### Precision Cylinder MTS Series

### ø8, ø12, ø16, ø20, ø25, ø32, ø40

### Cylinder with ball spline



### Series Variations





### **Precision Cylinder**

### Non-rotating accuracy: 0.1° or less

]**⊘** 15

(0.2° or less for Ø8, within allowable torque values)



Short mounting pitch: 15 mm

### Small size Ø8 introduced to series

Ø)

Rod through-hole allows vacuum piping (Made-to-order). Lifting and transfer of small electronic parts is possible with short mounting pitch.



Piping is possible from two directions.



# Two auto switches can be mounted even with the minimum 5 stroke (mm).

Uses new type compact

auto switches (ø8 only).

### Mounting space reduced

0



Auto switch capable on four sides (Two sides for Ø8)



Two types of rod end configuration

Standard: Rod end female threads Option: Rod end male thread (Using stud bolt)



Rod end female thread

ad Rod end male thread



## with Internal Guide Function.

## MTS Series

### Deflection: 0.1 mm or less

(For MTS12-25, within allowable lateral load values)

### Reduced labor for design and assembly

### Mounting is possible in high accuracy.



Parallelism of mounting surfaces (side, bottom) to rod: 0.1 mm or less Squareness of mounting surface (front) to rod: 0.1 mm or less



Rear end lock type added to series (Ø12 to Ø40)



Sealing and durability equivalent to current round rod models have been achieved with a specially configured rod seal.

#### Stroke adjustment mechanism/ Made to Order Specifications Stroke adjustment is possible on the rod extension side. Stroke adjustment range: 0 to 10 mm (08) : 0 to 25 mm (012 to 040)

### **Application Example**



1945) (B. a

### MTS Series Model Selection

Caution Confirmation of theoretical output is required separately. Refer to "Theoretical Output" on page 503.

Selection Conditions/Follow the tables below in order to determine selection conditions and choose one selection graph.

#### Vertical Mounting



#### **Horizontal Mounting**



\* L: Overhang The distance between the cylinder's central axis and the load center of gravity

### A Caution

 In the case of horizontal mounting, when the load center of gravity is beyond the rod end, add that distance to the stroke to select a graph.



#### Selection Example

1. Selection conditions

Mounting: Vertical Maximum speed: 800 mm/s Overhang: 50 mm Load mass: 2 kg

Refer to graph (7) based on vertical mounting and the maximum speed of 800 mm/s. On graph (7), find the intersecting point for the overhang of 50 mm and the load mass of 2 kg to determine ø32. 2. Selection conditions Mounting: Horizontal Maximum speed: 600

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Maximum speed: 600 mm/s Stroke: 125 mm Overhang: 80 mm Load mass: 0.7 kg

Refer to graph (16) based on horizontal mounting, the maximum speed of 600 mm/s, and 125 mm stroke. On graph (16), find the intersecting point for the overhang of 80 mm and the load mass of 0.7 kg to determine ø25.

### Vertical Mounting











Graph (7) Maximum Speed: Up to 800 (mm/s) mass W (kg) ø**40** ø**32** Load I 0.5 0.4 ø**25** 0.2 ø**20** ø12 0.1 30 200 10 20 50 100 Overhang L (mm)

### **Horizontal Mounting**



### ø12 to ø40











Maximum speed: Up to 800 mm/s

Graph (18) Stroke: Up to 50 stroke



Graph (19) Stroke: Up to 100 stroke



Graph (20) Stroke: Up to 150 stroke





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### MTS Series Spline Rod Displacement

### Warp Angle

#### Displacement angle of spline rod due to torque load

The displacement angle when a static load is applied in the direction of the arrow, with the spline rod retracted.





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### **Deflection Amount**

















Caution on Design

### **▲** Caution

### 1. Displacement may increase after an impact load has been applied.

If an impact load is applied to the spline rod, the guide unit may be permanently deformed and displacement may increase.

### Precision Cylinder **MTS** Series 08, 012, 016, 020, 025, 032, 040



Applicable Auto Switches/Refer to pages 1289 to 1383 for further information on auto switches.

			ight		l	oad voltag	je	Auto switc	h model	Lead	wire I	length (m)				
Туре	Special function	entry	Indicator	(Output)	DC AC		Perpendicular	In-line	0.5 (Nil)	1 (M)	3 (L)	5 (Z)	connector	Applicable load		
				3-wire (NPN)		EV 10 V		M9NV	M9N	٠	٠	۰	0	0	IC	
				3-wire (PNP)		5 V, 12 V		M9PV	M9P	•	•	•	0	0	circuit	Licuit IC circuit -
ے ہ				2-wire		12 V		M9BV	M9B	٠	•	٠	0	0	-	
jitat			res	3-wire (NPN)		EV 10 V		M9NWV	M9NW	٠	٠	۰	0	0	IC	
spa	Diagnostic indication	Grommet		3-wire (PNP)	24 V	5 V, 12 V	—	M9PWV	M9PW	•	•	•	0	0	circuit	
등육	(2-color indicator)			2-wire		12 V		M9BWV	A9BWV M9BW	•	٠	۰	0	0		
s e	Materia and States			3-wire (NPN)		EV 10 V		M9NAV*1	M9NA*1	0	0	۰	0	0	IC	
	(2-color indicator)			3-wire (PNP)		5 V, 12 V		M9PAV*1	M9PA*1	0	0	•	0	0	circuit	
				2-wire		12 V		M9BAV*1	M9BA*1	0	0	۰	0	0		
ed vitch		Grommet	nmet Yes	3-wire (NPN equivalent)	—	5 V	_	A96V	A96	•	-	•	-	-	IC circuit	-
6 B				2-wiro	24 V	12 V	100 V	A93V*2	A93	٠	٠	٠	٠	-	—	Relay,
auf			No	2-wire		12 V	100 V or less	A90V	A90	٠	-	٠	-	-	IC circuit	PLC

\* Solid state auto switches marked with "O" are produced upon receipt of order.

\*1 Water resistant type auto switches can be mounted on the above models, but in such case SMC cannot guarantee water resistance. \*2 1 m type lead wire is only applicable to D-A93.

\* Lead wire length symbols: 0.5 m...... Nil (Example) M9NW

- 1 m······ M (Example) M9NWM
- 3 m······· L (Example) M9NWM
- 5 m······· Z (Example) M9NWL

\* Since there are other applicable auto switches than listed, refer to page 513 for details.

\* For details about auto switches with pre-wired connector, refer to pages 1358 and 1359.

\* Auto switches are shipped together (not assembled).



### Specifications





Symbol	Specifications
-XC8	Adjustable stroke cylinder/Adjustable extention type
-XC38	Vacuum (Rod through-hole)

### Standard Stroke

Bore size (mm)	Standard stroke (mm)
8	5, 10, 15, 20, 25, 30
12, 16	25, 50, 75, 100
20, 25, 32, 40	25, 50, 75, 100, 125, 150, 175, 200

\* Strokes other than the above are produced upon receipt of order.

### Stud Bolt Part No.

Bore size (mm)	Part no.
8	MT-S8
12	MT-S12
16	MT-S16
20	MT-S20
25	MT-S25
32	MT-S32
40	MT-S40

Replacement parts for rod end male thread.
 Rod end nut is attached.

### A Caution

#### Mounting

When attaching or removing loads, be sure to do so while securing the spline rod's width across flats and not to apply a rotating torque on the spline nut.

If rotational torque must be applied due to unavoidable circumstances, use the table below to make sure the allowable rotational torque is not exceeded.

Bore size (mm)	8	12	16	20	25	32	40
Allowable rotating torque (N·m)	0.03	0.18	0.38	0.69	1.08	5.75	10.4

Bore siz	e (mm	)	8	12	16	20	25	32	40				
Spline rod siz	e (mm)	)	4	6	8	10	13	16	20				
Fluid						Air							
Min. operating	Withou	It end lock	0.15 MPa	0.12	MPa		0.1 M	ИРа					
pressure	With er	nd lock *	-	0.17	MPa		0.15	MPa					
Maximum ope	rating	pressure				0.7 MPa							
Proof pressure	•					1.0 MPa							
Ambient and fl	uid ten	nperature			-10 to	o 60° (No fr	eezing)						
Bearing type			Ball spline										
Cushion			Rubber bumper Air cushion										
Effective cushi	ion len	gth (mm)	-	9	10	11	12	17	17				
Lubrication			Not required (Non-lube)										
Piston speed	(mm/s	)	50 to 500			50 to	800						
Allowable kine	etic en	ergy (J)	0.02	0.19	0.32	0.55	0.78	1.6	2.8				
Stroke toleran	ce					+1.0 mm							
Non-rotating accuracy			0.2° or less (Within allowable torque values)	C	).1° or less	(Within all	owable tore	que values	)				
-		M3 x 0.5	M5 x 0.8	M5 x 0.8	M5 x 0.8	M5 x 0.8	Rc 1/8	Rc 1/8					
Piping port siz	ze	TN	_	_	_	_	_	NPT 1/8	NPT 1/8				
		TF	—	—	-	—	-	G 1/8	G 1/8				
-													

Except lock unit, 0.12 MPa for ø12 and 16; 0.10 MPa for ø20 to 40 respectively.

### End Lock Specifications

Bore size (mm)	12	16	20	25	32	40				
Lock position		Head end only								
Holding force (Max.) (N)	29	53	82	125	211	329				
Backlash		1 mm								
Manual release		Non-lock type only								

### **Theoretical Output**

								(14)				
Bore size	Operating	Piston area	Operating pressure (MPa)									
(mm)	direction	(mm²)	0.2	0.3	0.4	0.5	0.6	0.7				
•	OUT	50	10	15	20	25	30	35				
0	IN	37	8	11	15	19	22	26				
10	OUT	113	23	34	45	57	68	79				
12	IN	84	17	25	34	42	50	59				
16	OUT	201	40	60	80	101	121	141				
10	IN	150	30	45	60	75	90	105				
	OUT	314	63	94	126	157	188	220				
20	IN	235	47	71	94	118	141	165				
05	OUT	490	98	147	196	245	294	343				
25	IN	358	72	107	143	179	215	251				
20	OUT	804	161	241	322	402	482	563				
32	IN	603	121	181	241	302	362	422				
40	OUT	1,256	251	377	502	628	754	879				
40	IN	942	188	283	377	471	565	659				

▲ Caution Do not apply a load that is 50% or more of the theoretical output.

### Weight

														(g)
Model	Standard stroke (mm)													
wouer	5	10	15	20	25	30	50	75	100	125	150	175	200	additional weight
MTS8	36	40	44	48	52	56	-	-	—	-		—	_	-
MTS12	—	_	_	_	138	_	157	175	194	_	_	—	_	29
MTS16	-	-	_	-	186	-	222	258	294	-	_	-	-	34
MTS20	_		-	-	350	_	400	450	500	549	599	649	699	42
MTS25	_	_	_	_	487	_	547	608	669	729	790	851	912	55
MTS32	-		-	-	918	_	1,000	1,083	1,165	1,247	1,330	1,412	1,495	90
MTS40	_	_	_	_	1,420	_	1,533	1,645	1,758	1,870	1,983	2,095	2,208	133



(61)

#### Construction



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#### Not able to disassemble.

A special tool is required when disassembling or reassembling the cylinder. When replacing the seal, this work needs to be carried out at SMC's factory.

#### **Component Parts**

No.	Description	Material	Qty.	Note
1	Rod cover	Aluminum alloy	1	Clear anodized
2	Head cover Aluminum alloy		1	Clear anodized
3	Cylinder tube	Aluminum alloy	1	Hard anodized
4	Piston	Aluminum alloy	1	
5	Spacer for switch type	Aluminum alloy	1	Chromated
-	Coline red	Stainless steel	1	ø8: Quenched
0	Spillie Tou	Carbon steel	1	ø12 to ø40: Quenched/Hard chrome plated
-	Cuchion holt	Stainless steel	1	ø8 to ø16
'	Cusilion bolt	Carbon steel	1	ø20 to ø40: Zinc chromated
8	End lock bolt	Carbon steel	1	Quenched/Zinc chromated
9	Collar	Aluminum alloy	1	Chromated
10	Spline nut	—	1	
11	Cushion needle	Carbon steel	2	Nickel plated
12	Сар	Copper alloy	1	Nickel plated
13	Lock piston	Carbon steel	1	Quenched/Hard chrome plated
14	Lock spring	Steel wire	1	Zinc chromated

No.	Description	Material	Qty.	Note
15	Bumper	Urothono	2	ø8
15	Builiper	Orethane	1	ø12 to ø40
16	Key	Carbon steel	1	
17	Type C retaining	Corbon tool stool	2	ø8: Phosphate coated
17	ring for hole	Carbon toor steer	1	ø12 to ø40: Phosphate coated
18	Magnet	—	1	
19	Plug	Alloy steel	3	Nickel plated
20	Hexagon socket head set screw	Alloy steel	1	Black zinc chromated
21	Piston seal	NBR	1	
22	Spline seal	NBR	1	Rod seal for ø8
23	Collar gasket	NBR	1	
04	-	NPD	1	ø8
24	Tube gasket	INDIN	2	ø12 to ø40
25	Piston gasket	NBR	1	
26	Cushion seal	Urethane	2	ø12: NBR
27	Needle gasket	NBR	2	
28	Piston seal for lock	NBR	1	
29	Cap gasket	NBR	1	



### Dimensions: Ø8

### MTS8

Note) Spline rod's width across flats have nothing to do with the position of the body mounting face.



Stud bolt part no.: MT-S8 Material: Chromium molybdenum steel (Nickel plated) Rod end nut part no.: NTJ-006B Material: Carbon steel (Zinc chromated)

### Dimensions: ø12

### **MTS12**

Note) Spline rod's width across flats have nothing to do with the position of the body mounting face.



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### Dimensions: ø16

### **MTS16**

Basic type



97 + Stroke 113 + Stroke

### Dimensions: ø20

### MTS20



**⊘**SMC

### Dimensions: ø25

### MTS25

Note) Spline rod's width across flats have nothing to do with the position of the body mounting face.

Basic type



Material: Chromium molybdenum steel (Nickel plated)

Rod end nut part no.: NT-02 Material: Carbon steel (Zinc chromated)

#### With end lock



#### Dimensions: ø32



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### Dimensions: ø40



### MTS Series **Auto Switch Mounting 1**

Auto Switch Proper Mounting Position (Detection at Stroke End) and Its Mounting Height



D-A9 **D-M9**□ D-M9□W D-M9









D-F8



D-A9□V D-M9□V D-M9 WV D-M9 AV в 01.6 ≃Hv

#### **Operating Range**

							()			
Auto quitab model	Bore size									
Auto switch model	8	12	16	20	25	32	40			
D-A9□/A9□V	5	6	7.5	7.5	8	7	8			
D-M9□/M9□V D-M9□W/M9□WV D-M9□A/M9□AV	3.0	4.5	4	4.5	5	4.5	5.5			
D-F8	2.5	4	4.5	4.5	4.5	4.5	5			

(mm)

× ··· Not mountable

\* Since this is a guideline including hysteresis, not meant to be guaranteed. (Assuming approximately 30% dispersion.)

There may be the case it will vary substantially depending on an ambient environment.

Auto	uto Switch Proper Mounting Position (mm)																				
Bore	e Reed auto switch					Solid state auto switch								2-color indicator solid state auto switch							
size	1	D-A9□	1	D-A9 V D-M9 D-M9 V D-F8		]	D-M9 W, D-M9 A D-M9 WV			WV, D-N	/9□AV										
(mm)	Α	В	С	Α	в	Ηv	Α	в	С	Α	в	Hv	Α	в	Ηv	Α	в	С	Α	в	Hv
8	36	25	16	36	25	15	32	21	20	32	21	17.5	18	7	25	32	21	20	32	21	17.5

Note) Adjust the auto switch after confirming the operating conditions in the actual setting.

### Auto Switch Mounting Stroke for Ø8

Dining direction	Mounting condition	Applicable auto quitab	Stroke (mm)							
Piping direction	Mounting condition	Applicable auto switch	5	10	15	20	25	30	Note	
Standard piping type (1)	2 pcs. on same side	D-A9	×	×	×	0	0	0	(2)	
		D-M9□, D-M9□W, D-M9□A	×	×	0	0	0	0	(2)	
_ 0		D-A9⊡V	×	×	×	0	0	0		
- <u>- e</u>	1 pc. each on 2 sides	D-A9	×	0	0	0	0	0	(2)	
2 x part size		D-M9□, D-M9□W, D-M9□A	0	0	0	0	0	0	(2)	
		D-A9□V	×	0	0	0	0	0		
Axial piping type	2 pcs. on same side	D-A9	×	×	×	0	0	0	(2)	
		D-M9□, D-M9□W, D-M9□A	×	×	0	0	0	0	(2)	
	500	D-A9□V	×	×	×	0	0	0		
	190	D-M9 V, D-M9 WV, D-M9 AV	×	×	0	0	0	0		
		D-F8	0	0	0	0	0	0		
	1 pc, each on 2 sides	D-A9□	×	0	0	0	0	0	(2)	
		D-M9□, D-M9□W, D-M9□A	0	0	0	0	0	0	(2)	
	8.00	D-A9□V	×	0	0	0	0	0		
<u>2 x port size</u>		D-M9 V, D-M9 WV, D-M9 AV	0	0	0	Ó	0	0		
		D-F8	0	0	0	0	0	0		
Note 1) With the standard piping type, soli	id state auto switches D-F	8□, D-M9□V, D-M9□WV and D-M9□	AV with	perpend	icular		C	···· Mour	ntable	

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Note 1) With the standard piping type, solid state auto switches D-F8□, D-M9□V, D-M9□WV and D-M9□AV with perpendicular electrical entry cannot be mounted due to the interference of the fitting and speed controller.

Note 2) When mounting auto switches with in-line electrical entry, allow a space of 10 mm or more at the rear end to prevent lead wire interference.



### Auto Switch Proper Mounting Position (Detection at Stroke End) and Its Mounting Height



#### Auto Switch Proper Mounting Position

Bore	Reed auto switch							Solid state auto switch							2-color indicator solid state auto switch						
size	D-A9			D-A9⊟V			D-M9			D-M9⊡V			D-M9 W/D-M9 A D-M9 W				9¤WV	/V/D-M9□AV			
(mm)	Α	в	С	Α	в	Hs	Hv	Α	в	С	Α	в	Hs	Hv	Α	в	С	Α	в	Hs	Hv
12	42	15.5	35.5	42	15.5	13	18	46	19.5	31.5	46	19.5	15	20	46	19.5	31.5	46	19.5	15	20
16	43.5	17	37	43.5	17	15	20	47.5	21	33	47.5	21	17	22	47.5	21	33	47.5	21	17	22
20	59.5	23	43	59.5	23	17	22.5	63.5	27	39	63.5	27	19	24.5	63.5	27	39	63.5	27	19	24.5
25	63	26	46	63	26	20	23.5	67	30	42	67	30	22	25.5	67	30	42	67	30	22	25.5
32	84.5	32	52	84.5	32	23	26.5	88.5	36	48	88.5	36	25	28.5	88.5	36	48	88.5	36	25	28.5
40	98.5	32.5	52.5	98.5	32.5	28	28	102.5	36.5	48.5	102.5	36.5	30	30	102.5	36.5	48.5	102.5	36.5	30	30

Note) Adjust the auto switch after confirming the operating conditions in the actual setting.

Other than the applicable auto switches listed in "How to Order", the following auto switches can be mounted. For detailed specifications, refer to pages 1289 to 1383.											
Auto switch type	Auto switch type Model Electrical entry (Fetching direction) Features (mm)										
Solid state	D-F8N D-F8P D-F8B	Grommet (Perpendicular)	With indicator light	ø8 to ø40							
* Normally closed (NC = b contact) solid state auto switches (D-M9 E(V)) are also available. For details, refer to page 1308.											

(mm)

# MTS Series Auto Switch Mounting 2

(mm)

### Caution on Installing in Close Proximity to Each Other

### **▲** Caution

1. When cylinders are used in close proximity to one another as in mounting patterns (1) through (4), the magnetic force of the auto switch magnets in cylinder B may have an effect on the operation of the auto switches on cylinder A. The mounting pitch of cylinders should be at least the values given in the table below.

ø12 to ø40



#### **Dimensions by Mounting Type**

Bore size	Auto switch	(*	1)	(2)			
(mm)	model	L	d	L	d		
	D-A9□, D-A9□V	27 (37)	5 (15)	15	0		
	D-M9□, D-M9□V	27 (39)	5 (17)	15	0		
8	D-F8	47	25	15	0		
	D-M9□W, D-M9□WV D-M9□A, D-M9□AV	27 (39)	5 (17)	15	0		

( ): Denotes the values of D-A9□V, D-M9□V, D-M9□WV and D-M9□AV.

Mounting type (1) Mounting type (2) Cylinder A Cylinder B Cylinder A Cylinder B Auto switch position Auto switch position Mounting type (3) Mounting type (4) Cylinder A Cylinder A Auto switch position Auto switch position Cylinder B Cylinder B

#### **Dimensions by Mounting Type** (mm) Auto switch (1)(2) (3) (4)Bore size (mm) model L d L d L d L d D-A90. D-A90V 28 0 28 (43) 0 (15) 18 0 18 (33) 0 (15) D-M9□. D-M9□V 12 D-M9□Ŵ, D-M9□WV 28 0 10 (17) 33 (45) 18 28 (35) D-M9 A, D-M9 AV D-A9□, D-A9□V 0 32 (47 22 0 22 (37) 0 (15) 32 0 (15 D-M9□, D-M9□V 16 D-M9□W, D-M9□WV 32 0 37 (49) 5 (17) 22 0 32 (39) 10 (17) D-M9 A, D-M9 AV D-A9 . D-A9 V 38 38 (53) 0 (15) 26 0 26 (41) 0 (15) 0 D-M90. D-M90V 20 D-M9⊡Ŵ, D-M9⊡WV 38 0 38 (55) 0 (17) 26 0 56 (63) 30 (37) D-M9 A. D-M9 AV D-A90. D-A90V 40 0 40 (55) 0 (15) 32 0 32 (47) 0 (15) D-M90. D-M90V 25 D-M9 W, D-M9 WV 10 (17) 72 (74) 40 (42) 40 0 50 (57) 47 15 D-M9 A, D-M9 AV D-A9□, D-A9□V 50 0 50 (61 0 (11) 38 0 38 (53) 0 (15) D-M9□, D-M9□V 32 D-M9 W. D-M9 WV 50 0 55 (63) 5 (13) 38 0 48 (55) 10 (17) D-M9 A, D-M9 AV D-A90. D-A90V 54 0 54 (64) 0 (10) 48 0 48 (63) 0 (15) D-M90. D-M90V **4**0 D-M9 W, D-M9 WV 54 0 59 (66) 5 (12) 48 63 (70) 15 (22) D-M9 A, D-M9 AV ( ): Denotes the values of D-A9 V, D-M9 V, D-M9 WV and D-M9 AV If cylinders are used with a mounting pitch less than shown above, they must be shielded with iron plates or the separately sold magnetic shielding plate (part no.: MU-S025).

2. Avoid wiring patterns in which bending stress and pulling force are repeatedly applied to the lead wires.

When a bending stress is repeatedly applied to the lead wires, be sure to secure the lead wire close to the switch and to maintain a bending radius of R40 to R80 or more as a guideline.

Applying a stress or pulling force to the connection part of a lead wire and an auto switch may cause broken wires, or a sheath to be dropped outs. Be sure that no force of any kind is applied to the connection part.



### MTS Series Specific Product Precautions

Be sure to read this before handling the products. Refer to page 8 for safety instructions and pages 9 to 18 for actuator and auto switch precautions.

### Caution on Using End Lock Type

#### **Operating Precautions**

### **A**Caution

#### 1. Do not use 3 position solenoid valves.

Avoid use in combination with 3 position solenoid valves (especially closed center metal seal types). If pressure is trapped in the port on the lock mechanism side, the cylinder cannot be locked.

Furthermore, even after being locked, the lock may be released after some time, due to air leaking from the solenoid valve and entering the cylinder.

2. Back pressure is required when releasing the lock.

Before starting operation, be sure to control the system so that air is supplied to the side without the lock mechanism. There is a possibility that the lock may not be released. (Refer to the section on releasing the lock.)

3. Release the lock when mounting or adjusting the cylinder.

If mounting or other work is performed when the cylinder is locked, the lock unit may be damaged.

- 4. Operate with a load ratio of 50% or less. If the load ratio exceeds 50%, this may cause problems such as failure of the lock to release, or damage to the lock unit.
- 5. Do not operate multiple cylinders in synchronization.

Avoid applications in which two or more end lock cylinders are synchronized to move one workpiece, as one of the cylinder locks may not be able to release when required.

- 6. Use a speed controller with meter-out control. It may not be possible to release the lock with meter-in control.
- 7. Be sure to operate completely to the cylinder stroke end on the side with the lock.

If the cylinder piston does not reach the end of the stroke, locking and unlocking may not be possible.

#### **Operating Pressure**

### A Caution

 Apply air pressure of at least that shown in the table below to the port on the lock mechanism side. This is necessary to release the lock.

Bore size (mm)	Operating pressure (MPa)
12, 16	0.17
20, 25, 32, 40	0.15

#### Exhaust Speed

### **▲**Caution

 Locking will occur automatically if the pressure applied to the port on the lock mechanism side falls to 0.05 MPa or less. In the cases where the piping on the lock mechanism side is long and thin, or the speed controller is separated at some distance from the cylinder port, the exhaust speed will be reduced. Take note that some time may be required for the lock to engage. In addition, clogging of a silencer mounted on the solenoid valve exhaust port can produce the same effect.

#### **Relation to Cushion**

### A Caution

 When the cushion valve on the lock mechanism side is closed or nearly closed, the spline rod may not reach the stroke end, and consequently the lock may not engage. Moreover, if the lock does engage when the cushion valve is nearly closed, it may not be possible for the lock to release. Therefore, the cushion valve should be adjusted properly.

#### Releasing the Lock

### **▲ Warning**

 Before releasing the lock, be sure to supply air to the side without the lock mechanism, so that there is no load applied to the lock mechanism when it is released. If the lock is released when the port on the other side is in an exhaust state, and with a load applied to the lock unit, the lock unit may be subjected to an excessive force and may be damaged.

Furthermore, sudden movement of the spline rod is very dangerous.

#### Manual Release

### A Caution

 Insert the bolt, screw it into the lock piston, and then pull it to release the lock. If you stop pulling the bolt, the lock will return to an operational state. Thread sizes, pulling forces and strokes are as shown below.

Bore size (mm)	Thread size	Pulling force (N)	Stroke (mm)
12, 16	M2 x 0.4 x 15 L or more	2	1.5
20, 25, 32	M3 x 0.5 x 30 L or more	3	2
40	M3 x 0.5 x 30 L or more	4	3

 Remove the bolt for normal operation. It can cause lock malfunction or faulty release.

