CKD

SM－396161－A

INSTRUCTION MANUAL

CYLINDER WITH GUIDE

STM 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

First 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.

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STM SERIES
Cylinder With Guide
Manual No. SM-396161-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

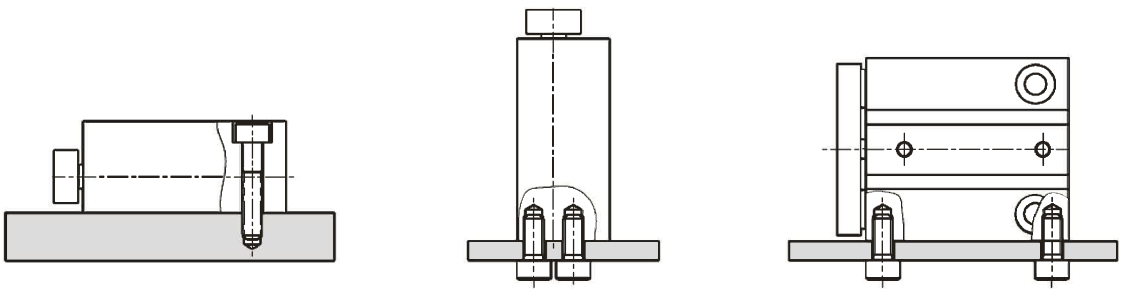
2.1 Installation

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

2) Install cylinder body with a hexagon socket head cap screw directly. Refer to the table below as for sizes of bolts.

Bore size (mm)	Thread size	Tightening torque(N·m)		
		Through bolt	Head end installation	Side installation
6 dia.	M3	1.1	0.6	
10 dia.	M4	2.7	1.6	

● Through bolt ● Head end installation ● Side installation



2.2 Piping

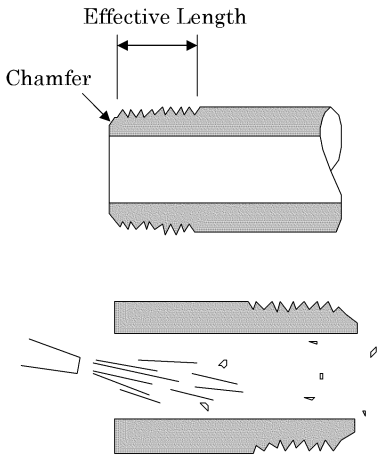
1) For piping beyond the filter, use pipes that are tough against corrosion such as galvanized pipes, nylon tubes, rubber tubes, etc.

2) See to it that the pipe connecting cylinder and solenoid valve has effective 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.

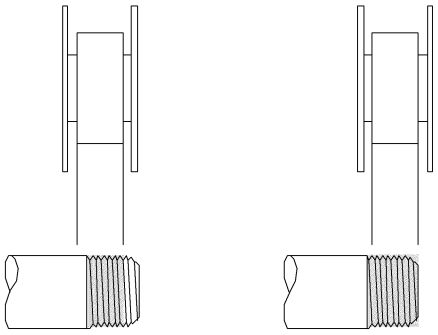
4) Be sure observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.

5) Flush air into the pipe to blow out foreign substances and chips before piping.



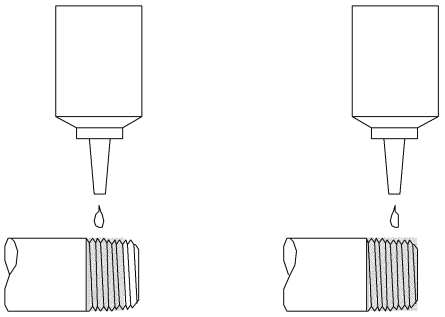
6) Refrain from applying sealant or sealing tape approx. two pitches of thread off the tip of pipe to avoid residual substances from falling into piping system.

● Seal Tape



(Correct) (Incorrect)

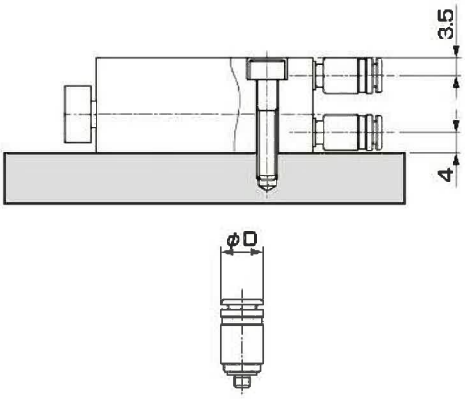
● Sealant (liquid)



(Correct) (Incorrect)

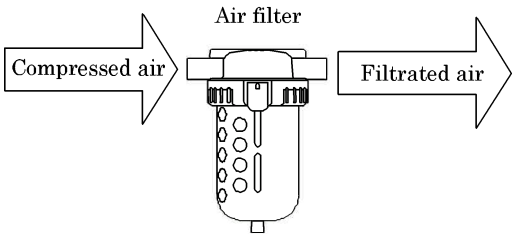
7) When installing rear piping with a through bolt, the following joints can be used.

Bore size (mm)	Port size	Applicable joint/ Flow control valve	Joint OD D dia.
6 dia. 10 dia.	M3	SC3W-M3-※ SC3WU-M3-※	8 dia.
		FTS4-M3 FTL4-M3	
		GWS※-M3-S	
		PTN2-M3 PTNL-M3	



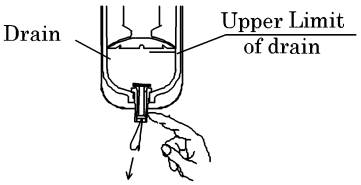
2.3 Fluid

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.

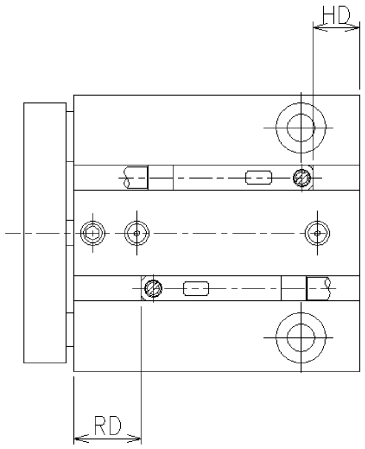
3) Note that the intrusion of carbide for the compressor oil (such as carbon or tarry substance) into the circuit causes malfunction of the solenoid valve and the cylinder. Be sure to carry out thorough inspec-tion and maintenance of the com-pressor.



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.

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

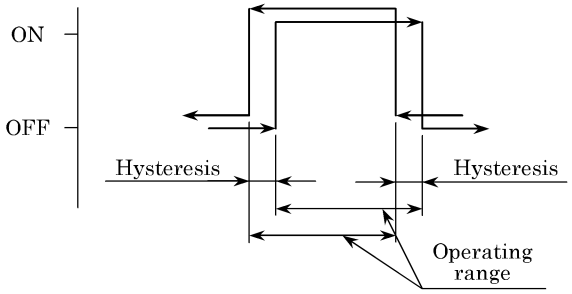
- Replacing switch
  Take out switch out of groove after loosening mounting screws. Slide new replacing switch into groove and tighten screws upon placing the switch at the maximum sensitive position.
  (Apply tightening torque of 0.03 to 0.08N･m)

2) Operating range
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.
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 (mm)

Maximum sensitive position / Bore size (mm)	Solid state switch							
	F2·F3				F2Y·F3Y			
	Maximum sensitive position		Operating range	Hysteresis	Maximum sensitive position		Operating range	Hysteresis
	HD	RD			HD	RD		
6 dia.	5.5(7.5)	8.0	2.5 to 4.5	1.0 or less	5.0(7.0)	7.5	2.5 to 5.5	1.0 or less
10 dia.	7.5	10.0			7.0	9.5		

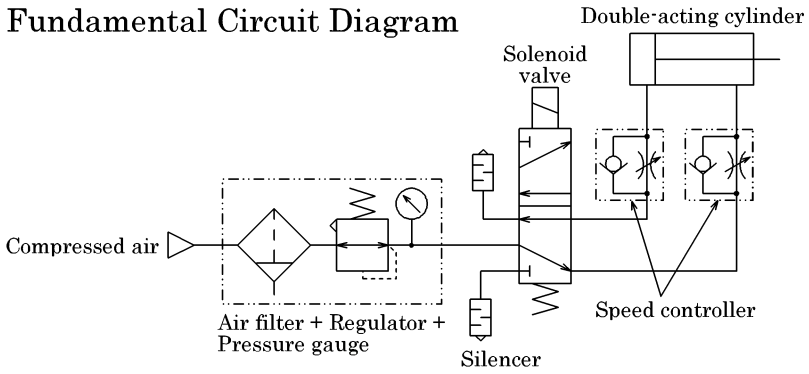
※Switches at ex-factory shipment are positioned at the maximum sensitive position (HD and RD).
Dimensions in ( ) apply to rear piping.

3. OPERATION

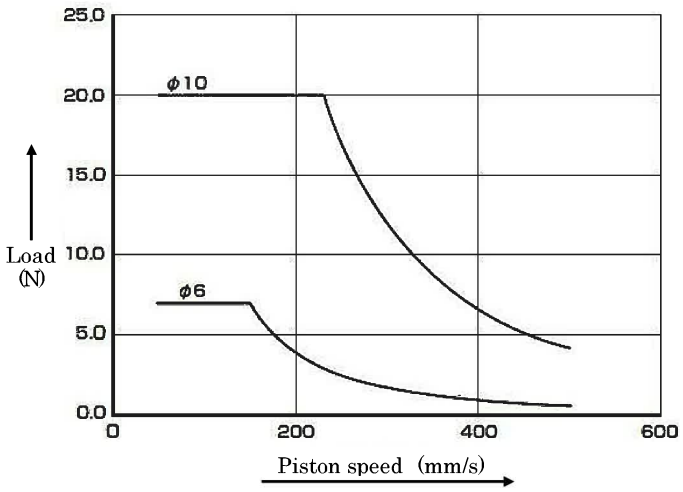
3.1 Operating the Cylinder

1) The working pressure for this type of cylinder is specified in "Cylinder Specifications". Operate the system within this range.
2) Although a rubber cushion is internally provided for this type of cylinder, 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.

● Fundamental Circuit Diagram



● Graphs for Tolerable kinetic energy



Note : The area left and under the plotted curve designates serviceable range for the cylinder. Additional external cushion is required to operate the cylinder within the area of right and upper plotted curve.

3.2 How to use the Switches

3.2.1 Common items

1) 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.

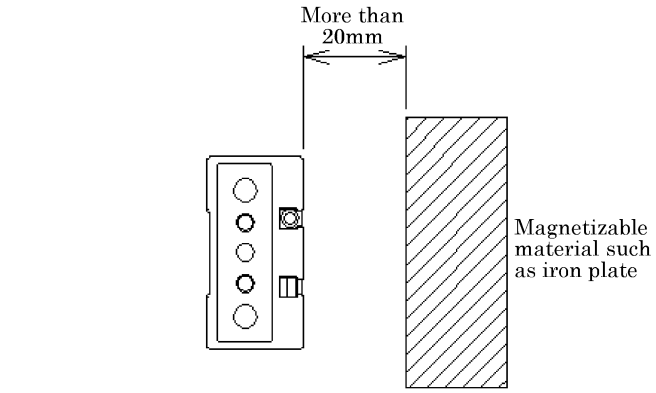
2) Protection of lead cord
Pay consideration to eliminate repeating bending stress or stretching of lead cord while laying the cord.
To the moving portion, use such cord of flexibility as for building a robot.

3) Operating temperature
Do not operate the product at a high temperature (60℃)
Always avoid operation of the product in a hot place due to temperature characteristics of magnetic and electronics parts.

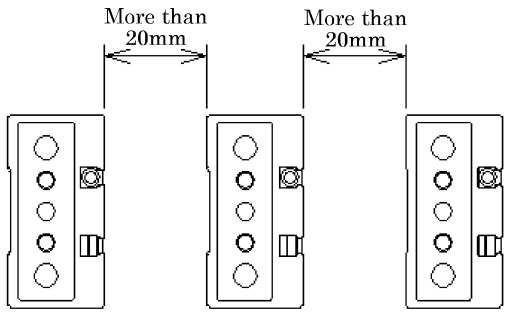
4) Intermediate position detection
When activating the switch halfway of the stroke, the relay may not respond if the piston speed is too fast.
(Example) Operate cylinder with the speed of less than 500mm/s in case the relay actuation time is 20ms.

5) Shock resistance
Do not apply a large vibration or impact to the product when transporting the cylinder, or mounting or adjusting the switch.

6) Magnetizable material such as iron plate near by cylinder switch is apt to cause malfunction of cylinder switches. Keep it from cylinder surface at least 20mm away.
(This is applicable for all bore sizes of tube.)



7) It usually causes malfunction cylinder switches when plural cylinders are laid adjoining.
Keep a space between each other as illustrated to right.
(This is applicable for all bore sizes of tube.)



3.2.2 Operational Cautions, Solid state switch (F2, F3)

1) Connection of lead cord

Comply with the color coding specified on the illustrations. Be sure to turn the power off before starting connecting work.

An erroneous wiring or short circuiting of load causes damage to not only switches, but also load side circuit. Wiring work without shutting electricity off may cause damage to the load side circuit

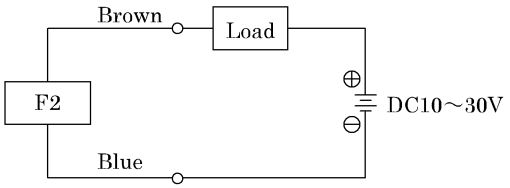


Fig.1 Fundamental circuit Example

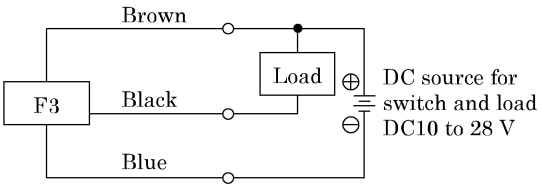


Fig.2 Fundamental circuit Example (1)
(In case the same source of power is used.)

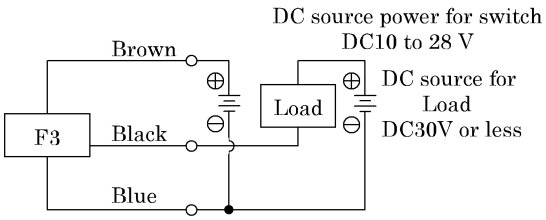


Fig.3 Fundamental circuit Example (2)
(In case individual sources of power are used.)

2) Protection of output circuit

Install some protective circuit as illustrated in Fig. 4 when inducing type load (Relay or solenoid valve) are to be used because those types apt to generate surge current switch off.

Install some protective circuit as illustrated in Fig. 5 when capacitor type load (Capacitor type) are to be used, because these types apt to generate a dash current when turning the switch ON.

Install some protective circuit as illustrated in Fig. 6 or 7 (in case of model F2) and Fig 8 (in case of model F3).

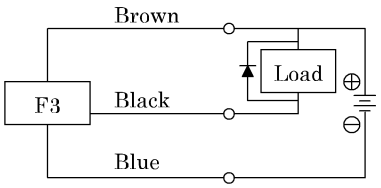
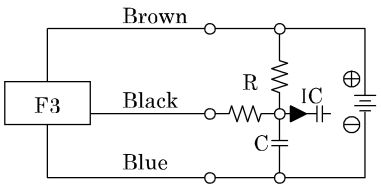


Fig.4 An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.)



Flg.5 An example of using capacitor type load together with current regulating resister R.
Comply with the following formula to figure out required R.

$$\frac{V}{0.05} = R(\Omega)$$

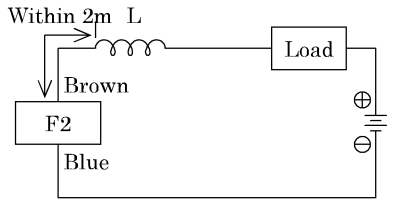


Fig.6 ・Choke coil
L = a couple hundred μH to a couple mH surpassing high frequency characteristic
・Install it near by a switch (within 2m).

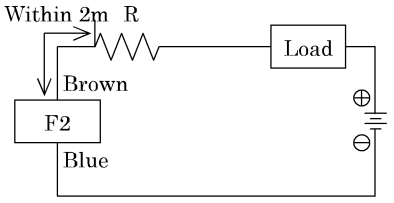


Fig.7 ・Dash current restriction resister.
R = As much large resister as the load circuit can afford.
・Install it near by a switch (within 2m).

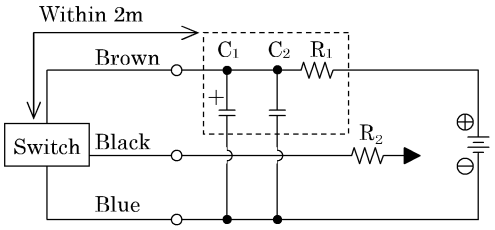


Fig8 ・Electric power noise absorptive circuit.
C_1=20 to 50 μF electrolytic capacitor
(Withstand voltage 50V or more)
C_2=0.01 to 0.1 μF ceramic capacitor
R_1=20 to 30 Ω

・Dash current restriction resister.
R_2=As much large resister as the load circuit can afford.
・Install it nearby the switch (Within 2m)

3) Connection to a programmable controller (Sequencer).

Type of connection varies depending upon the model of the programmable controller. Refer to the following Fig. 9 to 13 respectively.

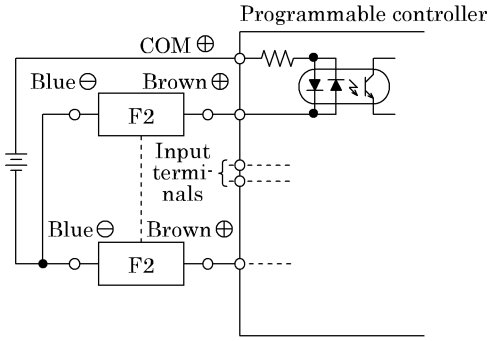


Fig.9 An example of F2 connection to source input type (an external power source)

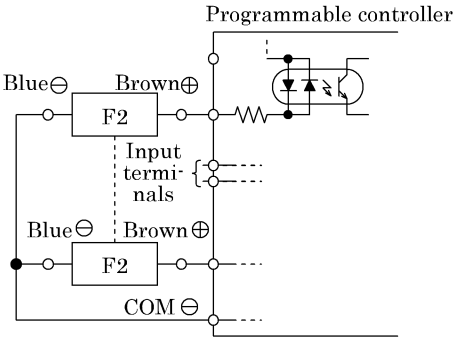


Fig.10 An example of F2 connection to source input type (an internal power source)

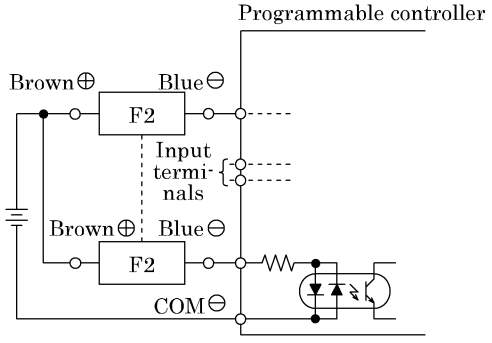


Fig.11 An example of F2 connection to sink input type

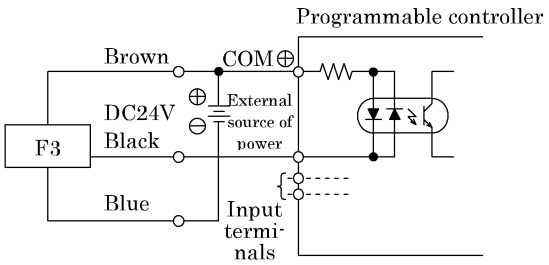


Fig.12 An example of F3 connection to source input type (an external power source)

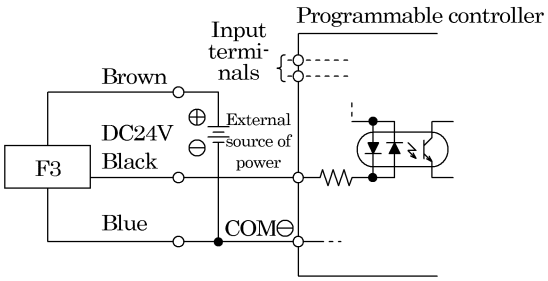


Fig.13 An example of F3 connection to source input type (an internal power source)

4) Series connection

The total voltage will decrease when the F2 switches connections have a leak. Therefore, confirm the input specifications for the programmable controllers, which are the connecting load. However, dimming or total failure of the indicator light may exist.

F3 switches hardly ever leak. When less than 10 μ A, then leakage may occur. Usually dimming and failure of the indicator light do not occur.

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 slack of a bolts and nuts.
   (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”, 4.2 should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.

4.2 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 cylinder.
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 installation direction 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.

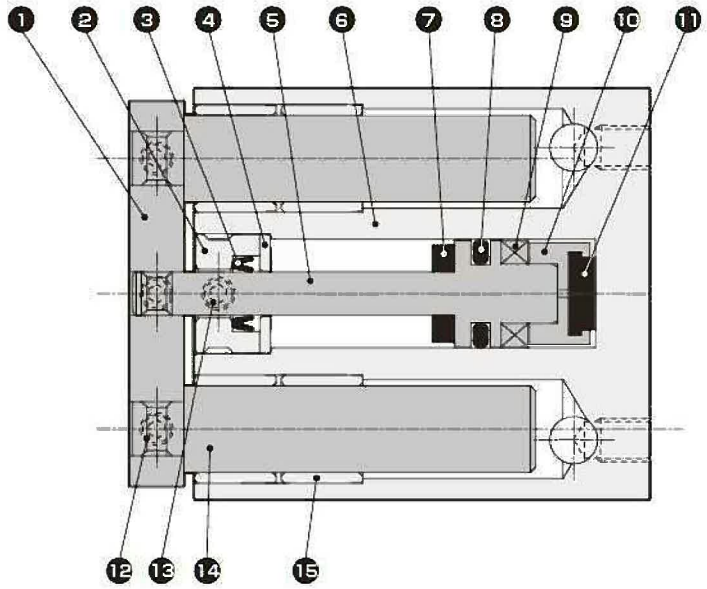
2) Switch

Troubles	Causes	Remedies
Indicator light is not lit.	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.

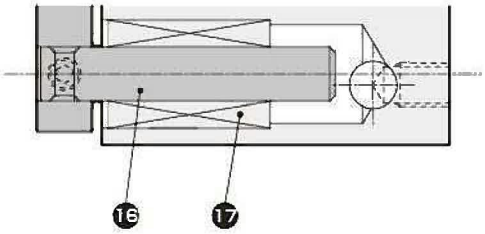
4.3 Disassembling

1) Cylinder of this type is not disassembled.

2) Internal structure drawings.



Metal bush bearing



Ball bearing

Part No.	Part Name	Material	Qty	Note
1	End plate	Aluminum alloy	1	Alumite
2	Rod bushing	Stainless steel	1	
3	Rod packing seal	Nitrile rubber	1	
4	Spacer	Aluminum alloy	1	Chromate
5	Piston	Stainless steel	1	
6	Tube body	Aluminum alloy	1	Hard alumite
7	Cushion rubber R	Urethane rubber	1	
8	Piston packing seal	Nitrile rubber	1	
9	Piston magnet		1	
10	Adaptor	Aluminum alloy	1	Chromate
11	Cushion rubber H	Urethane rubber	1	
12	Hexagon socket head set screw	Stainless steel	3	
13	Hexagon socket head set screw	Stainless steel	1	Chromate
14	Guide rod	Stainless steel	2	Industrial chrome plating(ϕ 10)
15	Metal	Oil impregnated copper alloy	4	
16	Guide rod	Alloy steel	2	Industrial chrome plating
17	Ball bearing		2	

5. HOW TO ORDER

5.1 How to order product

STM – M – 10 – 10 – F2H – D – A

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

(a) Type of bearing		(b) Bore size (mm)	
M	Sliding bearing (Metal bearing)	6	6 dia.
B	Rolling bearing (Ball bearing)	10	10 dia.

(c) Standard stroke (mm)	5	10	15	20
6 dia.	○	○	○	—
10dia.	○	○	○	○

○ : Standard, — : Not available

(d) Switch model No.					※ Lead wire length	
Lead wire straight type	Lead wire L-shaped type	Switch type	Indicator light	Lead wire	No code	1m (Standard)
					3	3m (Optional)
F2H※	F2V※	Solid state	1 color indicator	2 wire	※mark shows lead wire length.	
F3H※	F3V※			3 wire		
F2YH※	F2YV※		2 color indicator	2 wire		
F3YH※	F3YV※			3 wire		

(e) Qty. of switch		(f) Option	
R	One on rod side	A	Side installation type
H	One on head side	R	Rear piping type
D	Two		

5.2 How to order switch

SW – F2H※

(d)

→ Switch model No. (Previous page (d))

6. SPECIFICATION

6.1 Cylinder Specifications

Model / Item		STM-M/B	
Bore size	mm	6 dia.	10 dia.
Actuation		Double-acting type	
Working fluid		Compressed air	
Max. working pressure	MPa	0.7	
Min. working pressure	MPa	0.15	
Proof pressure	MPa	1.05	
Ambient temperature	℃	-10 to 60 (No freezing)	
Port size		M3	
Stroke tolerance	mm	+1.5 0	
Working piston speed	mm/s	50 to 500	
Cushion		With rubber cushion	
Lubrication		Not required (Use Grade 1 ISO VG 32 Turbine oil, if lubrication is preferred)	
Allowable energy absorption	J	0.008	0.054

6.2 switch Specifications

1) Type of switches and applications

Model / Item			Applications (Purpose)
Solid state	2 wire	F2H	DC Programmable controller, exclusive
		F2V	
	3 wire	F3H	DC Programmable controller, Relay
		F3V	
2 color indicator Solid state	2 wire	F2YH	DC Programmable controller, exclusive
		F2YV	
	3 wire	F3YH	DC Programmable controller, Relay
		F3YV	

Note1. F※H expresses the axial lead wire. F※V expresses the radial lead wire.
Note2. When using the STM-B-6 with a two-color indicator reed switch , the cylinder cannot be installed on a magnetized device (steel plate , etc.)

2) Switch specification

Type & Model / Item	Solid state 2 wire	
	F2H/V	F2YH/V
Applications	Programmable controller	
Power supply voltage	—	
Load Voltage	DC10 to 30V	DC24V±10%
Load Current	5 to 20mA (Note 1)	
Current consumption	—	
Internal voltage drop	4V or less	
Indicator light	Yellow LED (ON lighting)	Red/green LED (ON lighting)
Leakage current	1 mA or less	
Lead wire length (Note2)	Standard 1m (Oil resistant vinyl cabtire cord 2 conductor 0.15mm)	
Shock resistance	980m/s^2	
Insulation resistance	20MΩ over at DC500V meggeer	
Withstand voltage	No failure impressed at AC1000V for one minute	
Ambient temperature	-10 to 60℃	
Degree of protection	IEC Standards IP67, JIS C0920 (water tight type), oil resistance	

Type & Model / Item	Solid state 3 wire	
	F3H/V	F3YH/V
Applications	Programmable controller, relay	
Power supply voltage	DC10 to 28V	
Load Voltage	DC30V or less	
Load Current	50mA or less	
Current consumption	10mA or less at DC24V	
Internal voltage drop	0.5V or less	
Indicator light	Yellow LED (ON lighting)	Red/green LED (ON lighting)
Leakage current	10μA or less	
Lead wire length (Note2)	Standard 1m (Oil resistant vinyl cabtire cord 3 conductor 0.15mm^2)	
Shock resistance	980m/s^2	
Insulation resistance	20MΩ over at DC500V meggeer	
Withstand voltage	No failure impressed at AC1000V for one minute	
Ambient temperature	-10 to 60℃	
Degree of protection	IEC Standards IP67, JIS C0920 (water tight type), oil resistance	

Note1 : Maximum value, 20mA is at 25℃ of ambient temperature. Load current decreases less than 20mA when the ambient temperature exceeds 25℃. (For example: it may be 5 to 10mA at 60)

Note2 : 5m long lead wire is optionally available.