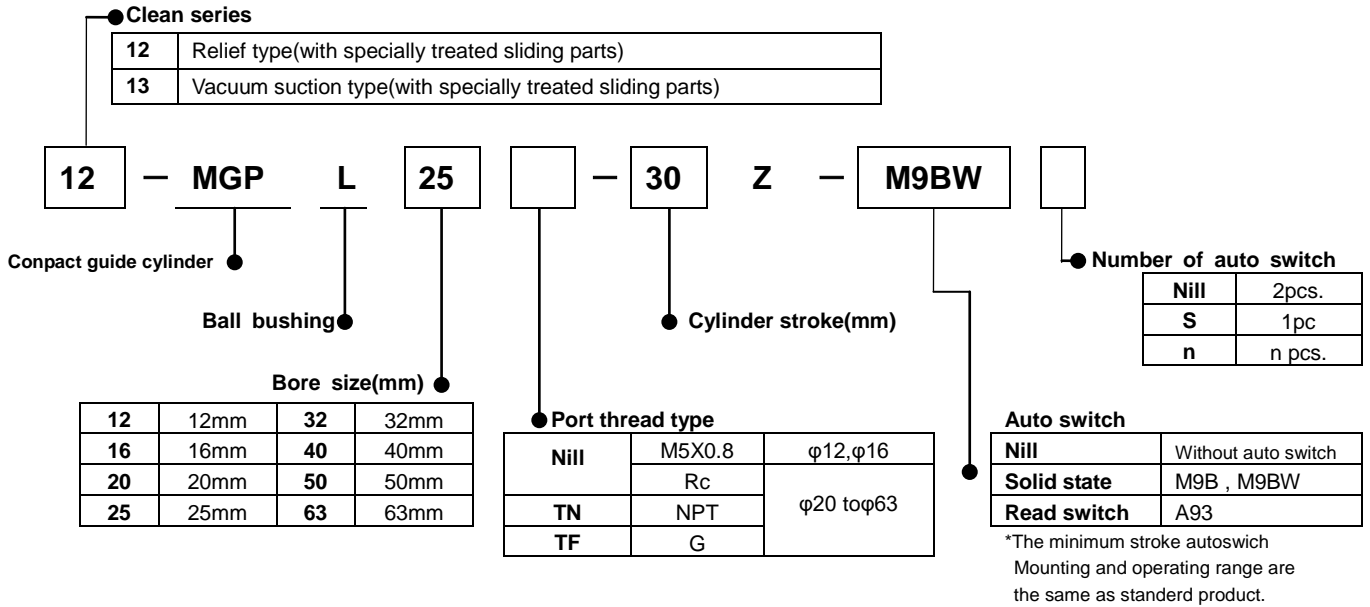
Suitable for clean environment.
Prevents particle generation in clean room.

Dust is kept from the clean room.

- After inspection, the product is blown with high purity air (of ISO Class 5 equivalent clean bench) in a clean environment.
- Products are sealed and shipped in antistatic double bags.



1. How to Order



2. Model

Model	Clean series	Bearing type	Bore size(mm)
12-MGPL□-□Z	Relief type	Ball bushing	12,16,20,25,32,40,50,63
13-MGPL□-□Z	Vacuum suction type	Ball bushing	12,16,20,25,32,40,50,63

3. Specifications

Model	12,13-MGPL□-□Z							
Bore size	φ12	φ16	φ20	φ25	φ32	φ40	φ50	φ63
Action	Double acting							
Fluid	Air							
Proof pressure	1.5MPa							
Maximum operating pressure	1.0MPa							
Minimum operating pressure	0.12MPa		0.1MPa					
Ambient and fluid temperature	-10 to 60°C (Not freezing)							
Piston speed	50 to 400mm/s							
Cushion	Rubber bumper on both ends							
Lubrication	Not required(Non-lube)							
Stroke length tolerance	+1.5 0 mm							
Grease	Fluorine grease							
Cleanliness class (ISO class)	13-	Class 4						
	12-	Class 5						
Suction Flow Rate of Vacuum Suction Type(Reference values)	5 L/min(ANR)				10 L/min(ANR)			
Port size	M5X0.8		1/8			1/4		

4. Standard strokes

Model	Bore size(mm)	Standard stroke(mm)
12- 13- MGPL □-□Z	12,16	10,20,30,40,50,75,100,125,150,175,200,250
	20,25	20,30,40,50,75,100,125,150,175,200,250,300,350,400
	32 to 100	25,50,75,100,125,150,175,200,250,300,350,400

5. Intermediate strokes

Spacer installation type		
Description	<p>Spacers are installed in the standard stroke cylinder.</p> <ul style="list-style-type: none"> •ϕ12 toϕ32: Available by the 1 mm stroke interval. •ϕ40 toϕ63: Available by the 5 mm stroke interval. 	
Model no.	Refer to "How to Order" for the standard model numbers.	
Applicable stroke (mm)	ϕ 12, ϕ 16	1 to 249
	ϕ 20, ϕ 25, ϕ 32	1 to 399
	ϕ 40 to ϕ 63	5 to 395
Example	<p>Part no.: 12-MGPL20-39Z</p> <p>A spacer 1 mm in width is installed in the 12-MGPL20-40Z.</p> <p>C dimension is 77 mm.</p>	

6. Precautions on Selection

Warning

1) **Confirm the specifications.**

Products represented in this manual are designed only for use in compressed air systems. Do not operate at pressures or temperatures, etc., beyond the range of specifications, as this can cause damage or malfunction. (Refer to the specifications.) Please contact SMC when using a fluid other than compressed air made by pneumatic equipment.

2) **Intermediate stops**

When intermediate stopped position is performed with a 3 position closed center type directional control valve, it is difficult to achieve accurate and precise stopped positions due to the compressibility of air.

Furthermore, since valves or 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.

3) **Keep the speed setting within the allowable energy values for the product.**

Operation with a load's kinetic energy exceeding the allowable value can lead to damage of the product and cause human injury as well as damage to other equipment and machinery.

4) **Provide a shock absorbing mechanism in cases where the product is subjected to kinetic energy exceeding the allowable value.**

Operation exceeding the allowable energy can lead to damage of the product and cause human injury as well as damage to other equipment and machinery.

5) **Do not give excessive force and vibrations from outside.**

This compact cylinder consists of precisely machined parts. External excessive vibrations may cause air leak, malfunction, parts breakage and deformation, which could result in injury or equipment damage.

7. Precautions on Design

Caution

1) **There is a danger of sudden action by air cylinders if sliding parts of machinery are twisted, etc. and changes in forces occur.**

In such cases, human injury may occur; e.g., by catching hands or feet in the machinery, or damage to the machinery itself may occur.

Therefore, the machine should be designed to avoid such dangers.

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

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

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

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

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

When a driven object is operated at high speed or the load is heavy, a cylinder's cushion will not be sufficient to absorb the impact.

Install a deceleration circuit to reduce the speed before cushioning, or install an external shock absorber to relieve the impact.

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

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

When a cylinder is used in a clamping mechanism, there is a danger of work pieces dropping if there is a decrease in clamping force due to a drop in circuit pressure caused by a power outage, etc.

Therefore, safety equipment should be installed to prevent damage to machinery and human injury. Suspension mechanisms and lifting devices also require consideration for drop prevention.

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

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

7) Design circuitry to prevent 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 high speed if pressure is applied to one side of the cylinder because of the absence of air pressure inside the cylinder.

Therefore, equipment should be selected and circuits designed to prevent sudden lurching because, there is a danger of human injury and/or damage to equipment when this occurs.

8) Consider emergency stops.

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

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

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

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

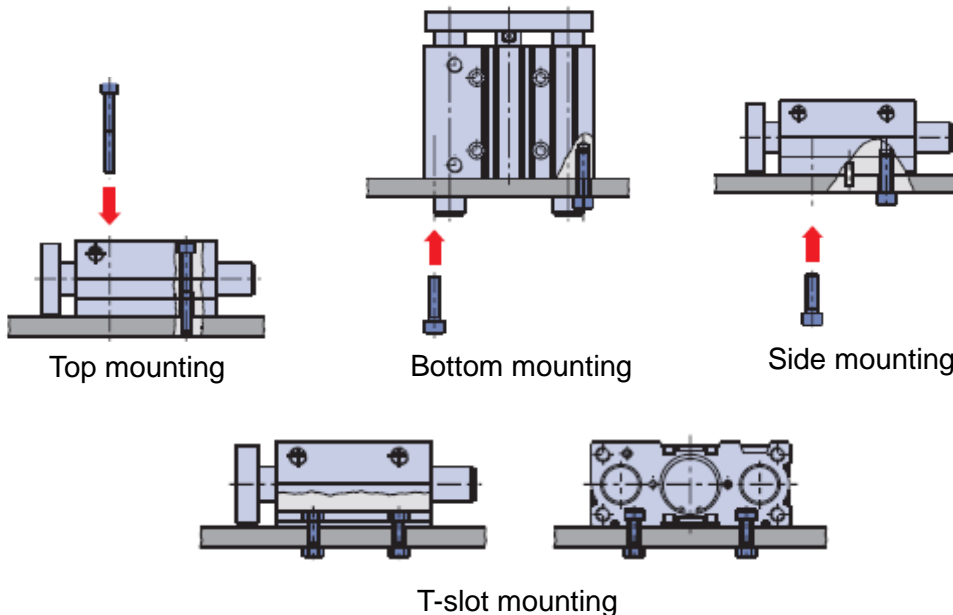
10) Do not synchronize cylinders only.

It is possible to synchronize cylinders for short period of time by adjusting them with speed controller. However, the synchronization could be failed easily due to changes of various conditions. Since cylinders receive excessive force in such a case, do not design circuit synchronizing cylinders only.

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

8. Mounting Methods

Various mounting methods are available as follows.

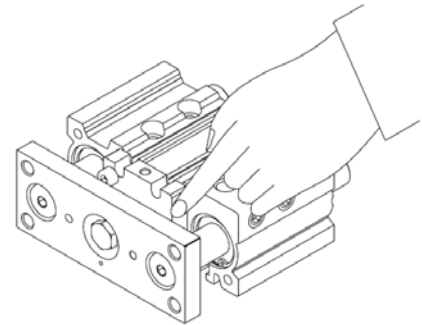


Cautions on Mounting

Warning

1) Never place your hands or fingers between the plate and the body.

Be very careful to prevent your hands or fingers from getting caught in the gap between the cylinder body and the plate when air is applied.



Caution

1) Use cylinders within the piston speed range.

An orifice is set for this cylinder, but the piston speed may exceed the operating range if the speed controller is not used. If the cylinder is used outside the operating speed range, it may cause damage to the cylinder and shorten the service life. Adjust the speed by installing the speed controller and use the cylinder within the limited range.

2) Pay attention to the operating speed when the product is mounted vertically.

When using the product in the vertical direction, if the load factor is large, the operating speed can be faster than the control speed of the speed controller (i.e. quick extension).

In such cases, it is recommended to use a dual speed controller.

3) When using near the lower limit of the piston speed, the stickslip may occur depending on the usage conditions, so use with sufficient air pressure.

4) Do not use in the state that air leakage occurs.

If an air leak occurs in the cylinder, the piston speed can not be controlled by meter-out, and the piston speed may increase more than the speed adjusted by speed controller.

If the piston speed increases excessively, internal parts, guides, etc. may be damaged.

5) Do not scratch or gouge the sliding portion of the piston rod and the guide rod.

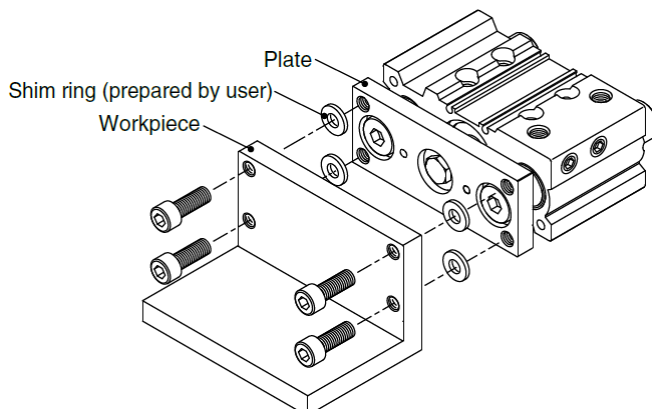
Damaged seals etc. will result in leakage or malfunction.

6) Do not dent or scratch the mounting surface of the body and the plate.

The flatness of the mounting surface may not be maintained, which would cause an increase in sliding resistance.

7) Make sure that the cylinder mounting surface has a flatness of 0.05 mm or less.

If the flatness of the work pieces and brackets mounted on the plate is not appropriate, sliding resistance may increase. If it is difficult to maintain a flatness of 0.05 or less, put a thin shim ring (prepared by user) between the plate and work piece mounting surface to prevent the sliding resistance from increasing.



8) When mounting the work piece to the plate, make sure that the piston rod is retracted.

When mounting the work piece to the plate, if the piston rod is extended, distortion may occur in the guide part, causing malfunction.

9) Do not perform additional machining to the product.

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

10) Do not enlarge the fixed throttle by modifying the pipe connectors.

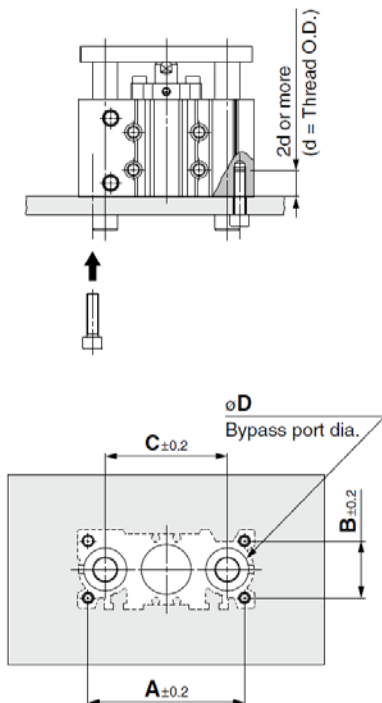
If the hole diameter is enlarged, the product's rotation speed will increase, causing the shock force to increase and damage to the product. As a result, it could pose a hazard to humans and damage the machinery and equipment.

11) Do not use until you can verify that equipment can operate properly.

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

12) Bottom of cylinder

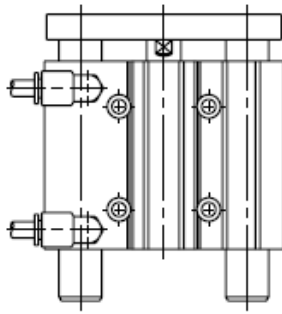
The guide rods protrude from the bottom of the cylinder at the end of the retracting stroke, and therefore, in cases where the cylinder is to be bottom mounted, it is necessary to provide bypass ports in the mounting surface for the guide rods, as well as holes for the hexagon socket head cap screws which are used for mounting. Moreover, in applications where impact occurs from a stopper etc., the mounting screws should be inserted to a depth of $2d$ or more.



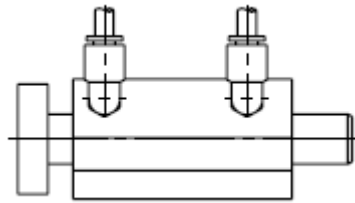
Bore size (mm)	A (mm)	B (mm)	C (mm)	øD (mm)	Hexagon socket head cap screw
12	50	18	41	8	M4 x 0.7
16	56	22	46	10	M5 x 0.8
20	72	24	54	12	M5 x 0.8
25	82	30	64	15	M6 x 1.0
32	98	34	78	18	M8 x 1.25
40	106	40	86	18	M8 x 1.25
50	130	46	110	22	M10 x 1.5
63	142	58	124	22	M10 x 1.5

9. Piping

This cylinder can do it by changing the position of the plug as the bottom figure from 2 directions of the top pipe and the side pipe.



Top piping



Side piping

Attention in piping

⚠ Warning

1) Use clean air.

If compressed air includes chemicals, synthetic oils containing organic solvents, salt or corrosive gases, etc., it can cause damage or malfunction.

⚠ Caution

1) Depending on the operating conditions, piping port positions can be changed using a plug.

① M5

After tightening by hand, tighten additional 1/6 to 1/4 rotation with a tightening tool

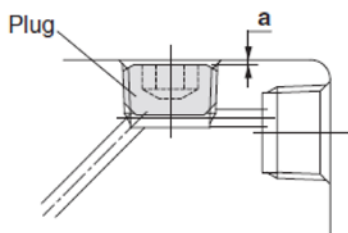
② Tapered thread for Rc port (MGP) and NPT port (MGP□□TN)

Use the correct tightening torques listed below.

Before tightening the plug, wrap pipe tape around it. Also, with regard to the sunk dimension of a plug (dimension “a” in the drawing), use the stipulated figures as a guide and confirm the air leakage before operation.

*If tightening plugs on the top mounting port with more than the proper tightening torque, plugs will be screwed much deeply and air passage will be squeezed. Consequently, the cylinder speed will be restricted.

Connection thread (plug) size	Proper tightening torque (N·m)	a dimension
1/8	7 to 9	0.5 mm or less
1/4	12 to 14	1 mm or less



③ Parallel pipe thread for G port (MGP□□TF)

Screw in the plug to the surface of the body (dimension “a” in the drawing) by checking visually instead of using the tightening torque shown in the table.

2) Secure dry air.

If moisture enters cylinder, grease inside the cylinder is washed away and air leak and malfunction may occur due to deterioration of lubrication.

Install air cleaning equipment such as air dryer and drain catch to secure dry air.

Refer to the catalogue, SMC Air Cleaning Equipment.

3) Supply air filtered and regulated down to the specific pressure.

4) Lubrication isn't necessary because it is a lubrication-less type.

The cylinder is lubricated at the factory and can be used without any further lubrication. However, in the event that it will be lubricated, use class 1 turbine oil (with no additives) ISO VG32.

Stopping lubrication later may lead to malfunction due to the loss of the original lubricant.

Therefore, lubrication must be continued once it has been started.

5) Shorten piping.

Since too long cylinder piping makes volume inside the cylinder < volume inside the tubing, mist from adiabatic expansion is not exhausted to the air and remains in tubing.

It accumulates due to repeated operation and then from water drops.

As grease inside the cylinder is washed away, lubrication deteriorates and air leak and malfunction may occur.

Take the following measures to prevent them.

- ① Make tubing between solenoid valve and cylinder as short as possible so that generated mist is surely exhausted into atmosphere.
Standard length is:
$$\frac{\text{Conversion value for volume inside the cylinder under atmospheric pressure}}{\times 0.7} \leq \text{Volume inside the tubing}$$
- ② Send exhaust pressure directly into atmosphere by attaching speed controller or quick exhaust valve to cylinder.
- ③ Set piping port downwards so that moisture inside the piping does not go back to cylinder easily.

10. Operating Environment

Warning

1) Do not use in environments where there is a danger of corrosion.

Refer to the construction drawings regarding cylinder materials.

2) In dirty areas, such as dusty locations or where water, oil, etc. splash on the equipment, take suitable measures to protect the entire actuator.

Use water resistant cylinders in areas where liquids are scattered.

Caution

1) Use the cylinder within specified temperature range.

This compact cylinder is applicable within the range from -10 to 60 °C.

Make sure to keep it during operation. In case of immoderate use over the range, extreme wearing due to hardening of packing may result in air leak and lubrication failure as lubrication grease cannot perform fully.

11. Speed Control

Caution

- 1) When speed controller is used for speed adjustment, throttle air supplied to cylinder or exhausted from cylinder. With the former, cylinder operation may become unstable. Normally, double acting cylinder is adjusted in the latter way.

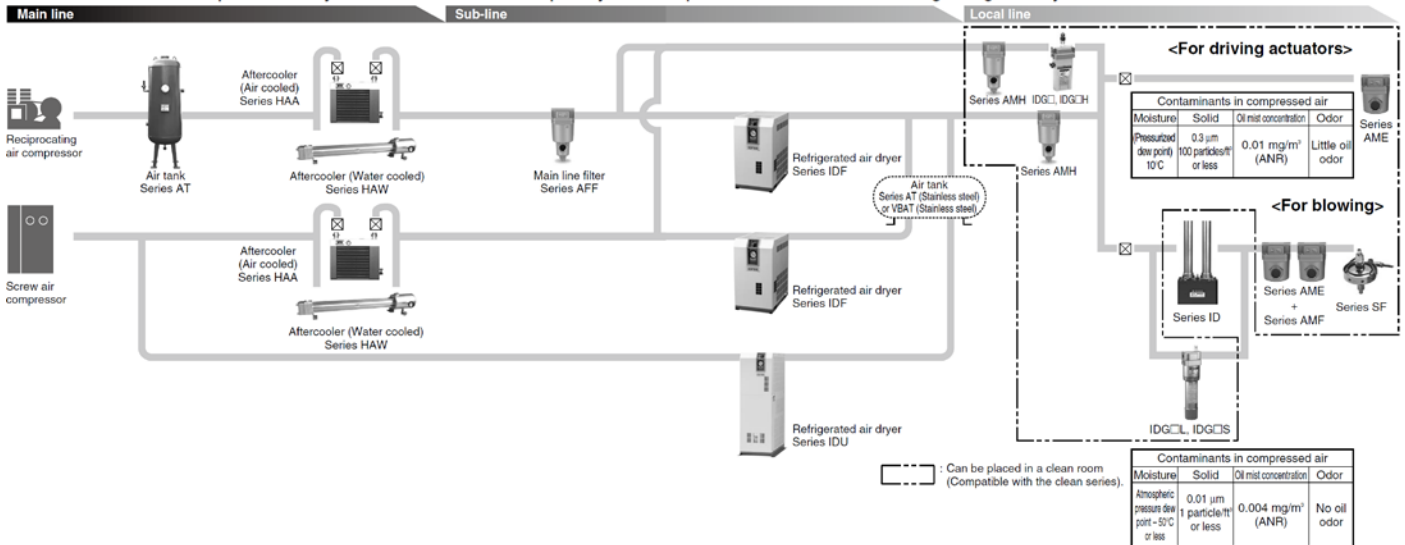
12. Clean Series / Precautions

Air Supply

Caution

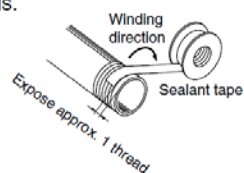
System Configuration

Refer to the "Air Preparation System" below for the quality of compressed air before configuring the system.



Piping

1. Provide an inclination of 1 cm per meter in the direction of the air flow to the main piping.
2. If there is a line branching from the main piping, provide an outlet of compressed air on top using a tee so that drainage accumulated in the piping will not flow out.
3. Provide a drainage mechanism at every recessed point or dead end to prevent drain accumulation.
4. For future piping extensions, plug the end of the piping with a tee.
5. Before piping
Before piping, the piping should be thoroughly flushed out with air or washed to remove chips, cutting oil and other debris from inside the pipe.
6. Winding of sealant tape
When screwing piping or fittings into ports, ensure that chips from the pipe threads or sealing material do not get inside the valve. Also, when sealant tape is used, leave approx. 1 thread ridge exposed at the end of the threads.



7. After piping
After piping, the piping should be thoroughly flushed out with air, and dust generated when piping should be removed.
8. If air with a low dew point (-40°C or less) is required, do not use nylon tubes or resin fittings (except for fluorine resin) for the outlet side of the membrane air dryer or heatless air dryer. Nylon tubing could be affected by the ambient air and thus may not be able to achieve the prescribed low dew point at the end of the tube. Therefore, for low dew point air, use stainless steel or fluorine tubes and fittings.

Maintenance

1. If the heatless air dryer Series ID is left unused for a long period, the absorbent may become moist. Prior to use, close the valve on the outlet side of the dryer for regeneration and drying.

Design

Employ a safe design, so that the following unexpected conditions will not occur.

Warning

1. Provide a design that prevents high-temperature compressed air from flowing into the outlet side of the cooling equipment.
If the flow of the coolant water in a water-cooled aftercooler is stopped or if the fan motor of an air cooled aftercooler is stopped, the high-temperature compressed air will flow to the outlet side of the cooling equipment, causing the equipment on the outlet side (such as the AFF, AM, AD, or IDF series) to be damaged or to malfunction.
2. Provide a design in which interruptions in the supply of compressed air are taken into consideration.
There are cases in which compressed air cannot flow due to freezing of the refrigerated air dryer or a malfunction (heatless dryer) in the switching valve.

Caution

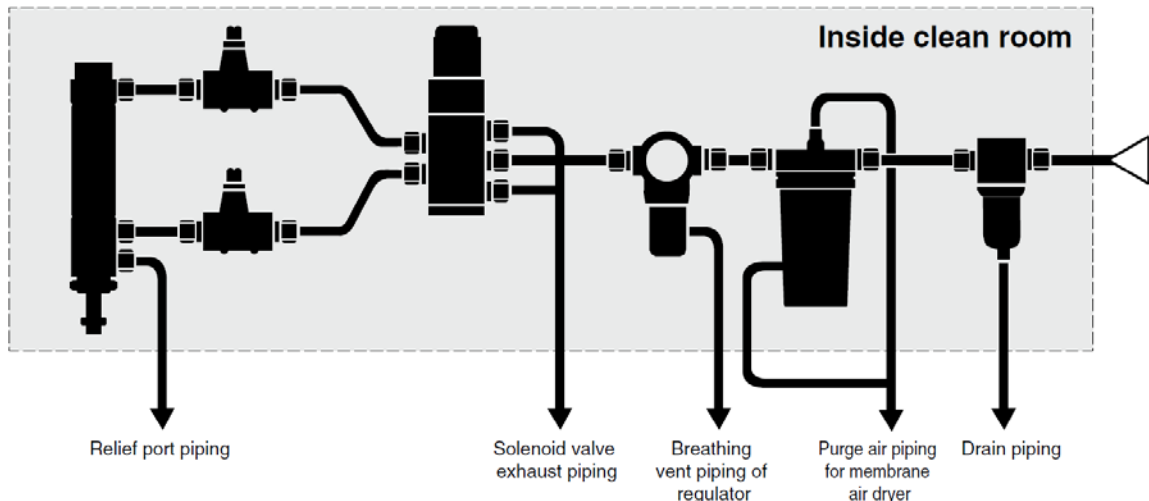
3. Design a layout in which the leakage of the coolant water and the dripping of condensation are taken into consideration.
A water-cooled aftercooler that uses coolant water could lead to water leakage due to freezing. Depending on the operating conditions, the refrigerated air dryer and its downstream pipes could create water droplets due to condensation formed by supercooling.
4. Provide a design that prevents back pressure and backflow.
The generation of back pressure and backflow could lead to equipment damage.
Take appropriate safety measures, including the proper installation methods.
5. When super dry air is used as the fluid, equipment reliability (service life) may be adversely affected due to deteriorating lubrication properties inside the equipment.
Please consult SMC in such cases.
6. Blowing system
Even a small amount of dust can be a problem for blowing systems.
Install Clean Gas Filter or Clean Air Filter Series SF to the end of the blowing line.

Piping: Inside of Clean Room

⚠ Caution

1. Do not make the piping for the air cylinder relief port and regulator breathing tube common with solenoid valve exhaust piping.
This can cause malfunctions in the air cylinder or regulator pressure change.
Do not apply pressure to the air cylinder relief port.
2. Arrange the piping so that the exhaust air of the solenoid valves is exhausted outside of the clean room.
3. Air filter drain piping
Exhaust drainage outside the clean room through piping from the drain guide of the air filter.
4. Arrange the membrane dryer air purge piping using standard size tubing so that air is exhausted outside the clean room.

5. Take precautions so that the threaded portion of the piping connection or the tubing connection will not be loosened.
Take sufficient precautions against piping shaking along with vibration of the equipment.
6. Use polyurethane tubing containing no plasticizer.
7. In case of the One-touch fitting 10-KQ (that includes built-in One-touch fitting solenoid valve manifolds, and speed controllers with One-touch fittings), changes in internal pressure may cause the collet chuck to slide very slightly. This may result in particle generation, so please avoid using this item in ISO Class 3 or ISO Class 4 areas.
However, there is no need for similar caution in the case of insert fittings (KF), miniature fittings (M/MS), clean One-touch fittings (KP/KPQ/KPG), or speed controllers with clean One-touch fittings (AS-FPQ/FPG).



Handling

⚠ Caution

1. The inner bag of a double-packed clean series package should be opened in a clean room or clean environment.
2. When standard pneumatic equipment is brought into a clean room, spray high-purity air onto it and remove dust thoroughly by wiping the external surfaces of the cylinder tube, solenoid valves and air line equipment with alcohol.
3. To replace parts or disassemble the product in a clean room, first exhaust the compressed air inside the piping to the outside of the clean room before the work.
4. Do not use rotation type mounting brackets such as clevises, trunnions, etc. They will generate a considerable amount of particulate matter due to the sliding friction between the metal parts.

Lubrication for Actuators

⚠ Warning

Be sure to wash your hands after handling fluoro-resin grease. The grease itself is not hazardous but it can produce a hazardous gas at temperatures exceeding 260°C.

Lubrication for Actuators

⚠ Caution

- Do not use any greases but those specified by SMC.
Use of greases not specified will cause malfunctions or particle generation.
- Do not lubricate the products since they are of a non-lubricant type.
As the clean series actuators are lubricated at the factory with fluororesin grease, the product specifications may not be satisfied if turbine oil or other such lubricants are applied.

Piston Speed

⚠ Caution

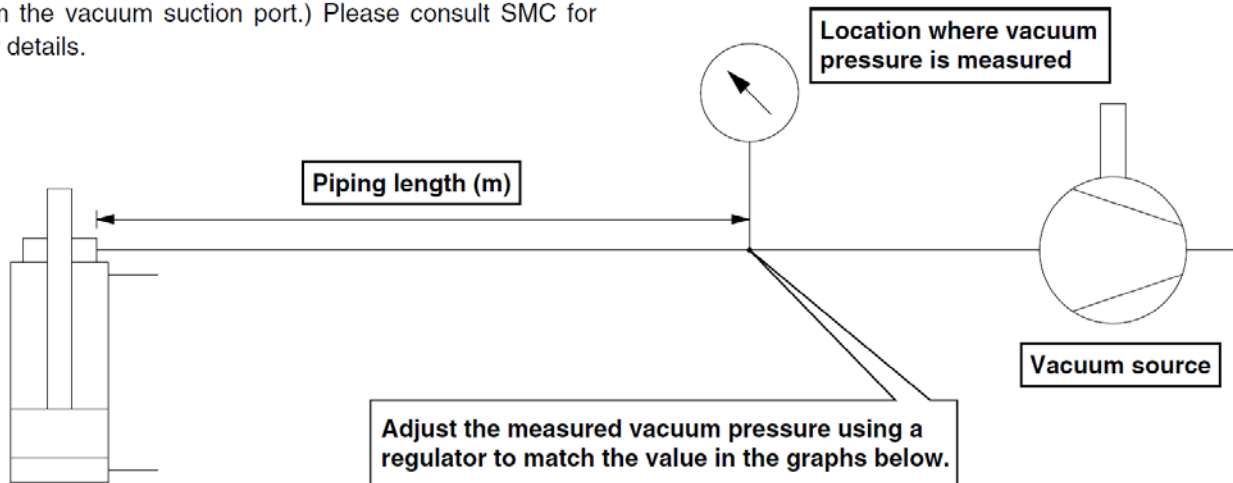
The air cylinder speed upper limit that retains the particle generation grade is 400 mm/s. When the maximum operating speed for the standard type is 400 mm/s or slower, operate the series within the operating speed range.

Suction Flow Rate of Vacuum Suction Types

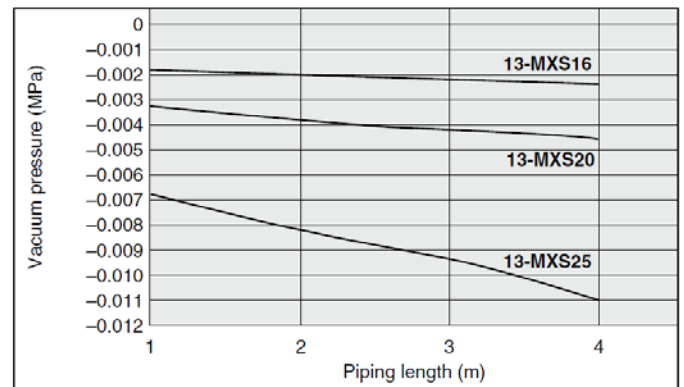
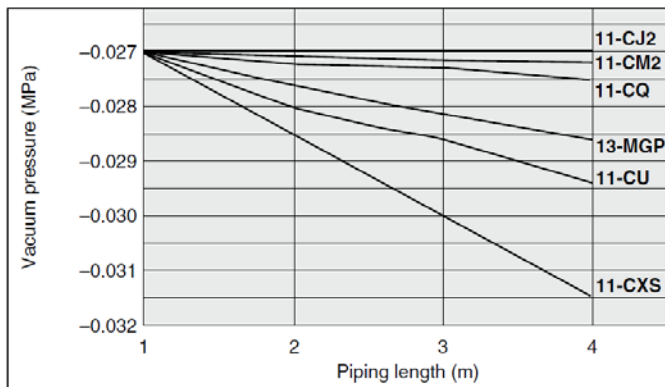
⚠ Caution

For vacuum suction types (11-/13-/22-Series), perform vacuum suction at the vacuum port to retain the particle generation grade.

The optimum suction flow rate varies depending on the series and size. Refer to "Suction flow rate of vacuum suction type (Reference values)" for each series. (The vacuum pressure will be approximately -27 kPa at around 1 m from the vacuum suction port.) Please consult SMC for further details.



* The symbol for the cylinder is an SMC original symbol.

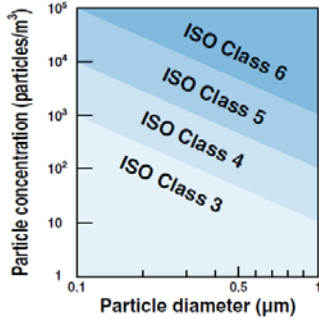


How to Use Clean Series

The position of the pneumatic equipment to the workpiece is determined by the degree of particle generation.

$$\text{Particle generation grade no. of pneumatic equipment} \leq \text{Particle concentration grade no. around workpiece}$$

Particle Generation Classification



Cleanliness Class (Reference)

ISO 14644-1	JIS B 9920	Fed.Std.209E <small>Note)</small>
		SI unit
ISO Class 3	JIS Class 3	M1.5
ISO Class 4	JIS Class 4	M2.5
ISO Class 5	JIS Class 5	M3.5
ISO Class 6	JIS Class 6	M4.5
ISO Class 7	JIS Class 7	M5.5
ISO Class 8	JIS Class 8	M6.5

Note) Fed.Std.209E was abolished in Nov. 2001, so these figures are for reference only.

Selection Procedure

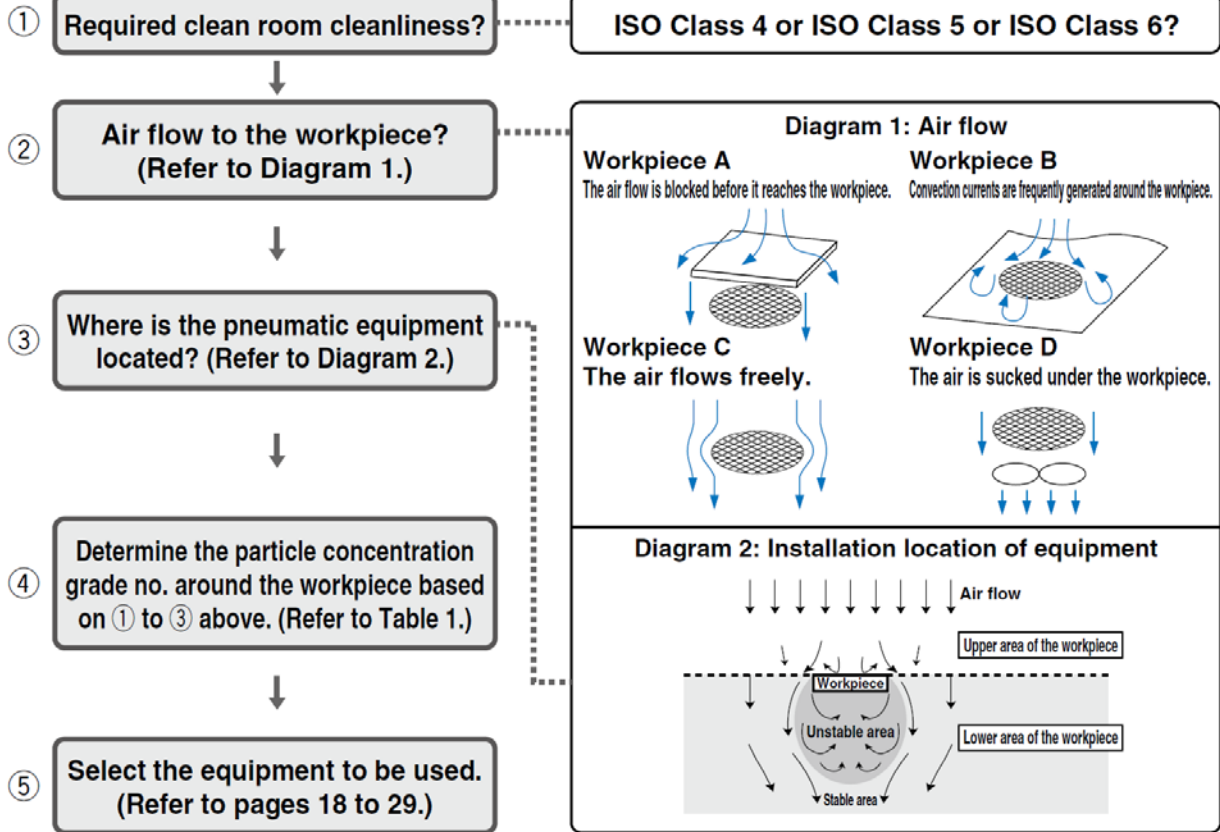


Table 1: Particle Concentration Grade around the Workpiece (Guide)

② Air flow		A: Air flow is blocked/B: Convection currents are frequently generated				C: Air flows freely		D: Air is sucked under the workpiece				
		Upper area of the workpiece	Lower area of the workpiece	Unstable area	Stable area	Upper area of the workpiece	Lower area of the workpiece	Upper area of the workpiece	Lower area of the workpiece			
① Cleanliness required on the workpiece	Class 3					Series 11- (Series 13-, 22-)		Series 10- (Series 12-, 21-)	Series 11- (Series 13-, 22-)	Series 10- (Series 12-, 21-)		
	Class 4					Series 10- (Series 12-, 21-)		Standard product		Series 10- (Series 12-, 21-)	Standard product	
	Class 5					Series 10- (Series 12-, 21-)		Standard product		Series 10- (Series 12-, 21-)	Standard product	
	Class 6					Series 11- (Series 13-, 22-)	Series 10- (Series 12-, 21-)	Standard product	Series 10- (Series 12-, 21-)	Standard product	Series 10- (Series 12-, 21-)	Standard product

: ISO Class 4 and 5 levels of cleanliness cannot be achieved in the area due to accumulated or airborne dust

13. Troubleshooting

Nonconformit	Causes	Countermeasures	Remarks
No smooth operation	High load factor	Increase Pressure.	
		Use larger cylinder.	
	Meter-in speed controller	Change it to meter-out.	
	Soiled cylinder	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.	
	Excessive eccentric load	Check vertical mounting of model selection with catalogue.	
	Excessive lateral load	Check horizontal mounting of model selection with catalogue.	
Dust	Set a cover over cylinder.		
Parts breakage Parts deformation	Impact force from high speed operation	Check allowable kinetic energy.	
		Lower speed.	
		Reduce load	
	Excessive eccentric load	Check vertical mounting of model selection with catalogue.	
Excessive lateral load	Check horizontal mounting of model selection with catalogue.		

14. Auto Switch

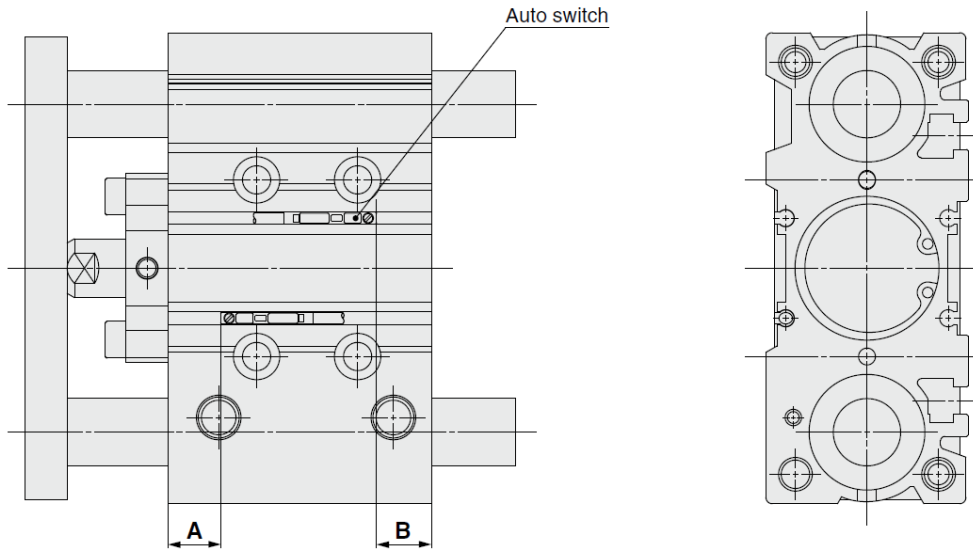
14-1. Applicable auto switches

Type	Electrical entry	Indicator light	Wiring (Output)	Load voltage			Auto switch model	Lead wire length (m)				Applicable load	
				DC	AC	Band mounting		0.5 (Nil)	1 (M)	3 (L)	5 (Z)		
Solid state auto switch	Grommet	Yes	2-wire	24 V	5 V	—	M9B	●	●	●	○	—	Relay, PLC
					12 V		M9BW	●	●	●	○		
Reed auto switch	Grommet	Yes	2-wire	24 V	12 V	100 V	A93	●	—	●	●	—	Relay, PLC

Note 1) Lead wire length symbols: 0.5 m..... Nil M9BW
 1 m..... M M9BWM
 3 m..... L M9BWL
 5 m..... Z M9BWZ

Note 2) Solid state auto switches marked with "○" are produced upon receipt of order.
 Note 3) PLC: Programmable Logic Controller

14-2. Auto switch proper mounting position (detection at stroke end) and its mounting height



Auto Switch Proper Mounting Position (mm)

Auto switch model Bore size (mm)	D-M9□ D-M9□W		D-A9□	
	A	B	A	B
	12	7.5	9.5	3.5
16	10.5	10.5	6.5	6.5
20	12.5	12.5	8.5	8.5
25	11.5	14	7.5	10
32	12.5	13	8.5	9
40	15.5	16.5	11.5	12.5
50	14.5	17	10.5	13
63	16.5	20	12.5	16

Note) The above values are a guide in the stroke end detection of the mounting positions of the auto switch.
 Please adjust in an actual setting after confirming the operating state of the auto switch.

14-3. Minimum mountable stroke for a cylinder with auto switch(es)

Auto switch model	Number of auto switches	(mm)							
		φ12	φ16	φ20	φ25	φ32	φ40	φ50	φ63
D-M9□	1pc.	5 ^{Note1)}					5		
	2pcs.	10 ^{Note1)}	10						
D-M9□W	1pc.	5 ^{Note2)}							
	2pcs.	10 ^{Note2)}	10						
D-A9□	1pc.	5 ^{Note1)}			5				
	2pcs.	10 ^{Note1)}		10					

Note1) Confirm that it is possible to secure the minimum bending radius of 10mm of the auto switch lead wire before use.

Note2) Confirm that it is possible to securely set the auto switch(es) within the range of indicator green light ON range before use.

14-4. Auto switch operating range

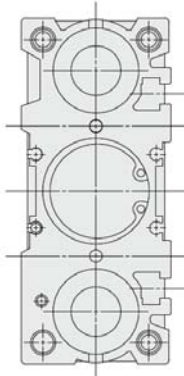
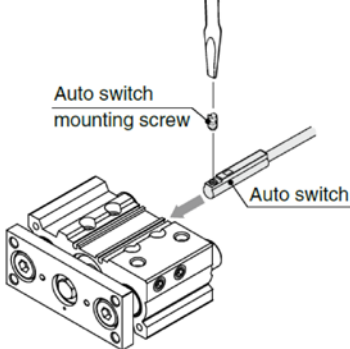
(mm)

Auto switch model	φ12	φ16	φ20	φ25	φ32	φ40	φ50	φ63
D-M9□/D-M9□W	3.5	5	5	5	6	6	6	6.5
D-A9□	7	9	9	9	9.5	9.5	9.5	11

※Values which include hysteresis are for guideline purposes only.

They are not a guarantee (assuming approximately ±30% dispersion) and may change substantially depending on the ambient environment.

14-5. Part number of auto switch mounting bracket

Applicable auto switches	D-M9□ D-M9□W D-A9□								
Bore(mm)	φ12 to φ63								
Auto switch mounting surfaces	Surface with auto switch mounting slot 								
Mounting of auto switch	 <ul style="list-style-type: none"> • When tightening the auto switch mounting screw, use a watchmakers' screwdriver with a handle 5 to 6 mm in diameter. <p>Tightening torque</p> <table border="1"> <thead> <tr> <th colspan="2">Auto switch Mounting Screw (N·m)</th> </tr> <tr> <th>Auto switch model</th> <th>Tightening torque</th> </tr> </thead> <tbody> <tr> <td>D-M9□ D-M9□W</td> <td>0.05 to 0.15</td> </tr> <tr> <td>D-A9□</td> <td>0.10 to 0.20</td> </tr> </tbody> </table>	Auto switch Mounting Screw (N·m)		Auto switch model	Tightening torque	D-M9□ D-M9□W	0.05 to 0.15	D-A9□	0.10 to 0.20
Auto switch Mounting Screw (N·m)									
Auto switch model	Tightening torque								
D-M9□ D-M9□W	0.05 to 0.15								
D-A9□	0.10 to 0.20								

Note) Auto switch mounting brackets and auto switches are enclosed with the cylinder for shipment .

Revision history
Initial release : 2021/8/10

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

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