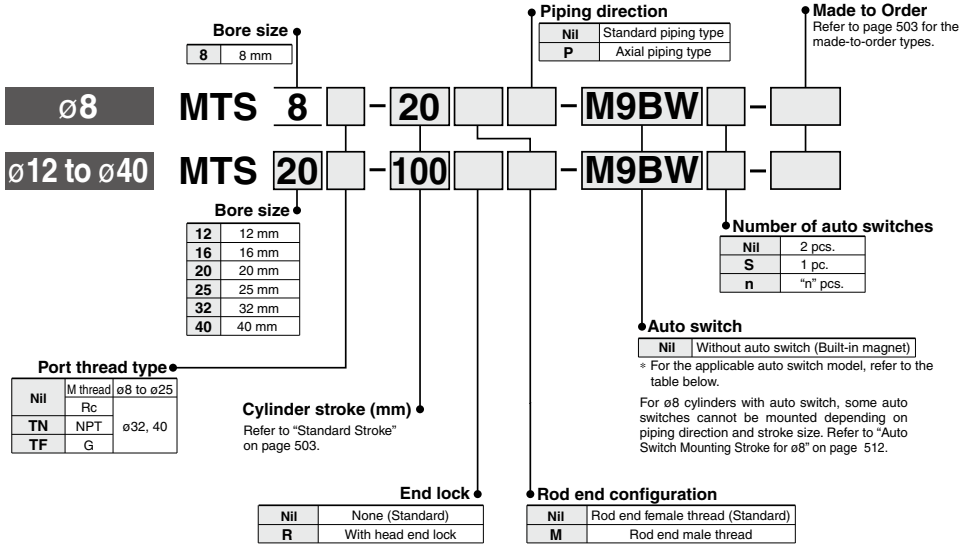


# Precision Cylinder

# MTS Series

ø8, ø12, ø16, ø20, ø25, ø32, ø40

## How to Order



## Applicable Auto Switches

Refer to pages 1289 to 1383 for further information on auto switches.

Type	Special function	Electrical entry	Indicator/light	Wiring (Output)	Load voltage		Auto switch model		Lead wire length (m)					Pre-wired connector	Applicable load	
					DC	AC	Perpendicular	In-line	0.5 (Nil)	1 (M)	3 (L)	5 (Z)	IC circuit		Relay, PLC	
Solid state auto switch	—	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	M9NV	M9N	●	●	○	○	—	IC circuit	Relay, PLC
				3-wire (PNP)				M9PV	M9P	●	●	○	○			
				2-wire				M9BV	M9B	●	●	○	○			
	Diagnostic indication (2-color indicator)			3-wire (NPN)				M9NVW	M9NW	●	●	○	○	—	IC circuit	
				3-wire (PNP)				M9PVW	M9PW	●	●	○	○			
				2-wire				M9BWW	M9BW	●	●	○	○			
Water resistant (2-color indicator)	3-wire (NPN)	M9NAV <sup>*1</sup>	M9NA <sup>*1</sup>	○	○	○	○	—	IC circuit							
	3-wire (PNP)	M9PAV <sup>*1</sup>	M9PA <sup>*1</sup>	○	○	○	○									
	2-wire	M9BAV <sup>*1</sup>	M9BA <sup>*1</sup>	○	○	○	○									
Reed auto switch	—	Grommet	Yes	3-wire (NPN equivalent)	24 V	12 V	—	A96V	A96	●	—	—	—	—	IC circuit	—
				No				2-wire	A93V <sup>*2</sup>	A93	●	●	●			
						100 V		A90V	A90	●	—	—	—	—	—	IC circuit

\*1 Water resistant type auto switches can be mounted on the above models, but in such case SMC cannot guarantee water resistance.

Consult with SMC regarding water resistant types with the above model numbers.

\*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) M9NWL  
 5 m..... Z (Example) M9NWX

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

\* 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



**Made to Order**  
[Click here for details](#)

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

## Standard Stroke

Bore size (mm)	Standard stroke (mm)
<b>8</b>	5, 10, 15, 20, 25, 30
<b>12, 16</b>	25, 50, 75, 100
<b>20, 25, 32, 40</b>	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.
<b>8</b>	<b>MT-S8</b>
<b>12</b>	<b>MT-S12</b>
<b>16</b>	<b>MT-S16</b>
<b>20</b>	<b>MT-S20</b>
<b>25</b>	<b>MT-S25</b>
<b>32</b>	<b>MT-S32</b>
<b>40</b>	<b>MT-S40</b>

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

## ⚠ 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 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	0.15 MPa	0.12 MPa		0.1 MPa			
	With end lock *	—	0.17 MPa		0.15 MPa			
Maximum operating pressure		0.7 MPa						
Proof pressure		1.0 MPa						
Ambient and fluid temperature		-10 to 60° (No freezing)						
Bearing type		Ball spline						
Cushion		Rubber bumper	Air cushion					
Effective cushion length (mm)		—	9	10	11	12	17	17
Lubrication		Not required (Non-lube)						
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
Stroke tolerance		+1.0 <sub>0</sub> mm						
Non-rotating accuracy		0.2° or less (Within allowable torque values)		0.1° or less (Within allowable torque values)				
Piping port size	—	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
	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

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

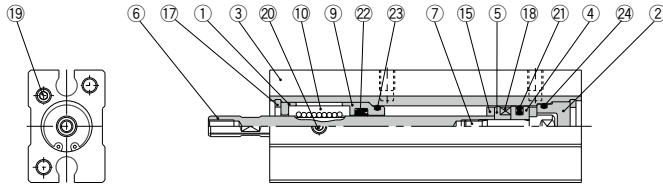
## Weight

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

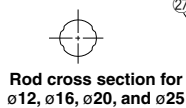
## Construction

### Basic type

ø8

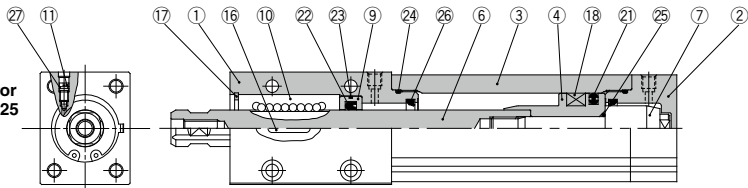


ø12 to ø40



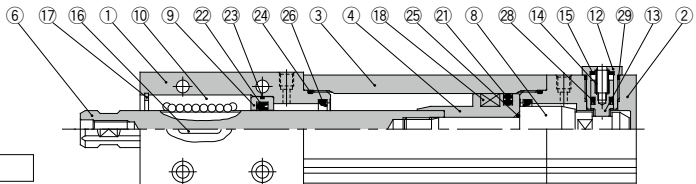
Rod cross section for ø12, ø16, ø20, and ø25

Rod cross section for ø32 and ø40



### With end lock

ø12 to ø40



### ⚠ Caution

**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. Please contact SMC sales representatives.

### 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
6	Spline rod	Carbon steel	1	ø12 to ø40: Quenched/Hard chrome plated
		Stainless steel	1	ø8: Quenched
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	Aluminum alloy	1	Chromated
10	Spline nut	—	1	
11	Cushion needle	Carbon steel	2	Nickel plated
12	Cap	Copper alloy	1	Nickel plated
13	Lock piston	Carbon steel	1	Quenched/Hard chrome plated
14	Lock spring	Steel wire	1	Zinc chromated

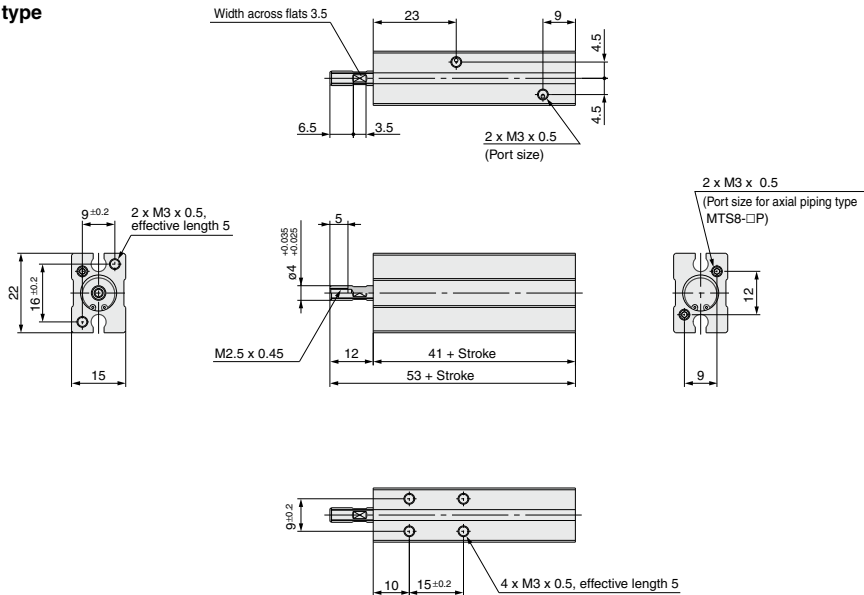
No.	Description	Material	Qty.	Note
15	Bumper	Urethane	2	ø8
			1	ø12 to ø40
16	Key	Carbon steel	1	
17	Type C retaining ring for hole	Carbon tool steel	2	ø8: Phosphate coated
			1	ø12 to ø40: Phosphate coated
18	Magnet	—	1	
19	Plug	Alloy steel	3	Nickel plated
20	Hexagon socket head set screw	Alloy steel	1	Black zinc chromated
21	Piston seal	NBR	1	
22	Spline seal	NBR	1	Rod seal for ø8
23	Collar gasket	NBR	1	
			1	ø8
24	Tube gasket	NBR	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:  $\phi 8$**

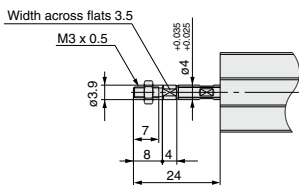
**MTS8**

**Basic type**

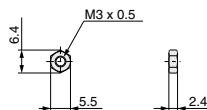
Note) Spline rod's width across flats have nothing to do with the position of the body mounting face.



**Rod end male thread**



Stud bolt part no.: MT-S8  
Material: Chromium molybdenum steel  
(Nickel plated)



Rod end nut part no.: NTJ-006B  
Material: Carbon steel  
(Zinc chromated)

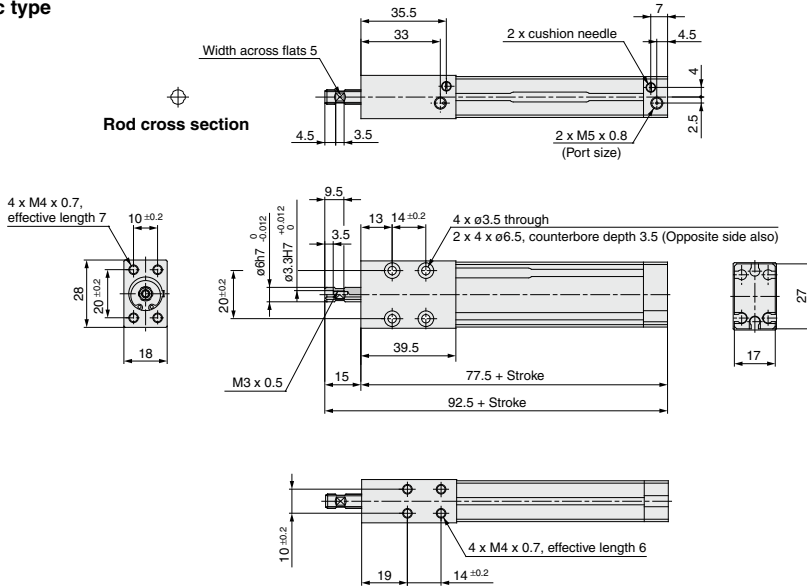
# MTS Series

Dimensions:  $\phi 12$

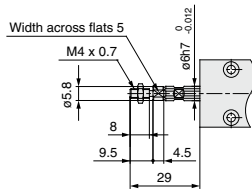
## MTS12

### Basic type

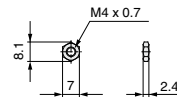
Note) Spline rod's width across flats have nothing to do with the position of the body mounting face.



### Rod end male thread

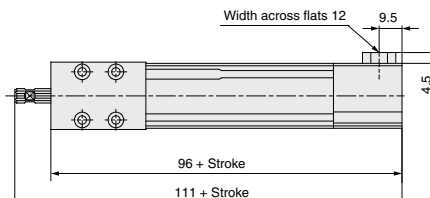


Stud bolt part no.: MT-S12  
Material: Chromium molybdenum steel  
(Nickel plated)



Rod end nut part no.: NTP-010  
Material: Carbon steel  
(Zinc chromated)

### With end lock

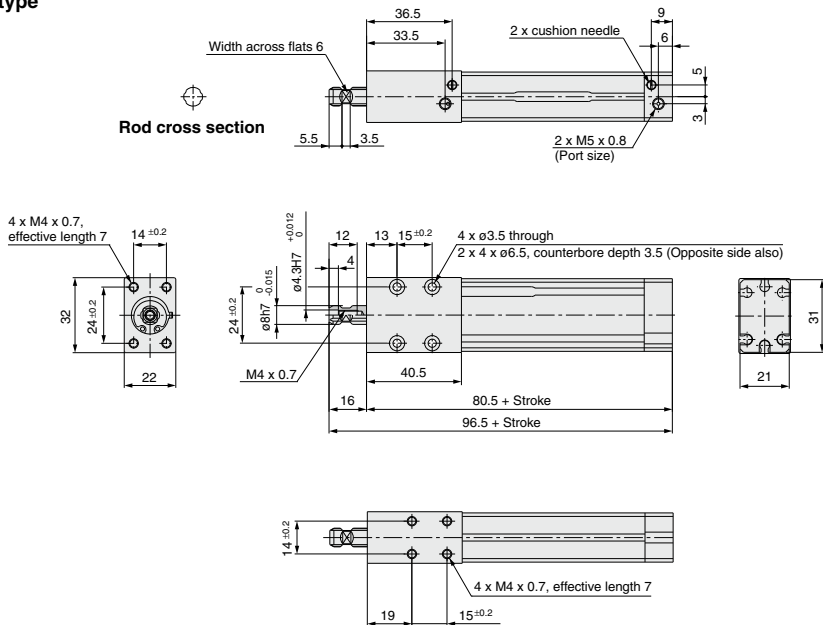


**Dimensions:  $\phi 16$**

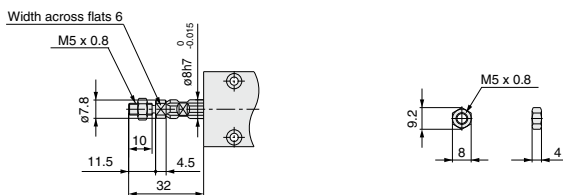
**MTS16**

**Basic type**

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



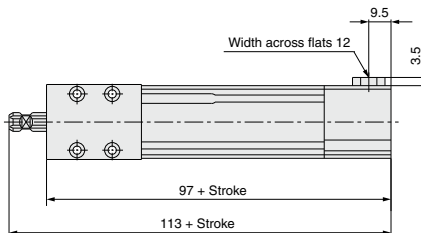
**Rod end male thread**



Stud bolt part no.: MT-S16  
Material: Chromium molybdenum steel  
(Nickel plated)

Rod end nut part no.: NTJ-015C  
Material: Carbon steel  
(Zinc chromated)

**With end lock**



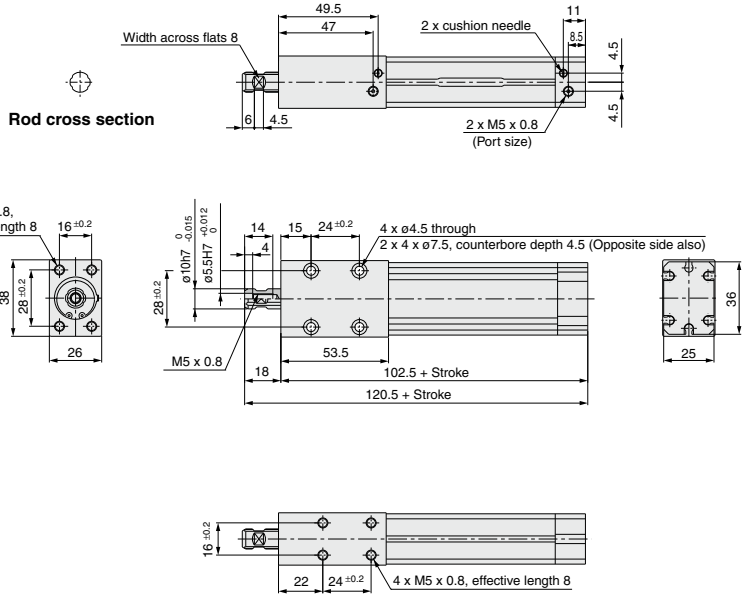
# MTS Series

Dimensions:  $\varnothing 20$

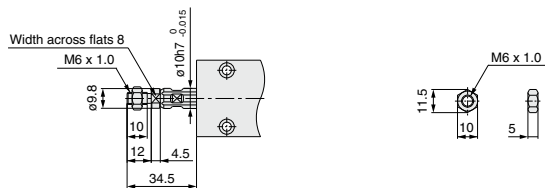
## MTS20

### Basic type

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



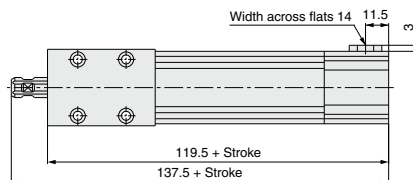
### Rod end male thread



Stud bolt part no.: MT-S20  
Material: Chromium molybdenum steel  
(Nickel plated)

Rod end nut part no.: NT-015A  
Material: Carbon steel  
(Zinc chromated)

### With end lock



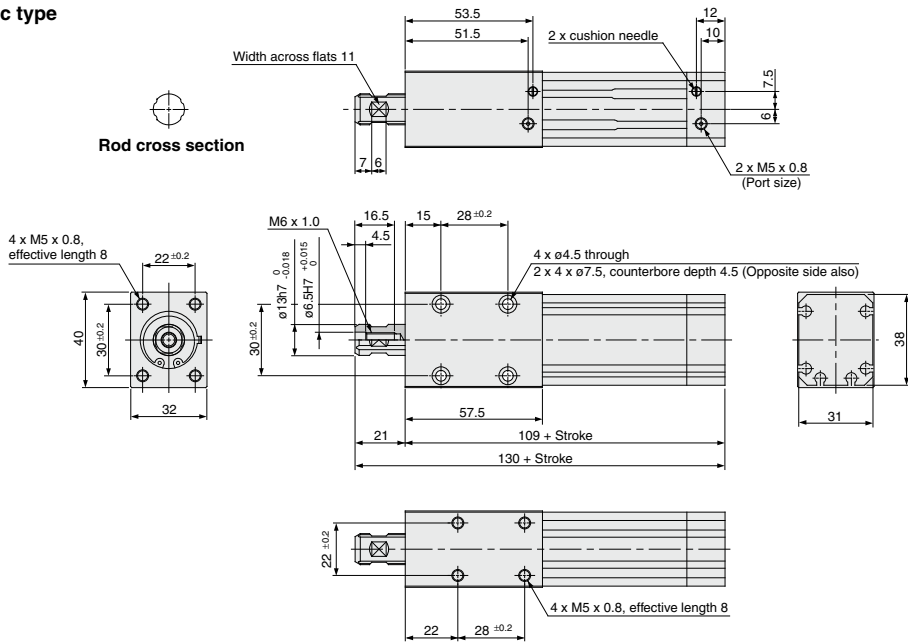
Dimensions:  $\varnothing 25$

**MTS25**

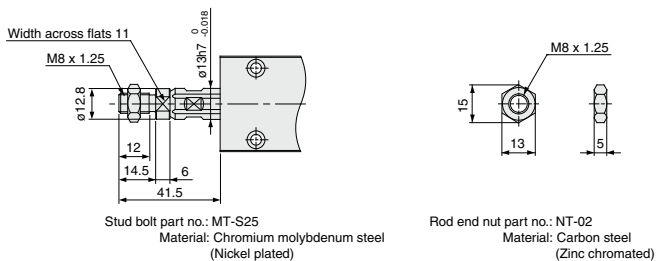
Basic type

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

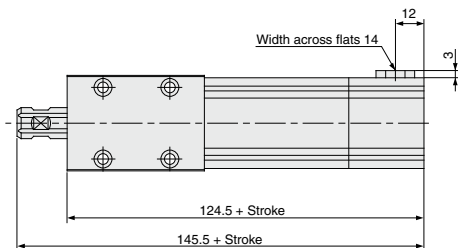
Rod cross section



Rod end male thread



With end lock





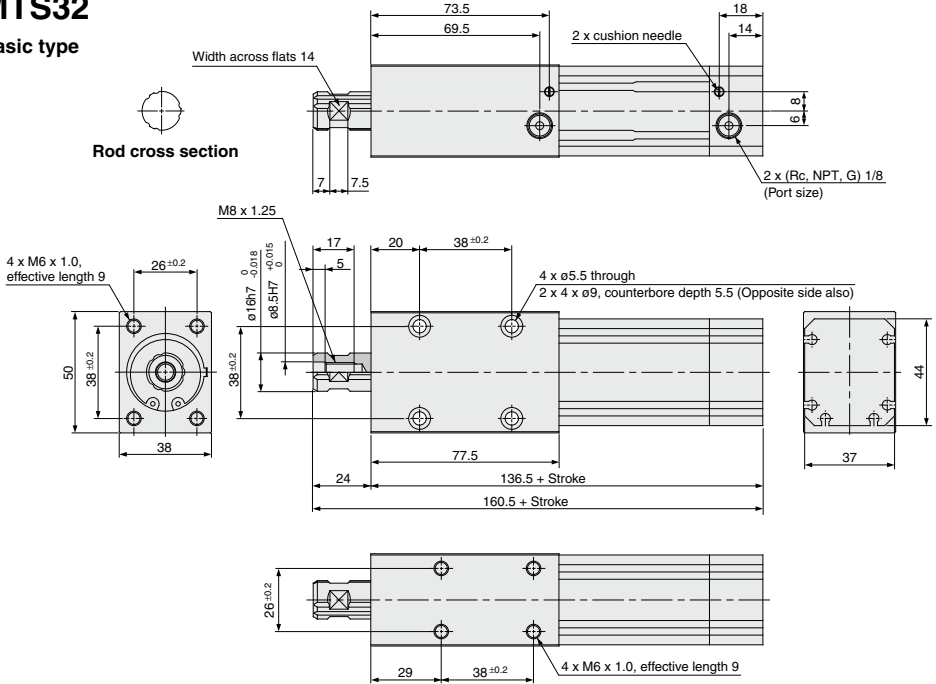
# MTS Series

## Dimensions: $\phi 32$

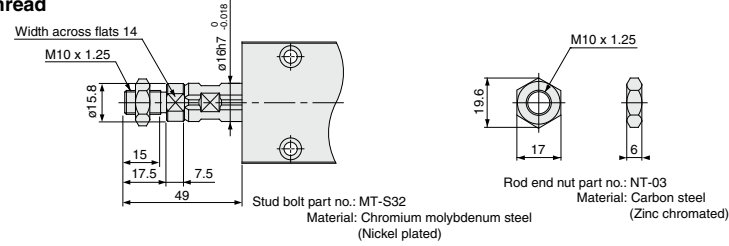
Note) Spine rod's width across flats have nothing to do with the position of the body mounting face.

### MTS32

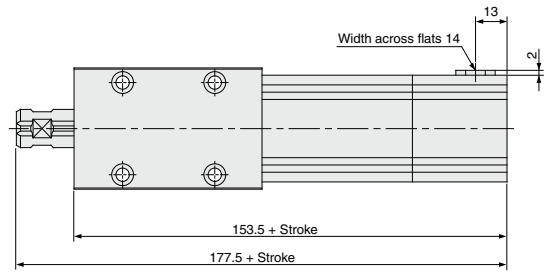
#### Basic type



#### Rod end male thread



#### With end lock

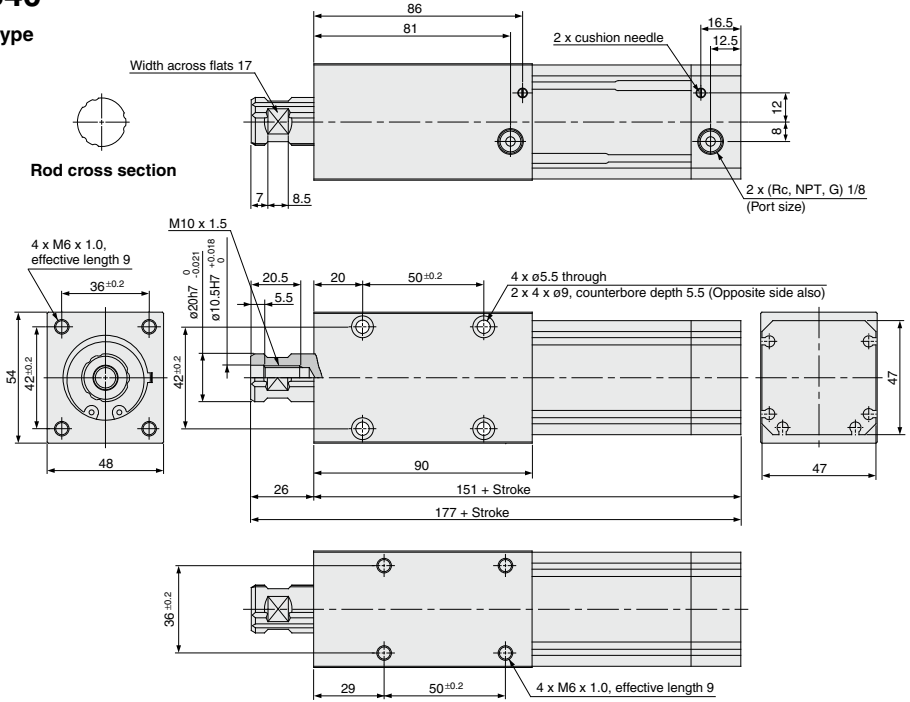


**Dimensions:  $\phi 40$**

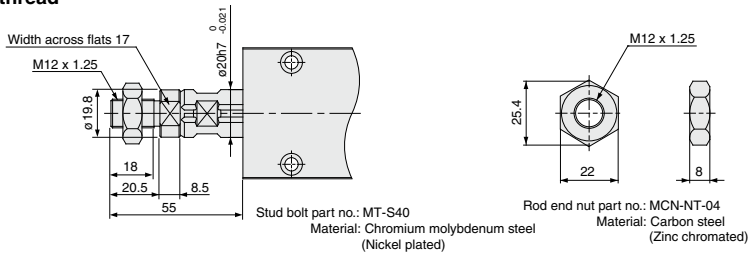
Note) Spline rod's width across flats have nothing to do with the position of the body mounting face.

**MTS40**

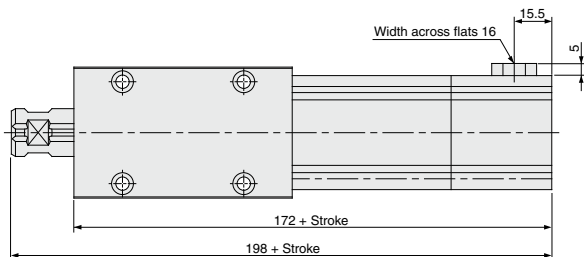
**Basic type**



**Rod end male thread**



**With end lock**

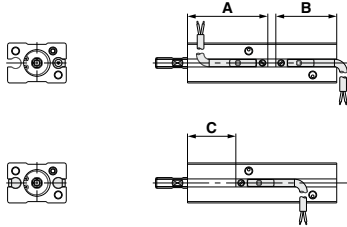


# Auto Switch Mounting 1

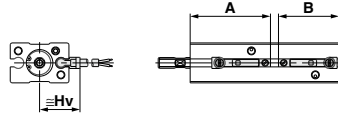
## Auto Switch Proper Mounting Position (Detection at Stroke End) and Its Mounting Height

ø8

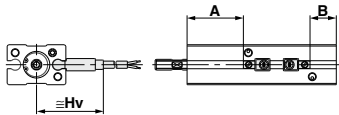
D-A9□  
D-M9□  
D-M9□W  
D-M9□A



D-A9□V  
D-M9□V  
D-M9□WV  
D-M9□AV



D-F8□



### Operating Range

(mm)

Auto switch model	Bore size						
	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

\* 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.

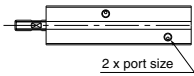




### Auto Switch Proper Mounting Position

(mm)

Bore size (mm)	Reed auto switch						Solid state auto switch						2-color indicator solid state auto switch								
	D-A9□		D-A9□V		D-M9□		D-M9□V		D-F8□		D-M9□W, D-M9□A		D-M9□WV, D-M9□AV								
	A	B	C	A	B	Hv	A	B	C	A	B	Hv	A	B	C	A	B	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.

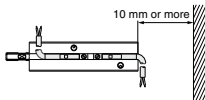
### Auto Switch Mounting Stroke for ø8

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

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.

○ ... Mountable  
× ... Not mountable

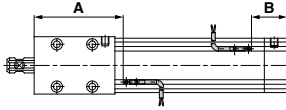
Note 2) When mounting auto switches with in-line electrical entry, allow a space of 10 mm or more at the rear end to prevent lead wire interference.



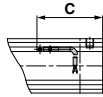
**Auto Switch Proper Mounting Position (Detection at Stroke End) and Its Mounting Height**

ø12 to ø40

D-A9□  
D-M9□  
D-M9□W  
D-M9□A

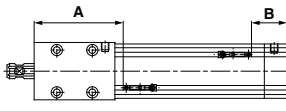


ø12/16/20

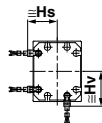


ø25/32/40

D-A9□V  
D-M9□V  
D-M9□WV  
D-M9□AV



ø12/16/20



ø25/32/40

**Auto Switch Proper Mounting Position**

(mm)

Bore size (mm)	Reed auto switch								Solid state auto switch								2-color 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. For detailed specifications, refer to pages 1289 to 1383.

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. For details, refer to page 1308.

# Auto Switch Mounting 2

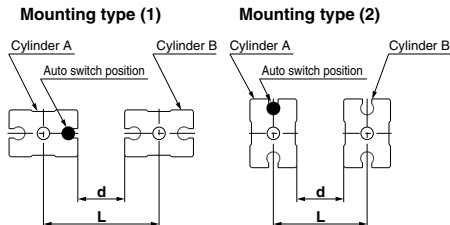
## Caution on Installing in Close Proximity to Each Other

### ⚠ 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.

When using cylinders with different orientations or bore sizes in proximity to one another, consult with SMC.

**ø8**

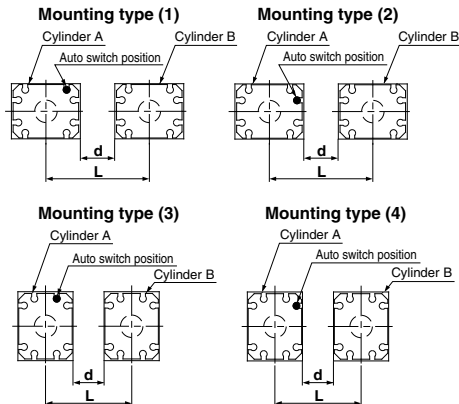


**Dimensions by Mounting Type**

Bore size (mm)	Auto switch model	(1)		(2)	
		L	d	L	d
8	D-A9□, D-A9□V	27 (37)	5 (15)	15	0
	D-M9□, D-M9□V	27 (39)	5 (17)	15	0
	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.

**ø12 to ø40**



**Dimensions by Mounting Type**

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 D-M9□A, D-M9□AV	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 D-M9□A, D-M9□AV	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	56 (63)	30 (37)
	D-M9□W, D-M9□WV D-M9□A, D-M9□AV	38	0	38 (55)	0 (17)	26	0	56 (63)	30 (37)
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)	47	15	72 (74)	40 (42)
	D-M9□W, D-M9□WV D-M9□A, D-M9□AV	40	0	50 (57)	10 (17)	47	15	72 (74)	40 (42)
32	D-A9□, D-A9□V	50	0	50 (61)	0 (11)	38	0	38 (53)	0 (15)
	D-M9□, D-M9□V	50	0	55 (63)	5 (13)	38	0	48 (55)	10 (17)
	D-M9□W, D-M9□WV D-M9□A, D-M9□AV	50	0	55 (63)	5 (13)	38	0	48 (55)	10 (17)
40	D-A9□, D-A9□V	54	0	54 (64)	0 (10)	48	0	48 (63)	0 (15)
	D-M9□, D-M9□V	54	0	59 (66)	5 (12)	48	0	63 (70)	15 (22)
	D-M9□W, D-M9□WV D-M9□A, D-M9□AV	54	0	59 (66)	5 (12)	48	0	63 (70)	15 (22)

( ): 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). Please contact SMC for further information.

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.