CKD

SM－274625－A

INSTRUCTION MANUAL

SMALL COMPACT CYLINDER
MSD Series

SMALL GUIDED COMPACT CYLINDER
MSDG Series

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

CKD Corporation

The 2nd edition

For Safety Use

To use this product safety, basic knowledge of pneumatic equipment, including materials, piping, electrical system and mechanism, is required (to the level pursuant to JIS B 8370 Pneumatic System Rules).

We do not bear any responsibility for accidents caused by any person without such knowledge or arising from improper operation.

Our customers use this product for a very wide range of applications, and we cannot keep track of all of them. Depending on operating conditions, the product may fail to operate to maximum performance, or cause an accident. Thus, before placing an order, examine whether the product meets your applications, requirements, and how to use it.

This product incorporates many functions and mechanisms to ensure safety. However, improper operation could result in an accident. To prevent such accidents, **read this operation manual carefully for proper operation.**

Observe the cautions on handling described in this manual, as well as the following instructions:

⚠ CAUTION :

- Before performing an overhaul inspection on the actuator, deactivate residual pressure completely.
- While the actuator is operating, do not step into or place hands in the driving mechanism.
- To prevent an electric shock, do not touch the electric wiring connections (exposed live parts) of the actuator equipped with a solenoid valve or switch.
  Perform an overhaul inspection with the power off. Also, do not touch these live parts with wet hands.

[SM-274625-A]

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MSD/MSDG
Small compact cylinder/Small guided compact cylinder
Manual No. SM-274625-A

1. UNPACKING

1) Make sure that the type No. on the nameplate of the delivered Super Compact Cylinder matches the type No. you ordered.
2) Check the appearance for any damage.
3) Stop up the piping port with a sealing plug to prevent the entry of foreign substances into the cylinder. Remove the sealing plug before piping.

2. INSTALLATION

2.1 Installation

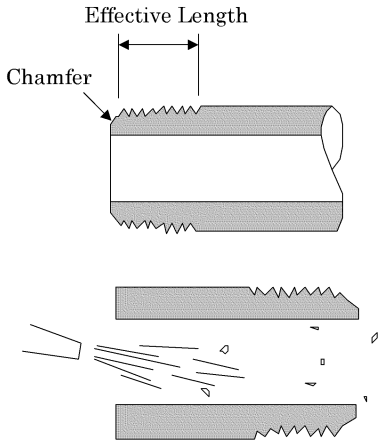
1) The ambient temperature for this cylinder (MSD series) is -10 to 60℃. (MSDG series is 5 to 60℃)
Always operate the cylinder within this temperature range.

2) Install cylinder body with a hexagon socket head cap screw directly.

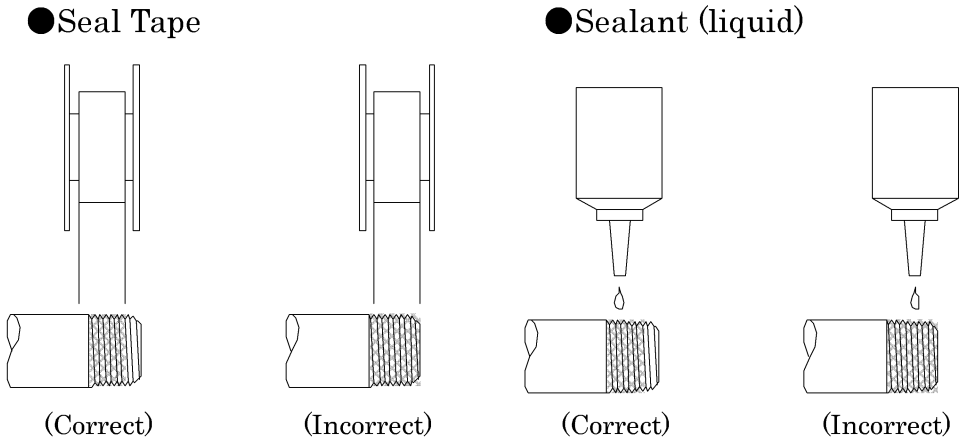
3) Attach a guide for MSD series so that no lateral load is exerted onto the piston rod.
(Example) Apply no lateral load at all for the purpose of a stopper.

2.2 Piping

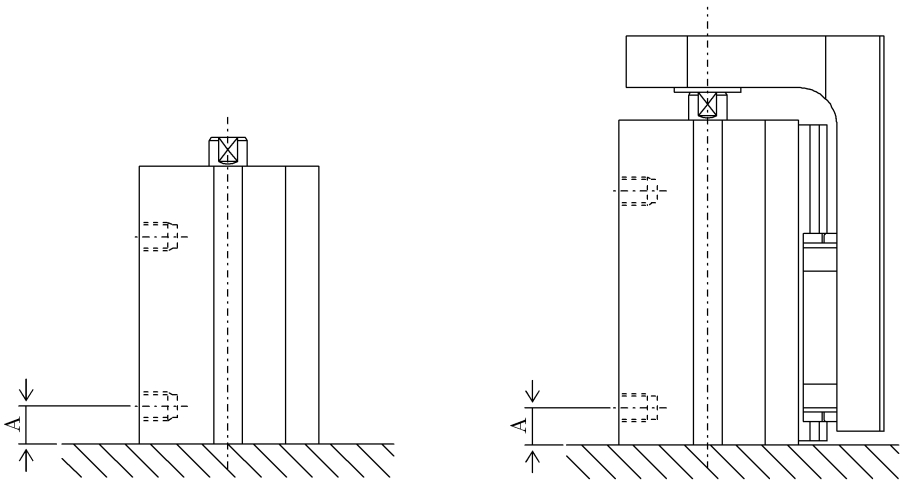
1) For piping beyond the filter, use pipes that are tough against corrosion such as galvanized pipes, nylon tubes, rubber tubes, etc.
2) See to it that the pipe connecting cylinder and solenoid valve has effective cross-sectional area which is needed for the cylinder to drive at the specified speed.
3) Install filter preferably adjacent to the upper-stream to the solenoid valve for eliminating rust, foreign substance in the drain of the pipe.
4) Be sure observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.
5) Flush air into the pipe to blow out foreign substances and chips before piping.



6) Refrain from applying sealant or sealing tape approx. two pitches of thread off the tip of pipe to avoid residual substances from falling into piping system.



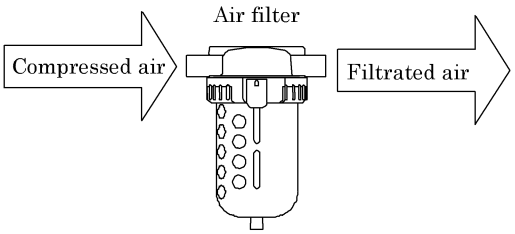
7) Because the usable piping joint has limitations, for using it, see the note below.



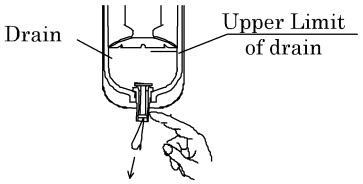
Symbol / Bore size (mm)	Port size	Port dimension A	Applicable flow control valve/joint	Joint outer diameter
6 dia. 8 dia.	M3	4	SC3W-M3-3, SC3W-M3-4 SC3WU-M3-3, SC3WU-M3-4 GWS3-M3-S, GWS3-M4-S FTS4-M3	8 dia. or less
12 dia. 16 dia.	M3	4	SC3W-M5-3, SC3W-M5-4 SC3WU-M5-6, SC3WU-M5-3 SC3WU-M5-4, SC3W U-M5-6 GWS4-M5-S, GWS6-M5-S FTS4-M5, FTS6-M5	10 dia. or less

2.3 Fluid

1) It is necessary to use dehumidified air that has been filtered from compressed air. Carefully select an adequate filter that has an adequate filtration rate (preferably 5 μ m or less), flow rate and its mounting location (as nearest to the directional control valve as possible).



2) Be sure to drain out the accumulation in the filter periodically.



3) Note that the intrusion of carbide for the compressor oil (such as carbon or tarry substance) into the circuit causes malfunction of the solenoid valve and the cylinder. Be sure to carry out thorough inspec-tion and maintenance of the com-pressor.

4) This cylinder does not require lubrication. It is recommended, however, to use Turbine oil Grade 1, ISO VG32 as a lubricant, if and when lubrication is needed.

2.4 Switch installation

1) Location of mounting switches on a cylinder.

(1) At the stroke end
Refer the illustration above. Mount switches within the rod side dimension RD as well as the head side dimension HD for the purpose of having switches function at the points of the maximum sensitive position.

(2) Intermediate of stroke
Move the piston where it is anticipated to stop and fix it tentatively Slide a switch carefully along the side of cylinder over the piston to find out the spot where switch turns on. This type spot should be located on both side of piston. The intermediate spot between those posits is of the maximum sensitive position and where the switch is supposed to be installed.

(3) Relocation of switch
Slide switch body along cylinder tube after loosening mounting screws and tighten screws when located the maximum sensitive position.

(4) Replacing switch
Take out switch out of groove after loosening mounting screws. Slide new replacing switch into groove and tighten screws upon placing the switch at the maximum sensitive position. (Apply tightening torque of 0.1 to 0.2N・m)

2) Operating range

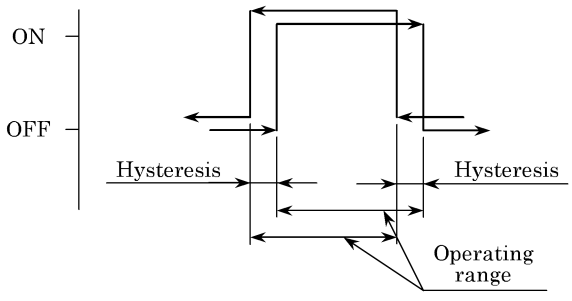
(1) The switch turns on first and turns off as the piston moves along its stroke. Precise operating range deviate slightly depending upon the direction of piston movement as shown right.

(2) The center of the range is the mostly sensitive position. Setting switch at this point eliminates majority of external disturbance and provides the most stabile actuation of switch.

3) Hysteresis

(1) Precise operating range deviate slightly depending upon the direction of piston movement as shown right.

(2) Switch is apt to be disturbed its accuracy by external effect when piston stops within this range. Carefully avoid designing stop-ping location of piston.



Maximum sensitive position (HD, RD), operating range, and hysteresis (unit : mm)

Model No.	Tube bore (mm)	Stroke	Solid state switch F2H/V、F3HV)				Reed switch (F0H/V)			
			Max. sensitive position		Operating range	Hysteresis	Max. sensitive position		Operating range	Hysteresis
			RD	HD			RD	HD		
MSD-L	6 dia.	All	7.5	1.5	1.5 to 3.0	1.0 or less	3.5	3.5(0)	5.0 to 6.0	1.0 or less
	8 dia.		9.5	1.0	1.5 to 3.5		5.5	4.0(0)	5.5 to 6.5	
MSD-XL	6 dia.	5	7.5	1.5	1.5 to 3.0		4.0	4.0(0)	5.0 to 6.0	
		10	12.5	1.5	1.5 to 3.0		9.0	4.0(0)	5.0 to 6.0	
	ϕ8 dia.	5	9.0	1.5	1.5 to 3.5		5.5	4.0(0)	5.5 to 6.5	
		10	14.0	1.5	1.5 to 3.5		10.5	4.0(0)	5.5 to 6.5	
MSD-YL	6 dia.	5	8.0	7.0	1.5 to 3.0		3.5	2.5	5.0 to 6.0	
		10	8.0	12.0	1.5 to 3.0		3.5	7.5	5.0 to 6.0	
	ϕ8 dia.	5	10.0	6.0	1.5 to 3.5		5.5	2.0	5.56 to.5	
		10	10.0	11.0	1.5 to 3.5		5.5	7.0	5.5 to 6.5	
MSD-KL	6 dia.	All	10.0	3.5	1.5 to 3.0		6.0	0	5.0 to 6.0	
	8 dia.		12.5	2.5	1.5 to 3.5		8.5	0	5.5 to 6.5	
	12 dia.		13.0	3.5	1.5 to 3.5		9.0	0	5.5 to 7.5	
	16 dia.		17.5	3.5	1.5 to 3.5		14.0	0	4.5 to 7.0	
MSDG-L	6 dia.	All	10.0	3.5	1.5 to 3.0		6.0	0	5.0 to 6.0	
	8 dia.		12.5	2.5	1.5 to 3.5		8.5	0	5.5 to 6.5	
	12 dia.		13.0	3.5	1.5 to 3.5		9.0	0	5.5 to 7.5	
	16 dia.		17.5	4.0	1.5 to 3.5		14.0	0	4.5 to 7.0	

Note) Dimensions in ( ) show F0V mounting orientation when F0H is different from F0V mounting orientation.

Note: 1. Min.stroke rength for two reed switches is 10mm. (full bore size)

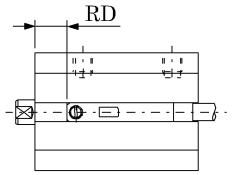
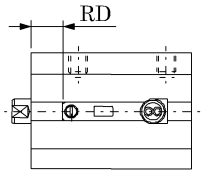
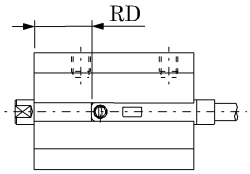
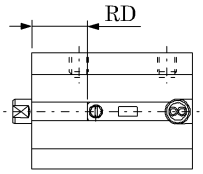
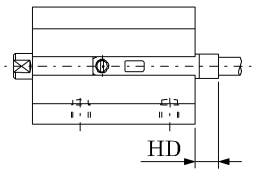
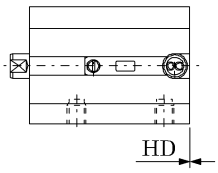
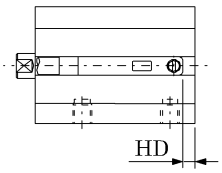
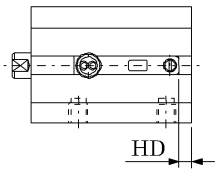
2. For 6, 8 mm bore cylinders with reed switches, use mounting bolts that do not contain magnetic substances. (stainless steel etc.)

3. For 6, 8 mm bore cylinders with solid state switches, use mounting bolts that do not contain magnetic substances. (stainless steel etc.)

For 12, 16 mm bore cylinders with using through bolts, use mounting bolts that do not contain magnetic substances.(stainless steel etc.)

Refer to fig.1 to fig.7 about mounting orientation of switch.

Fig1. MSD-L-6, 8 switch mounting orientations

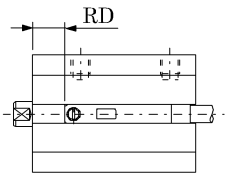
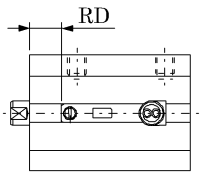
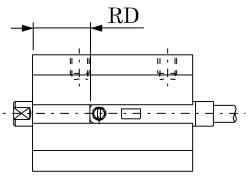
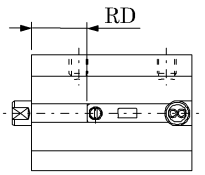
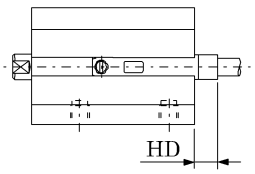
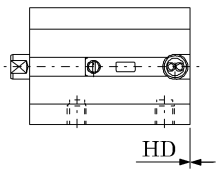
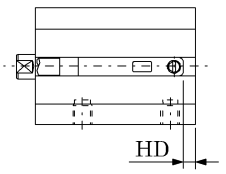
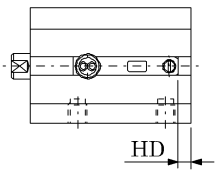
		Reed switch		Solid state switch	
		F0H	F0V	F2H/F3H	F2V/F3V
6 dia. 8 dia.	RD				
	HD				

Switch mounting orientations dimension

(mm)

Model	Bore size	Reed switch				Solid state switch			
		F0H		F0V		F2H/F3H		F2V/F3V	
		RD	HD	RD	HD	RD	HD	RD	HD
MSD-L	6 dia.	3.5	3.5	3.5	0	7.5	1.5	7.5	1.5
	8 dia.	5.5	4.0	5.5	0	9.5	1.0	9.5	1.0

Fig2. MSD-XL-6, 8 switch mounting orientations

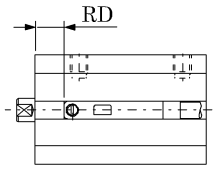
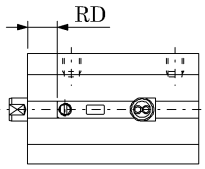
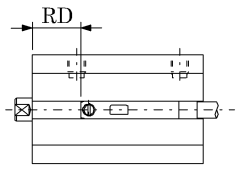
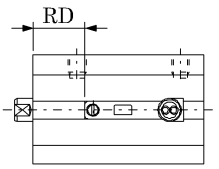
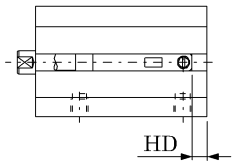
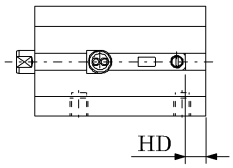
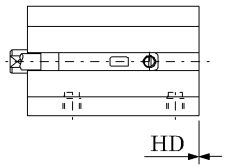
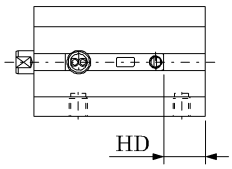
		Reed switch		Solid state switch	
		F0H	F0V	F2H/F3H	F2V/F3V
6 dia. 8 dia.	RD				
	HD				

Switch mounting orientations dimension

(mm)

Model	Tube bore	Stroke	Reed switch				Solid state switch			
			F0H		F0V		F2H/F3H		F2V/F3V	
			RD	HD	RD	HD	RD	HD	RD	HD
MSD-XL	6 dia.	5	4.0	4.0	4.0	0	7.5	1.5	7.5	1.5
		10	9.0	4.0	9.0	0	12.5	1.5	12.5	1.5
	8 dia.	5	5.5	4.0	5.5	0	9.0	1.5	9.0	1.5
		10	10.5	4.0	10.5	0	14.0	1.5	14.0	1.5

Fig3. MSD-YL-6, 8 switch mounting orientations

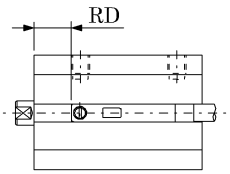
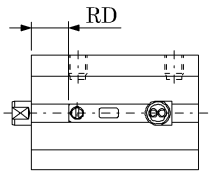
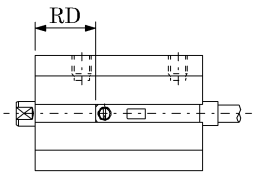
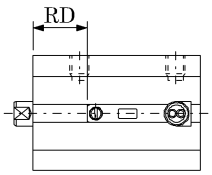
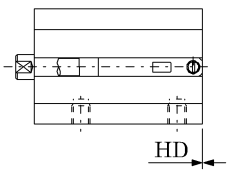
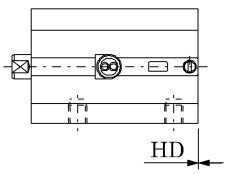
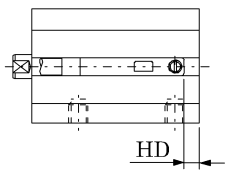
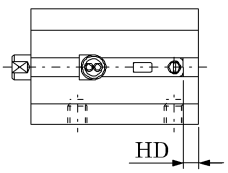
		Reed switch		Solid state switch	
		F0H	F0V	F2H/F3H	F2V/F3V
6 dia. 8 dia.	RD				
	HD				

Switch mounting orientations dimension

(mm)

Model	Bore size	Stroke	Reed switch				Solid state switch			
			F0H		F0V		F2H/F3H		F2V/F3V	
			RD	HD	RD	HD	RD	HD	RD	HD
MSD-YL	6 dia.	5	3.5	2.5	3.5	2.5	8.0	7.0	8.0	7.0
		10	3.5	7.5	3.5	7.0	8.0	12.0	8.0	12.0
	8 dia.	5	5.5	2.0	5.5	2.0	10.0	6.0	10.0	6.0
		10	5.5	7.0	5.5	7.0	10.0	11.0	10.0	11.0

Fig4. MSD-KL-6, 8 switch mounting orientations

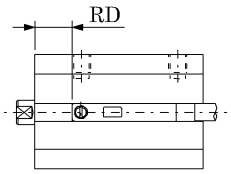
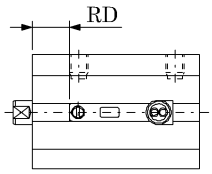
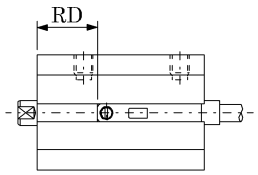
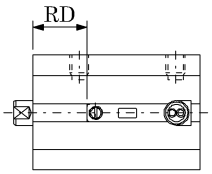
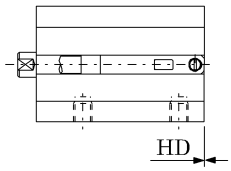
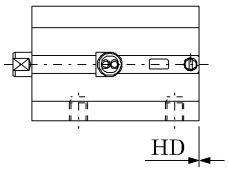
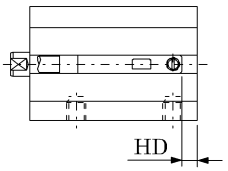
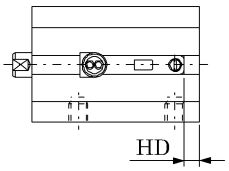
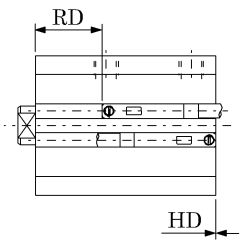
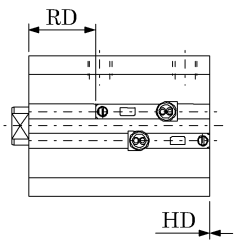
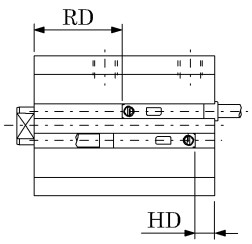
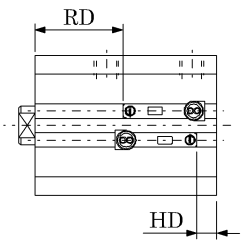
		Reed switch		Solid state switch	
		F0H	F0V	F2H/F3H	F2V/F3V
6 dia. 8 dia.	RD				
	HD				

Switch mounting orientations dimension

(mm)

Model	Bore size	Reed switch				Solid state switch			
		F0H		F0V		F2H/F3H		F2V/F3V	
		RD	HD	RD	HD	RD	HD	RD	HD
MSD-KL	6 dia.	6.0	0	6.5	0	10.0	3.5	10.0	3.5
	8 dia.	8.5	0	8.5	0	12.5	2.5	12.5	2.5

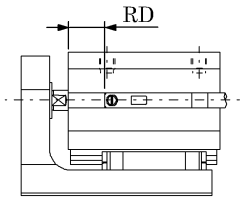
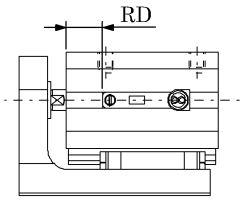
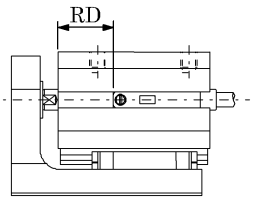
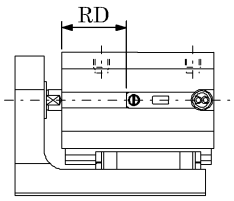
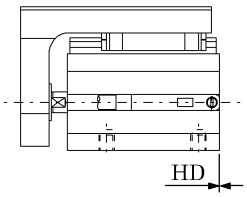
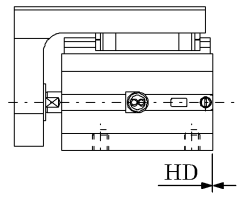
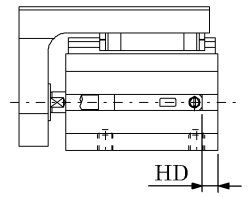
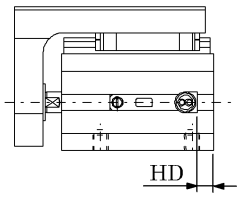
Fig5. MSD-KL-12, 16　switch mounting orientations

		Reed switch		Solid state switch	
		F0H	F0V	F2H/F3H	F2V/F3V
12 dia.	RD				
	HD				
16 dia.	RD				
	HD				

Switch mounting orientations dimension (mm)

Model	Bore size	Reed switch				Solid state switch			
		F0H		F0V		F2H/F3H		F2V/F3V	
		RD	HD	RD	HD	RD	HD	RD	HD
MSD-KL	12 dia.	9.0	0	9.0	0	13.0	3.5	13.0	3.5
	16 dia.	14.0	0	14.0	0	17.5	3.5	17.5	3.5

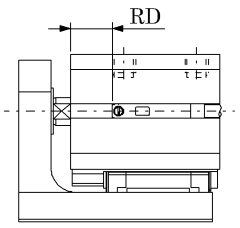
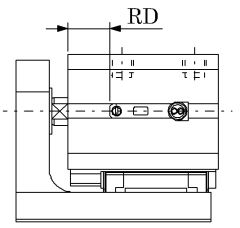
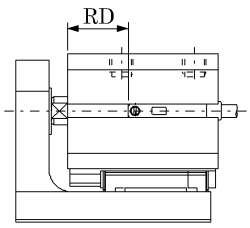
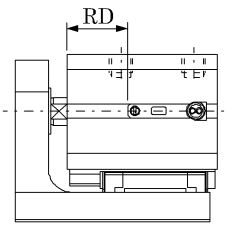
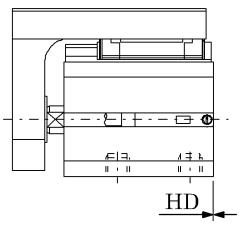
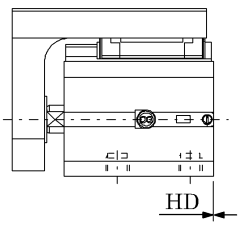
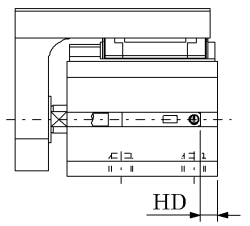
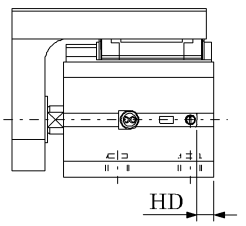
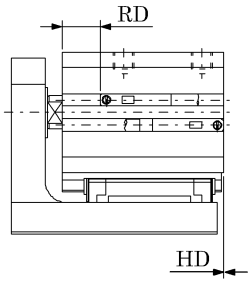
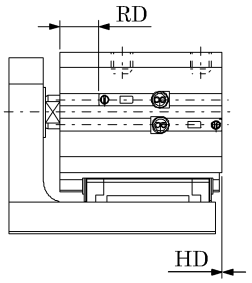
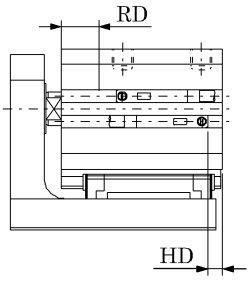
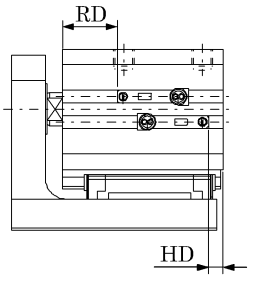
Fig.6. MSDG-L-6, 8 switch mounting orientations

		Reed switch		Solid state switch	
		F0H	F0V	F2H/F3H	F2V/F3V
6 dia. 8 dia.	RD				
	HD				

Switch mounting orientations dimension (mm)

Model	Bore size	Reed switch				Solid state switch			
		F0H		F0V		F2H/F3H		F2V/F3V	
		RD	HD	RD	HD	RD	HD	RD	HD
MSDG	6 dia.	6.0	0	6.0	0	10.0	3.5	10.0	3.5
	8 dia.	8.5	0	8.5	0	12.5	2.5	12.5	2.5

Fig7. MSDG-L-12, 16　switch mounting orientations

		Reed switch		Solid state switch	
		F0H	F0V	F2H/F3H	F2V/F3V
12 dia.	RD				
	HD				
16 dia.	RD				
	HD				

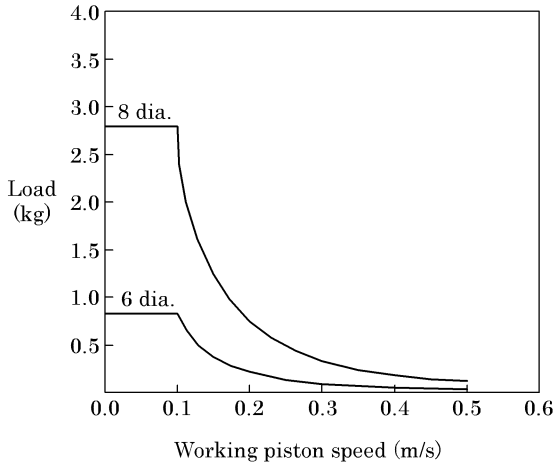
Switch mounting orientations dimension　(mm)

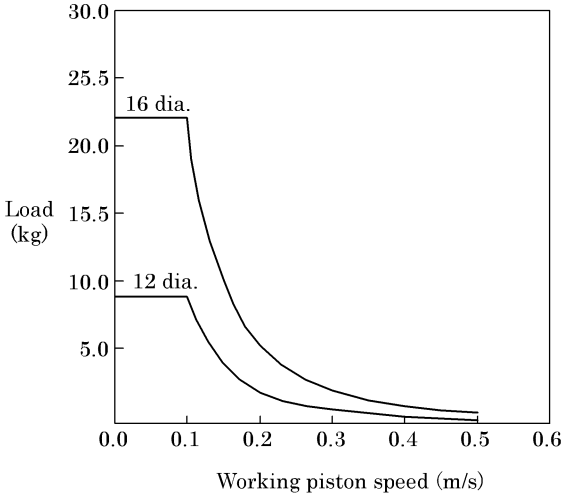
Model	Bore size	Reed switch				Solid state switch			
		F0H		F0V		F2H/F3H		F2V/F3V	
		RD	HD	RD	HD	RD	HD	RD	HD
MSDG-L	12 dia.	9.0	0	9.0	0	13.0	3.5	13.0	3.5
	16 dia.	14.0	0	14.0	0	17.5	3.5	17.5	3.5

3. OPERATION

3.1 Operating the Cylinder

1) The working pressure for this type of cylinder is specified in "Product Specifications". Operate the system within this range.
2) The MSD type without cushion cannot absorb a large energy generated by an external load. Although a rubber cushion is internally provided for the MSD-K type and MSDG type, it is advisable to install an additional external stopper when the kinetic energy is excessive. Tolerable kinetic energy is as the graphs below indicate.
3) Regulate the working piston speed by installing speed controllers as per illustration in the Fundamental Circuit Diagram, below.





3.2 Allowable moment

Allowable moment may vary depending on installation attitude of load (M1/M2/M3 directions).
Refer to the diagram below to calculate function moment.

1) When installation attitude of load is only one way.
   Check if the calculated value is within the range of allowable moment (Table 1).
2) When installation attitude of load is more than two directions (when combined moment).
   Divide the calculated values for each direction by allowable moment on (Table 1) to find moment ratio. Check if the total of ratio is less than 1.0.

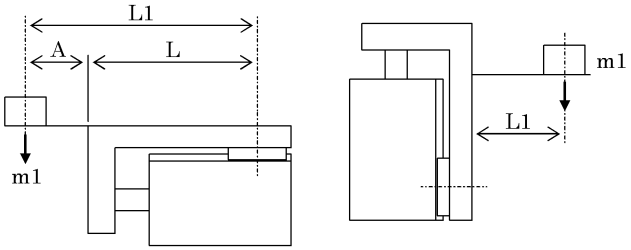
$$\frac{M1}{M1max} + \frac{M2}{M2max} + \frac{M3}{M3max} \leqq 1.0$$

Table1. Allowable moment during traveling (N·m)

Bore size (mm)	M1	M2	M3
6 dia.	0.16	0.24	0.16
8 dia.	0.16	0.24	0.16
12 dia.	0.27	0.55	0.27
16 dia.	0.57	1.16	0.57

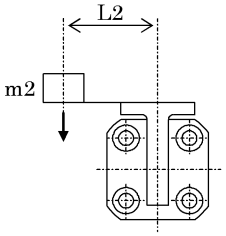
＜M1＞

M1(N･m)＝10×m1(kg)×L1(m)



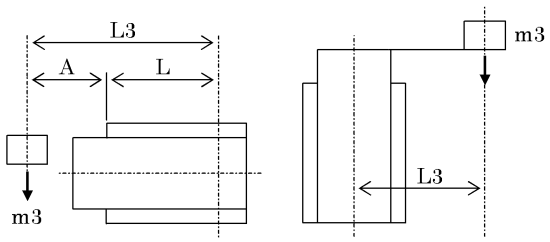
＜M2＞

M2(N･m)＝10×m2(kg)×L2(m)



＜M3＞

M3(N･m)＝10×m3(kg)×L3(mm)



Value L (m)

Bore size (mm)	Stroke					
	5	10	15	20	25	30
6 dia.	0.027	0.032	0.037	0.042	0.047	0.052
8 dia.	0.028	0.033	0.038	0.043	0.048	0.053
12 dia.	0.031	0.036	0.041	0.046	0.051	0.056
16 dia.	0.033	0.038	0.043	0.048	0.053	0.058

3.3 How to use the Switches

3.3.1 Design/Selection

1) Application, load current, voltage, temperature, impact, environment, etc., exceeding the specifications will result in damage or operation faults. Use the device as instructed in specifications.

2) Do not use this product in flammable environments. The cylinder switch is not explosion proof, and such use could result in explosions or damage.

3) Check the proximity of cylinders.
When installing more than 1 cylinder with switches in parallel, keep enough distance between cylinder tubes according to the cylinder specifications.
Magnetic interference of these cylinders may occur and cause the switch to malfunction.

4) Check the magnetic environment
Do not operate this product in a place where a strong magnetic field or large current (large magnet or spot welder, etc.) exists. If a cylinder with the switch is installed in parallel to this product or the magnetic substance moves near the cylinder, the mutual interference may occur and affect the detection accuracy.

5) Check the cylinder switch ON time at mid-stroke.
When setting the cylinder switch at mid-stroke and driving a load when the piston changes, if the speed is too fast, the cylinder switch will function but operation time will be too short and the load may not respond correctly.
The maximum detectable working piston speed is:

$$V(\text{mm/s}) = \frac{\text{Cylinder switch operation range (mm)}}{\text{Load operation time (s)}}$$

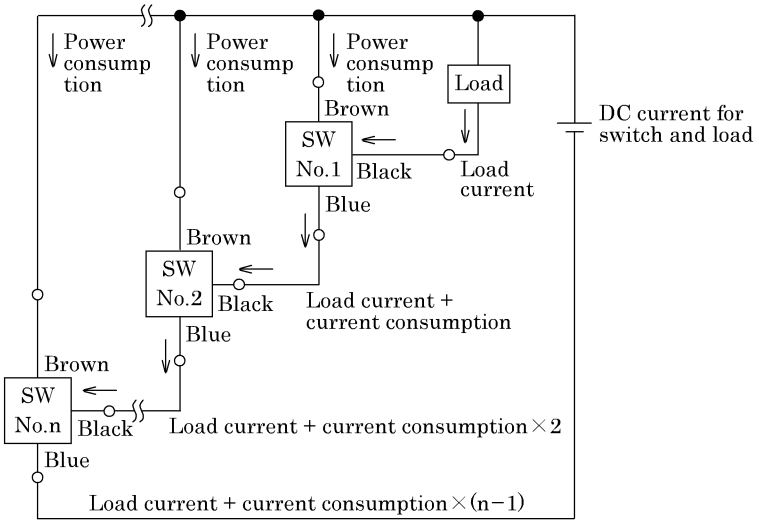
6) Check internal voltage drops caused by serial connections.

(1) When connecting several 2-wire type switches in serial, the switch voltage drop is the total voltage drop of all connected switches.
The voltage applied to the load is the voltage obtained by subtracting the voltage drop at switches from the power supply voltage.
Check load specifications and determine the number of switches to be connected.

(2) When connecting several 3-wire serial solid state switches, the switch's voltage drop is the total voltage drop of all connected switches, as with the 2-wire switch. The current that flows to the switch is the total of the connected switch's current consumption and load current, as shown at upper right. Check load specifications and determine the number of switches to be connected so that the maximum switch load current is not exceeded.

(3) The indicator light turn ON only when all switches are ON.

F3



7) Check the leakage current caused by parallel connections

(1) When connecting several 2-wire switches in parallel, note that leakage current increases in proportion to the number of connected units.
Check load specifications and determine the number of switches to be connected. Note that switch indicator light could dim or may not turn ON.

(2) With the 2-wire solid state switch, when 1 switch is changing from ON to OFF status, voltage at both ends of the switch connected in parallel drops to the internal voltage drop value at switch ON and is less than the load voltage range and other switches will not turn ON.
Check input specifications of the programmable controller, which is the connection load, before starting use.

(3) The 3-wire solid state switch has an extremely small leakage current (10 μA or less), so there is no problem in use under normal conditions.

8) Check when using for an interlock circuit.
When using the cylinder switch for an interlock signal, requiring high reliability, provide mechanical protection or use a double interlock, installing a switch (sensor) other than the cylinder switch as protection against faults.

9) Check the contact capacity.
Do not use a load that exceeds the switch's maximum contact capacity or faults could occur. Note that the indicator light may not turn ON if the load is less than the rated current valve.

10) Check the contact protection circuit.
(1) Provide a protection circuit when connecting an inductive load (relay, solenoid valve), as surge voltage is generated when the switch turns OFF.
(2) Provide a protection circuit when connecting a capacious load (capacitor), as rush current is generated when the switch turns ON.
(3) when the wiring length increases, wiring capacity is reached and rush current is generated. This can damage switch or shorten life. Provide a contact protection circuit if the wiring length of solid state switch exceeds 10m. Provide a contact protection circuit if the wiring length of reed switch exceeds values in below table.

Switch	Voltage	Wiring length
F type	DC	50m
F type	AC	10m

11) Avoid using in an environment exposed to water.
Operation faults could occur due to installation faults.

12) Avoid use in environments containing oil or chemicals.
The cylinder switch could be adversely affected (insulation fault, malfunction caused by swelling of filled resin, hardening of lead sheath, etc.) if used in an environment containing oil, coolant, cleaning fluid, or chemicals. Consult with CKD about such an environment.

13) Do not use in a high-impact environment.
When using the reed switch, an impact of 294 m/s^2 or more applied during use could output a signal for an instant (1 ms or less), or could turn OFF. It may be necessary to use a solid state switch depending on the working environment. Please consult with CKD.

14) Do not use where surge is generated.
If there is a device (magnetic lifter, high-frequency induction furnace, motor, etc.) that generates a large surge near the cylinder with a solid state switch, circuit elements in the switch could deteriorate or be damaged. Take measures against the surge-generating source.

15) Check the accumulation of iron chips and contact of magnetic material.
If a large amount of iron chips, such as cutting chips or welding spatter accumulate or if magnetic objects (material attached to magnets) are present around the cylinder with a cylinder switch, the magnetic force in the cylinder is lost, and the cylinder switch's operations may be inhibited.

3.3.2 Installation/Adjustment

1) Do not subject the product to undue vibration.
Do not drop, bump, or apply excessive impact (294 m/s^2 or more for reed switches, 980 m/s^2 or more for solid state switches). Even if the switch case does not break, switch components could break or malfunction.

2) Do not carry the cylinder by the switch's lead wire.
Do not carry the cylinder by the switch's lead wire because the wire could disconnect, and stress on the switch could damage switch components.

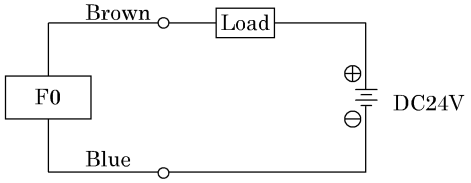
3) Protecting the lead wire
The lead wire's minimum bending radius is 9 mm or more (when fixed).
Pay attention to wiring so repeated bending and tensile strain are not applied to the lead wire.

4) Do not wire with a power cable or high voltage cable.
Avoid wiring in parallel with or in the same conduit as a power cable or high voltage cable. Wire separately. The control circuit containing the cylinder switch could malfunction because of noise.

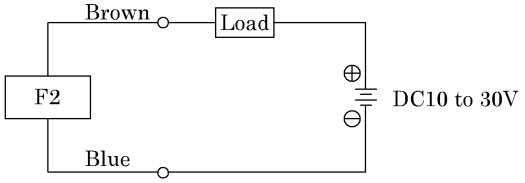
5) Do not short-circuit the load.
If the cylinder switch is turned ON while the load is short-circuited, the switch is damaged.

6) Check lead wire connections.
Turn OFF power to the device in the electric circuit to be connected before starting wiring. Conducting work with power ON could result in accidents from electric shock or unpredictable operation.
・Reed switch
Connect the switch's lead wire in parallel to the load instead of directly to power. When using F0, observe points (1) and (2) below.
(1) When used for DC, connect so that the brown wire is on the plus (+) side and the blue wire on the negative (−) side.
The switch will function when connected in reverse, but the indicator light will not turn ON.
(2) When connected to an AC relay or programmable controller input, conducting half wave rectification with that circuit may prevent the switch indicator light from turning ON. The indicator light will light when the switch lead's polarity is reversed.

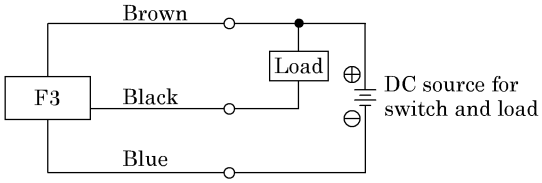
・Solid state switch
Correctly connected lead wires on the below based on color coding.
Incorrect wiring could result in damage.



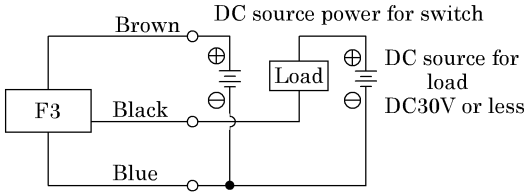
Fundamental circuit example of F0



Fundamental circuit example of F2

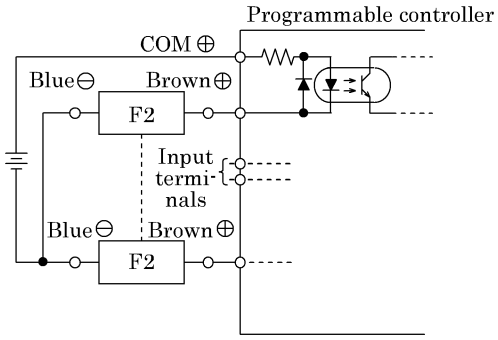


Fundamental circuit example (1) of F3
(In case the same source of power is used.)

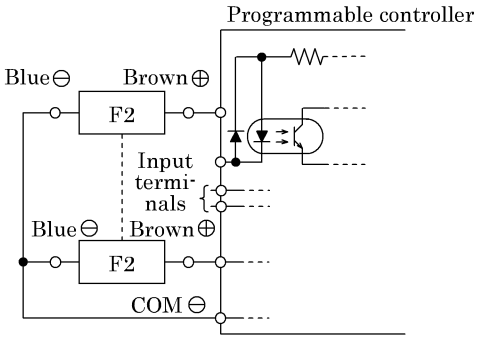


Fundamental circuit example(2) of F3
(In case individual source of power is used.)

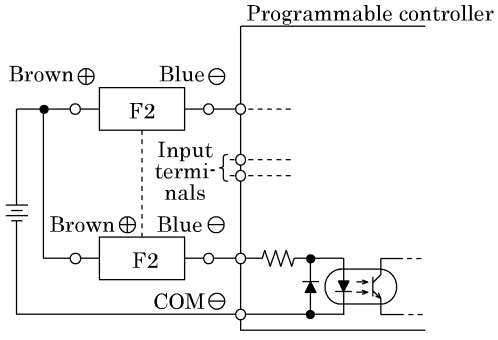
(3) Connection to a programmable controller (Sequencer).
Type of connection varies depending upon the model of the programmable controller.



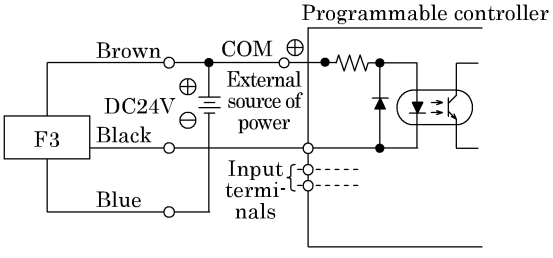
An example of F2 connection to source input type
(an external power source)



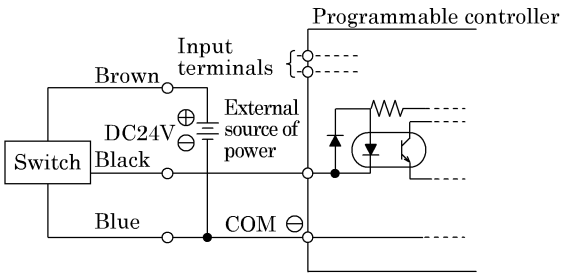
An example of F2 connection to source input type
(an internal power source)



An example of F2 connection to sink input type
(an external power source)



An example of F3 connection to source input type
(an external power source)



An example of F3 connection to source input type
(an internal power source)

7) Set the switch to the center of the operation range.
Adjust cylinder switch position so that the piston stops at the center of the operation range (ON range).

8) Install the switch with the designated tightening torque.
If the tightening torque range is exceeded, the set screw, bracket, switch, etc., could be damaged.
If installed with a tightening torque less than that designated, the switch mounting orientation could deviate.

9) Relay
Always use the relays listed below.
OMRON ····· MY type
Fuji Electric Corporation ····· HH5 type
Tokyo Electrical Engineering Company ····· MPM type
Panasonic, Ltd. ····· HC type

4. MAINTENANCE

4.1 Periodical Inspection

1) In order to upkeep the cylinder in optimum condition, carry out periodic inspection once or twice a year.
2) Inspection items
   (1) Check the bolts and nuts fitting the piston rod end brackets and mounting brackets for slackening.
   (2) Check to see that the cylinder operates smoothly.
   (3) Check any change of the working piston speed and cycle time.
   (4) Check for internal and/or external leakage.
   (5) Check the piston rod for flaw (scratch) and deformation.
   (6) Check the stroke for abnormality.

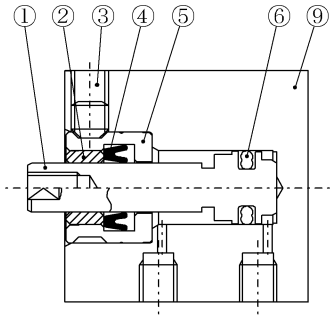
   See "TROUBLE SHOOTING, 5. should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.

4.2 Disassembling

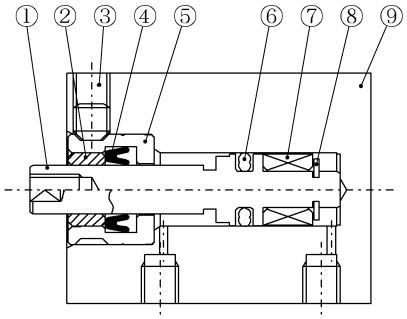
1) This cylinder is unable to be disassembled.

4.3 Internal structure and parts list

●MSD-6, 8

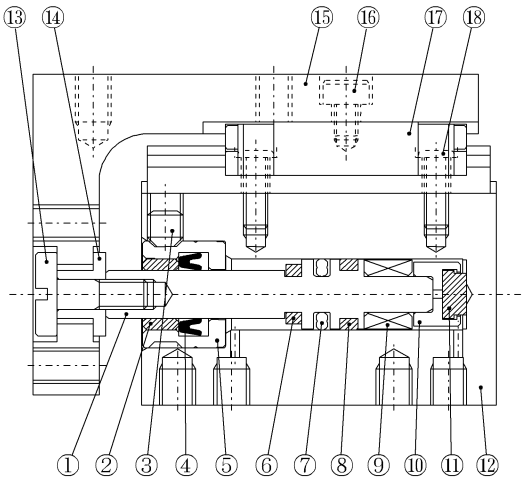


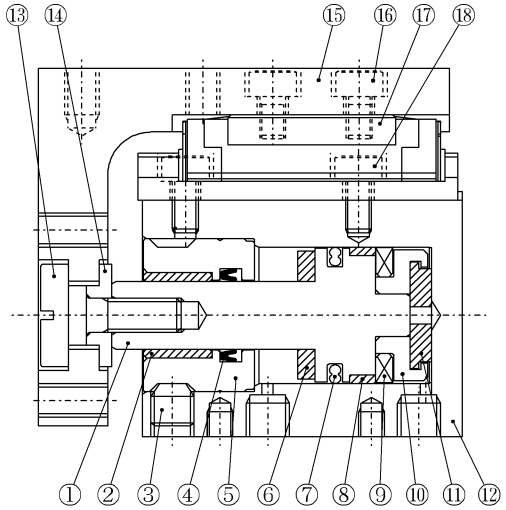
●MSD-L-6, 8



No.	Parts name	Material	Comment
1	Piston	Stainless steel	
2	Bush	Oil impregnated copper alloy	
3	Set screw with hexagon socket	Stainless steel	
4	Rod packing seal	Nitrile rubber	
5	Rod bush	Stainless steel	
6	Piston packing seal	Nitrile rubber	
7	Magnet		
8	E type snap ring	Stainless steel	
9	Main body	Aluminum alloy	Hard alumite disposal

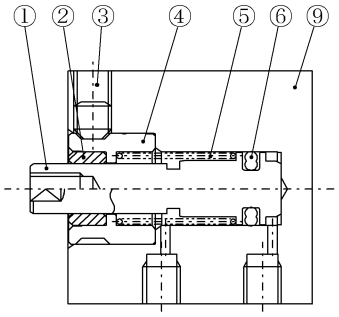
● MSDG-L-6、8、12



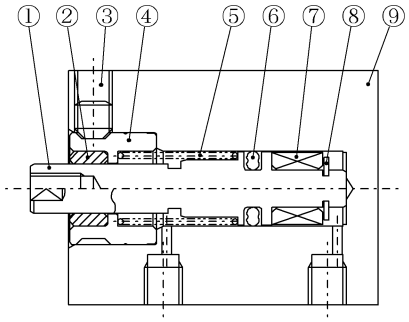


No.	Parts name	Material	No.	Parts name	Material	Comment
1	Piston	Stainless alloy	10	Adaptor	Aluminum alloy	
2	Bush	Oil impregnated copper alloy	11	Cushion rubber H	Urethane rubber	
3	Set screw with hexagon socket	Stainless alloy	12	Main body	Aluminum alloy	Alumite
			13	Floating bolt	Steel	Nickeling
4	Rod packing seal	Nitrile rubber	14	Floating bush	Stainless alloy	
5	Rod bush	Stainless alloy	15	Table	Aluminum alloy	Alumite
6	Cushion rubber R	Urethane rubber	16	Hexagon socket head cap screw	Stainless alloy	
7	Piston packing seal	Nitrile rubber				
8	Wear ring	Acetar resin	17	High precision guide	Stainless alloy	
9	Magnet		18	Bolt	Stainless alloy	

● MSD-X-6, 8

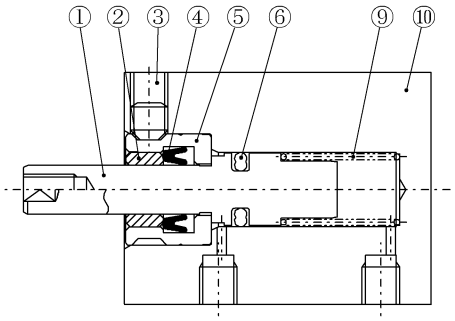


● MSD-XL-6, 8

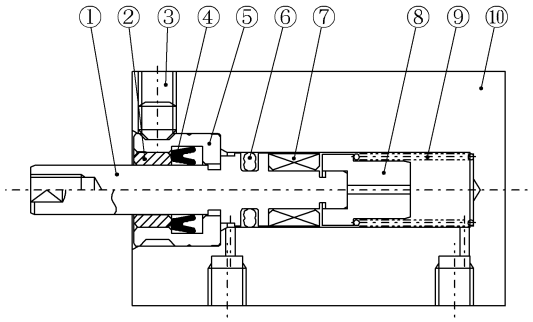


No.	Parts name	Material	Comment
1	Piston	Stainless steel	
2	Bush	Oil impregnated copper alloy	
3	Set screw with hexagon socket	Stainless steel	
4	Rod bush	Stainless steel	
5	Cylinder spring	Steel	Electrodeposition coating
6	Piston packing seal	Nitrile rubber	
7	Magnet		
8	E type snap ring	Stainless steel	
9	Main body	Aluminum alloy	Hard alumite disposal

● MSD-Y-6, 8

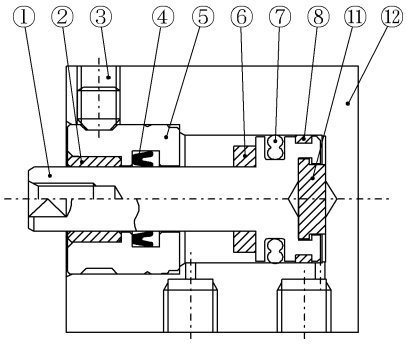


● MSD-YL-6, 8

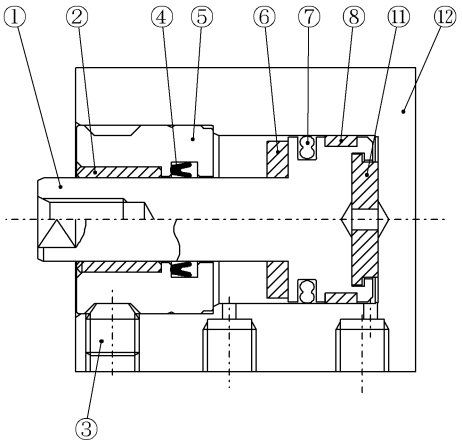


No.	Parts name	Material	Comment
1	Piston	Stainless steel	
2	Bush	Oil impregnated copper alloy	
3	Set screw with hexagon socket	Stainless steel	
4	Rod packing seal	Nitrile rubber	
5	Rod bush	Stainless steel	
6	Piston packing seal	Nitrile rubber	
7	Magnet		
8	Spring holder	Stainless steel	
9	Cylinder spring	Steel	Electrodeposition coating
10	Main body	Aluminum ally	Hard alumite disposal

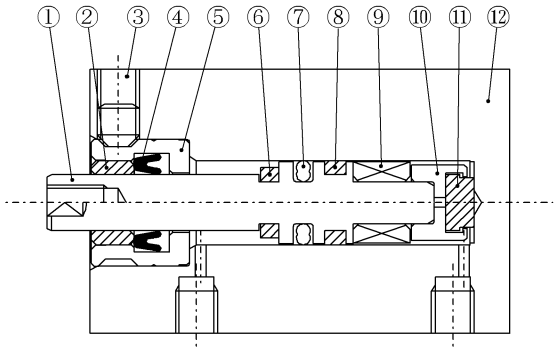
● MSD-K-6, 8, 12



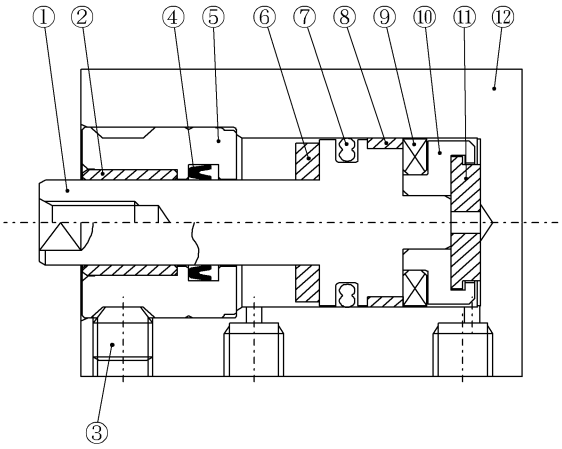
● MSD-K-16



● MSD-KL-6, 8, 12



● MSD-KL-16



No.	Parts name	Material	Comment
1	Piston	Stainless steel	
2	Bush	Oil impregnated copper alloy	
3	Set screw with hexagon socket	Stainless steel	
4	Rod packing seal	Nitrile rubber	
5	Rod bush	Stainless steel	
6	Cushion rubber R	Urethane rubber	
7	Piston packing seal	Nitrile rubber	
8	Wear ring	Acetar resin	
9	Magnet		
10	Adaptor	Aluminum alloy	
11	Cushion rubber H	Urethane rubber	
12	Main body	Aluminum alloy	Hard alumite disposal

5. TROUBLE SHOOTING

1) Cylinder

Trouble	Causes	Remedies
Does not operate.	No pressure or inadequate pressure.	Provide an adequate pressure source.
	Signal is not transmitted to direction control valve.	Correct the control circuit.
	Improper or misalignment of installation.	Correct the installation state and/or change the mounting style.
	Broken piston packing	Replace the piston packing.
Does not function smoothly.	Speed is below the low speed limit	Limit the load variation.
	Improper or misalignment of installation.	Correct the installation state and/or change the mounting style.
	Exertion of transverse (lateral) load.	Install a guide. Revise the installation state and/or change the mounting style.
	Excessive load.	Increase the pressure itself and/or the inner diameter of the tube.
	Speed control valve is built in the way of "Meter in" circuit.	Change the meter-out circuit of the speed control valve.
Breakage and / or deformation	Impact force due to high speed operation	Turn the speed down. Reduce the load and/or install a mechanism with more secured cushion effect (e.g.external cushion mechanism).
	Exertion of transverse load.	Install a guide. Reverse the installation state and/or change the mounting style.

2) Switch

Troubles	Causes	Remedies
Indicator light is not lit.	Deposited contact point	Replace the switch.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
	Damaged indicator light	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
Switch does not function right.	Broken circuit	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
	Improper voltage	Correct voltage to specified.
	Incorrect location of switch	Correct its location.
	Aberrant position of switch	Set it back to original position and tighten the mounting device.
	Incorrect direction of switch mounting	Correct the direction of the switch mounting.
	Relay is unable to respond properly	Turn the speed down. Replace the relay with a recommended one.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
Switch does not return.	Piston is not moving	Make the piston move.
	Deposited contact point	Replace the switch
	Excessive load (relay) than rated capacity	Replace the relay with a recommended one or replace the switch.
	The ambient temperature is out of the specification range	Adjust the ambient temperature within the range of -10 to 60℃
	Existence of a foreign magnetic field	Shield the magnetic field.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.

6. HOW TO ORDER

＜MSD/MSD-L＞

● Without switch

MSD – 6 – 5 ——————— R

● With switch

MSD-L – 6 – 5 – F0V – R – R

(a) (b) (c) (d) (e) (f)

(a) Model			(b) Bore size (mm)		(c) Stroke length (mm)	
MSD	Double acting/ single rod type	Without switch	6	6 dia.	5	5
MSD-L		With switch	8	8 dia.	10	10
					15	15
					20	20
					25	25
					30	30

(d) Switch model No. Note1					(e) Switch quantity	
Axial read wire	Radial read wire	Switch type	Indicator light	Lead wire	R	One on rod side
F0H※	F0V※	Reed	1 color indicator	2 wire	H	One on head side
F2H※	F2V※	Solid state			D	Two
F3H※	F3V※			3 wire		

※mark shows lead wire length.

※Lead wire length	
Blank	1m (Standard)
3	3m (Option)

(f) Piping port position Note2	
Blank	Main body side port
R	Rear common port

E

Note1 : For 6, 8 mm bore cylinders with reed switches, use mounting bolts that do not contain magnetic substances. (stainless steel etc.)

Note2 : For rear common port type, a side installation is possible. In this case, two bolts are used for head or rod side installation.

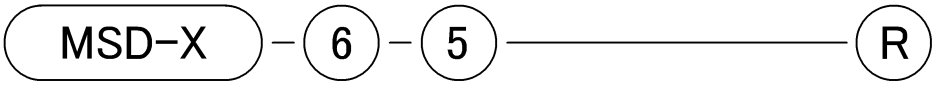
＜How to order switch＞

SW – F0H

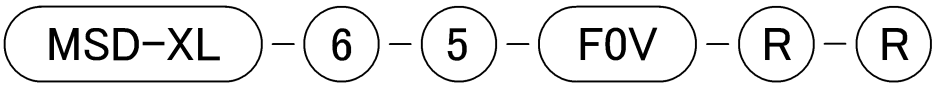
(d) Switch model No.

＜MSD-X,Y/MSD-XL,YL＞

● Without switch



● With switch



(a) (b) (c) (d) (e) (f)

(a) Model			(b) Bore size (mm)		(c) Stroke length (mm)	
MSD-X	Single acting/extend type	Without switch	6	6 dia.	5	5
MSD-Y	Single acting/retract type		8	8 dia.	10	10
MSD-XL	Single acting/extend type	With switch				
MSD-YL	Single acting/retract type					

(d) Switch model No. Note1					(e) Switch quantity	
Axial read wire	Radial read wire	Switch type	Indicator light	Lead wire	R	One on rod side
					H	One on head side
F0H※	F0V※	Reed	1 color indicator	2 wire	D	Two
F2H※	F2V※	Solid state				
F3H※	F3V※			3 wire		

※mark shows lead wire length.

※Lead wire length	
Blank	1m (Standard)
3	3m (Option)

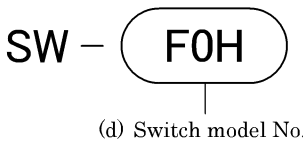
(f) Piping port position Note2	
Blank	Main body side port
R	Rear common port

E

Note1 : For 6, 8 mm bore cylinders with reed switches, use mounting bolts that do not contain magnetic substances. (stainless steel etc.)

Note2 : For rear common port type, a side installation is possible. In this case, two bolts are used for head or rod side installation.

＜How to order switch＞



(d) Switch model No.

＜MSD-K/MSD-KL＞

● Without switch

MSD-K – 6 – 5 ——————— R

● With switch

MSD-KL – 6 – 5 – F0V – R – R

(a) (b) (c) (d) (e) (f)

(a) Model			(b) Bore size (mm)		(c) Stroke length (mm)	
MSD-K	Double acting/ high load type	Without switch	6	6 dia.	5	5
MSD-KL		With switch	8	8 dia.	10	10
			12	12 dia.	15	15
			16	16 dia.	20	20
					25	25
					30	30

(d) Switch model No. Note1, Note2					(e) Switch quantity	
Axial read wire	Radial read wire	Switch type	Indicator light	Lead wire	R	One on rod side
					H	One on head side
F0H※	F0V※	Reed	1 color indicator	2 wire	D	Two
F2H※	F2V※	Solid state				
F3H※	F3V※			3 wire		

※mark shows lead wire length.

※Lead wire length	
Blank	1m (Standard)
3	3m (Option)

(f) Piping port position Note2	
Blank	Main body side port
R	Rear common port

Note1 : For 6, 8 mm bore cylinders with reed switches, use mounting bolts that do not contain magnetic substances. (stainless steel etc.)

Note 2: For 6, 8 mm bore cylinders with solid state switches, use mounting bolts that do not contain magnetic substances. (stainless steel etc.)
For 12, 16 mm bore cylinders with using through bolts, use mounting bolts that do not contain magnetic substances. (stainless steel etc.)

Note3 : For rear common port type, a side installation is possible. In this case, two bolts are used for head or rod side installation.

＜How to order switch＞

SW – F0H

(d) Switch model No.

＜MSDG＞

●スイッチなし

MSDG-L – 6 – 30 – F0V – D – R

(a) (b) (c) (d) (e) (f)

(a) Model			(b) Bore size (mm)		(c) Stroke length (mm)	
MSDG-L	Double acting・guided type	With switch	6	6 dia.	5	5
			8	8 dia.	10	10
			12	12 dia.	15	15
			16	16 dia.	20	20
					25	25
					30	30

(d) Switch model No. Note1, Note2					(e) Switch quantity	
Axial read wire	Radial read wire	Switch type	Indicator light	Lead wire	R	One on rod side
					H	One on head side
F0H※	F0V※	Reed	1 color indicator	2 wire	D	Two
F2H※	F2V※	solid state				
F3H※	F3V※			3 wire		

※mark shows lead wire length.

※Lead wire length	
Blank	1m (Standard)
3	3m (Option)

(f) Piping port position Note2	
Blank	Main body side port
R	Rear common port

Note1 : For 6, 8 mm bore cylinders with reed switches, use mounting bolts that do not contain magnetic substances. (stainless steel etc.)

Note 2: For 6, 8 mm bore cylinders with solid state switches, use mounting bolts that do not contain magnetic substances. (stainless steel etc.)
For 12, 16 mm bore cylinders with using through bolts, use mounting bolts that do not contain magnetic substances. (stainless steel etc.)

Note3 : For rear common port type, a side installation is possible. In this case, two bolts are used for head or rod side installation.

＜How to order switch＞

SW – F0H

(d) Switch model No.

7. SPECIFICATION

7.1 Cylinder Specifications

Model / Item		MSD MSD-L (with switch)
Bore size	mm	6 dia. , 8 dia.
Actuation		Double acting
Working fluid		Compressed air
Max. working pressure	MPa	1.0
Min. working pressure	MPa	0.15
Proof pressure	MPa	1.6
Ambient temperature	℃	−10 to 60 (No freezing)
Port size		M3
Stroke tolerance	mm	+0.5 0
Working piston speed	mm/s	50 to 500
Lubrication		Not required (when lubrication, use turbine oil ISOVG32.)

Model / Item		MSD-X MSD-XL (with switch)		MSD-Y MSD-YL (with switch)	
Bore size	mm	6 dia.	8 dia.	6 dia.	8 dia.
Actuation		Single acting/extend type		Single acting/retract type	
Working fluid		Compressed air			
Max. working pressure	MPa	1.0			
Min. working pressure	MPa	0.3		0.4	0.3
Proof pressure	MPa	1.6			
Ambient temperature	℃	−10 to 60 (No freezing)			
Port size		M3			
Stroke tolerance	mm	+0.5 0			
Working piston speed	mm/s	50 to 500			
Lubrication		Not required (when lubrication, use turbine oil ISOVG32.)			

Model / Item		MSD-K MSD-KL (with switch)			
Bore size	mm	6 dia.	8 dia.	12 dia.	16 dia.
Actuation		Double acting			
Working fluid		Compressed air			
Max. working pressure	MPa	1.0			
Min. working pressure	MPa	0.15		0.1	
Proof pressure	MPa	1.6			
Ambient temperature	℃	5 to 60 (No freezing)			
Port size	Main body side port	M3		M5	
	Real common port	M3		M3	
Stroke tolerance	mm	+2.0 0			
Working piston speed	mm/s	−10 to 60 (No freezing)			
Lubrication		Not required (when lubrication, use turbine oil ISOVG32.)			

Model / Item		MSDG-L (with switch)			
Bore size	mm	6 dia.	8 dia.	12 dia.	16 dia.
Actuation		Double acting			
Working fluid		Compressed air			
Max. working pressure	MPa	1.0			
Min. working pressure	MPa	0.15		0.1	
Proof pressure	MPa	1.6			
Ambient temperature	℃	5 to 60			
Port size	Main body side port	M3		M5	
	Real common port	M3		M3	
Stroke tolerance	mm	+2.0 0			
Working piston speed	mm/s	50 to 500			
Lubrication		Not required (when lubrication, use turbine oil ISOVG32.)			

7.2 Switch Specification

Model / Item	Reed 2 wire F0H, F0V	Solid state 2 wire F2H, F2V	Solid state 3 wire F3H, F3V
Applications	Programmable controller		Programmable controller, relay
Power supply voltage	——	——	DC10 to 28V
Load voltage	DC24V	DC10 to 30V	DC30V or less
Load current	5 to 20mA (Note1)	5 to 20mA (Note1)	50mA or less
Current consumption	——	——	10mA or less at DC24V(at ON state)
Internal voltage drop	4V or less		0.5V 以下
indicator light	Yellow LED (ON lighting)		
Leakage current	1mA or less		10 micron A or less
lead wire length (standard)	Standard 1m (oil resistant vinyl cabtire code 2 conductor 0.15mm^2)		Standard 1m (oil resistant vinyl cabtire code 2 conductor 0.15mm^2)
Shock resistance	294m/s^2	980m/s^2	
Insulation resistance	20MΩ over at DC500V megger		
Withstand voltage	No failure at AC1000V for one minute		
Ambient temperature	−10 to 60℃		
Degree of protection	IEC standards IP67, JIS C 0920 (water tight type), oil resistance		

Note 1: Max. load current 20mA is the value at 25 °C.
When ambient temperature around switches is higher than 25 °C, the value is lower than 20mA.
(5 to 10mA at 60 °C.)