CKD

SM-220632-A

INSTRUCTION MANUAL

LINEAR SLIDE CYLINDER

LCS 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

For Safety Use

To use this product safely, 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 application, 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 instruction manual carefully for proper operation.

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

⚠ Precautions

- 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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LCS
Linear Slide Cylinder
Manual No. SM 220632-A

NOTE : Letters & figures enclosed within Gothic style bracket (examples such as [C2-4PP07] · [V2-503-B] etc.) are editorial symbols being unrelated with contents of the book.

Jan.9.1997
Revision : Jun.29.2000

1. PRODUCT

1.1 Specifications

Model code / Item			LCS				
Type of motion			Double action, One end rod type				
Applicable fluid			Compressed air				
Max. operating pressure		MPa	0.7				
Min. operating pressure		MPa	0.15 (Note 1)				
Guaranteed proof pressure		MPa	1.0				
Ambient temperature		℃	−10 to 60 (no freezing)				
Tube bore		mm	φ8	φ12	φ16	φ20	φ25
Connecting port dia.	Side of body		M5			Rc1/8	
	Behind of body		M3		M5		Rc1/8
Tolerance of stroke		mm	+2.0 0 (Note 2)				
Cushion			with rubber cushion				
Lubrication			Not required (Use Turbine oil Class 1, ISO, VG32 if and when lubrication is needed)				

Note 1 : The min. operating pressure becomes 0.2 MPa when using 6 shock-killer type stopper.
2 : Consider a narrow gap between End plate and Floating bushing in case of the use without Stopper.

1.2 Switch Specifications

1) Type of switches and applications

Item / Model code			Application (Purpose)
Solid state type	2-wire	F2H	for DC programmable controller, exclusive
		F2V	
	3-wire	F3H	for DC programmable controller or Relay
		F3V	
	2-wire	T2H	for DC programmable controller, exclusive
		T2V	
	3-wire	T3H	for DC programmable controller or Relay
		T3V	
Reed switch type	2-wire	T0H	for AC/DC Relay or programmable controller
		T0V	
		T5H	for AC/DC programmable controller, relay or IC circuit (not including Lamp), for Series connection
		T5V	

Note 1 : T※H designates Lead cord outlet is straight out type as well as T※V designates Lead cord outlet is L shape type.

2) Switch specifications

Kind and Model code	Reed switch type switch		Solid state type switch	
Item	T0H · T0V	T5H · T5V	F2H · F2V	F3H · F3V
Application	For Relay or Programmable controller	For AC/DC programmable controller, relay or IC circuit (not including Lamp), for Series connection	For Programmable controller, exclusive	For Programmable controller or Relay
Voltage of source of power	———		———	DC10 to 28V
Load voltage and current	DC12/24V, 5 to 50mA AC100V, 7 to 20mA	DC5/12/24V, 50mA or lower AC100V, 20mA or lower	DC10 to 30V 5 to 20mA (Note 1)	DC30V or lower 50mA or lower
Power consumption	———		———	10mA or lower at DC24V (While Power is ON)
Internal voltage drop	2.4V or lower	0V	4V or lower	0.5V or lower
Lamp	LED (Lights while power is ON)	———	LED (Lights while power is ON)	
Leak current	0mA		1 mA or lower	10μA or lower
Length of lead wire (Note 1)	Standard 1m (Oil proof vinyl, Cabtyre wire, 2-wire, 0.2mm²)		Standard 1m (Oil proof vinyl, Cabtyre wore, 2-wire, 0.15mm²)	Standard 1m (Oil proof vinyl, Cabtyre wore, 3-wire, 0.15mm²)
Max. shock	294m/s² {30G}		980m/s² {100G}	
Insuration resistance	20MΩ or more by DC 500V megger			
Insuration voltage	No abnormalities upon charging AC1000V for one minute.			
Ambient temperature	−10 to + 60°C			
Protective structure	IEC Standard IP67, JIS C0920 (Intrusion type without water), Oil proof			

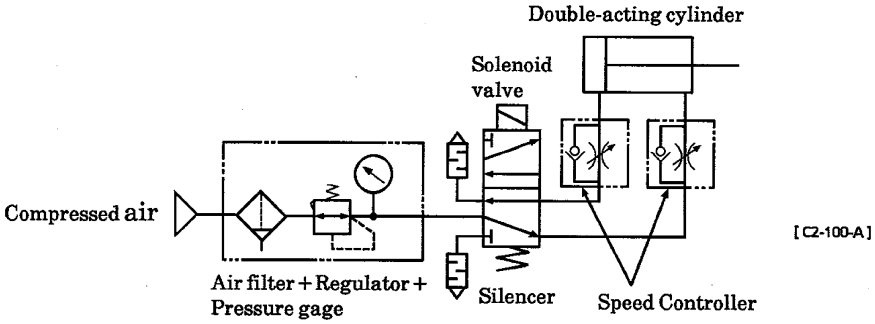
Kind and Model code	Solid state type switch			
Item	T2H · T2V	T2YH · T2YV	T3H · T3V	T3YH · T3YV
Application	For Programmable controller, exclusive		For Programmable controller or Relay	
Voltage of source of power	———		DC10 to 28V	
Load voltage and current	DC10 to 30V 5 to 20mA (Note 1)		DC30V or lower, 100mA or lower	DC30V or lower, 50mA or lower
Power consumption	———		10mA or lower at DC24V (While Power is ON)	
Internal voltage drop	4V or lower		0.5V or lower	
Lamp	LED (Lights while power is ON)	LED (Red/Green) (Lights while power is ON)	LED (Lights while power is ON)	LED (Red/Green) (Lights while power is ON)
Leak current	1 mA or lower		10μA or lower	
Length of lead wire (Note 1)	Standard 1m (Oil proof vinyl, Cabtyre cord, 2-core, 0.2mm²)		Standard 1m (Oil proof vinyl, Cabtyre cord, 3-core, 0.2mm²)	
Max. shock	980m/s² {100G}			
Insuration resistance	20MΩ or more by DC 500V megger	100MΩ or more by DC 500V megger	20MΩ or more by DC 500V megger	100MΩ or more by DC 500V megger
Insuration voltage	No abnormalities upon charging AC1000V for one minute.			
Ambient temperature	−10 to +60°C			
Protective structure	IEC Standard IP67, JIS C0920 (Intrusion type without water), Oil proof			

Note 1 20 mA of above maximum load current is obtained at 25C. If the switch operating ambient temperature is higher than 25C, this maximum load current becomes less than 20 mA. (The load current becomes 5 to 10 mA at 60C.)

1.3 Fundamental Circuit Diagram & Selection of Related Equipment

1) Fundamental Circuit Diagram of Double-acting Cylinder (Oilless type)

Fundamental Circuit Diagram:



2) Selection of Related Equipment with the Fundamental Circuit Diagram above :

The related equipment depends on the tubes inner diameter and speed of the driving cylinder. Select equipment from the Selection Guide Table. (The table posted below is an example of related equipment.)

Selection Guide Table for Related Equipment (example)

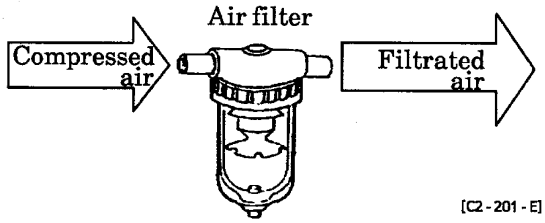
Tube bore (mm)	Theoretical speed (mm/s)	Required flow ℓ/min at P=0.5MPa	Solenoid valve		Speed Controller	Silencer	Plumbing Tube (Between solenoid valve and cylinder)
			Single Solenoid	Double Solenoid			
φ6	400	10	4SA010 4SB010	4SA020 4SB020	SC3W-M3-3.2,4 SC3WU-M3-3.2,4	SLM-M5	φ4×φ2.5 Nylon Tube
φ8		15	4KA110 4KB110	4KA120 4KB120	SC3W-M5-3,4,6 SC3WU-M5-3,4,6	SLM-M5 SLW-6A	φ6×φ4 Nylon Tube
φ12		35					
φ16		60					
φ20		90	4KA210 4KB210	4KA220 4KB220	SC3W-6-4,6,8 SC3WU-6-4,6,8	SLM-M5 SLW-6A	φ8×φ6 Nylon Tube
φ25		140					

2
CAUTION

2. CAUTION

2.1 Fluid

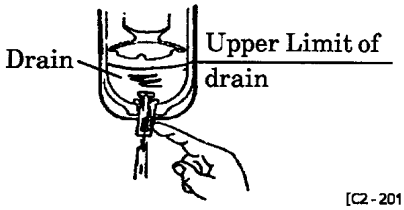
1) It is necessary to use dehumidified air that has been filtered from compressed air. Carefully select an adequate filter that has an adequate filtration rate (preferably 5μm or less), flow rate and its mounting location (as nearest to the directional control valve as possible).



[C2-201-E]

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 inspection and maintenance of the compressor.

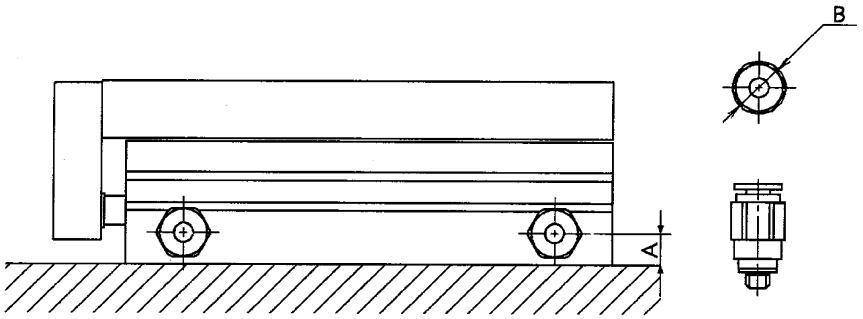


[C2-201-F]

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
CAUTION

5) Refer to the table, posted below, to select suitable joints because there are some restrictions for choosing appropriate plumbing joints.

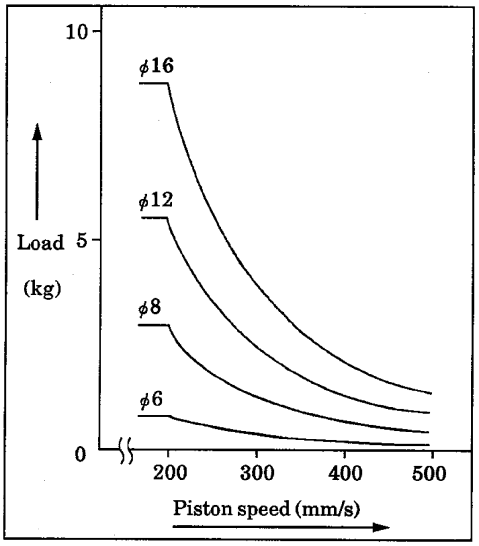


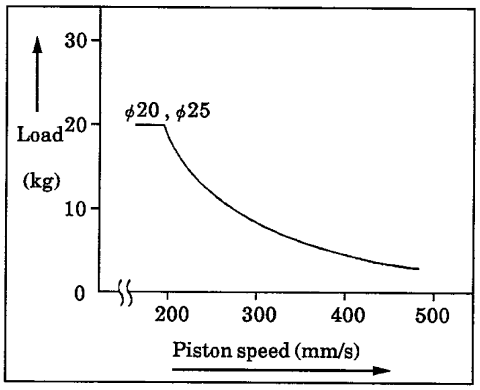
Item / Tube bore (mm)	Port diam.	Port location A	Available joints	Joint OD φB
φ6	M3×0.5	4	SC3W-M3-3.2, 4 SC3WU-M3-3.2, 4	φ7.4
φ8	M5×0.8	5.5	SC3W-M5-3, 4, 6 SC3WU-M5-3, 4, 6	φ9.6
φ12				
φ16		6.5		
φ20	Rc1/8	8	SC3W-6-4, 6, 8 SC3WU-6-4, 6, 8	φ14.6
φ25		9		

3. OPERATION

1) Air pressure supplied to the cylinder is as per specified in Section 1, "Specifications" and operates it within the 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 piston speed by installing speed controllers as per illustration in the Fundamental Circuit Diagram, page 3.

● Graphs for Tolerable kinetic energy



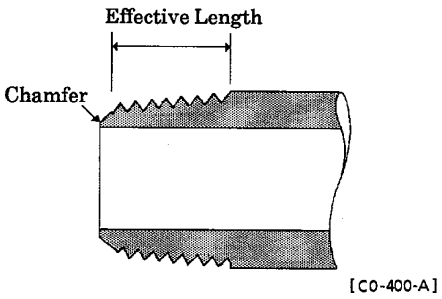


Note : The area left and under the plotted curve designates serviceable range for the cylinder. Additional external cushion is required to operate the cylinder within the area of right and upper plotted curve.

4. INSTALLATION

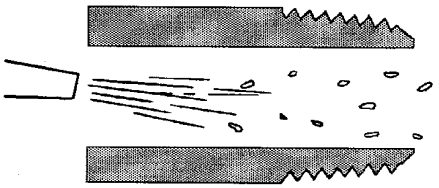
4.1 Piping

1) For piping beyond the filter, use pipes that are tough against corrosion such as galvanized pipes, nylon tubes, rubber tubes, etc. (Refer to Selection Guide Table for Related Equipment.)
2) See to it that the pipe connecting cylinder and solenoid valve has an effective sectional area which is needed for the cylinder to drive at the specified speed. (Refer to Selection Guide Table for Related Equipment.)
3) Install filter preferably adjacent to the upper-stream to the solenoid valve for eliminating rust and foreign substances in the drain of the pipe.
4) Be sure to adhere to the effective thread length of gas pipe and make a chamfer of approx. 1/2 pitch from the threaded end.



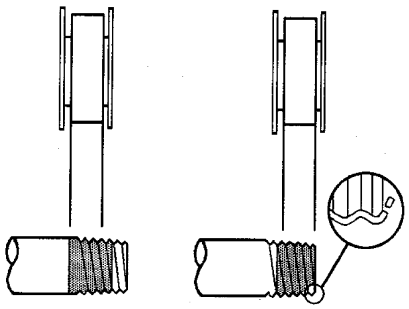
[C0-400-A]

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

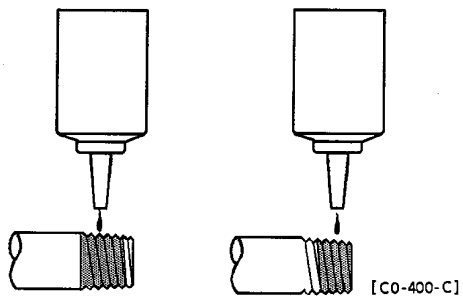

[C0-400-B]

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

● Seal Tape



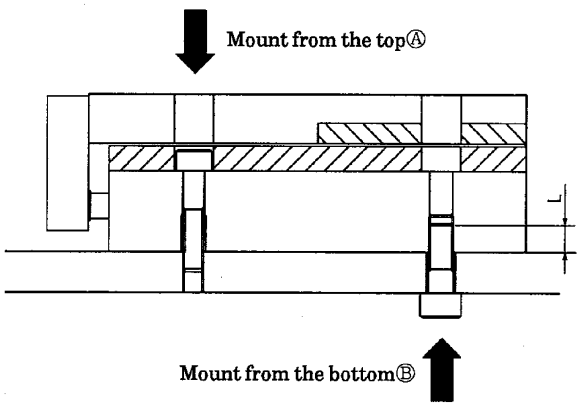
● Sealant (Paste or liquid)



[C0-400-C]

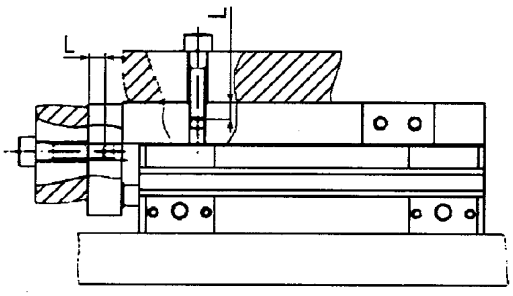
4.2 Installation

1) Operate cylinder within the range (−10℃ to +60℃, standard) of tolerance ambient temperature.
2) Install cylinder directly on the mounting plate using hex. socket headed bolts.



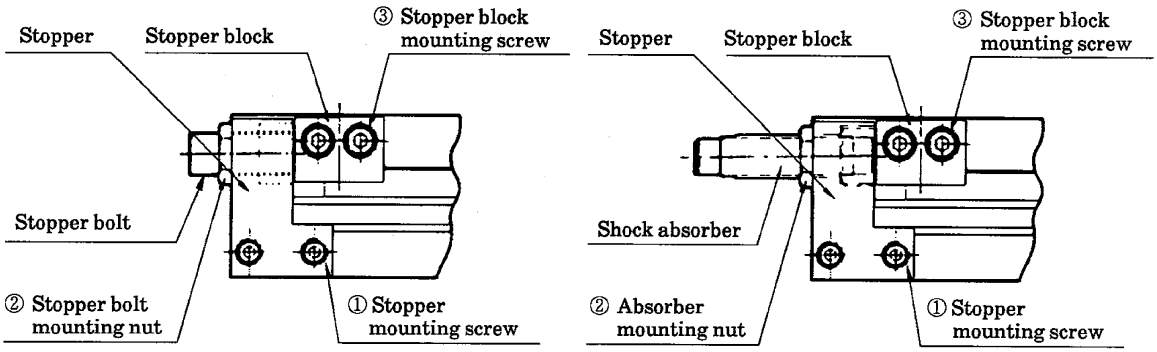
Item	Ⓐ		Ⓑ		
	Applicable screw	Tightening torque (N·m)	Applicable screw	Tightening torque (N·m)	Screw-in length L (mm)
LCS-6	M3×0.5	0.6 to 1.1	M4×0.7	1.4 to 2.4	4 to 6
LCS-8					
LCS-12	M4×0.7	1.4 to 2.4	M5×0.8	2.9 to 5.1	5 to 8
LCS-16			M6×1.0	4.8 to 8.6	6 to 9
LCS-20	M5×0.8	2.9 to 5.1			
LCS-25	M6×1.0	4.8 to 8.6	M8×1.25	12.0 to 21.6	8 to 12

3) Always strictly observe the following screw-in length and tightening torque values when mounting the jig on the slide table and end table.



Item	Slide table and end plate		
	Applicable screw	Tightening torque (N·m)	Screw-in length L (mm)
LCS-6	M3×0.5	0.6 to 1.1	3 to 4.5
LCS-8			
LCS-12	M4×0.7	1.4 to 2.4	4 to 6
LCS-16	M5×0.8	2.9 to 5.1	5 to 7.5
LCS-20			
LCS-25	M6×1.0	4.8 to 8.6	6 to 9

4) Strictly observe the following screw and nut tightening torque values of the stopper.



Item	① Stopper mounting screw (N · m)	② Stopper bolt mounting nut ② Absorber mounting nut (N · m)	③ Stopper block mounting screw (N · m)
LCS-6	0.4 to 0.5	1.2 to 2.0	0.6 to 0.8
LCS-8			
LCS-12	0.6 to 0.8		
LCS-16		3.0 to 4.0	1.4 to 1.8
LCS-20	2.9 to 3.5	4.5 to 6.0	
LCS-25			2.9 to 3.5

4.3 Allowable load

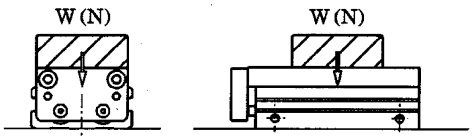
(1) Calculate the load (W) mounted on the table and the affected moment (M1, M2, M3) for each direction.

(2) Input the calculated values into the following formula and the each value which are shown on the following table.

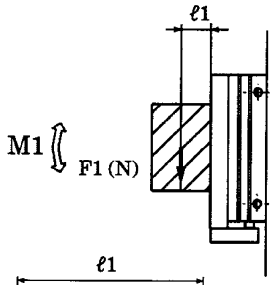
$$\frac{w}{wmax}+\frac{M1}{M1max}+\frac{M2}{M2max}+\frac{M3}{M3max}\leqq 1.0$$

Tube bore	Stroke (mm)	Vertical load Wmax (N)	Bending moment M1max (N · m)	Radial moment M2max (N · m)	Twisting moment M3max (N · m)
ϕ6	0 to 30	140	1.7	3.5	1.7
	40 to 50	186	10.68	5.64	10.68
ϕ8	0 to 30	140	1.7	3.5	1.7
	40 to 75	186	10.68	5.64	10.68
ϕ12	0 to 50	220.8	5.68	9.76	5.68
	75 to 100		22.2		22.2
ϕ16	0 to 50	380.8	17.82	19.2	17.82
	75 to 125		37.28		37.28
ϕ20	0 to 50	548.8	31.14	37.6	31.14
	75 to 150		56.24		56.24
ϕ25	0 to 50	961.5	65.11	116.25	65.11
	75 to 150		127.5		127.5

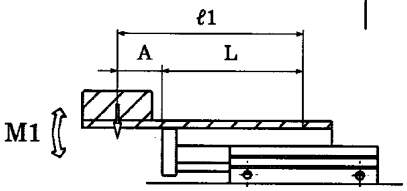
● Vertical load : W (N)



● Bending moment : M1 (N · m)

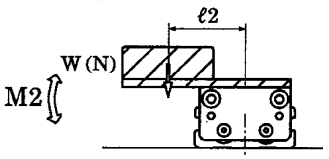


M1 = F1 × ℓ1

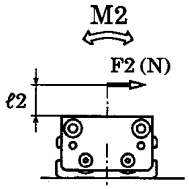


M1 = W × ℓ1
ℓ1 = A + L
See the lower table for the mark "L"

● Radial moment : W (N)

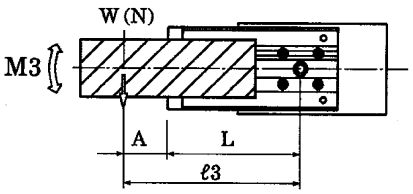


M2 = W × ℓ2

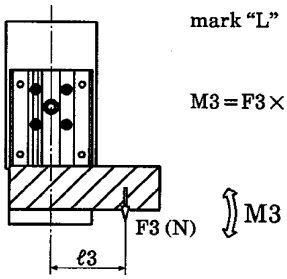


M2 = F2 × ℓ2

● Twisting moment : M1 (N · m)



M3 = W × ℓ3
ℓ3 = A + L
See the lower table for the mark "L"



M3 = F3 × ℓ3

Note : The upper mentions shown under the condition with the load on the table.
Contact our member at the case of the use with the load on End plate.

The Valve of the mark "L" (unit : m)

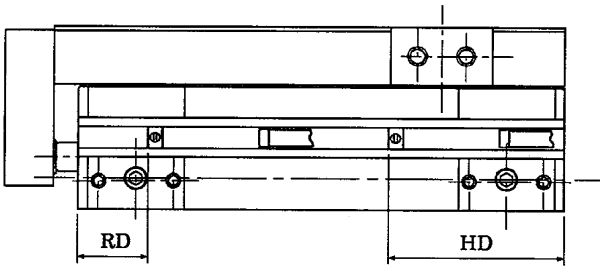
Stroke / Model	10	20	30	40	50	75	100	125	150
LCS-6	0.048	0.048	0.054	0.073	0.083	—	—	—	—
LCS-8	0.049	0.049	0.059	0.073	0.083	0.108	—	—	—
LCS-12	0.070	0.070	0.070	0.080	0.090	0.117	0.142	—	—
LCS-16	0.071	0.071	0.071	0.081	0.091	0.124	0.149	0.174	—
LCS-20	0.081	0.081	0.081	0.091	0.101	0.131	0.156	0.181	0.206
LCS-25	0.085	0.085	0.085	0.095	0.105	0.140	0.165	0.190	0.215

4.4 Switch installation

1) Switch mounting positions

(1) Stroke end mounting

To activate the switches at their most sensitive positions, mount the switches at a distance of RD on the rod side and at a distance of HD on the head side (for details, see page 12).



(2) Intermediate stroke mounting

Fix piston at the position where it is expected to stop. Slide switch back and forth along cylinder beyond fixed piston to locate positions where switch turns ON respectively. The center of those two points is the most sensitive position to have switch actuated. It is best suited where to have switch installed.

- How to slide switch

Loosen its mounting screws then slide switch back and forth along cylinder tube. Tighten screws after locating the point to have switch installed.

- How to replace the switch

Loosen its mounting screws then slide the switch all the way out of the groove on the cylinder side. Slide new one back to the groove. Locate its setting point and tighten mounting screws. (Apply screw setting torque to 0.1 to 0.2N · m)

2) Actuation range

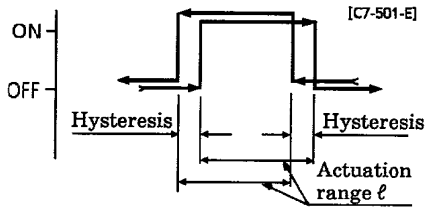
(1) It is the distance from where switch turns ON, while the piston strokes one way to the point where it turns OFF, while the piston continues to stroke in the same direction.

(2) The center of actuation range is the most sensitive point for the actuate switch. At this point, due to being the least of external magnetic disturbance, switch actuates most stably.

3) Hysteresis

(1) Switch turns ON while piston moves one way. Switch turns OFF while piston reverses its way after stopping at the point where switch turned ON once. The distance from ON point to OFF point is called hysteresis.

(2) When piston stops within the hysteresis, switch actuation becomes unstable as it easily is disturbed by an external magnetic field. Carefully avoid making it stop here.



The table of The most sensitive positions (HD & RD), Actuation range and Hysteresis

(Unit in mm)

The most sensitive position / Tube bore (mm)		Stroke									Solid state type switch (F2H/V, F3H/V)	
		10	20	30	40	50	75	100	125	150	Actuation range	Hysteresis
φ6	HD	22.5					—				2.5 to 3.5	1.5 or less
	RD	25.5	15.5		25.5		—					

The most sensitive position / Tube bore (mm)		Stroke									Solid state type switch (T2H/V, T3H/V)		Reed switch type switch (T0H/V, T5H/V)	
		10	20	30	40	50	75	100	125	150	Actuation range	Hysteresis	Actuation range	Hysteresis
φ8	HD	27.5			36.5			—			1.5 to 4	1.5 or less	5 to 9	3 or less
	RD	18.5	8.5					—						
φ12	HD	32.5					41.5		—		1.5 to 5		6 to 10	
	RD	34.5	24.5	14.5					—					
φ16	HD	36.5					53.5			—	1.5 to 5		4 to 9	
	RD	34.5	24.5	14.5						—				
φ20	HD	44.5					56				3 to 8		6 to 14	
	RD	35	25	15										
φ25	HD	59					79.5				3 to 9		5 to 14	
	RD	35.5	25.5	15.5										

※ Cylinder is shipped ex-factory having switches mounted at HD & RD locations respectively.

5. OPERATIONAL CAUTIONS OF SWITCHES

5.1 General Cautions

1) Magnetic environment

Avoid usage of these switches within the area where a strong magnetic field or large current exists. (such as a large magnet or spot welding equipment) Position censoring errors will result when installing many cylinders with switches that are parallel or a magnetized piece come across the cylinder due to intervention among each other.

2) Protection of lead cord

Pay consideration to eliminate bending stress or stretching of the lead cord while laying the cord. For the moving portion, use a cord of flexibility as for building a robot.

3) Service temperature

It is unsuitable to operate in high temperatures (above 60°C) due to thermal characteristics of magnetic parts and electronic parts. Eliminate operation in such high temperatures.

4) Intermediate position sensing

Beware of unstable responses of relay when piston speed is excessive in the event of intending actuation of switch in the way of piston stroke.

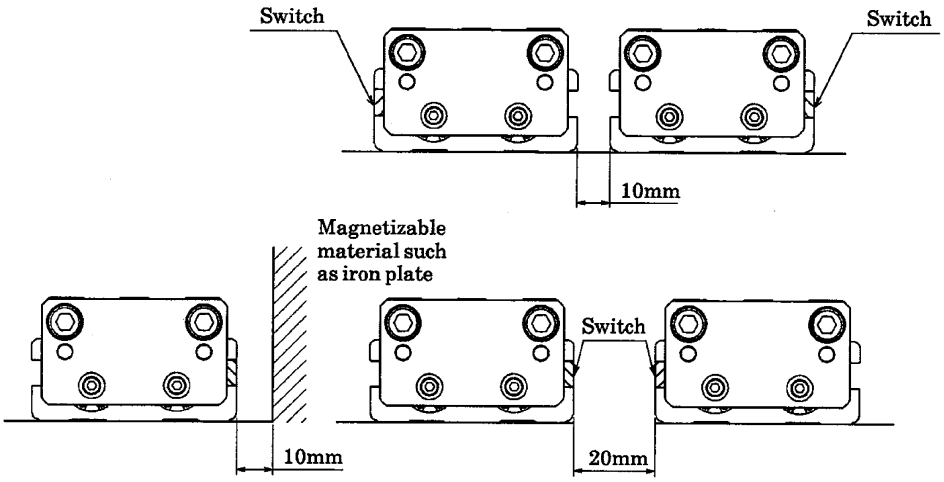
(Example) Operate cylinder with a speed of less than 500mm/s in case the relay actuation time is 20ms.

5) Shock

Carefully avoid big shocks or vibrations during transportation of the cylinder or mounting and adjusting the switch.

6) Magnetizable material such as an iron plate nearby the cylinder switch is apt to cause malfunction of the cylinder switches. Keep it at least 10mm away from the cylinder surface. (This is applicable for all bore sizes of tube.)

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


Switch
Switch
10mm
Magnetizable
material such
as iron plate
Switch
10mm
20mm

5.2 Operational Cautions, Proximity switch

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.

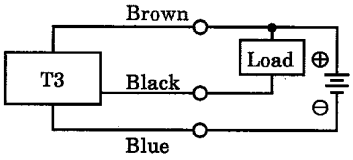


Fig.1 An example of the power for switch and load is the same.

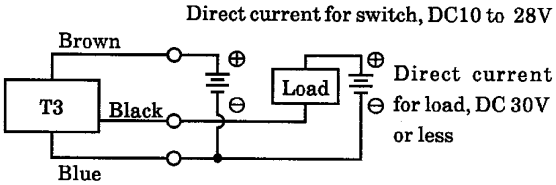


Fig.2 An example when the power for switch and load is independent.

2) Protection of output circuit

Install some protective circuit as illustrated in Fig. 3 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. 4 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. 5 or 6 (in case of model T2) and Fig 7 (in case of model T3)

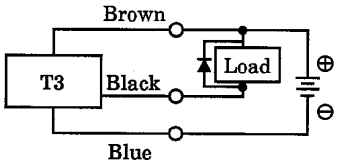


Fig.3 An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.

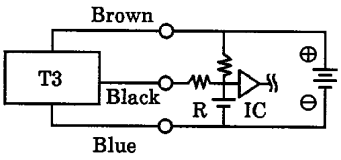


Fig. 4 An example of using capacitor type load together with current regulating resister R. Comply with the following formula to figure out required R. $\frac{V}{0.10} = R\,(\Omega)$

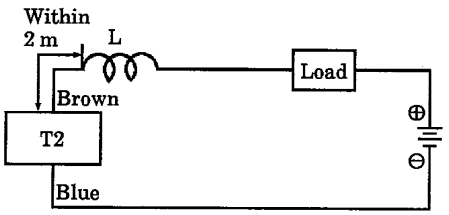


Fig. 5 ● Choke coil L
L= a couple hundred μH to a couple mH surpassing high frequency characteristic
● Install it nearby the switch (within 2 m).

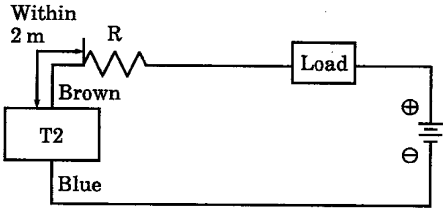


Fig. 6 ● Dash current restriction resister R
R= As much large resister as the load circuit can afford.
● Install it nearby the switch (within 2 m).

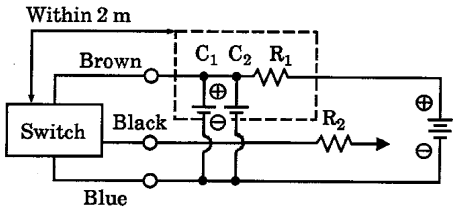


Fig. 7

- Electric power noise absorptive circuit C1
  C_1 = 20 to 50μF electrolytic capacitor (withstanding 50V or more)
  C_2 = 0.01 to 0.1μF ceramic capacitor
  R_1 = 20 to 30Ω
- Dash current restriction resister R2
  R_2 = As much large resister as the load circuit can afford.
- Install it nearby the switch (within 2 m).

3) Connection to a programmable controller (Sequencer)

Type of connection varies depending upon the model of the programmable controller. Refer to the following Fig. 8 to 12 respectively.

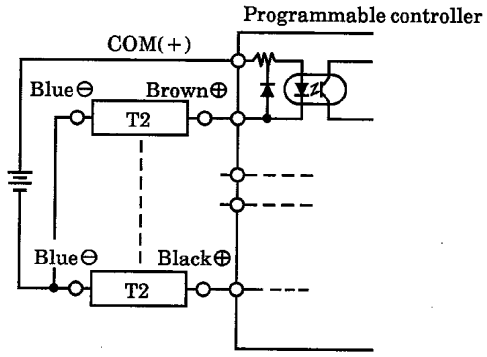


Fig. 8 An example of T2 connection to source input type (an external power source)

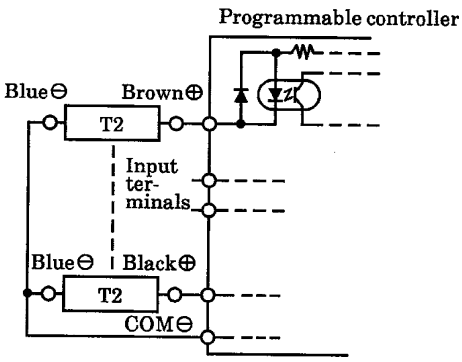


Fig. 9 An example of T2 connection to source input type (an internal power source)

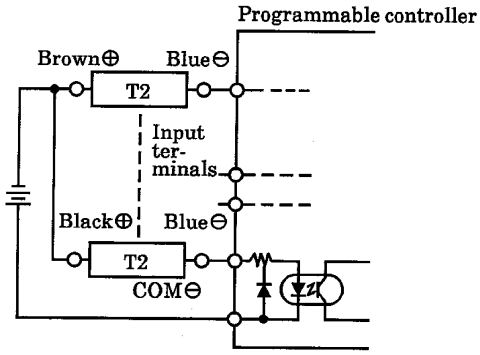


Fig. 10 An example of T2 connection to sink input type (an internal power source)

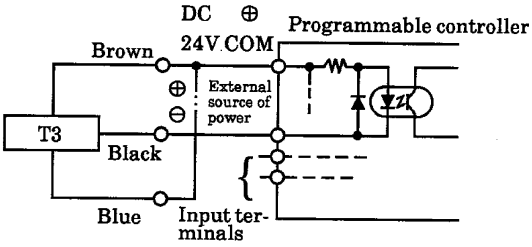


Fig. 11 An example of T3 connection to source input type (an external power source)

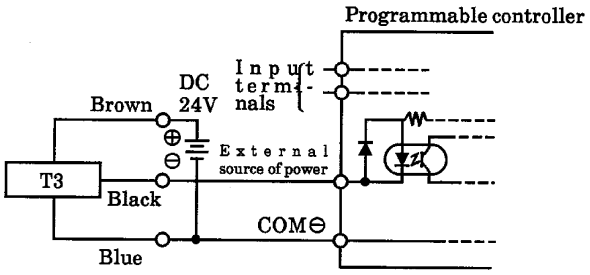


Fig. 12 An example of T3 connection to source input type (an internal power source)

4) Series connection

The total voltage will decrease when the T2 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 lamp may exist.

T3 switches hardly ever leak. When less than 10μA, then leakage may occur. Usually dimming and failure of the lamp do not occur.

5) Magnetic environment

Avoid usage of these switches within the area where a strong magnetic field or large current exists. (such as a large magnet or spot welding equipment) Position censoring errors will result when installing many cylinders with a switch which is parallel or a magnetized piece come across the cylinder due to intervention among them.

6) Protection of lead cord

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

5.3 Operational cautions, Contact point switch, Model T0 & T5

1) Connection of lead cord

Instead of connecting the cord to the power source directly, always connect to the load in series. In case of model T0 connection, pay the following precautions.

Ⓐ For DC connection, use such polarities of cords as Brown ⊕ and Blue ⊖. The switch still functions right with reversed polarities but lamp is not lit.

Ⓑ For AC connection to either relay or input terminal to programmable controller, Switch lamp sometimes is not lit in case when half-wave rectification is being carried out. Lamp is lit, in this occasion, when polarities of cords for switch is reversed.

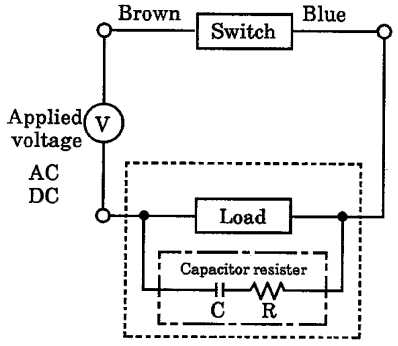
2) Capacity of contact points

Avoid using a load exceeding the max. capacity of contact points. On the other hand, in case of T0 model, switch lamp may not be lit sometimes when current is lower than the rated current.

3) Protection of contact point

Install such a protective circuit as illustrated in either Fig 1 or 2, as follows, when inducing a type load such as a relay is to be used.

Furthermore, install such protective circuits as illustrated in either Fig. 3 or 4, on the following page, in case the cord length exceeds the length per following table.

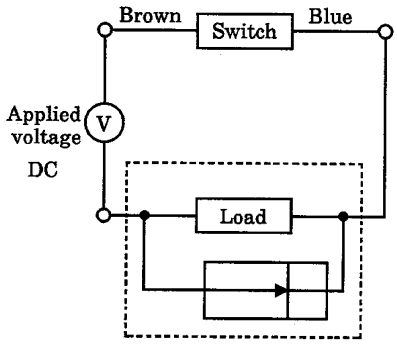


User circuit

Protective circuit (Spark absorbing circuit)

Recommended value C (Capacitor) = 0.033to 0.1μF
R (Resister) = 1to 3kΩ
XEB1K1 Okaya Denki Mfg. or equivalent

Fig. 1 When capacitor resister is used.

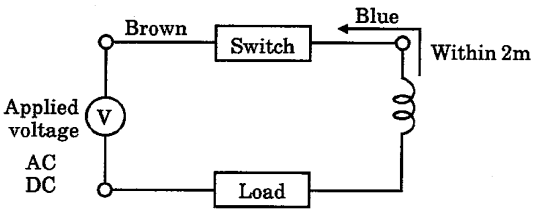


User circuit

Protective circuit

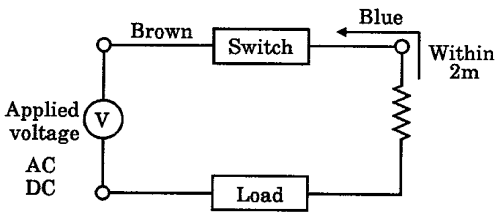
Rectifying diode, general use
Hitachi Mfg. product V06C or equivalent

Fig.2 When diode is used.



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

Fig. 3



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

Fig. 4

4) Relay

Use such products as specified below or equivalent.

OMRON Mfg.	model MY
Fuji Denki Mfg.	model HH5
Matsushita Denki Mfg.	model HC

5) Series connection

Total voltage loss, when connected T0 switches in series, equals to the sum of respective voltage loss of each switch. The total voltage loss becomes equivalent to one T0 (approx. 2.4V) when connecting the combination of one T0 for actuation confirming and rest of switches T5s. Lamp is lit only when all switches turn on.

6) Parallel connection

There is no restriction in parallel connection number of switches of these types. Multi number connection of model T0s, sometimes, cause a dimmed lamp or complete lamp failure.

7) Magnetic environment

Avoid usage of these switches within the area where strong magnetic fields or large currents exist. (such as a large magnet or spot welding equipment) Position censoring errors will result when installing many cylinders with switch in parallel or magnetized piece come across the cylinder due to intervention among each other.

8) Protection of lead cord

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

6. MAINTENANCE

6.1 Periodical Inspection

1) In order to upkeep the cylinder in optimum condition, carry out periodical inspection once or twice a year.

2) Inspection items

ⓐ check the bolts and nuts fitting the piston rod end fittings and supporting fittings for looseness.

ⓑ Check to see that the cylinder operates smoothly.

ⓒ Check any change of the piston speed and cycle time.

ⓓ Check for internal and external leakage.

ⓔ Check the piston rod for flaw (scratch) and deformation.

ⓕ Check the stroke for abnormality.

See "Troubleshooting", 6.2, should there be any trouble found, also carry out additional tightening if bolts, nuts, etc.are loose.

6.2 Troubleshooting

1) Cylinder

Troubles	Causes	Countermeasures
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 supporting system.
	Broken packing	Replace the packing.
Does not function smoothly	Lower speed than rated	Reduce the load. Consider the use of a hydraulic cylinder.
	Improper or misalignment of installation	Correct the installation state and/or change the supporting system.
	Exertion of transverse (lateral) load	Revise the installation state and/or change the supporting system.
	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. Install cushion device with more efficiency. (External cushion)
	Exertion of transverse load	Revise the installation state and/or change the supporting system.

2) Switch

Troubles	Causes	Countermeasures
Lamp is not lit.	Deposited contact point	Replace the switch.
	Excessive load than rated capacity	Replace the relay (recommended one) Replace the switch
	Damage to the lamp	Replace the lamp.
	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
	Incorrect direction of switch mounting	Correct the direction of the switch.
	Relay is unable to respond properly within the piston stroke	Adjust speed slow Replace the relay
	Excessive load than rated capacity	Replace the relay (recommended one) Replace the switch
Switch does not return.	Piston is not moving	Correct to have piston move.
	Deposited contact point	Replace the switch
	Excessive load (relay) than rated capacity	Replace the relay (recommended one) Replace the switch
	Improper ambient temperature	Adjust the ambient temperature within the range of −10~60°C
	Existence of a foreign magnetic field	Shield the magnetic field.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.

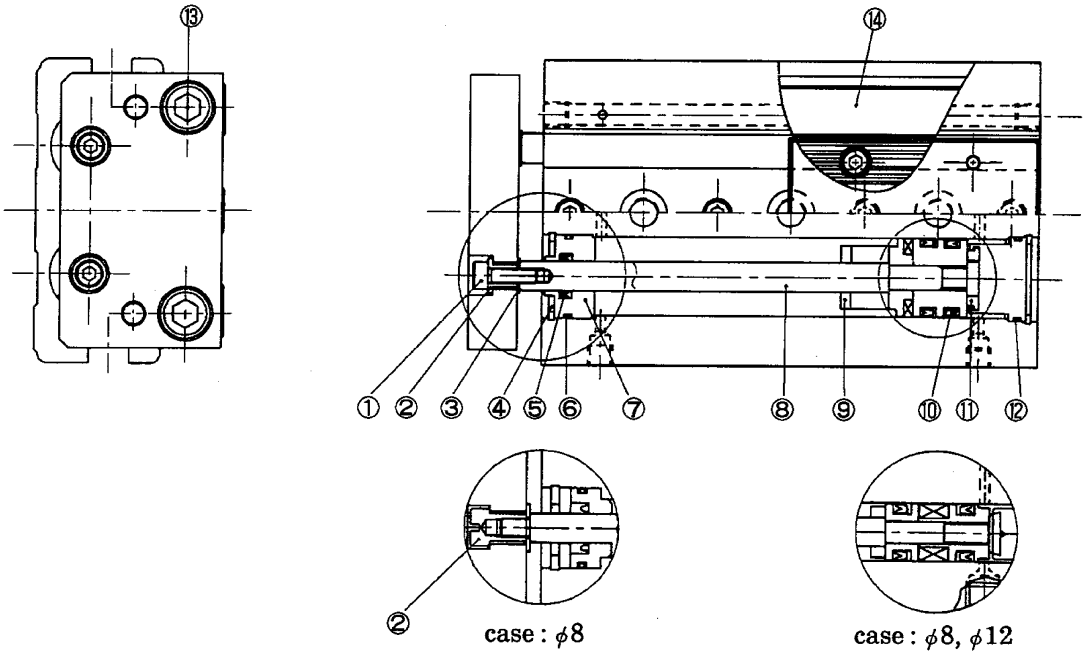
6.3 Disassembly

1) Cylinder of this type is able to be disassembled. Disassemble it, referring to the Internal structural drawing, should there be any disorder such as air leakage then replace the expendable parts refer to Exp. parts list posted below.

2) Keep the cylinder rod at a pulled down position befor disassembly. Remove Bolt① (Floating bushing② at the case of ϕ8), Floating bushing② and Washer③. Fix Slide table⑭ to Main body with an adhesive tape.(Because the linear guide don't have any stopper, and it is possible to fall off.)
Next, remove Hex. socket headed bolt⑬, and Retaining ring-C type④, and pull up Piston rod⑧ with Rod metal⑦.

Operate the reverse procedure for the assembly. Never forget to grease on packings.

3) Internal structure drawings and Expendable parts list



Expendable Parts list (Designate the Kit No. when ordering)

Tube bore (mm) / Part name / Kit No. / Part No.	⑤	⑥	⑨
	Rod packing	Metal gasket	Rubber cushion(R)
φ6	LCS-6K	DYR-3K	P12115-0460081	F4-662938
φ8	LCS-8K	DYR-4K	P12115-0900080	F4-252066
φ12	LCS-12K	MYN-6	P12115-1160070	F4-166347
φ16	LCS-16K	DYR-6K	P12115-1500100	F4-160423
φ20	LCS-20K	DYR-8K	P12115-1900150	F4-160424
φ25	LCS-25K	DYR-10SK	AS568-020	F4-116102

Tube bore (mm) / Part name / Kit No. / Part No.	⑩	⑪	⑫
	Piston packing	Rubber cushion(H)	Gasket
φ6	LCS-6K	MYP-6	F4-160422	P12115-0510100
φ8	LCS-8K	MYP-8		P12115-0900080
φ12	LCS-12K	MYP-12	F4-659142	P12115-1160070
φ16	LCS-16K	MYP-16	F4-659122	P12115-1500100
φ20	LCS-20K	MYP-20	F4-659113	P12115-1850080
φ25	LCS-25K	F4-348074		P12115-2350080

7. HOW TO ORDER

7.1 Product Code

• Without Switch

LCS – 8 – 40 ——————— S5

• With Switch

LCS – 12 – 40 – T0H※ – R – A1DT

ⓐ ⓑ ⓒ ⓓ ⓔ

ⓐ Tube bore (mm)	
Code	Discription
6	ϕ6
8	ϕ8
12	ϕ12
16	ϕ16
20	ϕ20
25	ϕ25

ⓑ Stroke (mm)		Tube bore					
Code	Standard stroke	ϕ6	ϕ8	ϕ12	ϕ16	ϕ20	ϕ25
10	10 mm	○	○	○	○	○	○
20	20 mm	○	○	○	○	○	○
30	30 mm	○	○	○	○	○	○
40	40 mm	○	○	○	○	○	○
50	50 mm	○	○	○	○	○	○
75	75 mm	—	○	○	○	○	○
100	100 mm	—	—	○	○	○	○
125	125 mm	—	—	—	○	○	○
150	150 mm	—	—	—	—	○	○

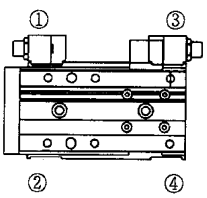
○ : Standard , — : Unavailable

ⓒ Switch model code				
LEad cord type				
Straight	L-shape			
T0H※	T0V※	Reed switch type		2-wire
T5H※	T5V※			
T2H※	T2V※	Solid state type		
F2H※	F2V※			
T3H※	T3V※			3-wire
F3H※	F3V※			

※ Lead cord length	
No code	1m (Standard)
3	3m (Optional)
5	5m (Optional)

ⓓ Qty of switch	
Code	Discription
R	Rod end, 1 ea.
H	Head end, 1 ea.
D	Switches, 2 ea.

ⓔ Option					
S : Hexagon socket set screw with Urethane type stopper (Standard)			A : Shock killer type stopper		
S1※※	Stopper position ①	See the lower drawing for the mounting position of the stopper	A1※※	Stopper position ①	See the lower drawing for the mounting position of the stopper
S2※※	Stopper position ②		A2※※	Stopper position ②	
S3※※	Stopper position ③		A3※※	Stopper position ③	
S4※※	Stopper position ④		A4※※	Stopper position ④	
S5※※	Stopper position ①, ③		A5※※	Stopper position ①, ③	
S6※※	Stopper position ②, ④		A6※※	Stopper position ②, ④	



※※ (note 4)	
No mark	Port of the stopper : no port
D	Port of the stopper : side, bottom
No mark	Material of the stopper block : rolled steel
T	Material of the stopper block : hardened steel

Note 1: Stroke adjustable range of Hexagon socket set screw with Urethane type stopper (Standard) is 5mm for one direction. Use stroke adjustable stopper at the case of the change for the stroke.

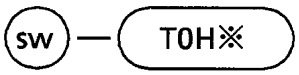
Note 2: Possible to change the stopper on the position① to the one on the position④, and the stopper on the position② to the one on the position③.
Be carefull : Imposible to change① to ② and ③ to ④.

Note 3: The port positions for standard type at the case of no stopper are position② and ④.

Note 4: Possiblt to select only at the case of the stopper type.

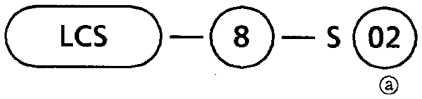
7.2 Parts Code

1) Switch
Code of switch



Switch code No.
(Same category with Ⓓ on preceding page.)

2) Stroke adjustalbe stopper
Code of stroke adjustable stopper



ⓐ Stroke adjustable range	
01	5mm for one direction (standard)
02	15mm for one direction
03	25mm for one direction

Imposible to offer S03 for ϕ8.