

Precision Cylinder *Series MTS*

ø8, ø12, ø16, ø20, ø25, ø32, ø40



Size ø8 newly introduced to Series MTS!

Series MTS



EMC-MTS-01A-UK

Precision Cylinder v

Precision Cylinder

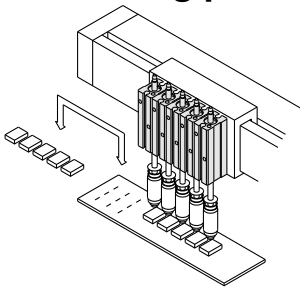
Non-rotating accuracy:
0.1° or less

(0.2° or less for $\varnothing 8$, within allowable torque values)

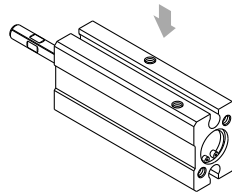
MTS8

Small size $\varnothing 8$ introduced to series

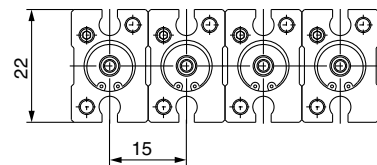
- Rod through hole allows vacuum piping (order made)
Lifting and transfer of small electronic parts is possible with short mounting pitch



- Piping is possible from two directions



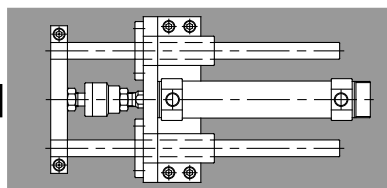
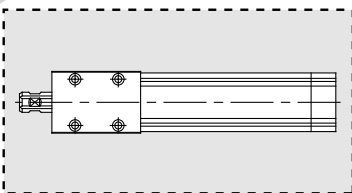
- Short mounting pitch: 15mm



- Uses new type compact auto switches ($\varnothing 8$ only)
Two auto switches can be mounted even with the minimum 5mm stroke



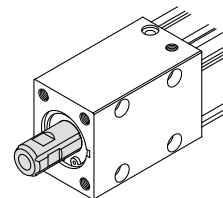
Mounting space reduced



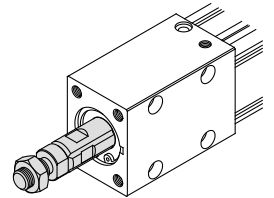
Two types of rod end configuration

Standard: Rod end female threads

Optional: Rod end male threads (using stud bolt)



Rod end female threads



Rod end male threads

Auto switch capable on four sides
(two sides for $\varnothing 8$)

Three types of mounting possible

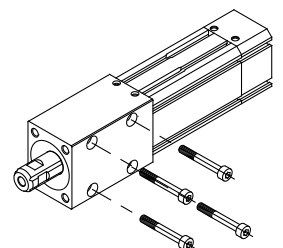
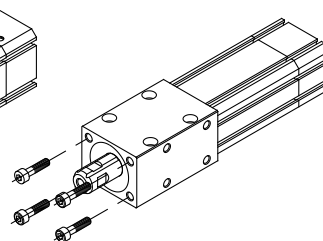
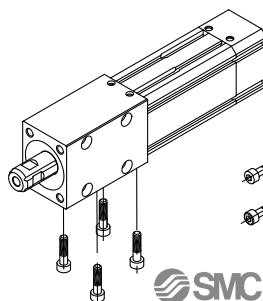
Tapped holes

Through holes

Bottom mount

Front mount

Side mount (both sides)



(Side mounting is not possible for size $\varnothing 8$.)

with Internal Guide Function

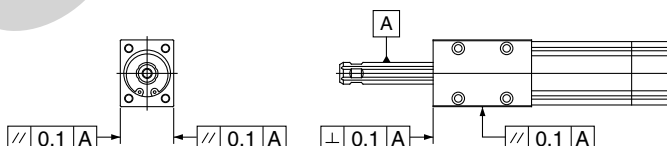
Series MTS

**Deflection:
0.1mm or less**

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

**Reduced labour for design
and assembly**

High precision mounting



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

Air cushion standardised
(ø8 equipped with rubber bumper)

**Rear end lock type added
to series (ø12 to ø40)**



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

Stroke adjustment mechanism
Order made specifications

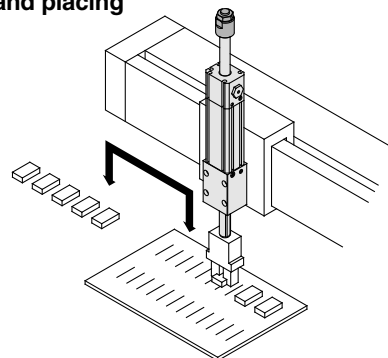
Stroke adjustment is possible on the rod extension side.
Stroke adjustment range: 0 to 10mm (ø8)
: 0 to 25mm (ø12 to ø40)

Series variations

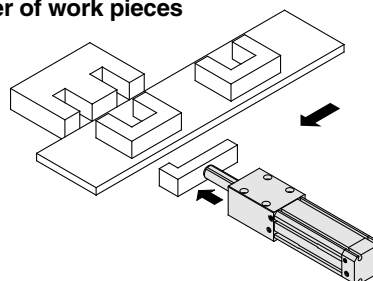
Model	Standard stroke (mm)													Rod end configuration	Cushion	Options		
	5	10	15	20	25	30	50	75	100	125	150	175	200			End lock	Rod through hole	Variable stroke Extension adjustment
MTS8	●	●	●	●	●	●								Female threads (standard) Male threads (optional)	Rubber bumper		●	●
MTS12					●		●	●	●						Air cushion	●		●
MTS16					●		●	●	●							●		●
MTS20					●		●	●	●	●	●	●	●			●		●
MTS25					●		●	●	●	●	●	●	●			●		●
MTS32					●		●	●	●	●	●	●	●			●		●
MTS40					●		●	●	●	●	●	●	●			●		

Applications

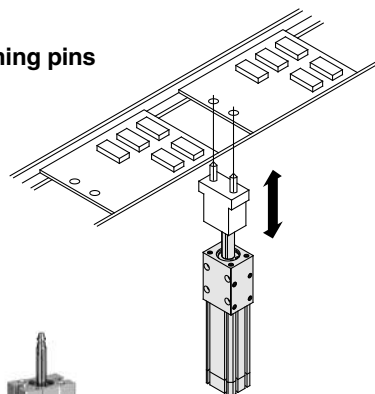
• Picking and placing



• Transfer of work pieces



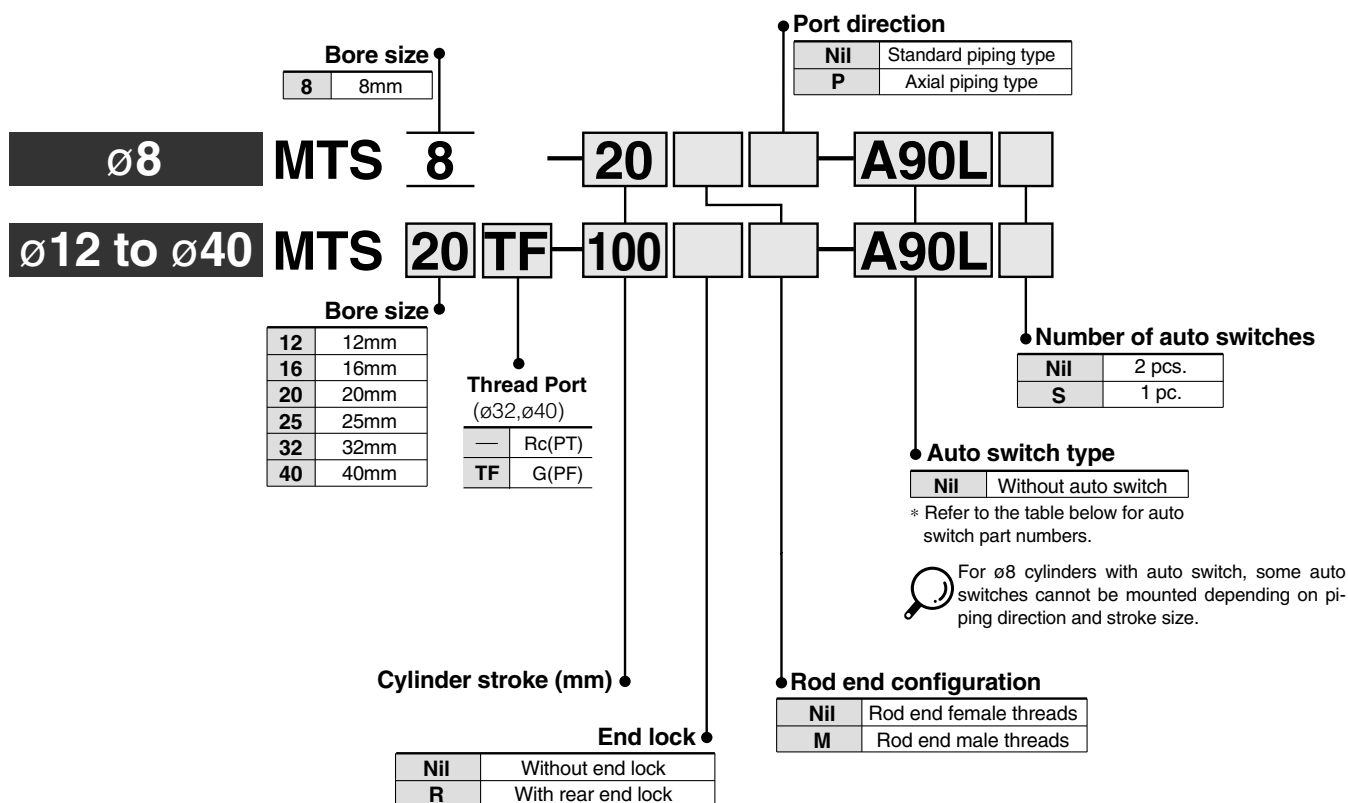
• Positioning pins



Series MTS

ø8, ø12, ø16, ø20, ø25, ø32, ø40

How to Order



Applicable auto switches

Type	Special functions	Electrical entry	Indicator light	Wiring (output)	Load voltage			Auto switch model		Lead wire length (m)			Applicable load	
								Electrical entry direction		0.5 (Nil)	3 (L)	5 (Z)		
					DC		AC	Perpendicular	In-line					
Reed switch	—	Grommet	No	2 wire	24V	5V 12V	100V or less	A90V	A90	●	●	—	IC circuit	Relay, PLC
			Yes	12V		100V	A93V	A93	●	●	—	—		
			Yes	3 wire (NPN equiv.)	—	5V	—	A96V	A96	●	●	—	—	—
Solid state switch	—	Grommet	Yes	3 wire (NPN)	24V	5V 12V	—	M9NV	M9N	●	●	○	IC circuit	Relay, PLC
				3 wire (PNP)				F8N**	—	●	●	○		
				2 wire				M9PV	M9P	●	●	○		
				F8P**				—	●	●	○			
				3 wire (NPN)	24V	5V 12V		M9BV	M9B	●	●	○	—	
				3 wire (PNP)				F8B**	—	●	●	○		
	2 wire	M9NWV	M9NW	●			●	○	IC circuit					
	3 wire (PNP)	M9PWV	M9PW	●	●	○								
	2 wire	M9BWV	M9BW	●	●	○	—							

* Lead wire length symbols 0.5m Nil (Ex.) A93
3m L (Ex.) A93L
5m Z (Ex.) M9NWZ

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

** D-F8□ type auto switches are only applicable to ø8 cylinders.

Precision Cylinder *Series MTS*

Specifications



Bore size (mm)		8	12	16	20	25	32	40
Spline rod size (mm)		4	6	8	10	13	16	20
Fluid		Air						
Min. operating pressure	Without end lock	0.15MPa	0.12MPa		0.1MPa			
	With end lock □	—	0.17MPa		0.15MPa			
Maximum operating pressure		0.7MPa						
Proof pressure		1.0MPa						
Ambient and fluid temperature		−10 to 60°C (with no freezing)						
Bearing type		Ball spline						
Cushion		Rubber bumper	Air cushion					
Effective cushion length (mm)		—	9	10	11	12	17	17
Lubrication		Non-lube						
Auto switches		Reed switch: D-A9 Solid state switch: D-F9 D-F8	Reed switch: D-A9 Solid state switch: D-F9					
Stroke tolerance		+1.0 0 mm						
Non-rotating accuracy		0.2° or less (within allowable torque values)	0.1° or less (within allowable torque values)					
Port size		M3	M5	M5	M5	M5	1/8	1/8

□ Except for lock unit: 0.12MPa for ø12 and 16; 0.10MPa for ø20 to 40

Piston Speed

Bore size (mm)	8	12	16	20	25	32	40
Piston speed (mm/s)	50 to 500			50 to 800			
Allowable kinetic energy J	0.02	0.19	0.32	0.55	0.78	1.6	2.8

End Lock Specifications

Bore size (mm)	12	16	20	25	32	40
Lock position	Rear end only					
Holding force (max.) N	29	53	82	125	211	329
Backlash	1mm					
Manual unlocking	Non-locking type only					

Standard Strokes

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 Numbers

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 threads.
□ Rod end nuts are included.

Theoretical Output

Bore size (mm)	Operating direction	Piston area (mm ²)	Operating pressure (MPa)						
			0.2	0.3	0.4	0.5	0.6	0.7	(N)
8	OUT	50	10	15	20	25	30	35	
	IN	37	8	11	15	19	22	26	
12	OUT	113	23	34	45	57	68	79	
	IN	84	17	25	34	42	50	59	
16	OUT	201	40	60	80	101	121	141	
	IN	150	30	45	60	75	90	105	
20	OUT	314	63	94	126	157	188	220	
	IN	235	47	71	94	118	141	165	
25	OUT	490	98	147	196	245	294	343	
	IN	358	72	107	143	179	215	251	
32	OUT	804	161	241	322	402	482	563	
	IN	603	121	181	241	302	362	422	
40	OUT	1,256	251	377	502	628	754	879	
	IN	942	188	283	377	471	565	659	

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

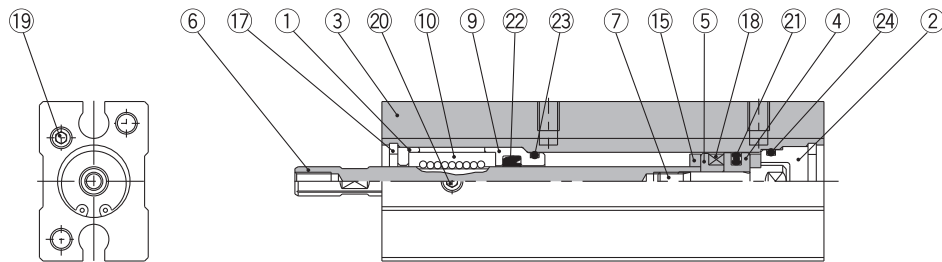
Weights

Model	Standard stroke (mm)													End lock additional weight (g)
	5	10	15	20	25	30	50	75	100	125	150	175	200	
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

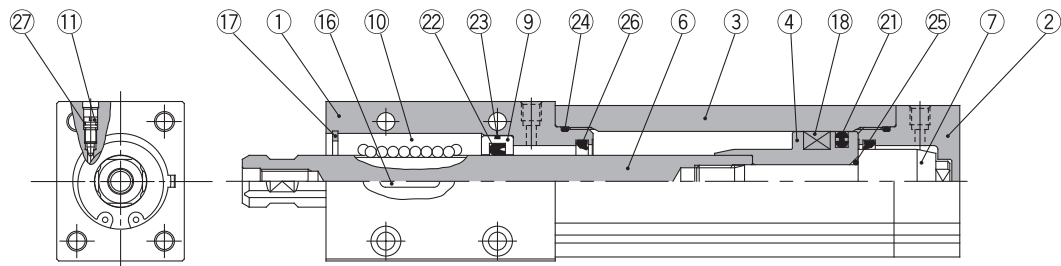
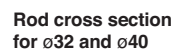
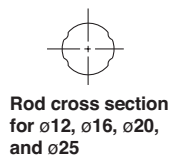
Series MTS

Construction

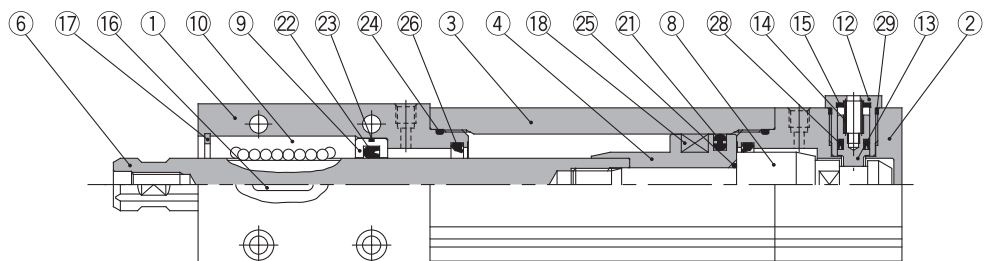
Basic type ø8



ø12 to ø40



With end lock ø12 to ø40

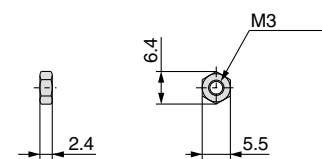


Parts list

No.	Description	Material	Qty.	Note
1	Rod cover	Aluminium alloy	1	Clear anodized
2	Head cover	Aluminium alloy	1	Clear anodized
3	Cylinder tube	Aluminium alloy	1	Hard anodized
4	Piston	Aluminium alloy	1	Chromated
5	Spacer for switch type	Aluminium alloy	1	Chromated
6	Spline rod	Stainless steel	1	ø8: Quenched
		Carbon steel	1	ø12 to ø40: Quenched/Hard chrome plated
7	Cushion bolt	Stainless steel	1	ø8 to ø16
		Carbon steel	1	ø20 to ø40: Zinc chromated
8	End lock bolt	Carbon steel	1	Quenched/Zinc chromated
9	Collar	Aluminium alloy	1	Chromated
10	Spline nut	—	1	
11	Cushion needle	Carbon steel	2	Nickel plated
12	Cap	Bronze 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	Urethane	2	ø8
16	Key	Carbon steel	1	ø12 to ø40
17	C type snap ring for hole	Carbon tool steel	2	ø8: Nickel plated
			1	ø12 to ø40: Nickel plated
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	
24	Tube gasket	NBR	1	
			2	ø8
25	Piston gasket	NBR	1	ø12 to ø40
26	Cushion seal	Urethane	2	
27	Needle gasket	NBR	2	ø12: NBR
28	Piston seal for lock	NBR	1	
29	Cap gasket	NBR	1	

Basic type



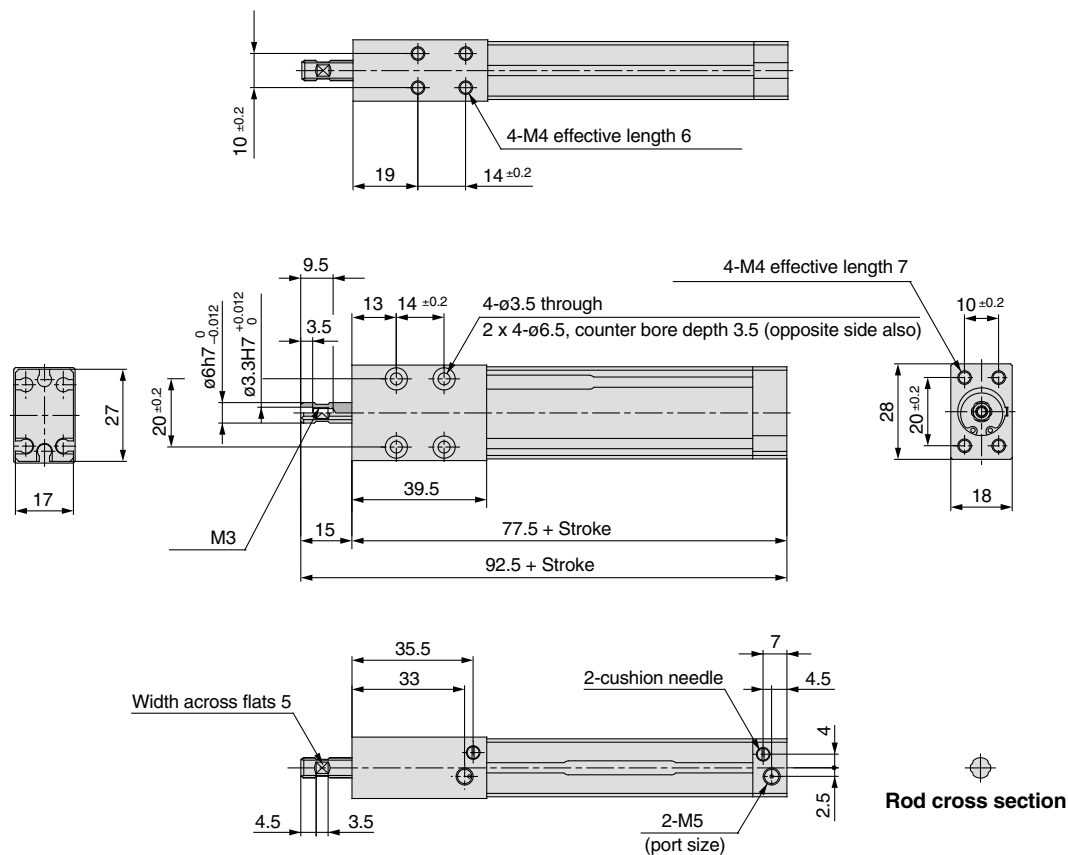
Rod end nut part number: NTJ-006A

Series MTS

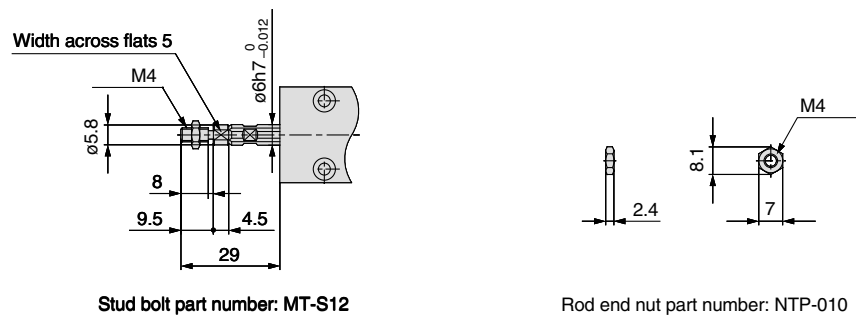
Dimensions/Ø12

MTS12

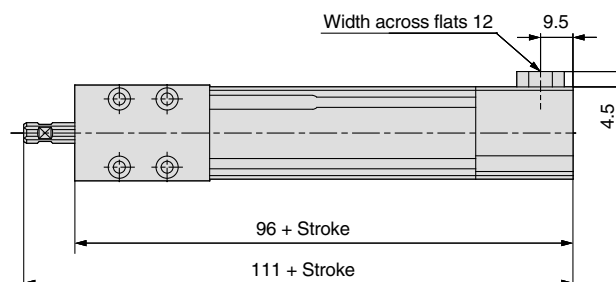
Basic type



Rod end male threads



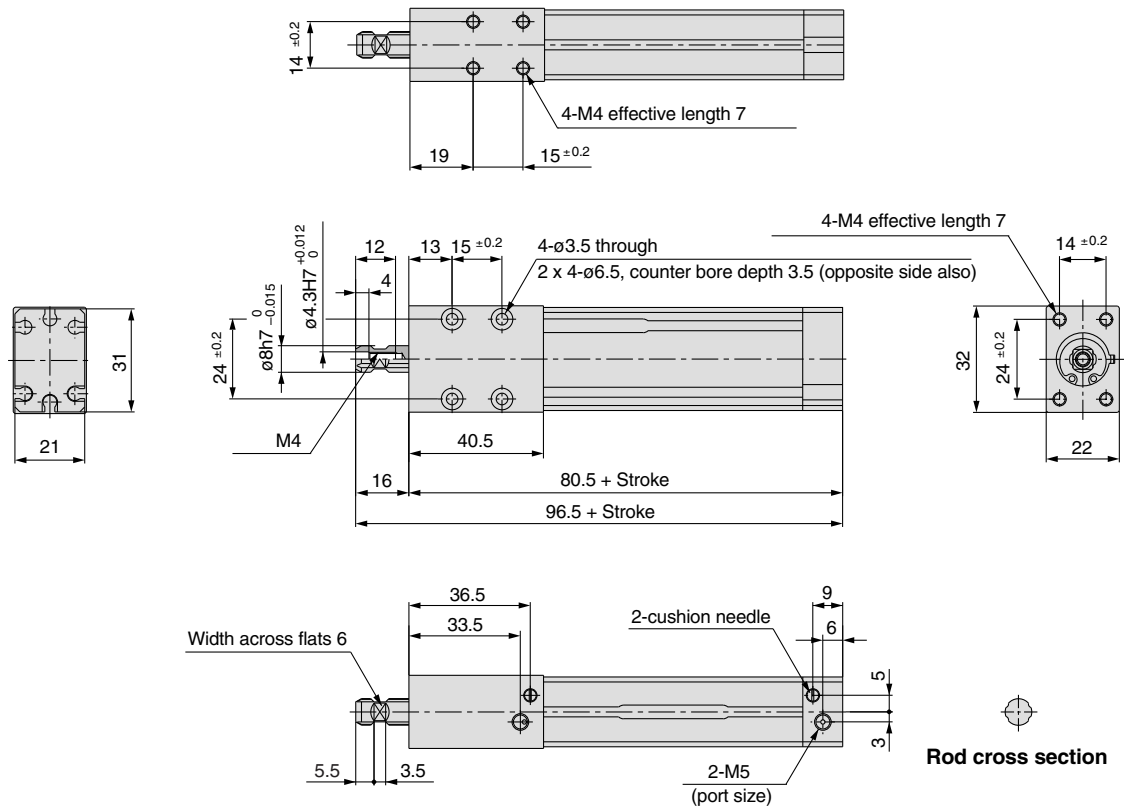
With end lock



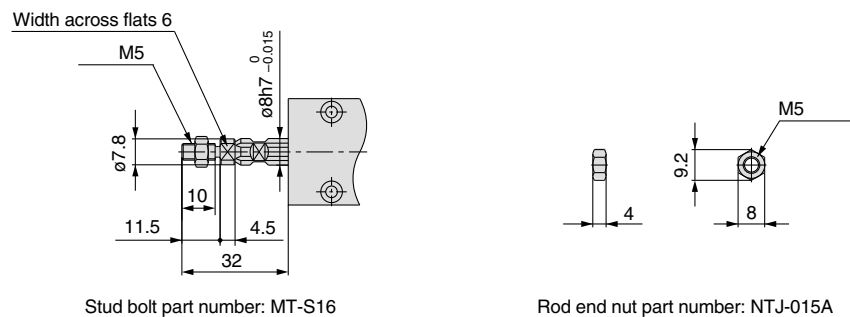
Dimensions/ $\varnothing 16$

MTS16

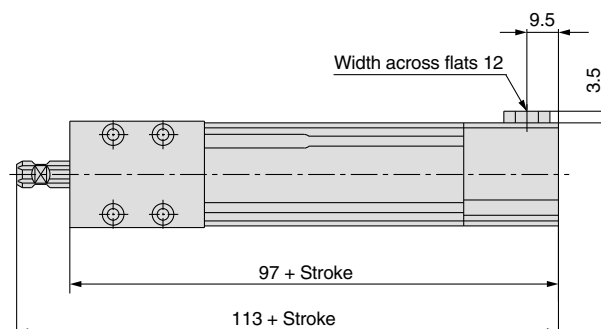
Basic type



Rod end male threads



With end lock



Basic type



Technical drawing of a mechanical part, likely a bracket or support, showing dimensions and labels:

- Width across flats 8**: Dimension across the flats of the hexagonal base.
- M6**: Label for the hexagonal base.
- ø9.8**: Dimension for the hole diameter.
- 10**: Dimension for the distance from the hole center to the edge of the base.
- 12**: Dimension for the distance from the hole center to the edge of the base.
- 4.5**: Dimension for the distance from the hole center to the edge of the base.
- 34.5**: Dimension for the total width of the base.
- ø10h7 -0.015**: Dimension for the hole diameter with tolerance.
- M6**: Label for the hexagonal base.
- 5**: Dimension for the distance from the hole center to the edge of the base.
- 11.5**: Dimension for the distance from the hole center to the edge of the base.
- 10**: Dimension for the distance from the hole center to the edge of the base.
- M6**: Label for the hexagonal base.

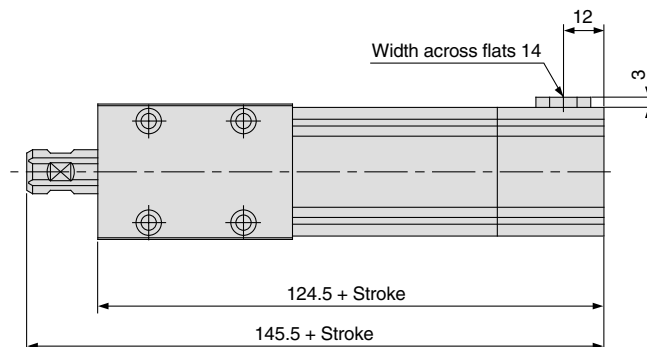
Rod end nut part number: NT-015A

Technical drawing of a piston assembly. The drawing shows a cross-section of the piston with various dimensions and labels. The main dimensions are:

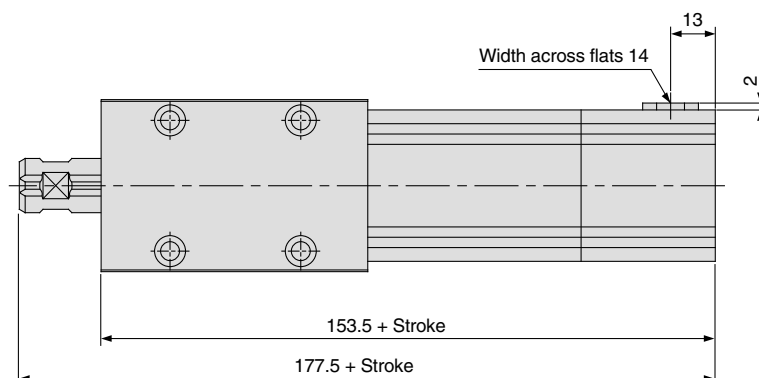
- Width across flats: 14
- Width across flats: 11.5
- Stroke: 119.5 + Stroke
- Stroke: 137.5 + Stroke

The drawing also includes a label "Width across flats 14" and a dimension line indicating the width across the flats of the piston head. The stroke is indicated by two dimension lines, one for the main stroke and one for the total stroke including the width across flats.

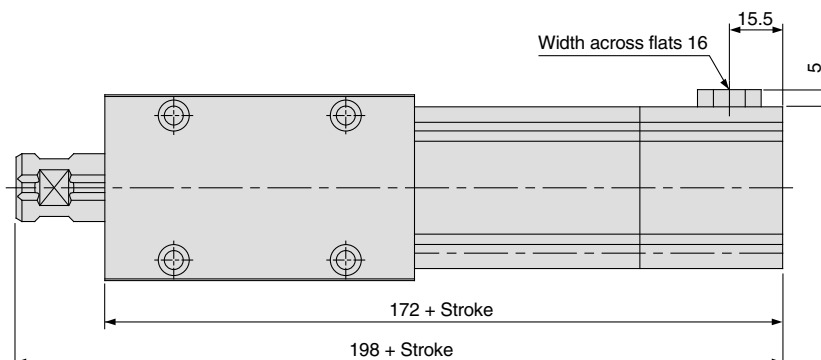
Basic type



Basic type



Basic type



Series MTS

Proper Auto Switch Mounting Positions for Stroke End Detection

ø8

Reed switch: D-A90/A93/A96

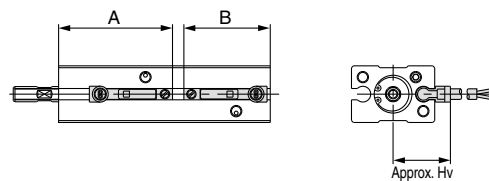
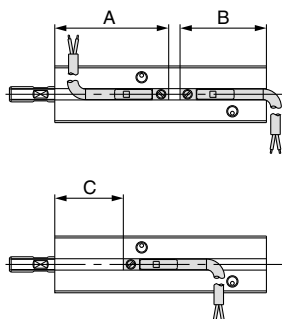
Solid state switch: D-M9N/M9P/M9B

2 colour indication solid state switch: D-M9NW/M9PW/M9BW

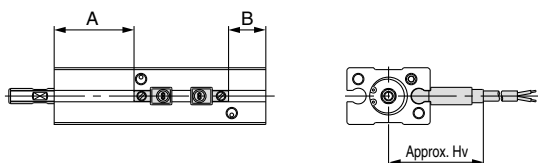
Reed switch: D-A90V/A93V/A96V

Solid state switch: D-M9NV/M9PV/M9BV

2 colour indication solid state switch: D-M9NWV/M9PWV/M9BWV



Solid state switch: D-F8N/F8P/F8B

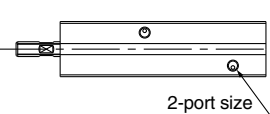
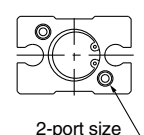


Proper auto switch mounting positions

(mm)

Bore size (mm)	Reed switch						Solid state switch						2 colour indication solid state switch					
	D-A90/A93/A96			D-A90V/A93V/A96V			D-M9N/M9P/M9B			D-M9NV/M9PV/M9BV			D-F8N/F8P/F8B			D-M9NW/M9PW/M9BW		
	A	B	C	A	B	Hv	A	B	C	A	B	Hv	A	B	Hv	A	B	C
8	36	25	16	36	25	15	32	21	20	32	21	17.5	18	7	25	32	21	20

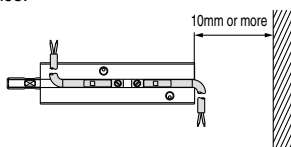
Auto Switch Mounting Strokes for ø8

Piping direction	Mounting condition	Applicable auto switch	Stroke (mm)						Note
			5	10	15	20	25	30	
Standard piping type  Note 1)	2 pcs. on same side 	D-A9□	X	X	X	○	○	○	Note 2)
		D-M9□, D-M9□W	X	X	○	○	○	○	Note 2)
		D-A9□V	X	X	X	○	○	○	
	1 pc. each on 2 sides 	D-A9□	X	○	○	○	○	○	Note 2)
		D-M9□, D-M9□W	○	○	○	○	○	○	Note 2)
		D-A9□V	X	○	○	○	○	○	
Axial piping type 	2 pcs. on same side 	D-A9□	X	X	X	○	○	○	Note 2)
		D-M9□, D-M9□W	X	X	○	○	○	○	Note 2)
		D-A9□V	X	X	X	○	○	○	
		D-M9□V, D-M9□WV	X	X	○	○	○	○	
		D-F8□	○	○	○	○	○	○	
	1 pc. each on 2 sides 	D-A9□	X	○	○	○	○	○	Note 2)
		D-M9□, D-M9□W	○	○	○	○	○	○	Note 2)
		D-A9□V	X	○	○	○	○	○	
		D-M9□V, D-M9□WV	○	○	○	○	○	○	
		D-F8□	○	○	○	○	○	○	

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

○ ... Mountable
X Not mountable

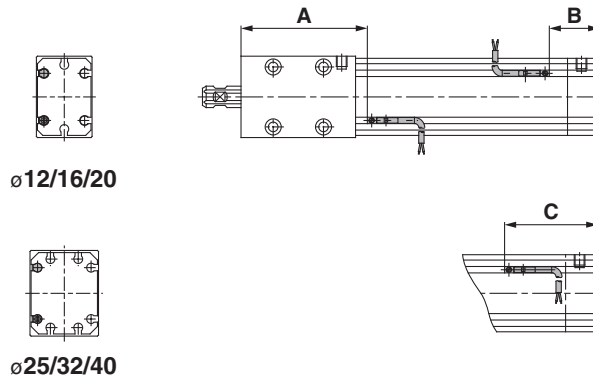
Note 2) When mounting auto switches with in-line electrical entry, allow a space of 10mm or more at the rear end to prevent lead wire interference.



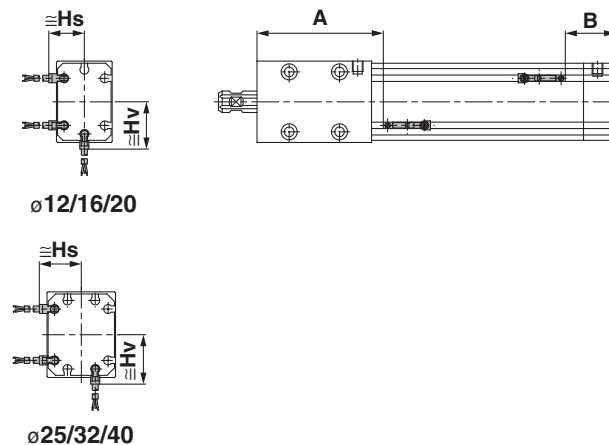
Proper Auto Switch Mounting Positions for Stroke End Detection

ø12 to ø40

D-A9□
D-M9□
D-M9□W
D-M9□A



D-A9□V
D-M9□V
D-M9□WV
D-M9□AV



Auto Switch Proper Mounting Position

(mm)

Bore size (mm)	Reed auto switch							Solid state auto switch							2-colour indicator solid state auto switch						
	D-A9□			D-A9□V				D-M9□			D-M9□V				D-M9□W/D-M9□A			D-M9□WV/D-M9□AV			
	A	B	C	A	B	Hs	Hv	A	B	C	A	B	Hs	Hv	A	B	C	A	B	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.

Auto switch type	Model	Electrical entry (Fetching direction)	Features	Applicable bore size (mm)
Solid state	D-F8N	Grommet (Perpendicular)	With indicator light	ø8 to ø40
	D-F8P			
	D-F8B			

* Normally closed (NC = b contact) solid state auto switches (D-M9□E(V)) are also available.

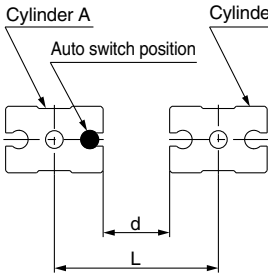
Using Cylinders in Close Proximity to One Another

⚠ Caution

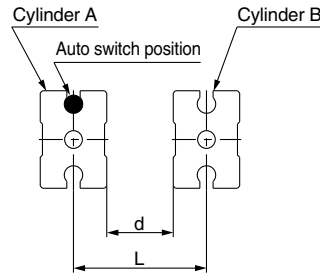
- When cylinders are used in close proximity to one another as in mounting patterns **1** through **4**, the magnetic force of the auto switch magnets in cylinder B may have an effect on the operation of the auto switches on cylinder A. The mounting pitch of cylinders should be at least the values given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

ø8

Mounting type 1



Mounting type 2



Dimensions by mounting type

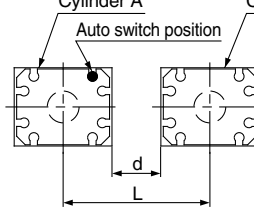
(mm)

Bore size (mm)	Auto switch model	1		2	
		L	d	L	d
8	D-A9□, D-A9□V	25 (37)	3 (15)	15	0
	D-M9□, D-M9□V	25 (39)	3 (17)	15	0
	D-F8□	47	25	15	0
	D-M9□W, D-M9□WV	25 (39)	3 (17)	15	0

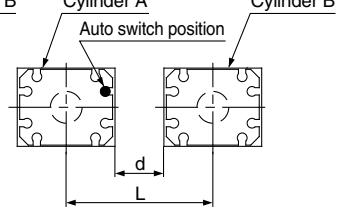
Values inside () are for models D-A9□V, D-M9□V and D-M9□WV.

ø12 to ø40

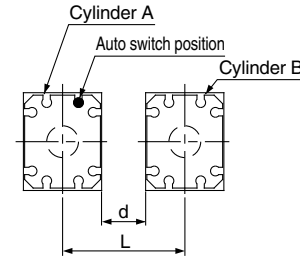
Mounting type 1



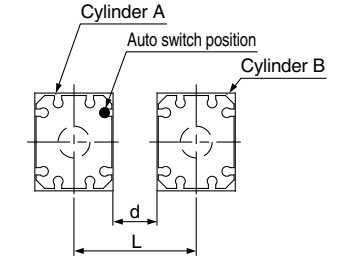
Mounting type 2



Mounting type 3



Mounting type 4



Dimensions by mounting type

(mm)

Bore size (mm)	Auto switch model	1		2		3		4	
		L	d	L	d	L	d	L	d
12	D-A9□, D-A9□V	28	0	28 (43)	0 (15)	18	0	18 (33)	0 (15)
	D-M9□, D-M9□V	28	0	33 (45)	5 (17)	18	0	28 (35)	10 (17)
	D-M9□W, D-M9□WV	28	0	33 (45)	5 (17)	18	0	28 (35)	10 (17)
16	D-A9□, D-A9□V	32	0	32 (47)	0 (15)	22	0	22 (37)	0 (15)
	D-M9□, D-M9□V	32	0	37 (49)	5 (17)	22	0	32 (39)	10 (17)
	D-M9□W, D-M9□WV	32	0	37 (49)	5 (17)	22	0	32 (39)	10 (17)
20	D-A9□, D-A9□V	38	0	38 (53)	0 (15)	26	0	26 (41)	0 (15)
	D-M9□, D-M9□V	38	0	38 (55)	0 (17)	26	0	31 (43)	5 (17)
	D-M9□W, D-M9□WV	38	0	38 (55)	0 (17)	26	0	36 (43)	10 (17)
25	D-A9□, D-A9□V	40	0	40 (55)	0 (15)	32	0	32 (47)	0 (15)
	D-M9□, D-M9□V	40	0	50 (57)	10 (17)	32	0	42 (49)	10 (17)
	D-M9□W, D-M9□WV	40	0	50 (57)	10 (17)	32	0	47 (49)	15 (17)
32	D-A9□, D-A9□V	50	0	50 (62)	0 (12)	38	0	38 (53)	0 (15)
	D-M9□, D-M9□V	50	0	55 (64)	5 (14)	38	0	48 (55)	10 (17)
	D-M9□W, D-M9□WV	50	0	55 (64)	5 (14)	38	0	48 (55)	10 (17)
40	D-A9□, D-A9□V	54	0	54 (66)	0 (12)	48	0	48 (63)	0 (15)
	D-M9□, D-M9□V	54	0	59 (68)	5 (14)	48	0	58 (65)	10 (17)
	D-M9□W, D-M9□WV	54	0	59 (68)	5 (14)	48	0	58 (65)	10 (17)

Values inside () are for models D-A9□V, D-M9□V and D-M9□WV.

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). Contact SMC for further information.

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

Series MTS Order Made Specifications

Contact SMC for detailed dimensions, specifications and lead times.

1 Variable Stroke Cylinder/Adjustable Extension Type -XC8

Basic type MTS Bore size - Stroke - XC8
With end lock MTS Bore size - Stroke R - XC8



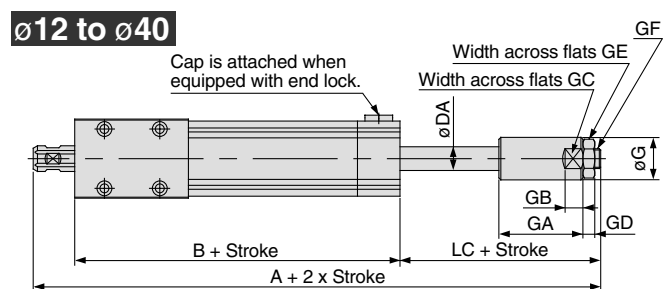
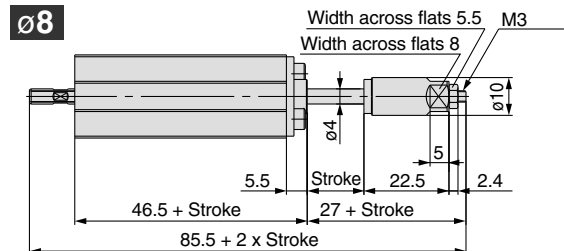
Stroke adjustment is possible on the rod extension side.
Stroke adjustment range: 0 to 10mm (ø8)
0 to 25mm (ø12 to ø40)

Specifications

Bore size (mm)	8	12	16	20	25	32	40
Minimum operating pressure	Without end lock 0.15MPa With end lock □	0.12MPa	0.12MPa	0.1MPa	0.1MPa	0.1MPa	0.1MPa
Piping direction	Standard piping type						
Rod end configuration	Female threads, Male threads						
Stroke adjustment method	Stopper adjustment						
Stroke adjustment range	0 to 10mm	0 to 25mm					

□ Except lock unit: 0.12MPa for ø12 and 16
0.10MPa for ø20 to 40

Dimensions



Basic type

Bore size (mm)	A	B	LC	DA	G	GA	GB	GC	GD	GE	GF
12	145	80.5	49.5	6	13.5	42.5	6	11	4	8	M5
16	149.5	83	50.5	8	15.5	42.5	7	13	5	10	M6
20	175	106.5	50.5	10	19.5	42.5	8.5	17	5	13	M8
25	187	114.5	51.5	12	21.5	42.5	9	19	6	17	M10 x 1.25
32	222.5	142.5	56	16	27.5	45	10.5	24	8	22	M14 x 1.5
40	240	155	59	20	32.5	45	11.5	27	11	27	M18 x 1.5

With end lock

Bore size (mm)	A	B
12	163	98.5
16	165.5	99
20	191.5	123
25	201.5	129
32	238.5	158.5
40	258.5	173.5

□ Other dimensions are the same as the standard type.

2 Vacuum Specification/Rod Through Hole Type -XC38

MTS8 - Stroke (P) - XC38

Axial piping type

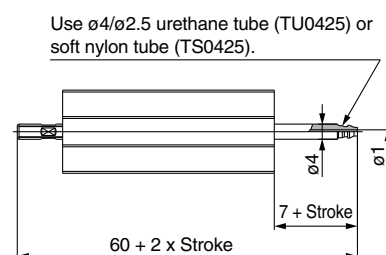
Vacuum specification
Rod through hole type



Specifications

Bore size (mm)	8
Piping direction	Standard piping type, Axial piping type
Rod end configuration	Female threads

Dimensions



Series MTS Model Selection



Theoretical output must be confirmed separately.

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

Vertical mounting

Mounting orientation								
Max. speed mm/s		to 100	to 200	to 300	to 400	to 500	to 600	to 800
Stroke mm		All strokes common						
Selection graph	ø8	1	—	2	—	3	—	—
	ø12 to ø40	—	4	—	5	—	6	7

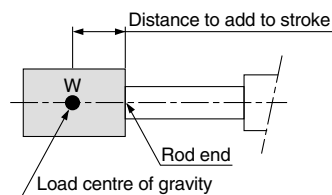
Horizontal mounting

Mounting orientation															
		* Direction for L can be up, down, left, right, or diagonal.													
Max. speed mm/s		to 300			to 500			to 600				to 800			
Stroke mm		to 10	to 20	to 30	to 10	to 20	to 30	to 50	to 100	to 150	to 200	to 50	to 100	to 150	to 200
Selection graph	ø8	8	9	10	11	12	13	—	—	—	—	—	—	—	—
	ø12 to ø40	—	—	—	—	—	—	14	15	16	17	18	19	20	21

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



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



Selection Examples

- Selection conditions
 - Mounting: Vertical
 - Maximum speed: 800mm/s
 - Overhang: 50mm
 - Load weight: 2kg

Refer to graph **7** based on vertical mounting and the maximum speed of 800mm/s. On graph **7**, find the intersecting point for the overhang of 50mm and the load weight of 2kg to determine ø32.

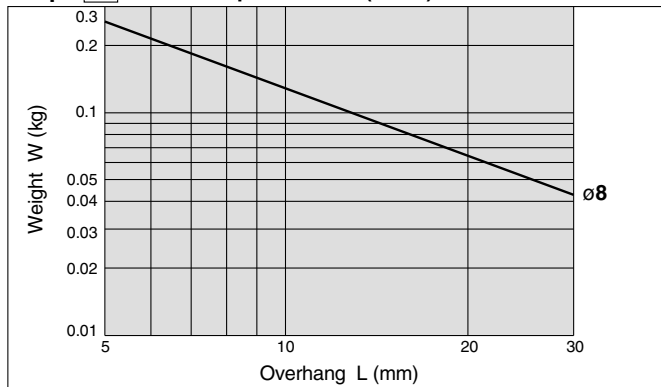
- Selection conditions
 - Mounting: Horizontal
 - Maximum speed: 600mm/s
 - Stroke: 125mm
 - Overhang: 80mm
 - Load weight: 0.7kg

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

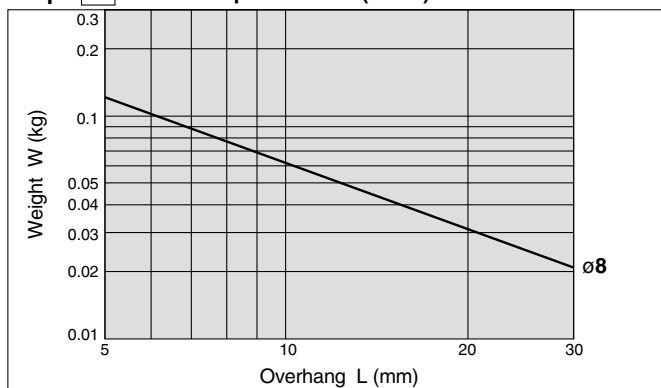
Horizontal Mounting

ø8

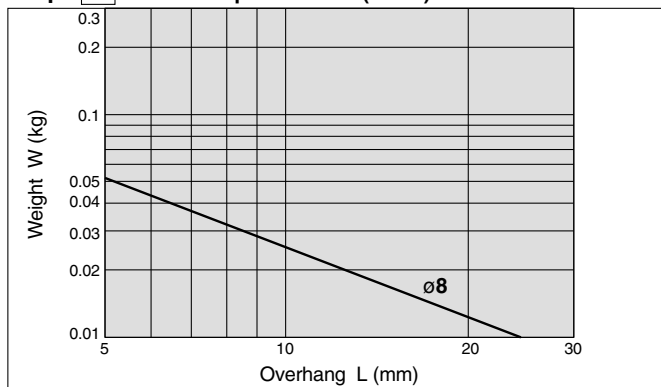
Graph 1 Maximum speed: to 100 (mm/s)



Graph 2 Maximum speed: to 300 (mm/s)

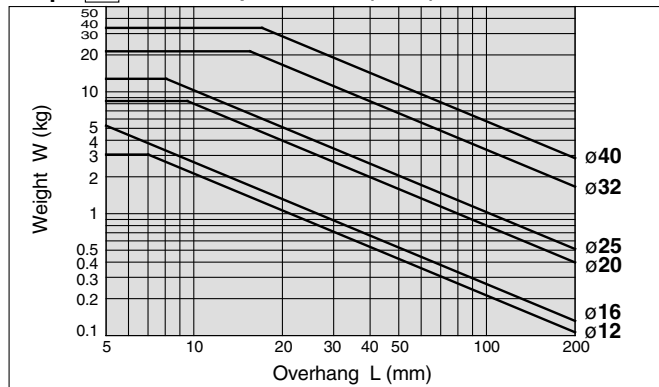


Graph 3 Maximum speed: to 500 (mm/s)

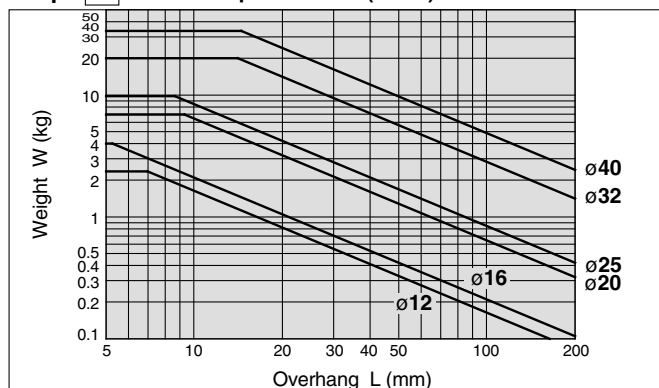


ø12 to ø40

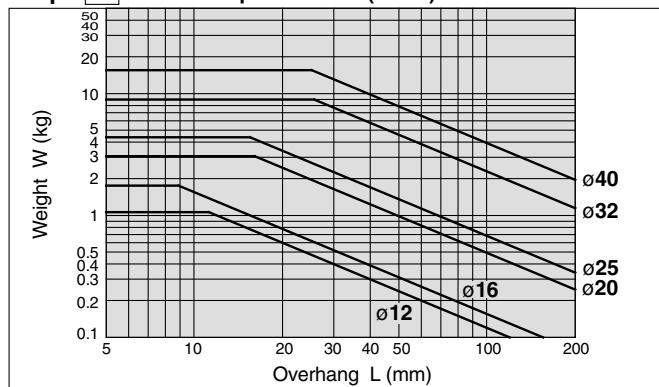
Graph 4 Maximum speed: to 200 (mm/s)



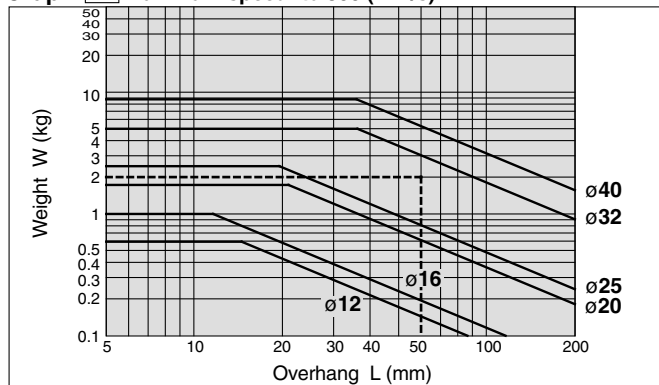
Graph 5 Maximum speed: to 400 (mm/s)



Graph 6 Maximum speed: to 600 (mm/s)



Graph 7 Maximum speed: to 800 (mm/s)



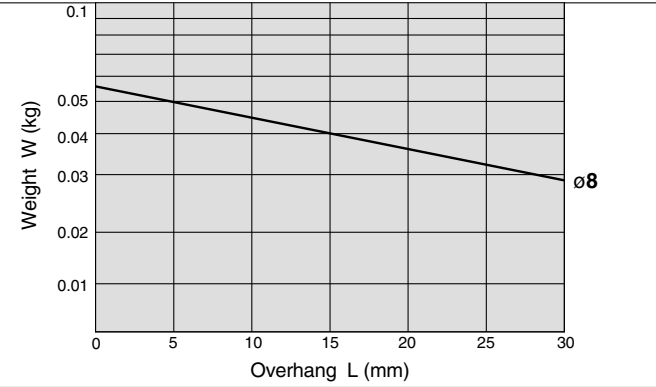
Series MTS

Horizontal Mounting

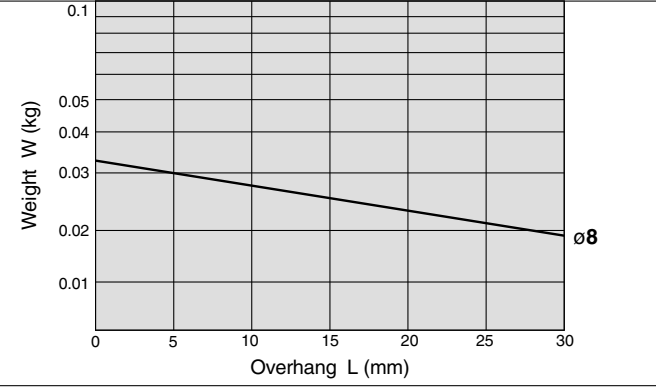
ø8

Maximum speed: to 300mm/s

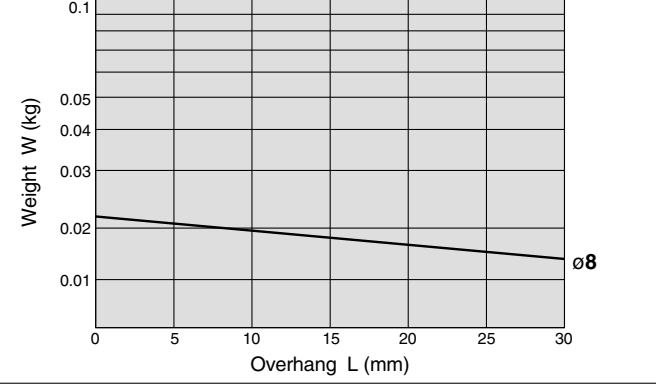
Graph 8 Stroke: to 10mm



Graph 9 Stroke: to 20mm

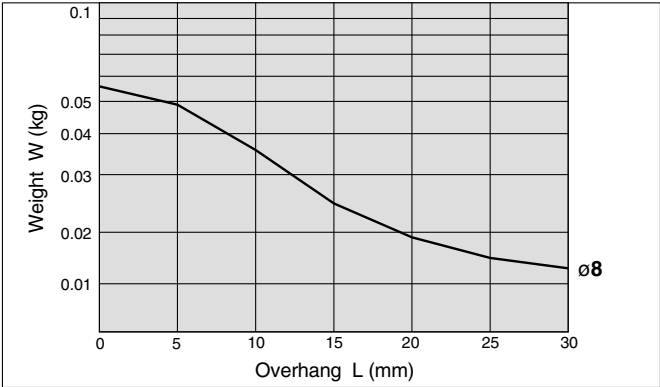


Graph 10 Stroke: to 30mm

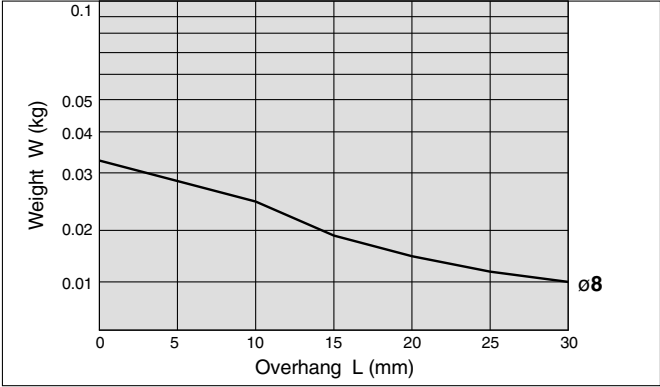


Maximum speed: to 500mm/s

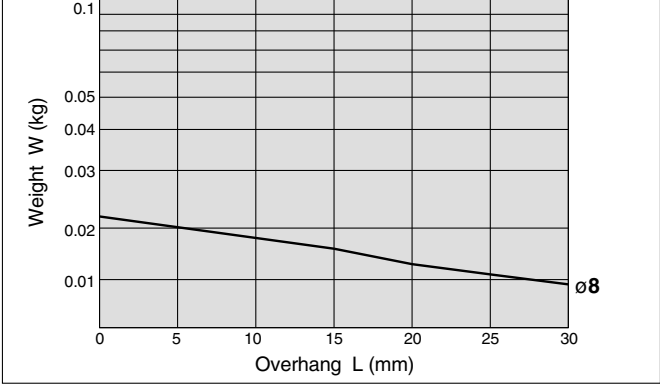
Graph 11 Stroke: to 10mm



Graph 12 Stroke: to 20mm



Graph 13 Stroke: to 30mm

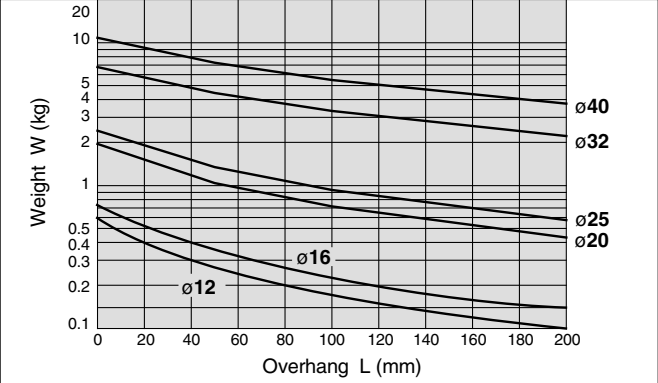


Horizontal Mounting

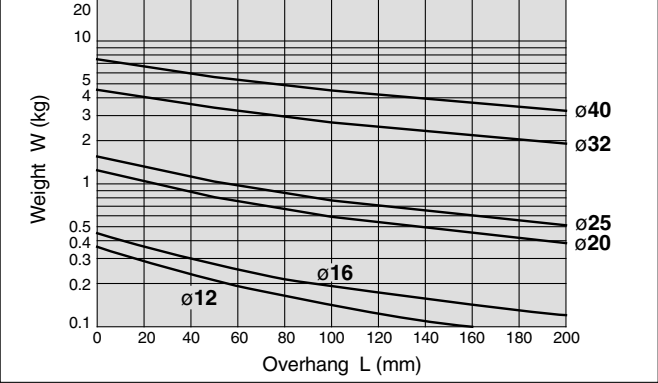
ø12 to ø40

Maximum speed: to 600mm/s

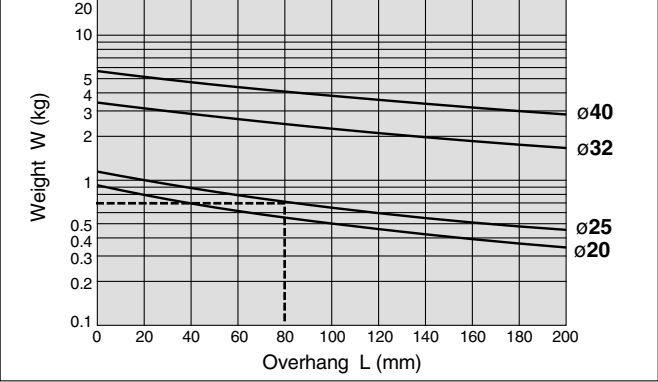
Graph 14 Stroke: to 50mm



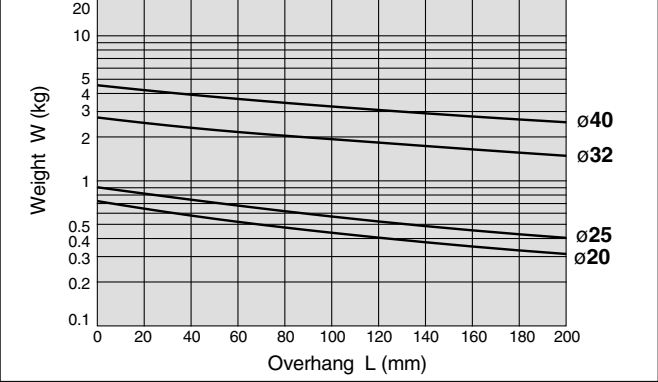
Graph 15 Stroke: to 100mm



Graph 16 Stroke: to 150mm

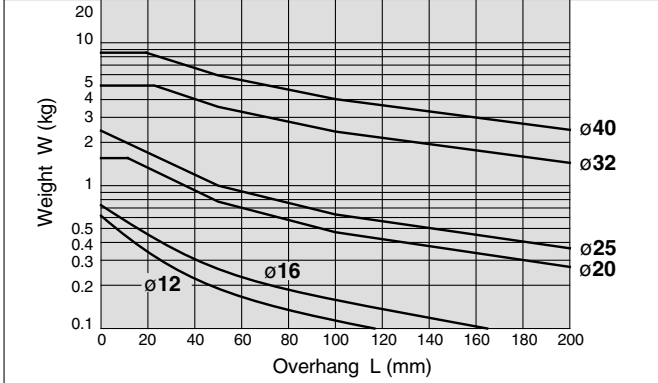


Graph 17 Stroke: to 200mm

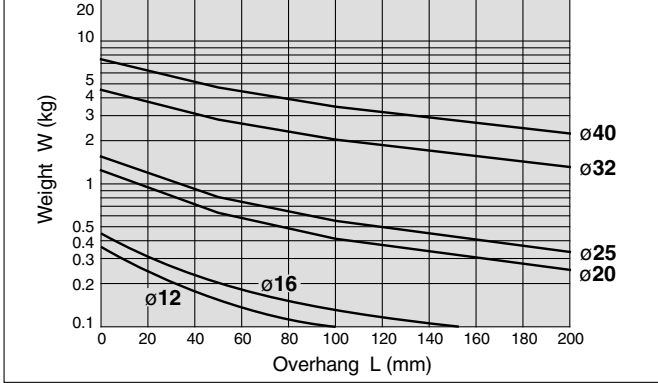


Maximum speed: to 800mm/s

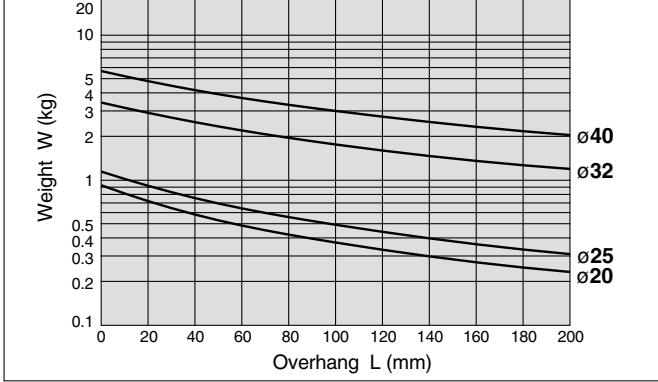
Graph 18 Stroke: to 50mm



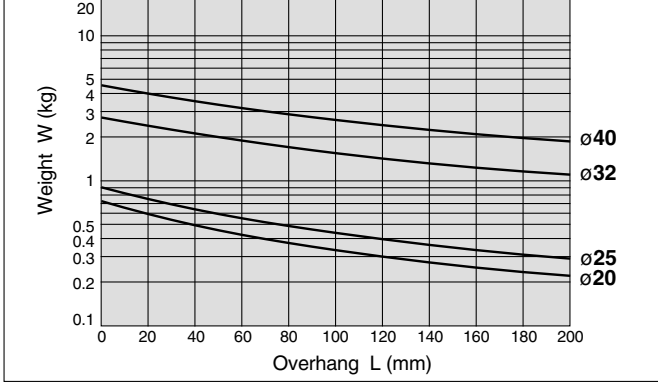
Graph 19 Stroke: to 100mm



Graph 20 Stroke: to 150mm



Graph 21 Stroke: to 200mm

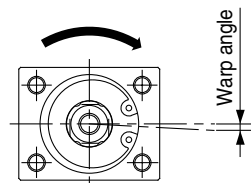


Series MTS Spline Rod Displacement

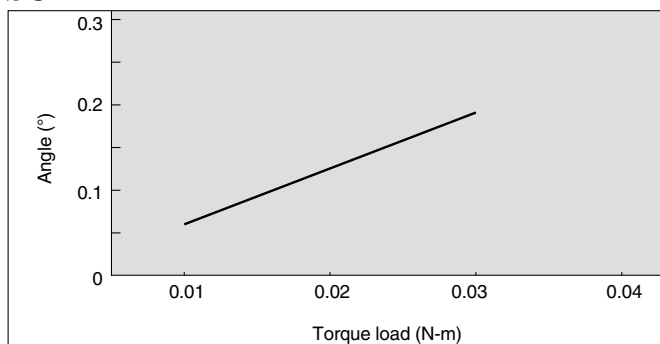
Warp Angle

Displacement angle of spline rod due to torque load

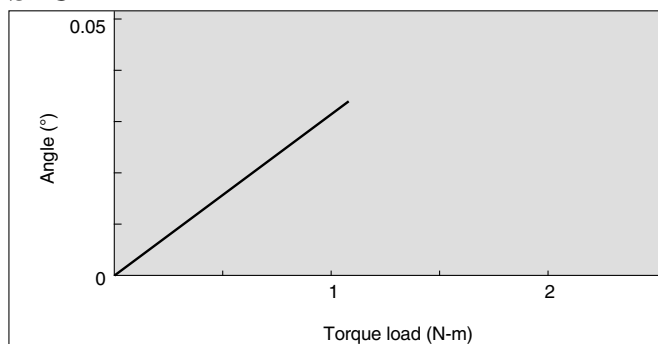
The displacement angle when a static load is applied in the direction of the arrow, with the spline rod retracted.



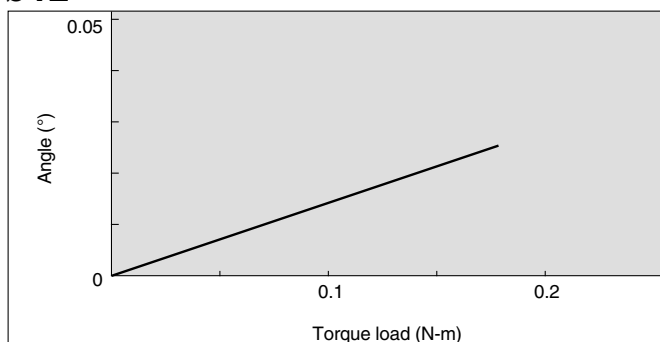
ø8



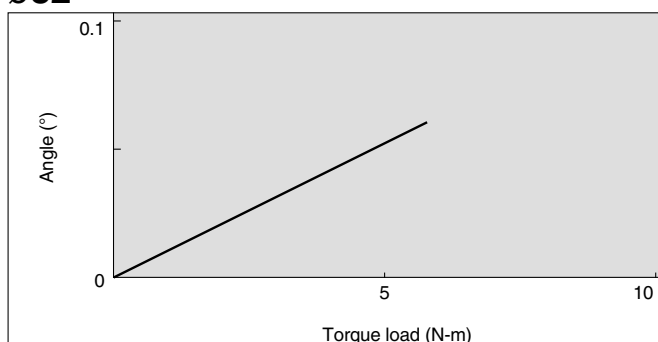
ø25



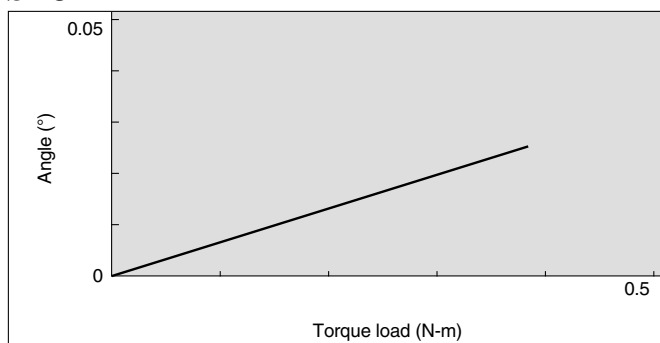
ø12



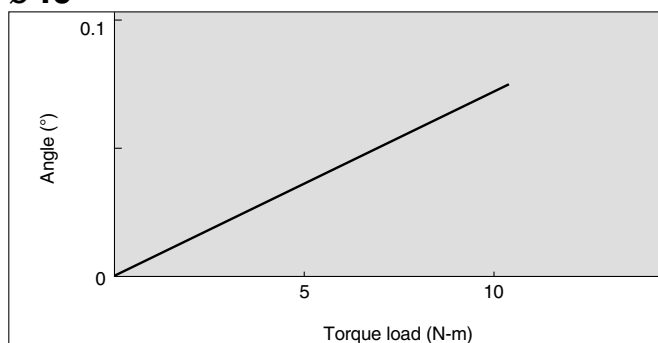
ø32



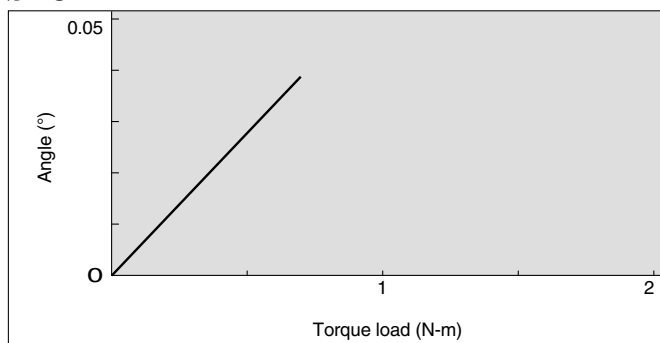
ø16



ø40



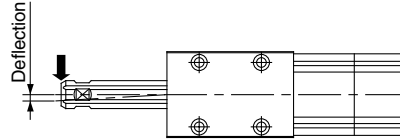
ø20



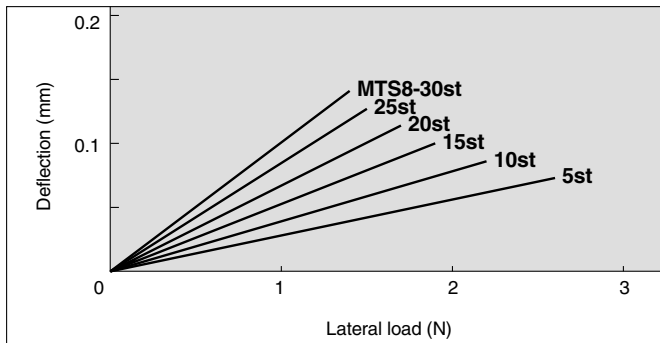
Deflection

Displacement of spline rod due to pitch moment load

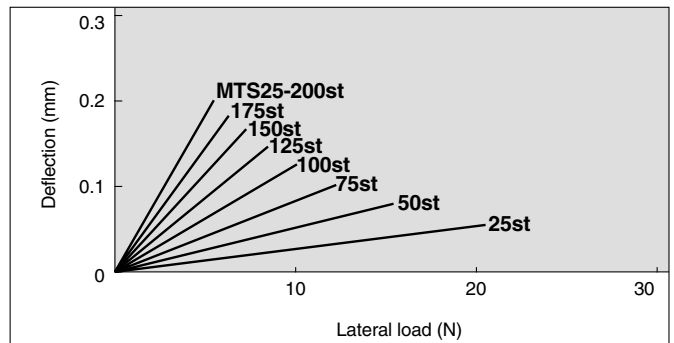
Displacement of the rod end when a static load is applied in the direction of the arrow, with the spline rod fully extended.



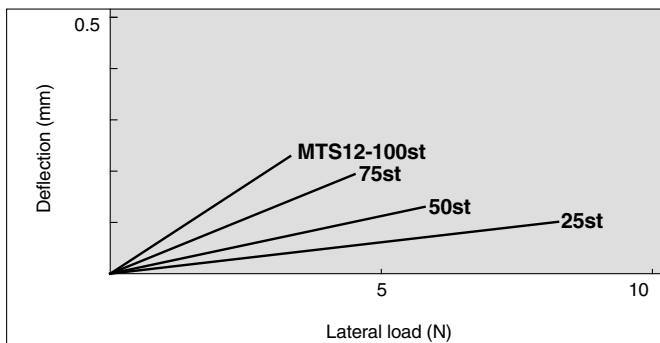
ø8



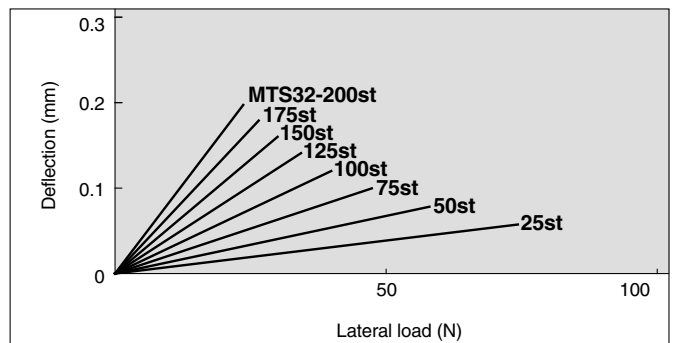
ø25



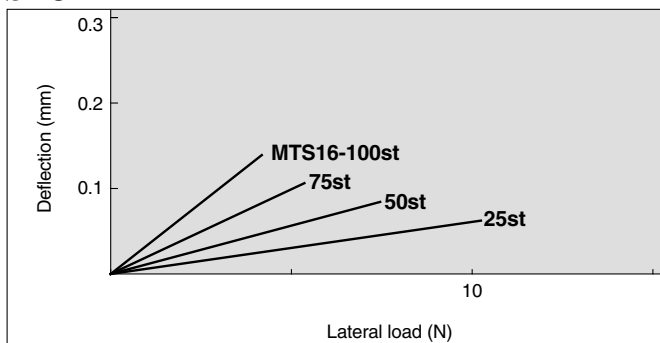
ø12



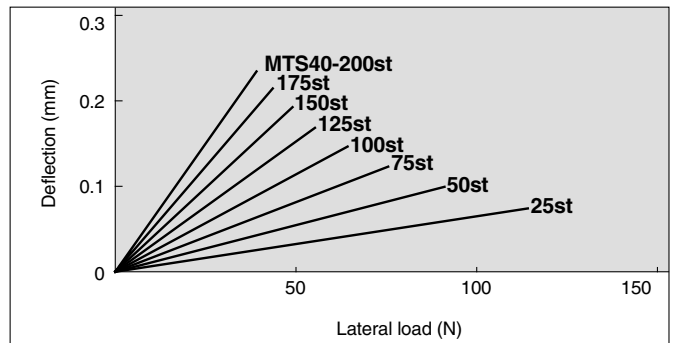
ø32



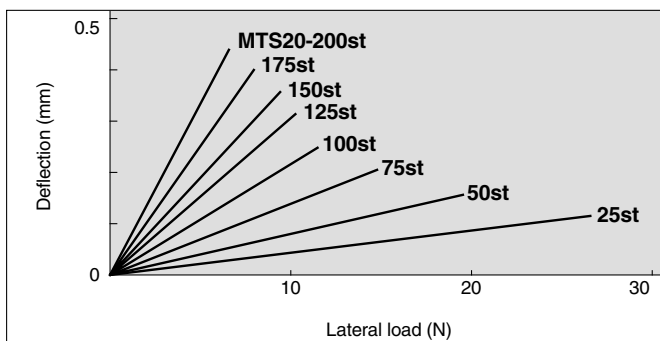
ø16



ø40



ø20



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.



Series MTS Specific Product Precautions

Be sure to read before handling.

Use of the End Lock Type

Operation

⚠ Caution

1. Do not use 3 position solenoid valves.

Avoid use in combination with 3 position solenoid valves (especially closed centre 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 synchronized cylinders.

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

⚠ Caution

1. 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

1. Locking will occur automatically if the pressure applied to the port on the lock mechanism side falls to 0.05MPa or less. In 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 EXH. port will also produce the same effect.

Relationship with the Cushion

⚠ Caution

1. 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

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

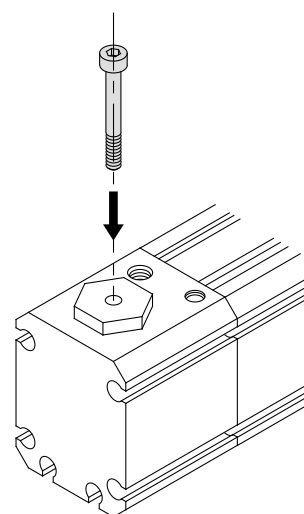
Manual Release

⚠ Caution

1. 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 15ℓ or more	2	1.5
20, 25, 32	M3 x 30ℓ or more	3	2
40	M3 x 30ℓ or more	4	3

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



Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “Caution,” “Warning” or “Danger.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC) ¹⁾, and other safety regulations.

-  **Caution:** **Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
-  **Warning:** **Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
-  **Danger:** **Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

- 1) ISO 4414: Pneumatic fluid power – General rules relating to systems.
ISO 4413: Hydraulic fluid power – General rules relating to systems.
IEC 60204-1: Safety of machinery – Electrical equipment of machines.
(Part 1: General requirements)
ISO 10218-1: Manipulating industrial robots - Safety.
etc.

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalogue information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalogue.
3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

Caution

1. The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”. Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first. ²⁾
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided. This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalogue for the particular products.
- 2) Vacuum pads are excluded from this 1 year warranty.
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered. Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

Caution

SMC products are not intended for use as instruments for legal metrology.

Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country.
Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

Safety Instructions

Be sure to read “Handling Precautions for SMC Products” (M-E03-3) before using.

SMC Corporation (Europe)

Austria	+43 (0)2262622800	www.smc.at	office@smc.at
Belgium	+32 (0)33551464	www.smc.be	info@smc.be
Bulgaria	+359 (0)2807670	www.smc.bg	office@smc.bg
Croatia	+385 (0)13707288	www.smc.hr	office@smc.hr
Czech Republic	+420 541424611	www.smc.cz	office@smc.cz
Denmark	+45 70252900	www.smcdk.com	smc@smcdk.com
Estonia	+372 651 0370	www.smcee.ee	info@smcee.ee
Finland	+358 207513513	www.smc.fi	smcfr@smc.fi
France	+33 (0)164761000	www.smc-france.fr	supportclient@smc-france.fr
Germany	+49 (0)61034020	www.smc.de	info@smc.de
Greece	+30 210 2717265	www.smchellas.gr	sales@smchellas.gr
Hungary	+36 23513000	www.smc.hu	office@smc.hu
Ireland	+353 (0)14039000	www.smcautomation.ie	sales@smcautomation.ie
Italy	+39 03990691	www.smcitalia.it	mailbox@smcitalia.it
Latvia	+371 67817700	www.smc.lv	info@smc.lv

Lithuania	+370 5 2308118	www.smclt.lt	info@smclt.lt
Netherlands	+31 (0)205318888	www.smc.nl	info@smc.nl
Norway	+47 67129020	www.smc-norge.no	post@smc-norge.no
Poland	+48 222119600	www.smc.pl	office@smc.pl
Portugal	+351 214724500	www.smc.eu	apoioclientept@smc.smces.es
Romania	+40 213205111	www.smcromania.ro	smcromania@smcromania.ro
Russia	+7 (812)3036600	www.smc.eu	sales@smcru.com
Slovakia	+421 (0)413213212	www.smc.sk	office@smc.sk
Slovenia	+386 (0)73885412	www.smc.si	office@smc.si
Spain	+34 945184100	www.smc.eu	post@smc.smces.es
Sweden	+46 (0)86031240	www.smc.nu	smc@smc.nu
Switzerland	+41 (0)523963131	www.smc.ch	info@smc.ch
Turkey	+90 212 489 0 440	www.smcturkey.com.tr	satis@smcturkey.com.tr
UK	+44 (0)845 121 5122	www.smc.uk	sales@smc.uk

South Africa	+27 10 900 1233	www.smcza.co.za	zasales@smcza.co.za
--------------	-----------------	-----------------	---------------------