Discontinue

Use of wide and high precision guide increases accuracy & rigidity.

For linear slide cylinder LCS, wide and high precision guide is used.
This is high precision actuator with increased operational reliability.
(6, 8, 12, 16, 20, 25 mm)

High precision guide provided

High cylinder position accuracy, and wide guide realizes radial moment resistant high rigid structure.

Reliable operation oriented design

Power of twin rods and accuracy/rigidity of wide linear guide are combined.
Reliable operation will be realized.

Increasing flexibility in design

Multi-side piping, two side installation, dowel hole, symmetry shape design etc., increasing flexibility in design stage.

Wide optional variation

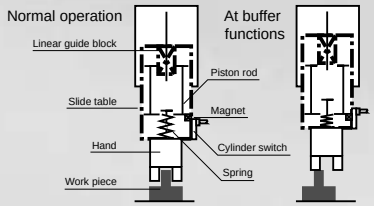
6 types of bore size from 6 to 25 mm, 10 to 150 mm stroke, buffer, shock absorber type stopper, stopper for adjustable stroke, and position locking are available.

Stopper for adjustable stroke

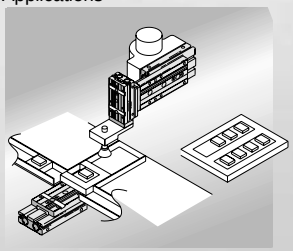
Shock absorber type stopper

Buffering function

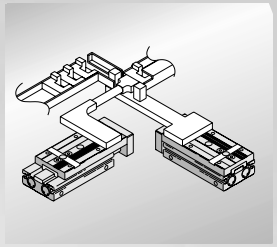
When work piece collides with driving section at cylinder advanced, buffer functions to protect a work piece and the cylinder. This is optimum for the top of pick & place etc. that need buffer function.
Cylinder switch detects buffer operation can be installed (B1, B2 only). Detection of line failure is possible.



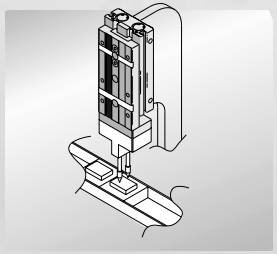
Applications



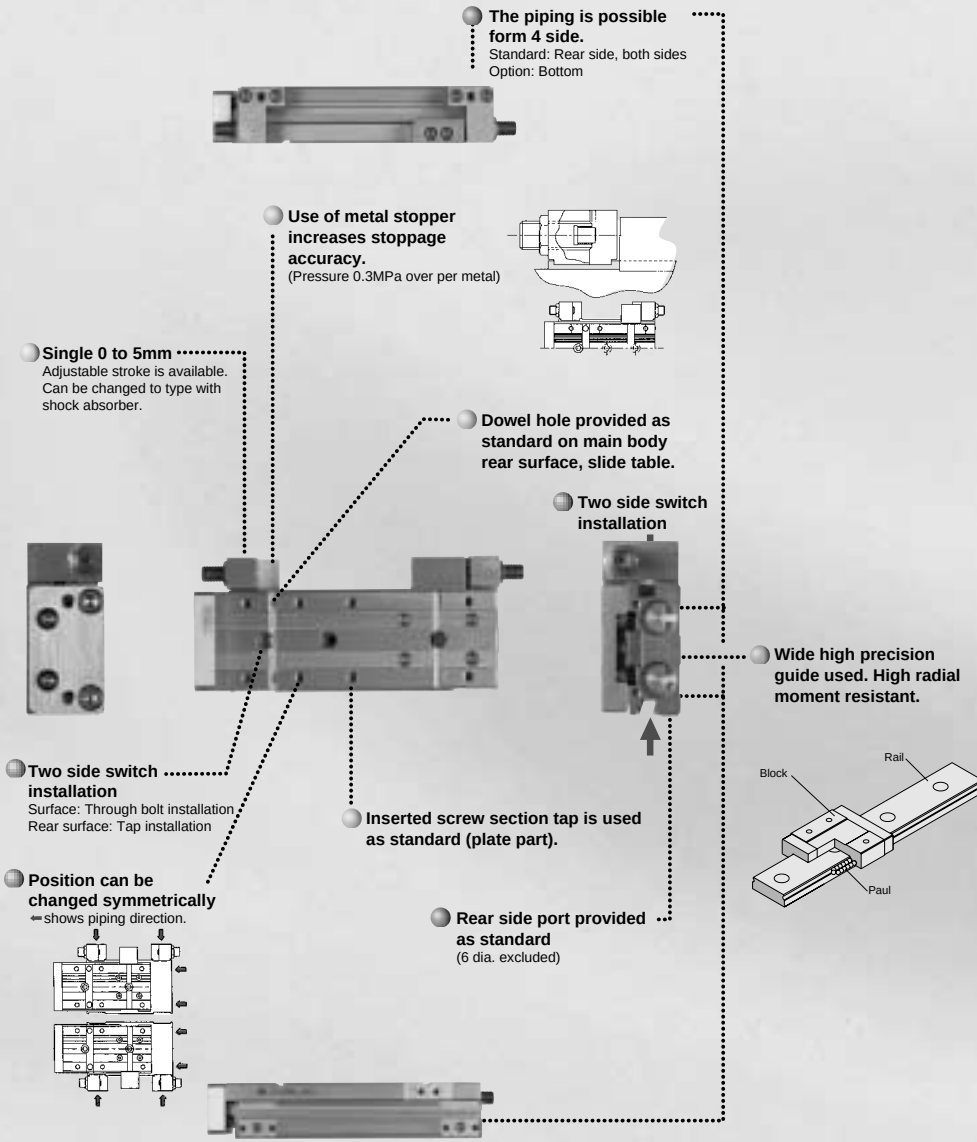
Small parts stored on the tray or supplied from the tray



Feed of small parts



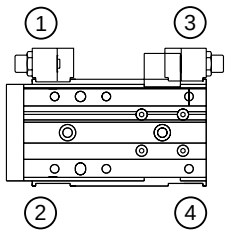
Inspection of part



●: Standard, ◎: Option, : Not available

Variation	Model No. JIS symbol	Bore size (mm)	Stroke length (mm) 10	20	30	40	50	75	100	125	150	Max. stroke length (mm)	Option: Hexagon socket head set screw type stopper with urethane rubber — Stopper position ① S1	② S2	③ S3	④ S4	①/③ S5	②/④ S6	Option: Shock absorber type stopper — Stopper position ① A1	② A2	③ A3	④ A4	①/③ A5	②/④ A6	Option: Buffer — No switch rail B	Switch rail position ① side B1	Switch rail position ② side B2	Switch	Page
Double acting/ single rod type	LCS	6	●	●	●	●	●					50	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	1046
		8	●	●	●	●	●	●				75	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎		
		12	●	●	●	●	●	●	●			100	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎		
		16	●	●	●	●	●	●	●	●		125	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎		
		20, 25	●	●	●	●	●	●	●	●	●	150	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎		
Double acting/ position locking type	LCS-Q	8	●	●	●	●	●	●				75	◎	◎					◎	◎					◎	◎	◎	◎	1046
		12	●	●	●	●	●	●	●			100	◎	◎					◎	◎					◎	◎	◎		
		16	●	●	●	●	●	●	●	●		125	◎	◎					◎	◎					◎	◎	◎		
		20, 25	●	●	●	●	●	●	●	●	●	150	◎	◎					◎	◎					◎	◎	◎		
Double acting/ fine speed type	LCS-F	12	●	●	●	●	●	●	●			100	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎				◎	1064
		16	●	●	●	●	●	●	●	●		150	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎					
		20, 25	●	●	●	●	●	●	●	●	●	150	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎					

• Stopper position



Safety Precautions

Always read before starting use

Refer to Intro 45 for general details on the cylinder, and to Intro 52 for details on the cylinder switch.

Linear slide cylinder LCS Series

⚠ CAUTION — Design & Selection

1 Select the cylinder based on the "LCS selection guide" on pages 1066 to 1072.

2 Precautions for cylinders with switches

- If the T*V type switch is used with the stopper for stroke adjustment (S3**, S4**, S5**, S6**) or shock absorber type stopper (A3**, A4**, A5**, A6**), the switch on the head interferes with the stopper. Install the switch on the opposite side of the stopper.
- When using a switch with a stroke of 30 or less, 1 switch is installed on each side of the main unit. Take care for the lead wire outlet direction when designing the system.

3 Precautions for position locking type (LSC-Q)

Do not use a 3-position valve.

Do not use this cylinder combined with a 3-position valve, especially that with a closed center metal seal. The lock will not be applied if pressure is sealed on the port having a locking mechanism. Even if the lock is applied, air that leaks from the valve may enter the cylinder or the lock may be released over time.

4 Precautions for fine speed type (LCS-F)

Use with oil-free specifications.

Features may change if the device is lubricated.

Assemble the flow control valve near the cylinder.

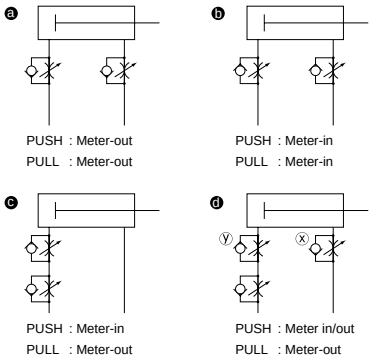
Adjustments become unstable if assembled away from the cylinder.

Use the SC-M3/M5, SC3W, SCD-M3/M5, or SC3WU Series flow control valve.

Generally, the higher air pressure, and the smaller load result in the more stable operation.

Use a load at 50% or less.

Stable speed control is achieved with a meter-out circuit.



When driving the single rod cylinder at fine speed with the operation direction set to PUSH, popping out may occur if operation is started when load resistance is small. As a corrective action, use a ⓑ, ⓒ, or ⓓ circuit.

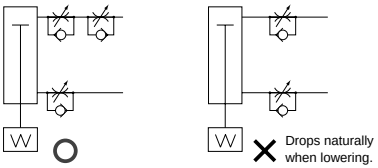
Note that the (d) circuit is the most stable.

Adjusting speed for ⓓ circuit PUSH operation

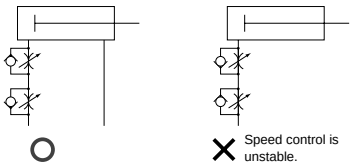
1. Set the speed with the x flow control valve.
2. Lower the flow rate with the y flow control valve until popping out no longer occurs.
3. Reconfirm speed.

Note 1: When circuits ⓑ, ⓒ, and ⓓ are compared, ⓓ circuit operation is most stable.

Note 2: When installed vertically, the unit will drop naturally if the meter-in circuit is used. Use the meter-out circuit in this case.



Note 3: Connect the flow control valve in parallel with the following circuit:



(Cause of popping out)

The meter-out circuit slows the flow so fine speed is attained on the exhaust side, so both sides reach the same pressure immediately after the valve is changed and the thrust of the piston pressurized area difference functions in the PUSH direction, causing popping out.

When the piston moves, exhaust pressure rises and speed decelerates. The set speed is then attained.

(Guide for popping out occurrence)

Popping out occurs when the piston rod area x air pressure > load resistance.

Do not apply a lateral load on the cylinder. Install the cylinder so the sliding guide is not twisted.

Operation may become unstable due to fluctuations in load and resistance.

Operation of a guide having a large difference in static and dynamic friction may become unstable.

Avoid use with vibration.

The product will be adversely affected by vibration and operation will become unstable.

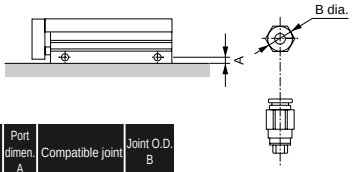
Discontinue

⚠ CAUTION Installation & Adjustment

Piping

1 **When changing the piping port position, use adhesive on M3 and M5 plugs (hexagon socket set screw). Use a low-strength adhesive such as Locktite 222 or 221, or ThreeBond 1344.**

2 **Precautions for piping joints**
Install a flow control valve when piping. The following types of joints are used:

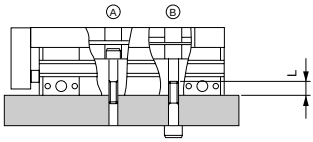


Item: Bore size (mm)	Port size	Port dimen. A	Compatible joint	Joint O.D. B
6 dia.	M3	4	SC3W-M3-4 SC3WU-M3-4 SC3W-M3-3.2 SC3WU-M3-3.2 GWS3-M3-S GWS4-M3-S	8 dia. or less
8 dia.	M5	5.5	SC3W-M5-4 SC3W-M5-6 GWS4-M5-S GWS4-M5	11 dia. or less
12 dia.		5.5		
16 dia.		6.5	SC3W-M5-4 SC3W-M5-6 GWS4-M5-S GWS4-M5 GWL4-M5 GWL6-M5 GWS6-M5	13 dia. or less
20 dia.	Rc1/8	8	SC3W-6-4, 6, 8 GWS4-6 GWS8-6 GWL6-6 GWS6-6 GWL4-6	15 dia. or less
25 dia.		9		

Installation

1 **Check that no dents or scratches occur on main tubing installation or end plates that may adversely affect flatness.**
The flatness of the counterpart onto which the end plate is installed must be 0.05 mm or less.

2 **Use the bolt threaded length and tightening torque below when installing the main body.**
<Fig. 1>



Item	A		B		
	Bolt	Torque (N·m)	Bolt	Torque (N·m)	Thread L (mm)
LCS-6	M3 X 0.5	0.6 to 1.1	M4 X 0.7	1.4 to 2.4	4 to 6
LCS-8	M3 X 0.5	0.6 to 1.1	M4 X 0.7	1.4 to 2.4	4 to 6
LCS-12	M4 X 0.7	1.4 to 2.4	M5 X 0.8	2.9 to 5.1	5 to 8
LCS-16	M4 X 0.7	1.4 to 2.4	M6 X 1.0	4.8 to 8.6	6 to 9
LCS-20	M5 X 0.8	2.9 to 5.1	M6 X 1.0	4.8 to 8.6	6 to 9
LCS-25	M6 X 1.0	4.8 to 8.6	M8 X 1.25	12.0 to 21.6	8 to 12

Discontinue

Pneumatic Components

Safety Precautions

Always read before starting use

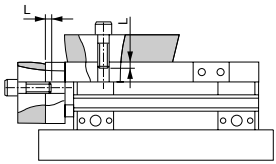
Refer to Intro 45 for general details on the cylinder, and to Intro 52 for details on the cylinder switch.

Linear slide cylinder LCS Series

CAUTION Installation & Adjustment

3 Use the bolt threaded length and tightening torque below when installing the jig onto the slide table or end plate.

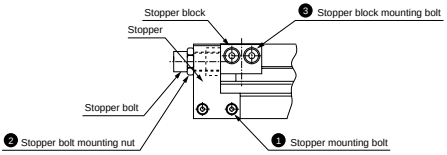
<Fig. 2>



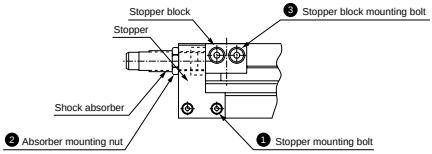
Item	Slide table/end plate		
	Bolts	Torque (N·m)	Thread L (mm)
LCS-6	M3 X 0.5	0.6 to 1.1	3 to 4.5
LCS-8	M3 X 0.5	0.6 to 1.1	3 to 4.5
LCS-12	M4 X 0.7	1.4 to 2.4	4 to 6
LCS-16	M5 X 0.8	2.9 to 5.1	5 to 7.5
LCS-20	M5 X 0.8	2.9 to 5.1	5 to 7.5
LCS-25	M6 X 1.0	4.8 to 8.6	6 to 9

4 Use the following bolt and nut tightening torques for the stopper section.

<Fig. A>



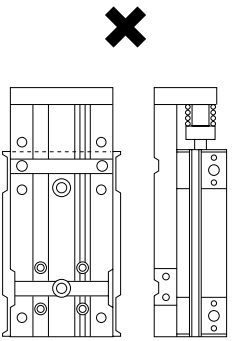
Hexagon socket set screw type stopper with urethane rubber



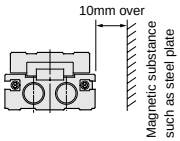
Shock absorber

Model	❶ Stopper bolt (N·m)	❷ Stopper bolt nut ❷ Absorber nut (N·m)	❸ Stopper block bolt (N·m)
LCS-6	0.4 to 0.5	1.2 to 2.0	0.6 to 0.8
LCS-8	0.4 to 0.5	1.2 to 2.0	0.6 to 0.8
LCS-12	0.6 to 0.8	1.2 to 2.0	0.6 to 0.8
LCS-16	0.6 to 0.8	3.0 to 4.0	1.4 to 1.8
LCS-20	2.9 to 3.5	4.5 to 6.0	1.4 to 1.8
LCS-25	2.9 to 3.5	4.5 to 6.0	2.9 to 3.5

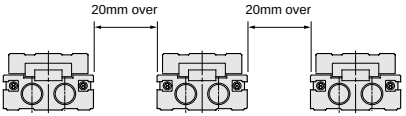
5 Note that cylinders with buffers cannot be used vertically upward.



6 The cylinder may malfunction if a magnetic substance, such as a steel plate, is nearby. Move the magnetic substance to at least 10 mm from the cylinder. (Same clearance for all diameters)



7 The cylinder switch may malfunction if cylinders are installed adjacently. Separate cylinders by the following distances. (Same clearance for all bore size)



⚠ CAUTION Installation & Adjustment

8 Precautions for fine speed type (LCS-F)

Adjust the core, etc., so lateral load is not applied to the cylinder.

Adjust and install so the sliding guide is not twisted.

- Operation may become unstable due to fluctuations in load and resistance.
- Operation of a guide having greatly different static and dynamic friction may become unstable.

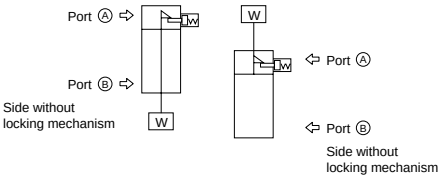
9 Precautions for position locking type (LCS-Q)

- The locking mechanism functions at stroke limit, so if the stopper is applied with the external stopper in the middle of a stroke, the locking mechanism will not function and the load may drop. Check that the locking mechanism functions before setting the load.
- Supply pressure exceeding the model's minimum working pressure to the port at the side on which the locking mechanism isinstalled.
- If piping on the side with the locking mechanism is long and thin, or if the flow control valve is separated from the cylinder port, exhaust speed may drop and it may take longer for the lock to be applied. This may also occur if a silencer installed on the solenoid valve EXH. port is clogged.

⚠ WARNING During use & Maintenance

1 Precautions for position locking type (LCS-Q)

If pressure is applied from port A in the locked state and with neither port pressurized, it may not be possible to release locks or the lock may be released suddenly and cause the piston rod to pop out, which is extremely hazardous. When releasing the locking mechanism, supply pressure to port B and check that no load is applied to the locking mechanism.



If lowering speed is to be increased with the quick exhaust valve, the cylinder may move out faster than the lock pin and prevent the lock pin from being released correctly. Do not use a quick exhaust valve with a position locking type cylinder.

Discontinue

Pneumatic Components

Safety Precautions

Always read before starting use

Refer to Intro 45 for general details on the cylinder, and to Intro 52 for details on the cylinder switch.

Linear slide cylinder LCS Series

⚠ CAUTION During use & maintenance

1 Precautions for position locking type (LCS-Q)

If back pressure is applied to the locking mechanism, the lock may be released. Use a discrete solenoid valve, or use an individual exhaust manifold.

If the locking mechanism has been manually operated, check and then return it to the original position manually. Do not use manual operation for other than adjustment, or this may be very hazardous.

Release the lock when installing or adjusting the cylinder.
The lock may be damaged if the cylinder is installed while the lock is applied.

Do not use multiple cylinders together.

Do not move one workpiece using more than one end lock cylinder. It may not be possible to release one of the cylinder's locks.

Use the flow control valve with meter-out control.

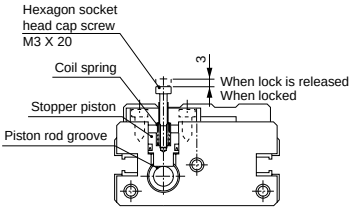
It may not be possible to release locks used with meter-in control.

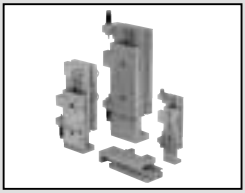
Use the side with the lock with a cylinder stroke limit.

If the cylinder's position does not reach stroke limit, the lock may not be applied or released.

Release

Screw a hexagon socket head cap screw (M3 X 20) into the stopper piston, and pull the bolt up 3 mm with a force of 20 N over. The stopper piston moves and the lock is released during no-load horizontal installation or with rod port pressurized. When the hand is released, the stopper piston returns by the internal spring and enter the piston rod groove, locking the cylinder.





Discontinue

Linear slide cylinder double acting/single rod type/position locking type

LCS/LCS-Q
LCS- * - * B Series

• Bore size: 6, 8, 12, 16, 20, 25 mm bore

JIS symbol

Basic type 

Position locking type 

CAD DATA AVAILABLE.

Common specifications

Descriptions		LCS					
Bore size mm		6 dia.	8 dia.	12 dia.	16 dia.	20 dia.	25 dia.
Actuation		Double acting					
Working fluid		Compressed air					
Max. working pressure MPa		0.7					
Min. working pressure MPa		0.15 (Note 1)					
Withstanding pressure MPa		1					
Ambient temperature °C		-10 to 60 (to be unfrozen) (Note 2)					
Port size	Main body side	M3	M5			Rc 1/8	
	Main body rear	—	M3		M5		Rc 1/8
Stroke length tolerance mm		+2.0 0 (Note 3)					
Working piston speed mm/s		50 to 500					
Cushion		Rubber cushioned					
Lubrication		Not required (when lubrication, use turbine oil Class 1 ISOV G32.)					
Allowable energy absorption J		Please refer to Table 3 on Page 1066.					

Note 1: 0.2MPa when using shock absorber type stopper with 6 mm diameter.
Note 2: For 6 mm bore cylinder, when using switches, max. ambient temperature is 50 °C (45 °C when installing on an iron plate)
Note 3: When using this without stopper, be careful about a small gap between end plate and floating bush.

Individual specifications

Specifications other than below are as same as above common specifications.

Model No.	Descriptions		Descriptions					
LCS-Q	Bore size (mm)		6 dia	8 dia.	12 dia.	16 dia.	20 dia.	25 dia.
	Min. working pressure (MPa)		—	0.2				
	Position locking type		—	Head side				
	Holding force (N)		—	When PULL, theoretical thrust X 0.7 (0.7 MPa)				
	Port size	Main body side	—	M5			Rc 1/8	
		Main body rear	—	Blank				
LCS- * - * -B/B1/B2	Buffer stroke length (mm)		4	4	9		10	
	Buffer part	At setting (N)	3	5	10	13	17	21
	spring load	During operation (N)	7	8	14	20	25	29

Note 1: Rod side stroke adjustment by a type with buffer shortens buffer stroke length as adjusted stroke length. This also results in higher spring load at setting.
Note 2: For 6 mm bore LCS, position locking type is not available.
Note 3: For LCS-6 with buffer, shock absorber type stopper A1, A2, A5, A6 are not available.

Stroke length

Bore size (mm)	Standard stroke length (mm)
6 dia.	10, 20, 30, 40, 50
8 dia.	10, 20, 30, 40, 50, 75
12 dia.	10, 20, 30, 40, 50, 75, 100
16 dia.	10, 20, 30, 40, 50, 75, 100, 125
20 dia.	10, 20, 30, 40, 50, 75, 100, 125, 150
25 dia.	10, 20, 30, 40, 50, 75, 100, 125, 150

Note: Stroke other than above is not available.

Discontinue

Switch specifications

Descriptions	Proximity 2 wire	Proximity 3 wire	Proximity 2 wire	Proximity 3 wire
	T2H, T2V, T2VR3	T3H, T3V	F2H, F2V	F3H, F3V
Applications	Programmable controller	Programmable controller /relay	Programmable controller	Programmable controller /relay
Power voltage	—	DC10 to 28V	—	DC10 to 28V
Load voltage/current	DC10 to 30V, 5 to 20mA (Note 1)	DC30V or less, 100mA or less	DC10 to 30V, 5 to 20mA	DC30V, 50mA or less
Light	LED (ON lighting)			
Max. shock resistance	980m/s^2 (100G)			
Lead wire	Standard 1m (oil resistant vinyl cabtire code 2 conductor 0.2mm^2) elasticity lead wire (T2VR3 *)	Standard 1m (oil resistant vinyl cabtire code 2 conductor 0.2mm^2)	Standard 1m (oil resistant vinyl cabtire code 2 conductor 0.15mm^2)	Standard 1m (oil resistant vinyl cabtire code 3 conductor 0.15mm^2)

Note 1: T2VR3 is only for buffer part.

Descriptions	Reed 2 wire	
	T0V, T0H	T5V, T5H
Applications	Programmable controller, relay	Programmable controller, relay IC circuit (without indicator light), serial connection
Power voltage	—	
Load voltage/current	DC 12/24V, 5 to 50mA AC110V, 7 to 20mA	DC 5/12/24V, 50mA or less AC110V, 20mA or less
Light	LED (ON lighting)	No indicator light
Max. shock resistance	294m/s^2 (30G)	
Lead wire	Standard 1m (oil resistant vinyl cabtire code 2 conductor 0.2mm^2)	

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

Cylinder mass

• Basic type

(Unit: g)

Bore size (mm)	Basic type stroke length type (mm)								
	10	20	30	40	50	75	100	125	150
6 dia.	120	120	140	170	190	—	—	—	—
8 dia.	160	160	190	230	260	320	—	—	—
12 dia.	320	320	320	360	400	520	610	—	—
16 dia.	530	530	530	590	640	870	1020	1120	—
20 dia.	940	940	940	1030	1120	1440	1670	1900	2180
25 dia.	1690	1690	1690	1840	1990	2620	2990	3350	3720

• Variation/option (stopper part) increase

(Unit: g)

Bore size (mm)	Option/stopper symbol					Position locking type
	S1 to S4	S5/S6	A1 to A4	A5/A6	B/B1/B2	Q
6 dia.	40	60	40	60	25	—
8 dia.	50	70	50	70	35	100
12 dia.	70	110	70	110	65	105
16 dia.	130	180	130	180	85	180
20 dia.	130	200	130	200	140	250
25 dia.	200	270	200	270	250	380

Discontinue

How to order

Without switch

LCS - 8 - 40 ——— S5

With switch

LCS - 12 - 40 - T0H * - R - A1DT

Ⓐ Model

Ⓑ Bore size

Ⓒ Stroke length

Ⓓ Switch model No.

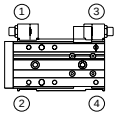
Ⓔ Switch quantity

Ⓕ Option

Cautions for model No. selection

Note 1: When changing adjustable stroke range, use a discrete stopper for adjustable stroke listed on Page 1051.
Note 2: When using shock absorber type, refer to stopper dimensions table on P1062 about adjustable stroke range.
Note 3: Please refer to stopper dimensions on Page 1062 about port positions.
Note 4: When no stopper, port positions of standard type are as following Fig. (2) and (4).
Note 5: When using a stopper for adjustable stroke and a shock absorber type stopper together, this is treated as a custom order.
Note 6: Refer to "How to order switch" on Page 1050 about buffer part switches.
Note 7: Only available when using stopper type.
Note 8: Please refer to selection table on Page 1049 about optional combination.
Note 9: For 6 to 8 mm bore cylinder with 10 mm stroke or less, or 12 to 25 mm bore cylinders with 20 mm stroke or less, custom order is applied because A1**, A2**, A5** and A6** can not be adjusted by a standard stopper.
Note 10: For 6 mm bore and 10 mm stroke cylinder with S*** or A*** switch, when two switches will be installed, select F * H type switch.

• Stopper position



<Example of model number>

LCS-12-40-T0H * -R-A1DT

Model: Linear slide cylinder
Ⓐ Model : Standard type LCS
Ⓑ Bore size : 12 mm
Ⓒ Stroke length : 40 mm
Ⓓ Switch model No. : Reed 2 wire
Axial lead wire
Ⓔ Switch quantity : One on rod side
Ⓕ Other options : Shock absorber type stopper position ①, side and bottom port, equivalent to quenched material

Ⓐ Model			Basic type	Position locking type
			LCS	LCS-Q
Ⓑ Bore size	Symbol	Descriptions		
	6	6 dia.	●	—
	8	8 dia.	●	●
	12	12 dia.	●	●
	16	16 dia.	●	●
	20	20 dia.	●	●
	25	25 dia.	●	●

Ⓒ Stroke length (mm)		Bore size (mm)	6	8	12	16	20	25	6	8	12	16	20	25
	10	10	●	●	●	●	●	●		●	●	●	●	●
	20	20	●	●	●	●	●	●		●	●	●	●	●
	30	30	●	●	●	●	●	●		●	●	●	●	●
	40	40	●	●	●	●	●	●		●	●	●	●	●
	50	50	●	●	●	●	●	●		●	●	●	●	●
	75	75		●	●	●	●	●		●	●	●	●	●
	100	100			●	●	●	●			●	●	●	●
	125	125				●	●	●				●	●	●
	150	150					●	●					●	●

Ⓓ Switch model No.	Axial lead wire	Radial lead wire	Contact	Display	Lead wire	6	8	12	16	20	25	6	8	12	16	20	25
	T0H *	T0V *	Reed	1 color indicator	2 wire			●						●			
	T5H *	T5V *						●						●			
	T2H *	T2V *	Proximity	1 color indicator	2 wire			●						●			
	T3H *	T3V *			3 wire			●						●			
	F2H *	F2V *	Proximity	1 color indicator	2 wire	●											
	F3H *	F3V *			3 wire	●											
Lead wire length	Blank	1m (standard)						●						●			
	3	3m (option)						●						●			
	5	5m (option)						●						●			

Ⓔ				
	R	One on rod side	●	●
	H	One on head side	●	●
	D	Two	●	●

Ⓕ Option				
	Blank	No option	●	●
	S	Stopper for adjustable stroke		
		Adjustable stroke single 5mm	Note 1, Note 5, Note 8	
Stopper installation position	S1 * *	Stopper position ①(to ④)	●	●
	S2 * *	Stopper position ②(to ③)	●	●
	S3 * *	Stopper position ③(to ②)	●	
	S4 * *	Stopper position ④(to ①)	●	
	S5 * *	Stopper position ①, ③	●	
	S6 * *	Stopper position ②, ④	●	
	A	Shock absorber type stopper	Note 2, Note 5, Note 8	
Stopper installation position	A1 * *	Stopper position ①(to ④)	●	●
	A2 * *	Stopper position ②(to ③)	●	●
	A3 * *	Stopper position ③(to ②)	●	
	A4 * *	Stopper position ④(to ①)	●	
	A5 * *	Stopper position ①, ③	●	
	A6 * *	Stopper position ②, ④	●	
Section **	Blank	Stopper part port: No port	●	●
	D	Port at stopper section: Side, bottom surface port	● Note 3 Note 7	● Note 3 Note 7
	Blank	Stopper block material: Rolled steel	●	●
	T	Stopper block material: Equivalent to quenched material	● Note 7	● Note 7

Option	B Buffer		Note 6, Note 8	
	B	No switch rail	●	●
	B1	Switch rail position ①	●	●
	B2	Switch rail position ②	●	●

Discontinue

LCS basic type selection table

(Combination of stopper for adjustable stroke and shock absorber type stopper)

○: Combination available, —: Combination not available

Model No. symbol	Option symbol		Stopper for adjustable stroke						Shock absorber type stopper					
	Bore size	Stroke length	S1	S2	S3	S4	S5	S6	A1	A2	A3	A4	A5	A6
LCS base	6, 8 dia.	10	○	○	○	○	○	○	—	—	○	○	—	—
		20 over	○	○	○	○	○	○	○	○	○	○	○	○
	12 to 25 dia.	10 to 20	○	○	○	○	○	○	—	—	○	○	—	—
		30 over	○	○	○	○	○	○	○	○	○	○	○	○
LCS-φ-St-B	6 dia.	10	○	○	○	○	○	○	—	—	○	○	—	—
		20 over	○	○	○	○	○	○	—	—	○	○	—	—
	8 dia.	10	○	○	○	○	○	○	—	—	○	○	—	—
		20 over	○	○	○	○	○	○	○	○	○	○	○	○
	12 to 25 dia.	10 to 20	○	○	○	○	○	○	—	—	○	○	—	—
		30 over	○	○	○	○	○	○	○	○	○	○	○	○
LCS-φ-St-B1	6 dia.	10	—	○	○	○	—	○	—	—	○	○	—	—
		20 over	—	○	○	○	—	○	—	—	○	○	—	—
	8 dia.	10	—	○	○	○	—	○	—	—	○	○	—	—
		20 over	—	○	○	○	—	○	—	○	○	○	—	○
	12 to 25 dia.	10 to 20	○	○	○	○	○	○	—	—	○	○	—	—
		30 over	○	○	○	○	○	○	○	○	○	○	○	○
LCS-φ-St-B2	6 dia.	10	○	—	○	○	○	—	—	—	○	○	—	—
		20 over	○	—	○	○	○	—	—	—	○	○	—	—
	8 dia.	10	○	—	○	○	○	—	—	—	○	○	—	—
		20 over	○	—	○	○	○	—	○	—	○	○	○	—
	12 to 25 dia.	10 to 20	○	○	○	○	○	○	—	—	○	○	—	—
		30 over	○	○	○	○	○	○	○	○	○	○	○	○

Option symbol D: Port at stopper section T: Refer to selection table about above combination of stopper block equivalent to quenched material.

LCS-Q position locking type selection table

(Combination of stopper for adjustable stroke and shock absorber type stopper)

○: Combination available, —: Combination not available

Model No. symbol	Option symbol		Stopper for adjustable stroke						Shock absorber type stopper					
	Bore size	Stroke length	S1	S2	S3	S4	S5	S6	A1	A2	A3	A4	A5	A6
LCS-Q base	8 dia.	10	○	○	—	—	—	—	—	—	—	—	—	—
		20 over	○	○	—	—	—	—	○	○	—	—	—	—
	12 to 25 dia.	10 to 20	○	○	—	—	—	—	—	—	—	—	—	—
		30 over	○	○	—	—	—	—	○	○	—	—	—	—
LCS-Q-φ-St-B	8 dia.	10	○	○	—	—	—	—	—	—	—	—	—	—
		20 over	○	○	—	—	—	—	○	○	—	—	—	—
	12 to 25 dia.	10 to 20	○	○	—	—	—	—	—	—	—	—	—	—
		30 over	○	○	—	—	—	—	○	○	—	—	—	—
LCS-Q-φ-St-B1	8 dia.	10	—	○	—	—	—	—	—	—	—	—	—	—
		20 over	—	○	—	—	—	—	—	○	—	—	—	—
	12 to 25 dia.	10 to 20	○	○	—	—	—	—	—	—	—	—	—	—
		30 over	○	○	—	—	—	—	○	○	—	—	—	—
LCS-Q-φ-St-B2	8 dia.	10	○	—	—	—	—	—	—	—	—	—	—	—
		20 over	○	—	—	—	—	—	○	—	—	—	—	—
	12 to 25 dia.	10 to 20	○	○	—	—	—	—	—	—	—	—	—	—
		30 over	○	○	—	—	—	—	○	○	—	—	—	—

Option symbol D: Port at stopper section T: Refer to selection table about above combination of stopper block equivalent to quenched material.

Discontinue

How to order switch

For 6 mm bore

• Cylinder part: 6 mm bore

SW - F2H (D)

Switch model No.
(Page 1048 Ⓓ)

• Buffer part: 6 mm bore

SW - F 2 V 3

Output type	
2	DC2 wire proximity
3	DC3 wire proximity
Radial lead wire	
Lead wire length	
Blank	1m (standard)
3	3m (option)
5	5m (option)

When 8 to 25mm bore

• Cylinder part: 8 to 25mm

SW - T2H3 (D)

Switch model No.
(Page 1048 Ⓓ)

• Buffer part: 8 to 25mm bore

SW - T2VR3

DC 2 wire proximity,
elasticity switch,
lead wire 3m

• Buffer part: 8 to 25mm bore

SW - T 2 V 3

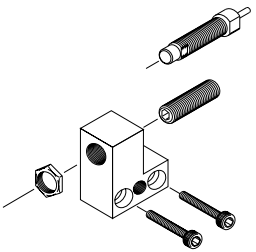
Output type	
2	DC2 wire proximity
3	DC3 wire proximity
Radial lead wire	
Lead wire length	
Blank	1m (standard)
3	3m (option)
5	5m (option)

Note: Please purchase a switch at buffer part separately.
Buffer part switch moves according to cylinder operation.
Therefore, an elastic switch lead wire is recommended.

How to order stopper set

• Set of stopper part and stopper for adjustable stroke or shock absorber type stopper
• Used when changing standard type to shock absorber type stopper or stopper for adjustable stroke.

LCS - Bore size - S 2 D
(A) (B) (C)



(A) Stopper type	
S	Stopper for adjustable stroke
A	Shock absorber type stopper
(B)	
1	For stopper position (1) or (4)
2	For stopper position (2) or (3)
(C)	
Blank	No port
D	Side/bottom port

Cautions when purchasing stopper set

In stopper for adjustable stroke set, S01 is integrated in a discrete stopper for adjustable stroke.
Only when installed on installation position ①,② (refer to Page 1048), add the right part according to stroke length and adjustable stroke length.

— : Not available

Model No. symbol	Option symbol		Discrete stopper for adjustable stroke		
			Adjustable stroke length (mm)		
	Bore size	Stroke length	-5	-15	-25
LCS all series	6, 8	10	S02	—	—
		20 over	Not required	S02	—
	12 to 25	10	S03	—	—
		20	S02	S03	—
		30 over	Not required	S02	S03

How to order discrete stopper for adjustable stroke

- Hexagon socket set screw with urethane rubber
- Used when changing adjustable stroke range or setting custom stroke length.

LCS - Bore size - S02 (Ⓐ)

Ⓐ Adjustable stroke range	
S01	Single 5mm (standard)
S02	Single 15mm
S03	Single 25mm

Indicate S01, S02 or S03 for Ⓐ.
Note: S03 is not available for 6, 8 mm bore.
Depending on model No., some models are not available and adjustable stroke range may be different from above.

Cautions when purchasing discrete stopper

Only when installing a stopper for adjustable stroke or a shock absorber type stopper on installation position (1) or (2) (refer to Page 1048), the right combination may be applied depending on stroke length and adjustable stroke length.

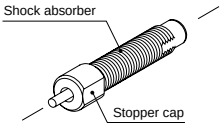
— : Not available

Model No. symbol	Option symbol		Discrete stopper for adjustable stroke			Discrete shock absorber type stopper
			Adjustable stroke length (mm)			
	Bore size	Stroke length	-5	-15	-25	
LCS all series -S1, S2, S5, S6 -A1, A2, A5, A6	6, 8	10	S02	—	—	—
		20 over	S01	S02	—	A01
	12 to 25	10	S03	—	—	—
		20	S02	S03	—	—
		30 over	S01	S02	S03	A01

How to order discrete shock absorber type stopper

- Shock absorber and stopper cap set
- Used when changing from stopper for adjustable stroke to shock absorber type stopper .

LCS - Bore size - A01



Note: Not available depending on Model No.
Refer to Page 1049.
Stopper cap is not available for LCS-8-A01.

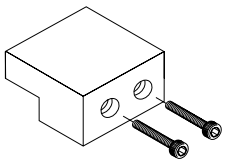
Applicable shock absorber model No.

Model	Shock absorber model No.
LCS- 6	NCK-00-0.1
LCS- 8	NCK-00-0.3
LCS-12	NCK-00-0.3
LCS-16	NCK-00-0.7
LCS-20	NCK-00-1.2
LCS-25	NCK-00-1.2

How to order discrete stopper block model No.

- Used when changing standard type to shock absorber type stopper or stopper for adjustable stroke.

LCS - Bore size - SB1 (Ⓐ) T (Ⓑ)



Ⓐ Stopper block	
SB1	6, 8 mm bore: 30 mm stroke or less
	12 to 25 mm bore: 50 stroke length or less
SB2	6, 8 mm bore: 40 mm stroke over
	12 to 25 mm bore: 75 mm stroke over

Ⓑ	
Blank	Stopper block material: Rolled steel
T	Stopper block material: Equivalent to quenched material

Discontinue

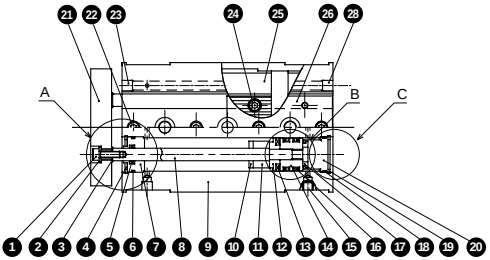
Internal structure and parts list

LCS

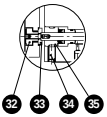
• Basic type

When right figure is as following stroke length.

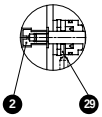
6 mm bore : 10 to 30
8 mm bore : 10 to 30
12 mm bore : 10 to 50
16 mm bore : 10 to 50
20 mm bore : 10 to 50
25 mm bore : 10 to 50



Section A For 6 mm bore

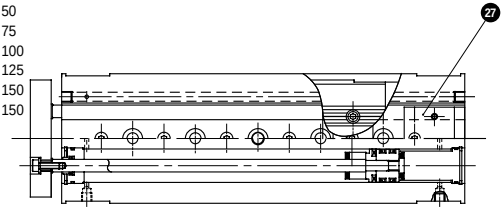


Section A For 8 mm bore

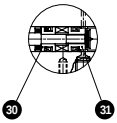


When right figure is as following stroke length.

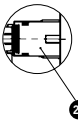
6 mm bore : 40 to 50
8 mm bore : 40 to 75
12 mm bore : 75 to 100
16 mm bore : 75 to 125
20 mm bore : 75 to 150
25 mm bore : 75 to 150



Section B For 6, 8, 12 mm bore



Section C For 6 mm bore



Parts list

No.	Parts name	Material	Comment	No.	Parts name	Material	Comment
1	Hexagon socket head cap screw	Stainless steel		18	Metal gasket	Nitrile rubber	
2	Floating bush	Steel	Electroless nickeling treatment (silver color)	19	C type snap ring	Stainless steel	For 6 dia., none
3	Plain washer	Stainless steel		20	Cover	Aluminum alloy	Chromate
4	C type snap ring	Stainless steel	For 6 dia., none	21	End plate	Aluminum alloy	Alumite
5	Rod packing seal	Nitrile rubber		22	Hexagon socket head cap screw	Stainless steel	
6	Metal gasket	Nitrile rubber		23	Hexagon socket head set screw	Stainless steel	For 6 dia., none
7	Rod bushing	Aluminum alloy	Alumite	24	Hexagon socket head cap screw	Stainless steel	
8	Piston rod	Stainless steel		25	Slide table	Aluminum alloy	Alumite
9	Cylinder main body	Aluminum alloy	Hard alumite	26	High precision guide	Stainless steel	One guide block
10	Cushion rubber (R)	Urethane rubber		27	High precision guide	Stainless steel	Two guide blocks
11	Spacer	Aluminum alloy	6, 8 dia. : 20 to 30st 12 dia. : 30 to 50st 25 dia. : For 30 to 50st, none.	28	Plug	Stainless steel	For 6 dia., none
				29	Cap	Aluminum alloy	
12	Magnet spacer	Aluminum alloy	Chromate	30	Piston A	Aluminum alloy	Chromate
13	Piston magnet	Plastic magnet		31	Piston B	Aluminum alloy	Chromate
14	Piston	Aluminum alloy	Chromate	32	Floating bush A	Stainless steel	
15	Plug	Stainless steel		33	Floating bush B	Stainless steel	
16	Piston packing seal	Nitrile rubber		34	Hexagon socket head set screw	Stainless steel	
17	Cushion rubber (H)	Urethane rubber		35	Cap	Stainless steel	

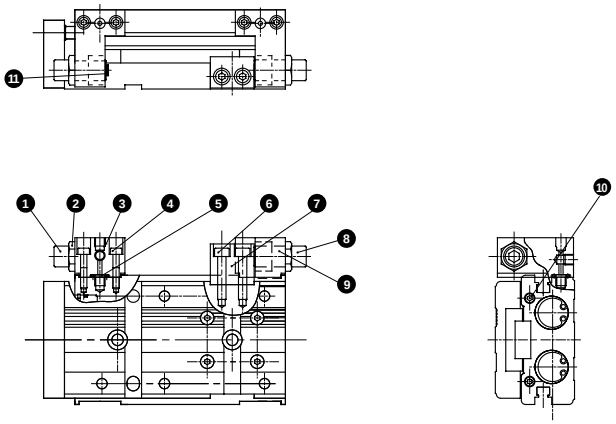
Repair parts list

Bore size (mm)	Kit number	Repair parts number
6 dia.	LCS-6K	
8 dia.	LCS-8K	5 6 10
12 dia.	LCS-12K	
16 dia.	LCS-16K	16 17 18
20 dia.	LCS-20K	
25 dia.	LCS-25K	

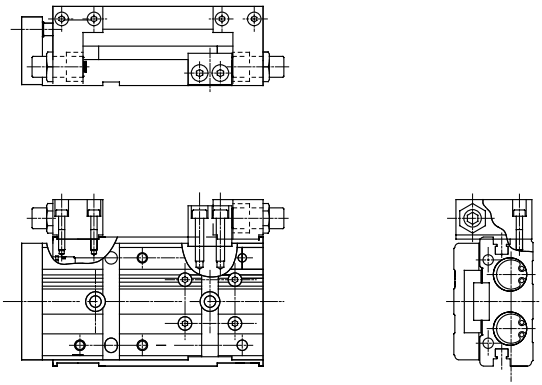
Internal structure and parts list

Structural drawing with stopper

• Type of stopper part with side and bottom ports (symbol D)



• When no port at stopper part



Parts list

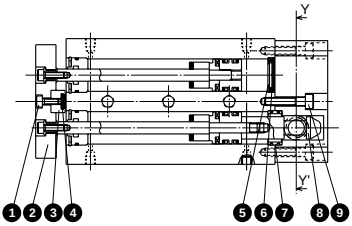
No.	Parts name	Material	Comment	No.	Parts name	Material	Comment
1	Stopper bolt	Steel	Nickeling	7	Stopper block	Steel	Nickeling
2	Hexagon nut	Steel	Nickeling	8	Stopper bolt	Steel	Nickeling
3	Stopper A	Aluminum alloy	Alumite	9	Stopper B	Aluminum alloy	Alumite
4	Hexagon socket head cap screw	Stainless steel		10	Plug	Stainless steel	
5	Gasket	Nitrile rubber		11	Cushion rubber	Urethane rubber	
6	Hexagon socket head cap screw	Stainless steel					

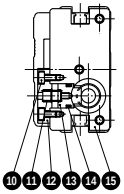
Discontinue

Internal structure and parts list

LCS-Q

• Position locking type





Cross section Y-Y'

Repair parts list

Bore size (mm)	Kit number	Repair parts number	
		Position locking part repair parts	Basic repair parts
8 dia.	LCS-Q-8K	4 14	5 6 10 16 18
12 dia.	LCS-Q-12K		
16 dia.	LCS-Q-16K		
20 dia.	LCS-Q-20K		
25 dia.	LCS-Q-25K		

Note: Refer to parts list of basic type on Page 1052 about basic repair part No.

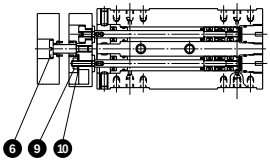
Parts list

No.	Parts name	Material	Comment	No.	Parts name	Material	Comment
1	Hexagon socket head cap screw	Stainless steel		9	Hexagon socket head cap screw	Stainless steel	
2	End plate	Aluminum alloy	Alumite	10	Hexagon socket head cap screw	Stainless steel	
3	Stopper	Aluminum alloy	Alumite	11	Cylinder spring	Steel	
4	Cushion rubber (H)	Urethane rubber		12	Stopper cover	Aluminum alloy	Alumite
5	Cover	Aluminum alloy		13	Stopper piston	Stainless steel	
6	Gasket	Nitrile rubber		14	Stopper packing seal	Nitrile rubber	
7	Joint ring	Aluminum alloy	Chromate	15	Head cover	Aluminum alloy	Alumite
8	Sleeve	Stainless steel	Hard chrome plated				

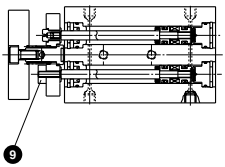
LCS- * - * -B

• Types with buffer but without switch rail

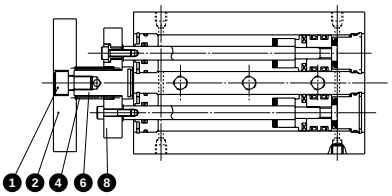
6 mm bore



8 mm bore

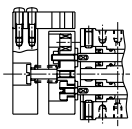


12, 16, 20, 25 mm bore

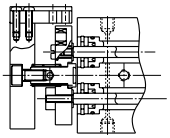


• With buffer and switch rail (Figure shows B1 type)

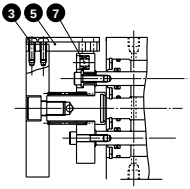
6 mm bore



8 mm bore



12, 16, 20, 25 mm bore



Parts list

No.	Parts name	Material	Comment	No.	Parts name	Material	Comment
1	Hexagon socket head cap screw	Stainless steel		7	Magnet	Plastic magnet	
2	End plate	Aluminum alloy	Alumite	8	Connecting plate	Aluminum alloy	Alumite
3	Cross headed pan	Stainless steel		9	Joint nut	Stainless steel	
4	Cylinder spring	Steel		10	Plain washer	Stainless steel	
5	Switch rail	Aluminum alloy	Alumite				
6	Connecting rod	Stainless steel					

Discontinue

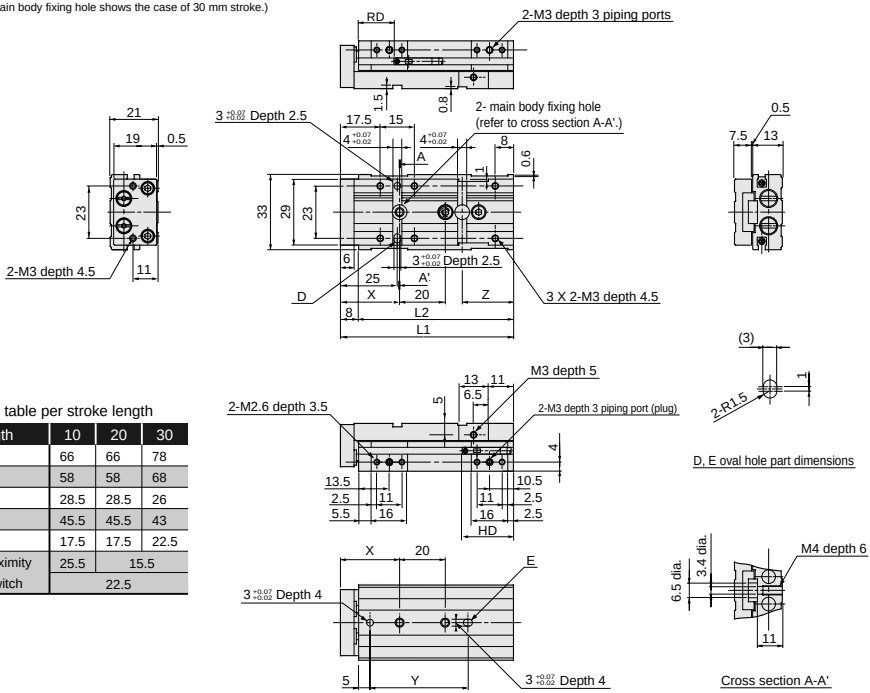
Dimensions

LCS-6

(File name: Page 1073 or Ending 130)

• Stroke length: For 10, 20, 30 mm

(This figure main body fixing hole shows the case of 30 mm stroke.)



Dimensions table per stroke length

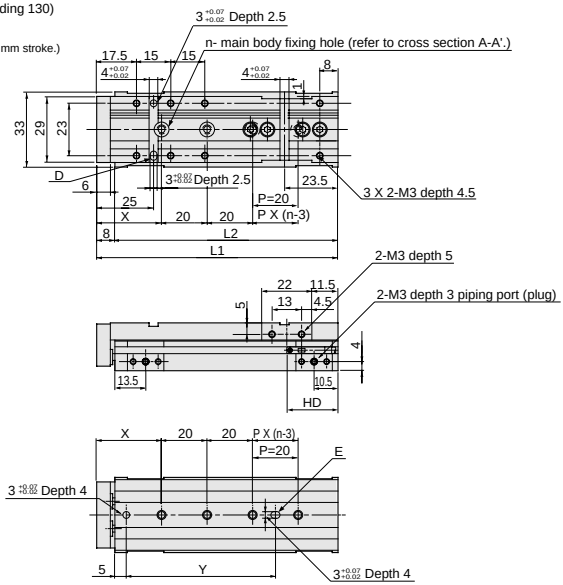
Stroke length		10	20	30
L1		66	66	78
L2		58	58	68
X		28.5	28.5	26
Y		45.5	45.5	43
Z		17.5	17.5	22.5
RD	Proximity	25.5	15.5	
HD	switch	22.5		

LCS-6

(File name: Page 1073 or Ending 130)

• Stroke length: For 40, 50 mm

(Main body fixing holes in this drawing shows the case of 50 mm stroke.)



Dimensions table per stroke length

Stroke length		40	50
L1		96	106
L2		88	98
n		3	4
X		27	28.5
Y		44	65.5
RD	Proximity	25.5	
HD	switch	22.5	

Note: Dimensions not mentioned are as same as the figure above.

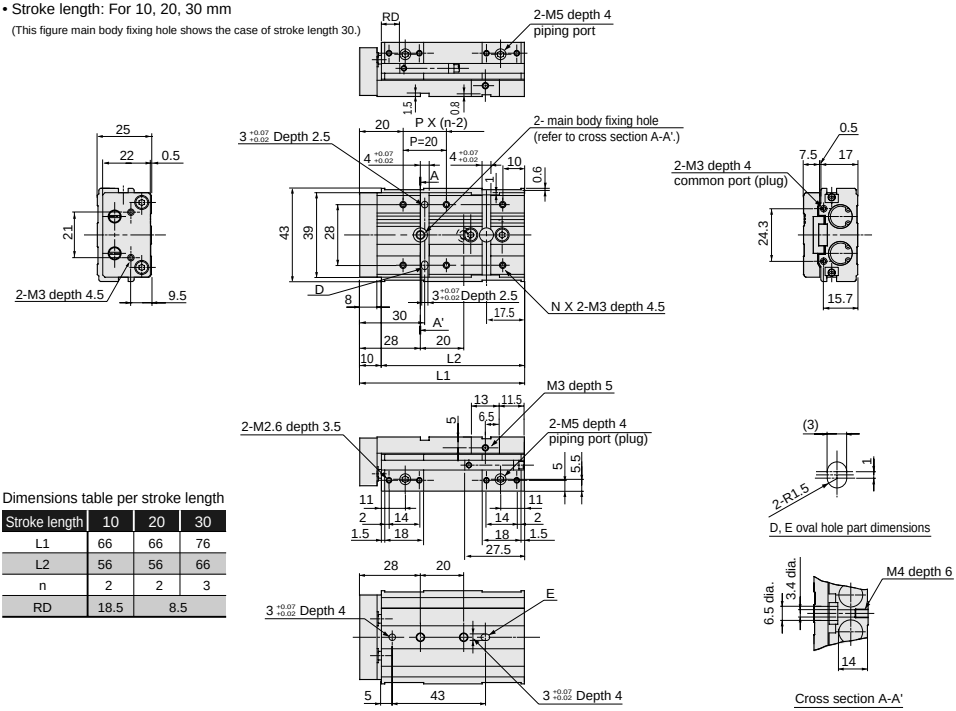
Discontinue

Dimensions

LCS-8 CAD (File name: Page 1074 or Ending 131)

• Stroke length: For 10, 20, 30 mm

(This figure main body fixing hole shows the case of stroke length 30.)



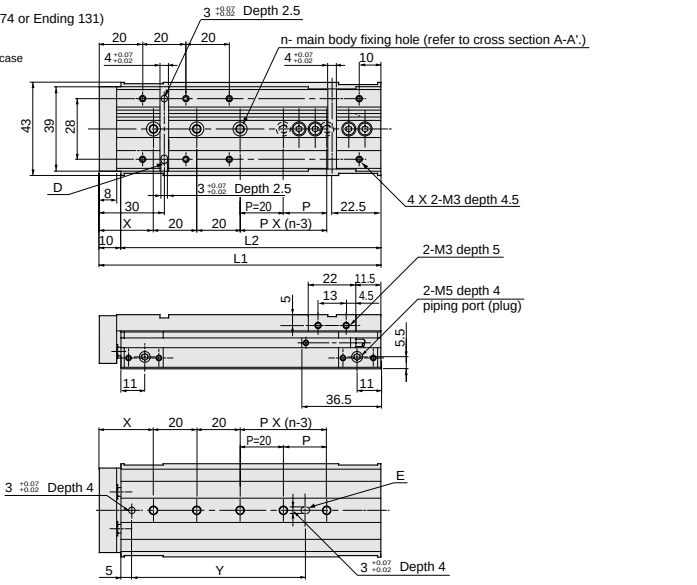
Dimensions table per stroke length

Stroke length	10	20	30
L1	66	66	76
L2	56	56	66
n	2	2	3
RD	18.5	8.5	

LCS-8 CAD (File name: Page 1074 or Ending 131)

• Stroke length: For 40, 50, 75 mm

(Main body fixing holes in this drawing shows the case of 75 mm stroke.)



Dimensions table per stroke length

Stroke length	40	50	75
L1	95	105	130
L2	85	95	120
n	3	4	5
X	26.5	28	25
Y	41.5	63	80
RD	8.5		

Note: Dimensions not mentioned are as same as the figure above.

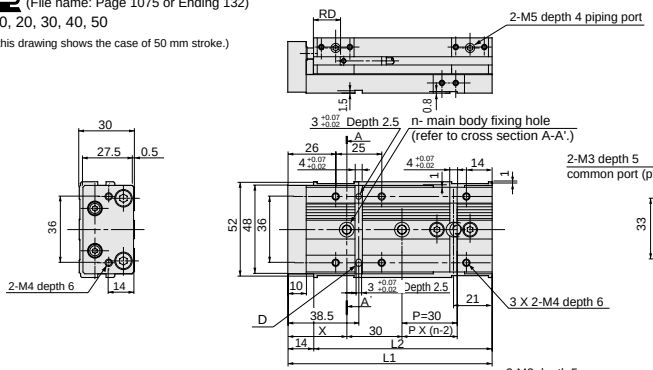
Dimensions

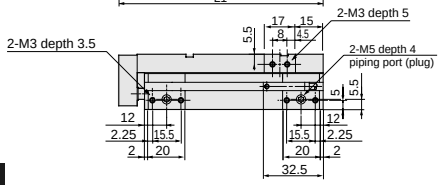
LCS-12- *

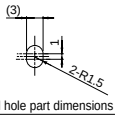
CAD (File name: Page 1075 or Ending 132)

• Stroke length: For 10, 20, 30, 40, 50

(Main body fixing holes in this drawing shows the case of 50 mm stroke.)



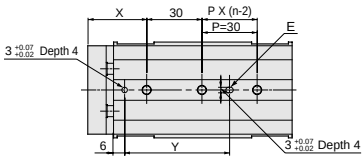


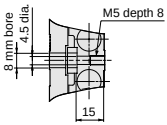


D, E oval hole part dimensions

Dimensions table per stroke length

Stroke length	10	20	30	40	50
L1	91	91	91	101	111
L2	77	77	77	87	97
n	2	2	2	3	3
X	37.5	37.5	37.5	36	32
Y	32.5	32.5	32.5	31	57
RD	34.5	24.5	14.5		





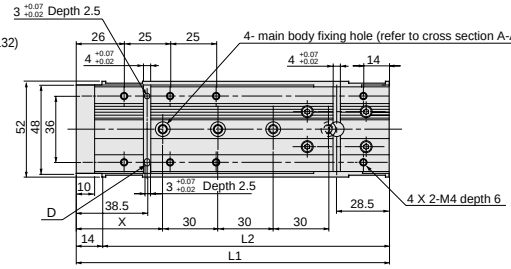
A - A' Cross section

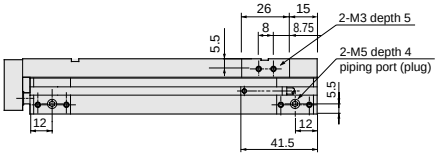
LCS-12- *

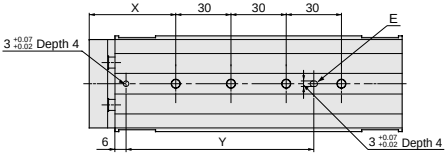
CAD (File name: Page 1075 or Ending 132)

• Stroke length: For 75, 100 mm

(Main body fixing holes in this drawing shows the case of 100 mm stroke.)







Dimensions table per stroke length

Stroke length	75	100
L1	145	170
L2	131	156
X	34.5	47
Y	89.5	102
RD	14.5	

Note: Dimensions not mentioned are as same as the figure above.

Discontinue

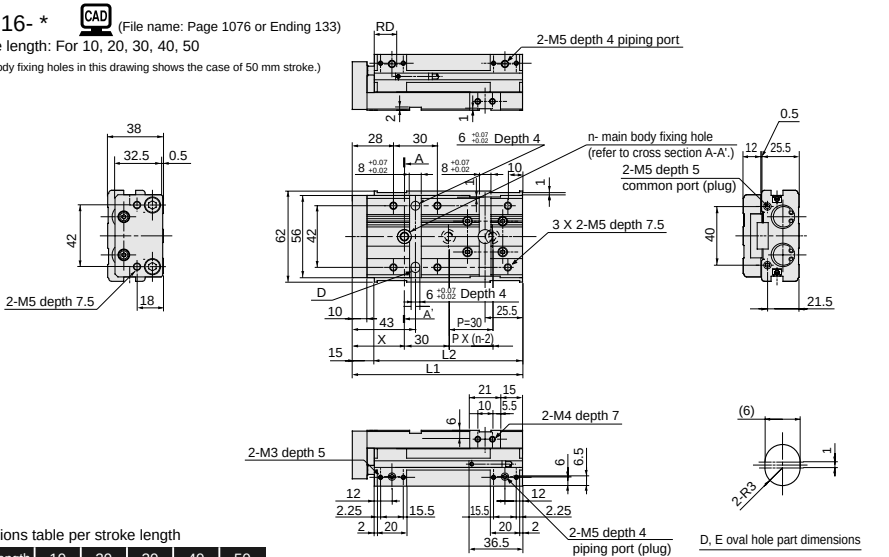
Dimensions

LCS-16- *

CAD (File name: Page 1076 or Ending 133)

• Stroke length: For 10, 20, 30, 40, 50

(Main body fixing holes in this drawing shows the case of 50 mm stroke.)



Dimensions table per stroke length

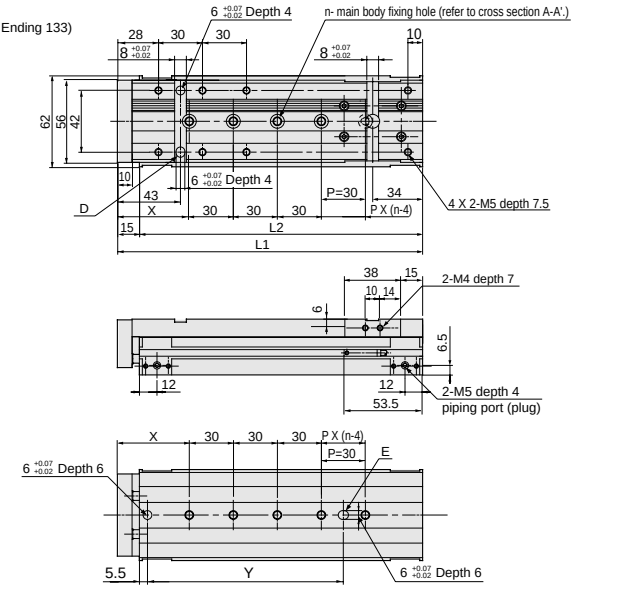
Stroke length	10	20	30	40	50
L1	96	96	96	106	116
L2	81	81	81	91	101
n	2	2	2	2	3
X	34	34	34	45.5	35.5
Y	28.5	28.5	28.5	40	60
RD	34.5	24.5	14.5		

LCS-16- *

CAD (File name: Page 1076 or Ending 133)

• Stroke length: For 75, 100, 125 mm

(Main body fixing holes in this drawing shows the case of 125 mm stroke.)



Dimensions table per stroke length

Stroke length	75	100	125
L1	158	183	208
L2	143	168	193
n	4	5	5
X	39	37	49
Y	93.5	121.5	133.5
RD	14.5		

Note: Dimensions not mentioned are as same as the figure above.

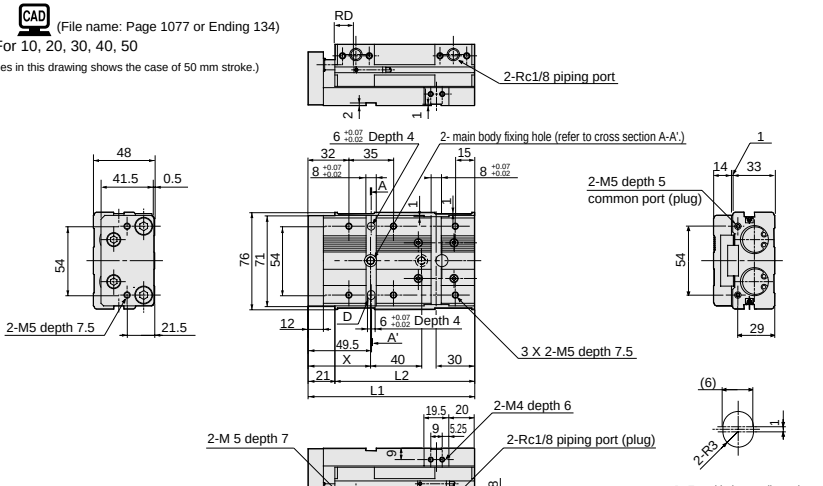
Dimensions

LCS-20- *

CAD (File name: Page 1077 or Ending 134)

• Stroke length: For 10, 20, 30, 40, 50

(Main body fixing holes in this drawing shows the case of 50 mm stroke.)



Dimensions table per stroke length

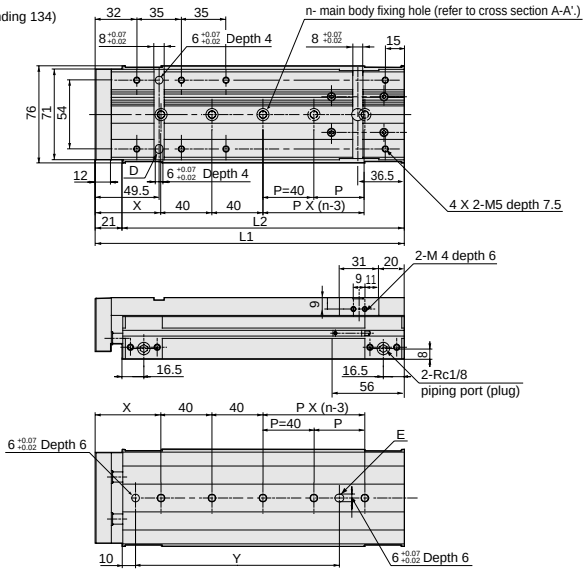
Stroke length	10	20	30	40	50
L1	110.5	110.5	110.5	120.5	130.5
L2	89.5	89.5	89.5	99.5	109.5
X	45	45	45	51	49
Y	34	34	34	40	38
RD	35	25	15		

LCS-20- *

CAD (File name: Page 1077 or Ending 134)

• Stroke length: When 75, 100, 125, 150

(Main body fixing holes in this drawing shows the case of 150 mm stroke.)



Dimensions table per stroke length

Stroke length	75	100	125	150
L1	167	192	217	242
L2	146	171	196	221
n	3	4	4	5
X	46	46	53	51
Y	75	115	122	160
RD	15			

Note: Dimensions not mentioned are as same as the figure above.

Discontinue

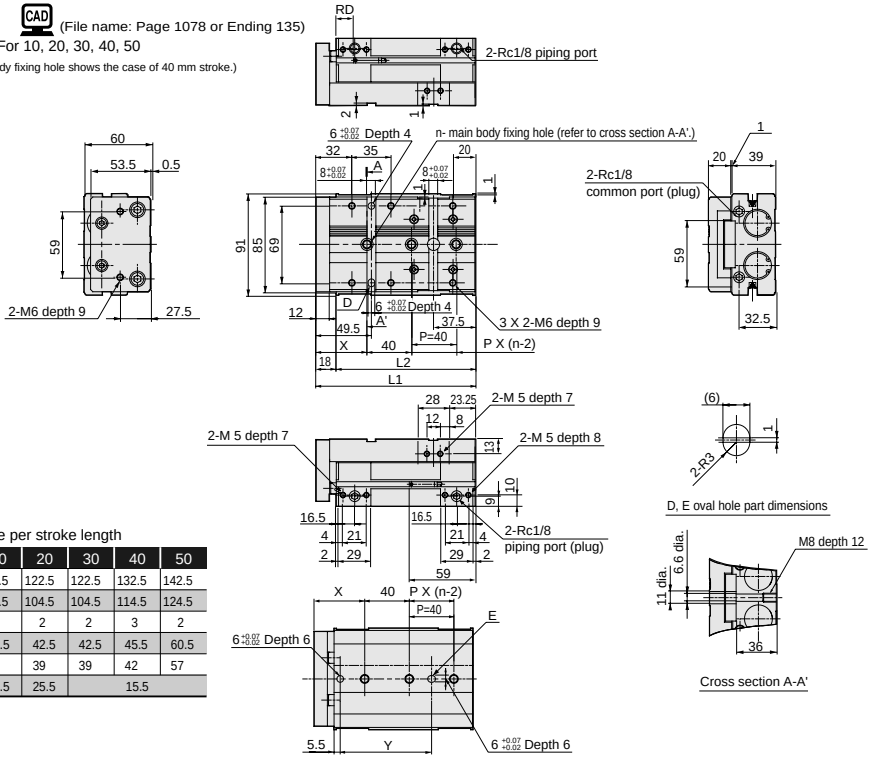
Dimensions

LCS-25- *

CAD (File name: Page 1078 or Ending 135)

• Stroke length: For 10, 20, 30, 40, 50

(This figure main body fixing hole shows the case of 40 mm stroke.)



Dimensions table per stroke length

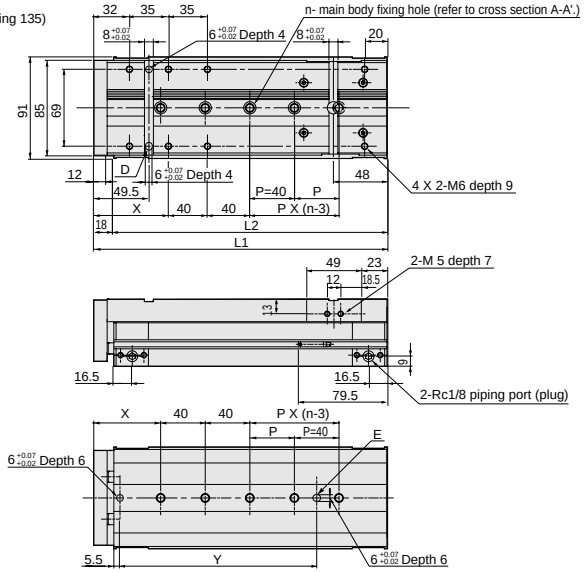
Stroke length	10	20	30	40	50
L1	122.5	122.5	122.5	132.5	142.5
L2	104.5	104.5	104.5	114.5	124.5
n	2	2	2	3	2
X	42.5	42.5	42.5	45.5	60.5
Y	39	39	39	42	57
RD	35.5	25.5	15.5		

LCS-25- *

CAD (File name: Page 1078 or Ending 135)

• Stroke length: When 75, 100, 125, 150

(Main body fixing holes in this drawing shows the case of 150 mm stroke.)



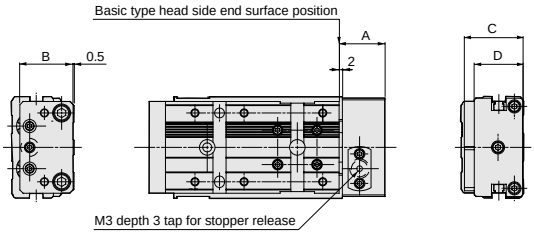
Dimensions table per stroke length

Stroke length	75	100	125	150
L1	188	213	238	263
L2	170	195	220	245
n	3	4	5	5
X	60	55	45	60
Y	96.5	131.5	161.5	176.5
RD	15.5			

Note: Dimensions not mentioned are as same as the figure above.

Position locking type dimensions

LCS-Q-8/12/16/20/25 (File name: Page 1079 to 1083 or Ending 136 to 140)



Unit (mm)

Symbol / Bore size (mm)	A	B	C	D
8 dia.	23	22.5	29.5	23.5
12 dia.	24.5	28	31	25
16 dia.	28	32.5	36	30
20 dia.	30	41.5	41.5	35.5
25 dia.	30	53.5	47	41

Note: Not indicated dimensions are as same as basic type.

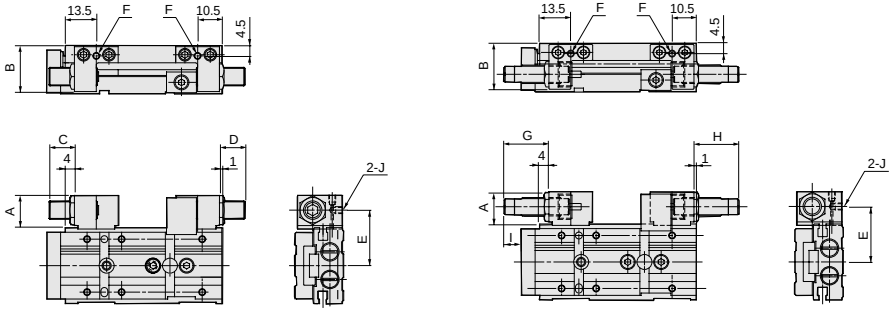
Note: Main body rear port is not available for position locking type.

Discontinue

Dimensions: Option

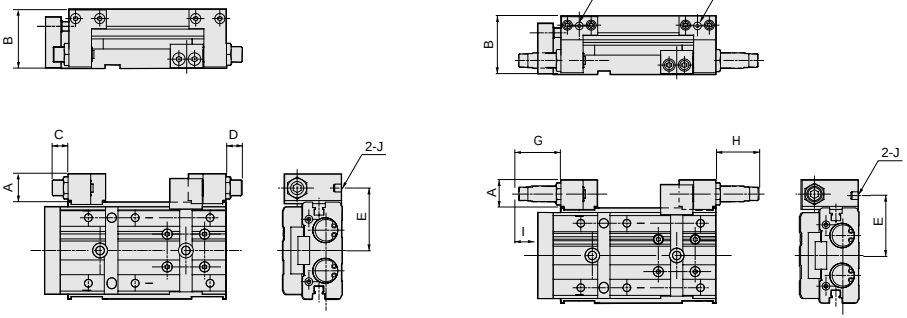
• Stopper for adjustable stroke: (S1 to S6)
For 6 mm bore

CAD (File name: Page 1073 or Ending 130)



• Stopper for adjustable stroke: (S1 to S6)
When 8 to 25mm bore

CAD (File name: Page 1074 to 1078 or Ending 131 to 135)



• Shock absorber type stopper: (A1 to A6)

E, F and J dimensions are applied only when ports are provided at stopper section (S*D*, A*D*)
Adjustable stroke range of stopper for adjustable stroke is 5mm at single side.
For position locking function type, S3** to S6** and A3** to A6** are not available.

Unit: mm

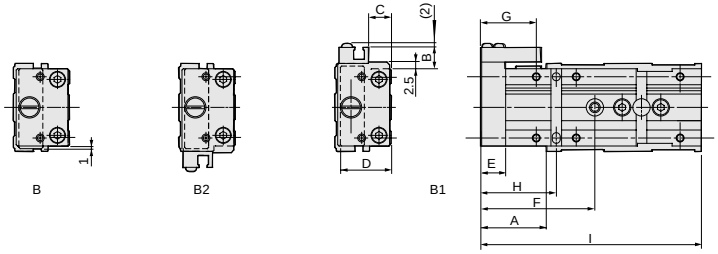
Symbol / Bore size (mm)	A	B	C		D		E	F	G	H	I	J	K
			30St or less	40St over	30St or less	40St over							
6 dia.	14	19.5	11	10.5	11	10.5	24	M3 depth 3	19.5	19.5	7.5	M3 depth 3	9
8 dia.	16	24.5	9.5		9.5		27.3	M5 depth 4	27.5	27.5	17.5	M5 depth 4	17
12 dia.	16	29	12		12		31	M5 depth 4	25	25	11	M5 depth 4	14.5
16 dia.	18.5	37	10		10		39	M5 depth 4	27.5	27.5	12.5	M5 depth 4	15
20 dia.	21	45	14.5		14.5		46	Rc1/8	28.5	28.5	7.5	M5 depth 4	13
25 dia.	21	57	11.5		11.5		54.5	Rc1/8	25.5	25.5	7.5	M5 depth 4	10

K: Single side adjustable stroke range of shock absorber type

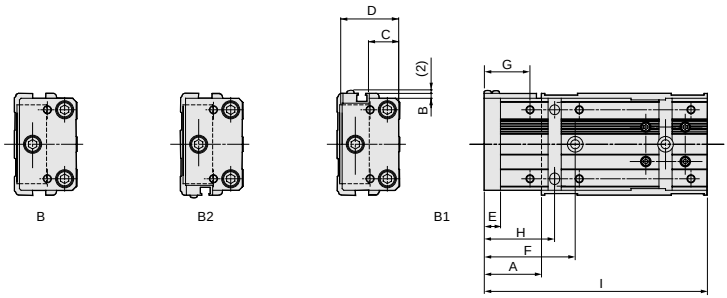
Dimensions: Option

• Buffer: (B, B1, B2)
For 6 mm bore

CAD (File name: Page 1073 or Ending 130)



When 8 to 25mm bore CAD (File name: Page 1074 to 1078 or Ending 131 to 135)



Unit: mm

Symbol / Bore size (mm)	A	B	C	D	E	F Stroke length (mm) 10	20	30	40	50	75	100	125	150	G	H
6 dia.	24.5	8	8.5	19	14	45	45	42.5	43.5	45	—	—	—	—	20.5	28
8 dia.	24.5	5.5	7.5	23	9	42.5		42.5	41	42.5	39.5	—	—	—	20	30
12 dia.	34	5	12	28.5	10	57.5			56	52	54.5	67	—	—	26	38.5
16 dia.	35	3	18.5	35.5	10	54			65.5	55.5	59	57	69	—	28	43
20 dia.	41	1.5	27.5	44	14	65			71	69	66	66	73	71	32	49.5
25 dia.	43	0	39.5	56.5	14	67.5			70.5	85.5	85	80	70	85	32	49.5

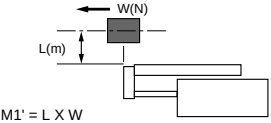
Symbol / Bore size (mm)	I Stroke length (mm) 10	20	30	40	50	75	100	125	150
6 dia.	82.5	82.5	92.5	112.5	122.5	—	—	—	—
8 dia.	80.5	80.5	90.5	109.5	119.5	144.5	—	—	—
12 dia.	111	111	111	121	131	165	190	—	—
16 dia.	116	116	116	126	136	178	203	228	—
20 dia.	130.5	130.5	130.5	140.5	150.5	187	212	237	262
25 dia.	147.5	147.5	147.5	157.5	167.5	213	237	263	288

Note: Not indicated dimensions are as same as basic type.
Note: Dimension D shows dimension to the connecting plate lower face.
Note: Dimension C shows dimension to switch rail projecting portion at buffer part.
Note: For a 6 mm bore cylinder with buffer, when installing switches, a switch may project from the switch rail depending on adjustment of switch detecting position.

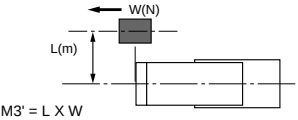
Discontinue

STEP-1

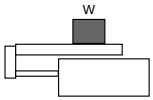
❶ Find loads to each direction and impact moment occur at the stroke limit.



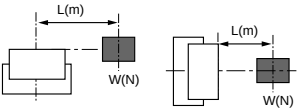
M1' = L X W



M3' = L X W



W' = W



M2' = L X W

Find rough value of coefficient G from [Table 1].

[Table 1] Va (average speed) = $\frac{\text{Movement distance}}{\text{Travel time}}$ (m/s)

Average speed Va (m/s)	Vm Stroke length end speed (m/s)	Coefficient G
to 0.07	to 0.1	5
to 0.2	to 0.3	14
to 0.27	to 0.4	19
to 0.35	to 0.5	24

Coefficient G = ☐

M1' X G = ☐ (N • m)

M2' = ☐ (N • m)

M3' X G = ☐ (N • m)

W' = ☐ (N)

E' = $\frac{1}{2}$ X mX Vm^2 = ☐ (J)

(M ≒ $\frac{W}{9.8}$)

❷ Select the bore size temporally to meet the conditions of below formula.

$$M'T = \frac{M1' \times G}{M1'\ max} + \frac{M2'}{M2'\ max} + \frac{M3' \times G}{M3'\ max} + \frac{W'}{W'\ max.} < 1$$

$$E' < E\ max$$

M'T : Composite moment (should be smaller than 1.)

G : Coefficient G

W' max : Max. allowable value of W' (from Table 2)

M1'max : Max. allowable value of M1' (from Table 2)

M2'max : Max. allowable value of M2' (from Table 2)

M3'max : Max. allowable value of M3' (from Table 2)

E max. : Max. allowable value of E0 (from Table 3)

[Table 2] Allowable static load

Bore size	Stroke length (mm)	Vertical load W' max. (N)	Bending moment M1' max. (N • m)	Radial moment M2' max. (N • m)	Twist moment M3' max. (N • m)
6 dia.	0 to 30	140	1.7	3.5	1.7
	40 to 50	186	10.68	5.64	10.68
8 dia.	0 to 30	140	1.7	3.5	1.7
	40 to 75	186	10.68	5.64	10.68
12 dia.	0 to 50	220.8	5.68	9.76	5.68
	75 to 100		22.2		22.2
16 dia.	0 to 50	380.8	17.82	19.2	17.82
	75 to 125		37.28		37.28
20 dia.	0 to 50	548.8	31.14	37.6	31.14
	75 to 150		56.24		56.24
25 dia.	0 to 50	961.5	65.11	116.25	65.11
	75 to 150		127.5		127.5

[Table 3] Allowable energy absorption of LCS (E_0)

Bore size	Standard (J)	Stopper for adjustable stroke (J)	Shock absorber type stopper (J)
6 dia.	0.0112	0.0032	0.6
8 dia.	0.058	0.0032	0.6
12 dia.	0.112	0.014	2.1
16 dia.	0.176	0.043	5.4
20 dia.	0.314	0.055	9.7
25 dia.	0.314	0.14	9.7

STEP-2

Then, increase accuracy of load factor, effective thrust, speed at stroke end and composite moment.

• Find the load factor.

$$\alpha = \frac{F_0}{F} \times 100[\%]$$

α : Load factor

F_0 : Required force to move a work piece (N).

F : Cylinder theoretical thrust (N)

[Table 4]

At horizontal operation	At vertical operation
F0 = FW	F0 = W+FW
FW: W X 0.2 Note (N)	
W: Load (N)	

Note: Friction coefficient

[Table 4] Theoretical thrust table (Unit: N)

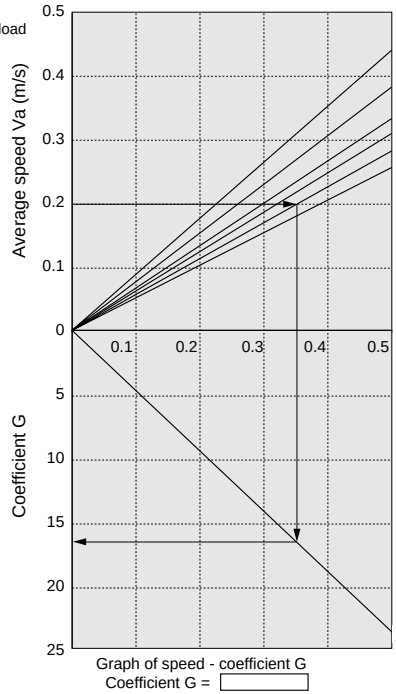
Bore size (mm)	Operational direction	Working pressure MPa						
		0.15	0.2	0.3	0.4	0.5	0.6	0.7
6 dia.	PUSH	8	11	16	22	27	33	38
	PULL	6	8	12	16	20	24	29
8 dia.	PUSH	14	19	28	38	48	57	67
	PULL	10	14	21	28	36	43	50
12 dia.	PUSH	32	43	65	86	108	130	152
	PULL	24	32	48	65	81	97	114
16 dia.	PUSH	57	77	115	154	193	231	270
	PULL	49	66	99	132	165	199	232
20 dia.	PUSH	90	120	181	241	301	362	422
	PULL	76	101	152	202	253	304	354
25 dia.	PUSH	141	188	282	377	481	565	660
	PULL	188	158	237	316	396	475	554

[Table 5] Reference of load factor

Working pressure MPa	Load factor (%)
0.2 to 0.3	$\alpha \leqq 40$
0.3 to 0.6	$\alpha \leqq 50$
0.6 to 0.7	$\alpha \leqq 60$

STEP-3

Find the speed at stroke end (Vm) and coefficient G with average speed (Va) and load factor found at STEP-2.



Graph of speed - coefficient G

Coefficient G = ☐

Arrow (→) in the figure shows an example to find [speed at stroke end: 0.35m/s] and [coefficient G: 6.8] at average speed: 0.20m/s and load factor: 50%.

Discontinue

STEP-4

Confirm the composite moment (M_T) with coefficient G and speed at stroke end (Vm) found at STEP-3

M1' X G = ☐ (N · m)

M2' = ☐ (N · m)

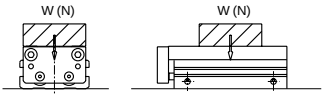
M3' X G = ☐ (N · m)

W' = ☐ (N)

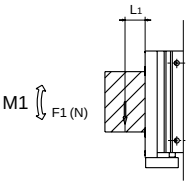
$$M'_T = \frac{M1' \times G}{M1' \text{ max}} + \frac{M2'}{M2' \text{ max}} + \frac{M3' \times G}{M3' \text{ max}} + \frac{W'}{W' \text{ max.}} = \square$$

Confirm composite moment MT during travel. (This value is different from the value found at STEP-1).

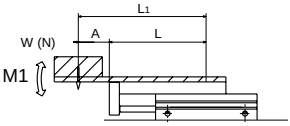
• Vertical load: W (N)



• Bending moment: M1 (N • m)



M1 = F1 X L_1

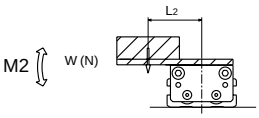


M1 = W X L_1

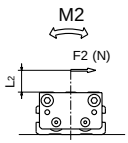
L_1 = A + L

L below table value

• Radial moment: M2 (N • m)

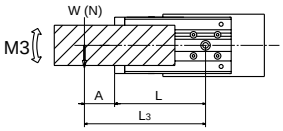


M2 = W X L_2



M2 = F2 X L_2

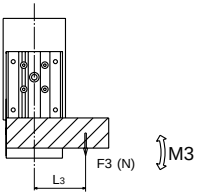
• Twist moment: M3 (N• m)



M3 = W X L_3

L_3=A+L

L below table value



M3 = F3 X L3

Value L

Unit (m)

Bore size	Stroke length									Buffer increase
	10	20	30	40	50	75	100	125	150	
6 dia	0.048	0.048	0.054	0.073	0.083	—	—	—	—	0.017
8 dia	0.049	0.049	0.059	0.073	0.083	0.108	—	—	—	0.015
12 dia.	0.070	0.070	0.070	0.080	0.090	0.117	0.142	—	—	0.020
16 dia.	0.071	0.071	0.071	0.081	0.091	0.124	0.149	0.174	—	0.020
20 dia.	0.081	0.081	0.081	0.091	0.101	0.131	0.156	0.181	0.206	0.020
25 dia.	0.085	0.085	0.085	0.095	0.105	0.140	0.165	0.190	0.215	0.025

M1 = M1 = ☐ (N · m)

M2 = M2 = ☐ (N · m)

M3 = M3 = ☐ (N · m)

W = W = ☐ (N)

$$M_T = \frac{M1}{M1max} + \frac{M2}{M2max} + \frac{M3}{M3max} + \frac{W}{Wmax} = \square$$

M_T : Composite moment

Wmax : Max. allowable value of W (from Table 6)

M1max : Max. allowable value of M1 (from Table 6)

M2max : Max. allowable value of M2 (from Table 6)

M3max : Max. allowable value of M3 (from Table 6)

E max. : Max. allowable value of E0 (from Table 3)

[Table 6] Allowable travel load

Bore size	Stroke length (mm)	Vertical load Wmax (N)	Bending moment M1 max (N · m)	Radial moment M2 max. (N · m)	Twist moment M3 max (N · m)
6 dia.	0 to 30	14.00	0.17	0.35	0.17
	40 to 50	15.50	0.89	0.47	0.89
8 dia.	0 to 30	14.00	0.17	0.35	0.17
	40 to 75	15.50	0.89	0.47	0.89
12 dia.	0 to 50	27.60	0.71	1.22	0.71
	75 to 100		2.22		2.22
16 dia.	0 to 50	47.60	1.98	2.40	1.98
	75 to 125		4.66		4.66
20 dia.	0 to 50	68.60	3.46	4.70	3.46
	75 to 100		7.03		7.03
25 dia.	0 to 50	128.20	7.66	15.50	7.66
	75 to 100		17.00		17.00

Confirm that MT, M'T ≦ 1.

↓

Bore size determination

↓

A dia.

STEP-5

Confirming allowable energy absorption

$$E = \frac{1}{2} \times m \times Vm^2$$

E : Kinetic energy at work piece end (J)

m : Mass of load (kg) ($m \fallingdotseq \frac{W(N)}{9.8}$)

Vm : Speed at stroke end (m/s)

E max. : Max. allowable value of E0 (from Table 3)

Confirm if E ≦ E max.

↓

Bore size determination

↓

B dia.

STEP-6

STEP-4 Bore size determined according to (load conditions)

A dia.

STEP-5 Bore size determined according to (allowable energy absorption)

B dia.

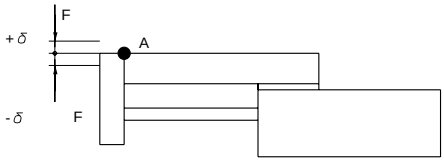
A dia. ≦ B dia. → B dia. should be selected.

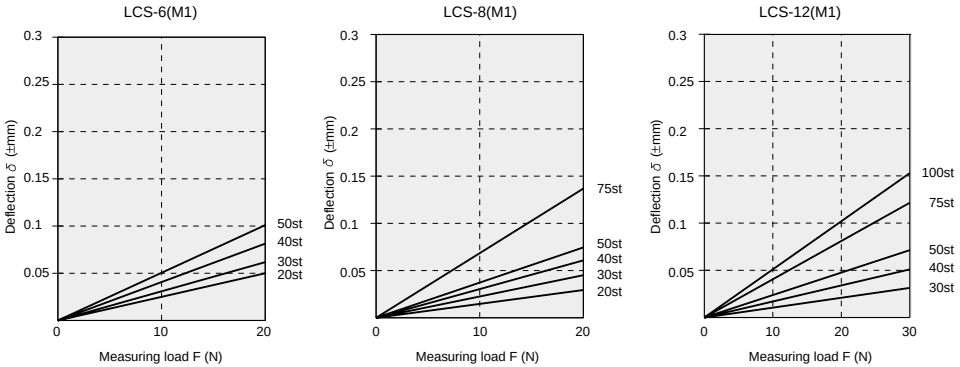
or → A dia. can be selected if a shock absorber type stopper is used together.

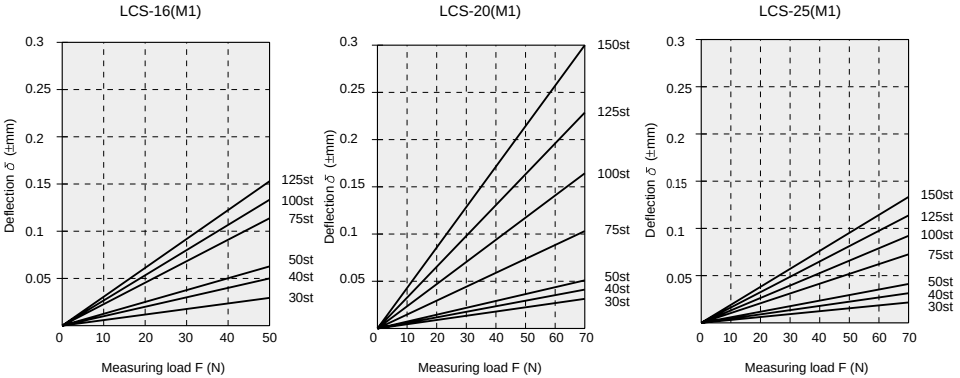
A dia. > B dia. → A dia. should be selected.

Discontinue

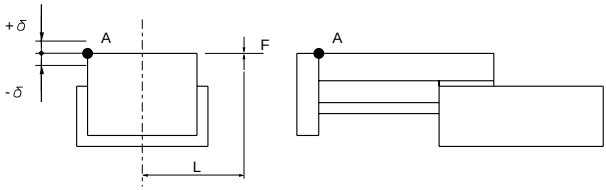
Displacement at A point



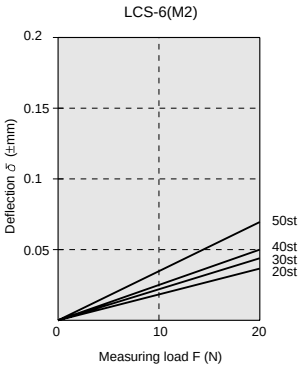


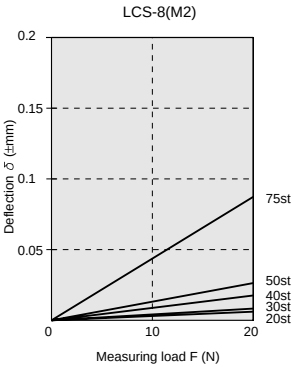


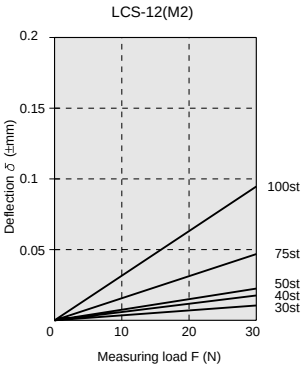
Displacement at A point

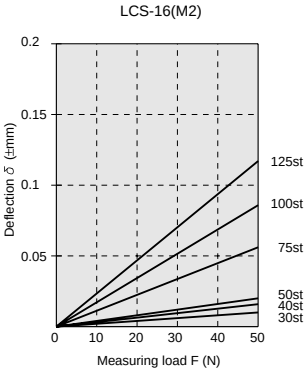


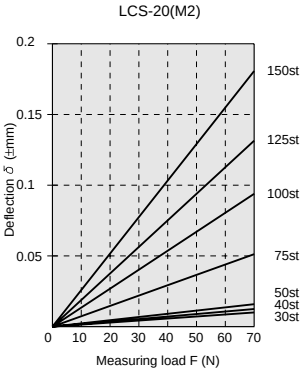
Value of L
6 dia.: L= 70, 8 dia.: L= 70
12 dia.: L= 90, 16 dia.: L=100
20 dia.: L= 100, 25 dia.: L=100

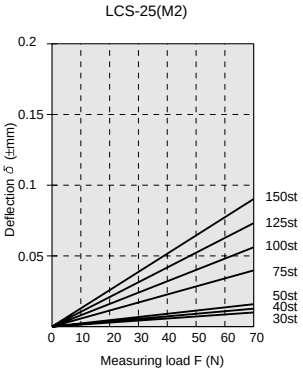












Discontinue

Displacement at A point