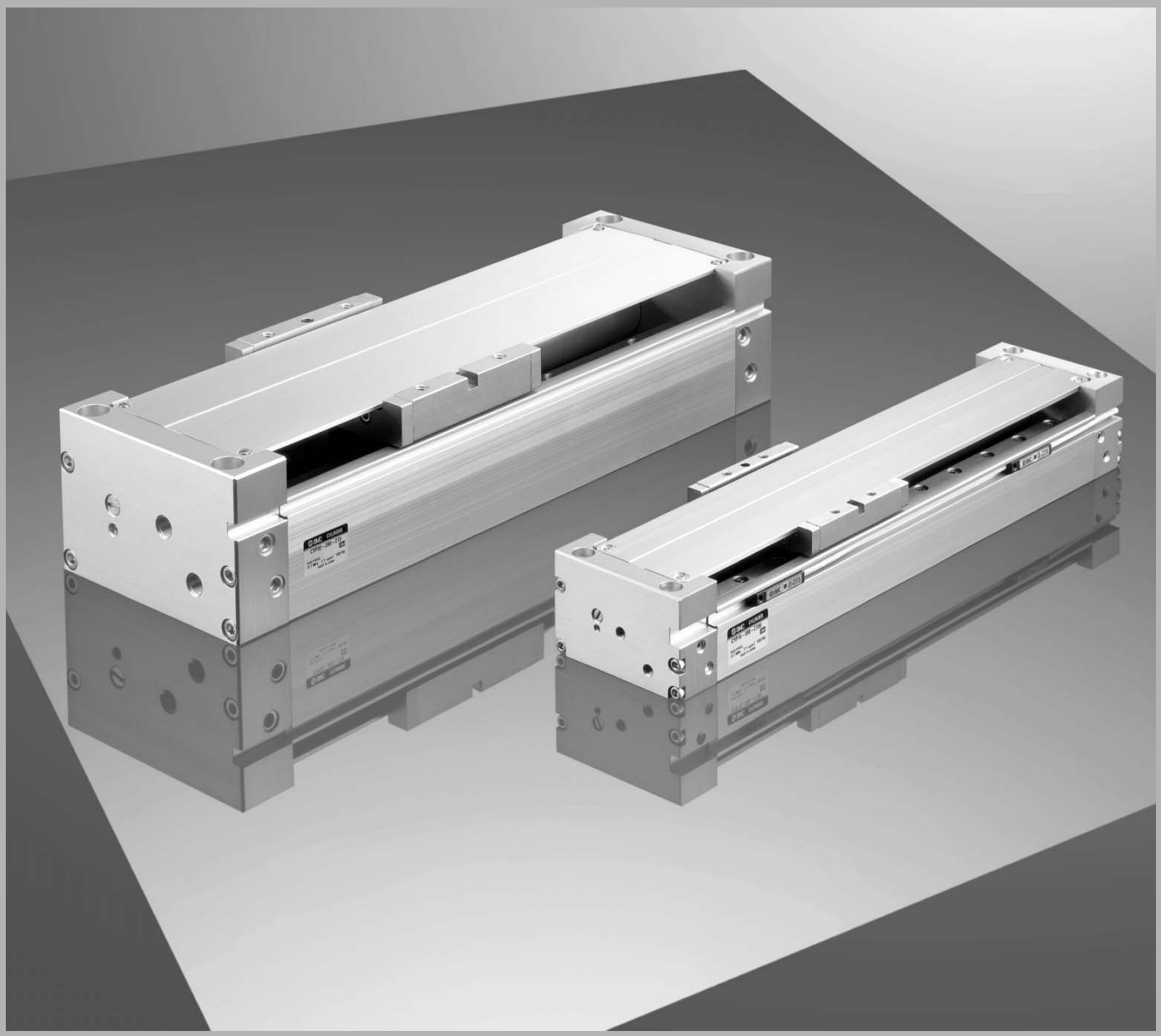
Clean Room Rodless Cylinder

Series CYP

ø15, ø32

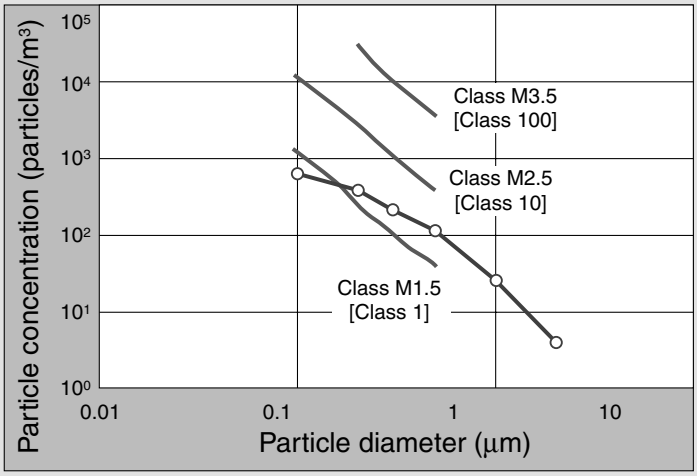


Magnetically coupled rodless cylinder for transfer in clean environments.

Low particle generation: 1/20

(compared to previous series)

- High cleanliness is achieved with **non-contact construction** of the cylinder tube exterior and a **stainless steel linear guide (specially treated)**.
- Particle generation has been reduced to 1/20 compared to series 12-CY1B (previous SMC product) even without vacuum suction.



Note 1) This chart indicates the level of cleanliness inside the measurement chamber.

Note 2) The vertical axis shows the number of particles per unit volume (1 m³) of air which are no smaller than the particle size shown on the horizontal axis.

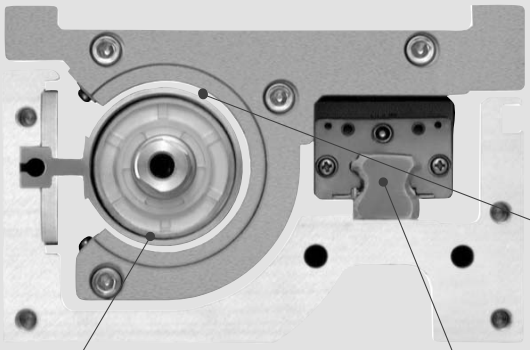
Note 3) The gray lines show the upper concentration limit of the cleanliness class based on Fed.Std.209E-1992.

Note 4) The plots indicate the 95% upper reliability limit value for time series data up to 500 thousand operation cycles. (Cylinder: CYP32-200, Workpiece weight: 5 kg, Average speed: 2000 mm/s)

Note 5) The data above provide a guide for selection but is not guaranteed.

Long stroke

(Max. 700 mm)

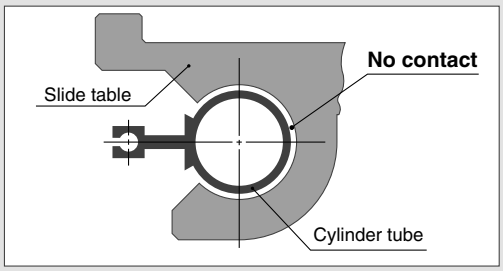


Stainless steel linear guide
(specially treated)

The specially treated linear guide achieves low particulate generation, high linearity and high precision.

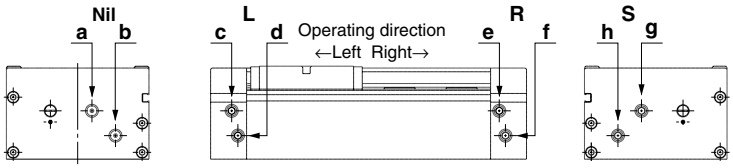
Non-contact construction

There is no particulate generation from sliding, because the construction avoids contact between the cylinder tube's exterior surface and the slide table's interior surface.



Piping port variations provide a high degree of freedom

Piping port positions can be selected to accommodate the installation.



Note) Plugs are installed in ports other than those indicated for the model.

Model	Nil		L		R		S	
Piping port position	a	b	c	d	e	f	g	h
Operating direction	Right	Left	Right	Left	Right	Left	Right	Left

Cleaned, assembled and double packaged in a clean room

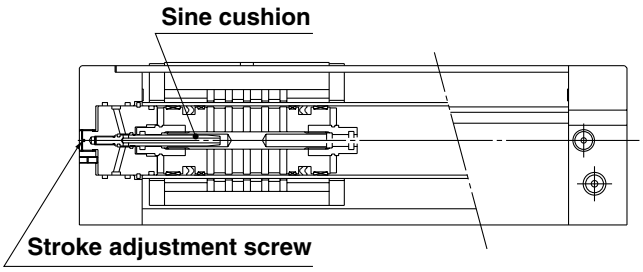
A magnetically coupled rodless cylinder that can be used for transfer in clean environments

Special cylinder tube

A special cylinder tube is employed using extruded aluminum material. Even long strokes are not subject to deflection because of direct attachment to the cylinder body, and non-contact construction is achieved through combination with a linear guide.

Shock-free

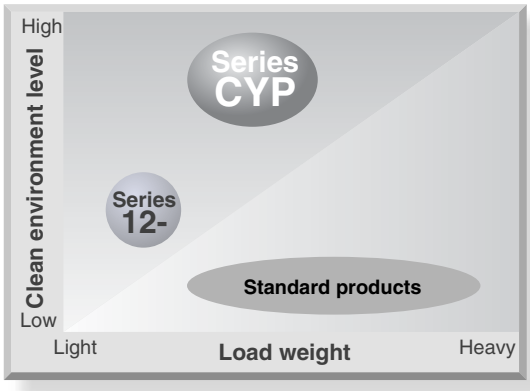
A **sine cushion** is used at the end of the stroke. Smooth acceleration and deceleration are possible at 0.5 G or less.



Stroke adjustment

The **stroke adjustment screw** allows fine control of the stroke (±1 mm on each side)

■ Series Variations



Series	Guide type	Bore size (mm)
Clean room rodless *CYP*	High precision guide type	6 10 15 20 25 32 40 50 63
12-CY1B	Basic type	
12-CY1R	Basic type Direct mount type	

Model Selection 1

Caution on Design (1)

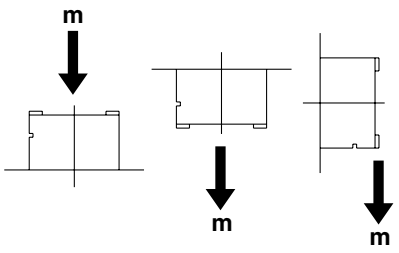
The load mass allowable moment differs depending on the workpiece mounting method, cylinder mounting orientation and piston speed. In making a determination of usability, do not allow the sum ($\Sigma\alpha n$) of the load factors (αn) for each mass and moment to exceed "1".

$$\Sigma\alpha n = \frac{\text{Load mass (m)}}{\text{Max. load mass (m max)}} + \frac{\text{Static moment (M)}}{\text{Allowable static moment (M max)}} + \frac{\text{Dynamic moment (Me)}}{\text{Allowable dynamic moment (Me max)}} \leq 1$$

Load Mass

Max. load mass (kg)

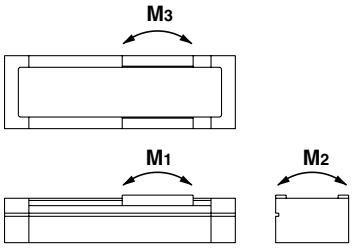
Model	m_{max}
CYP15	1
CYP32	5



Moment

Allowable moment

(Static moment/Dynamic moment)



(N·m)

Model	M_1	M_2	M_3
CYP15	0.3	0.6	0.3
CYP32	3	4	3

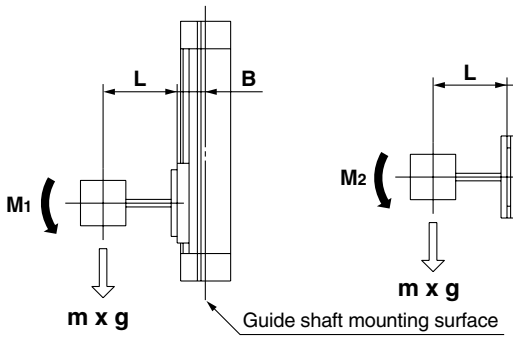
Static Moment

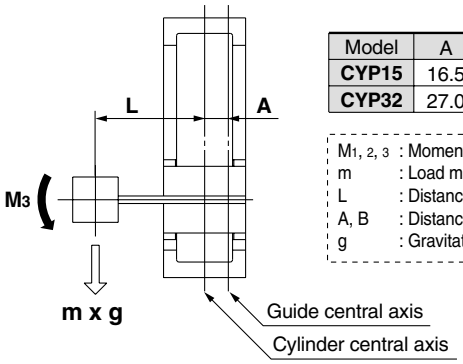
Moment generated by the workpiece weight even when the cylinder is stopped

■ **Pich moment**
$M_1 = m \times g \times (L + B) \times 10^{-3}$

■ **Roll moment**
$M_2 = m \times g \times (L + B) \times 10^{-3}$

■ **Yaw moment**
$M_3 = m \times g \times (L + A) \times 10^{-3}$





(mm)

Model	A	B
CYP15	16.5	25.5
CYP32	27.0	48.0

$M_{1, 2, 3}$: Moment [N·m]
m : Load mass [kg]
L : Distance to load center of gravity [mm]
A, B : Distance to guide shaft [mm]
g : Gravitational acceleration [9.8 m/s²]

Dynamic Moment

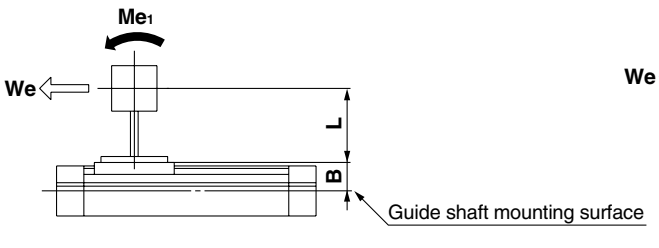
Moment generated by the load equivalent to impact at the stroke end

$We = 5 \times 10^{-3} \times m \times g \times U$

We: Load equivalent to impact [N]
m : Load mass [kg]
U: Max. speed [mm/s]
g: Gravitational acceleration [9.8 m/s²]

■ **Pich moment**
$Me_1 = 1/3^{*} \cdot We\ (L + B) \cdot 10^{-3}$

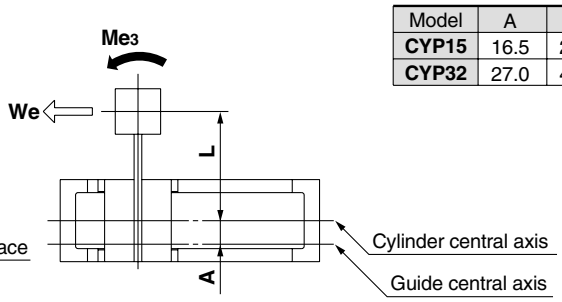
* **Average load coefficient**



■ **Yaw moment**
$Me_3 = 1/3^{*} \cdot We\ (L + A) \cdot 10^{-3}$

(mm)

Model	A	B
CYP15	16.5	25.5
CYP32	27.0	48.0



Model Selection 2

Selection Calculation

The selection calculation finds the load factors (αn) of the items below, where the total ($\Sigma \alpha n$) does not exceed 1.

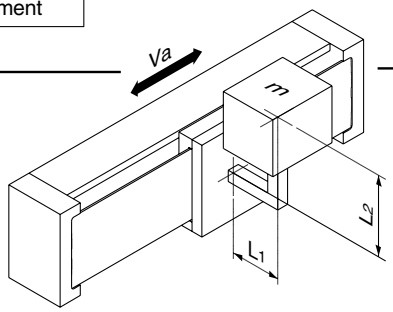
$$\Sigma\, \alpha n = \alpha_1 + \alpha_2 + \alpha_3 \leq 1$$

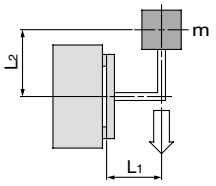
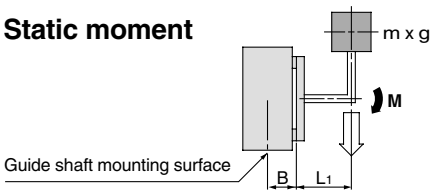
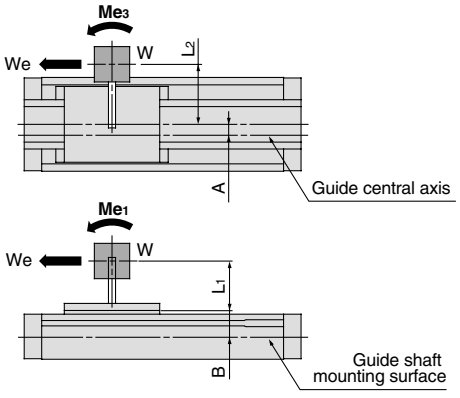
Item	Load factor αn	Note
1. Max. load mass	$\alpha_1 = m/m_{max}$	Review m m_{max} is the maximum load mass
2. Static moment	$\alpha_2 = M/M_{max}$	Review M_1, M_2, M_3 Mmax is the allowable moment
3. Dynamic moment	$\alpha_3 = Me/Me_{max}$	Review Me_1, Me_3 Memax is the allowable moment

Calculation Example

Operating Conditions

Cylinder: CYP32
Mounting: Horizontal wall mounting
Maximum speed: U = 300 [mm/s]
Load mass: m = 1 [kg] (excluding mass of arm section)
L_1 = 50 [mm]
L_2 = 50 [mm]



Item	Load factor αn	Note
1. Maximum load mass 	$\alpha_1 = m/m_{max}$ $= 1/5$ **$= 0.20$**	Review m.
2. Static moment 	$M_2 = m \cdot g \cdot (L_1 + B) \cdot 10^{-3}$ $= 1 \cdot 9.8 \cdot (50 + 48) \cdot 10^{-3}$ $= 0.96$ [N·m] $\alpha_2 = M_2/M_2$ max $= 0.96/4$ **$= 0.24$**	Review M_2. Since M_1 & M_3 are not generated, review is unnecessary.
3. Dynamic moment 	$We = 5 \times 10^{-3}\, m \cdot g \cdot U$ $= 5 \times 10^{-3} \cdot 1 \cdot 9.8 \cdot 300$ $= 14.7$ [N] $Me_3 = 1/3 \cdot We\ (L_2 + A) \cdot 10^{-3}$ $= 1/3 \cdot 14.7 \cdot (50 + 27) \cdot 10^{-3}$ $= 0.38$ [N·m] $\alpha_3 = Me_3/Me_3$ max $= 0.38/3$ **$= 0.13$**	Review Me_3.
	$Me_1 = 1/3 \cdot We \cdot (L_1 + B) \cdot 10^{-3}$ $= 1/3 \cdot 14.7 \cdot (50 + 48) \cdot 10^{-3}$ $= 0.48$ [N·m] $\alpha_4 = Me_1/Me_1$ max $= 0.48/3$ **$= 0.16$**	Review Me_1.

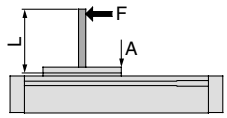
$\Sigma \alpha n = \alpha_1 + \alpha_2 + \alpha_3 + \alpha_4$
$= 0.20 + 0.24 + 0.13 + 0.16$
$= 0.73$
$\Sigma \alpha n = 0.73 \leq 1$ Therefore it can be used.

Model Selection 3

Caution on Design (2)

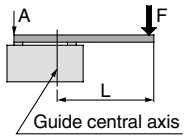
Table Deflection Note)

Table deflection due to pitch moment load



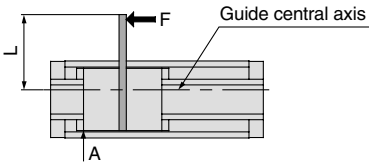
$M_1 = F \times L$

Table deflection due to roll moment load



$M_2 = F \times L$

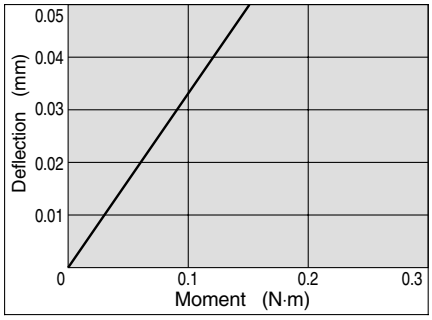
Table deflection due to yaw moment load



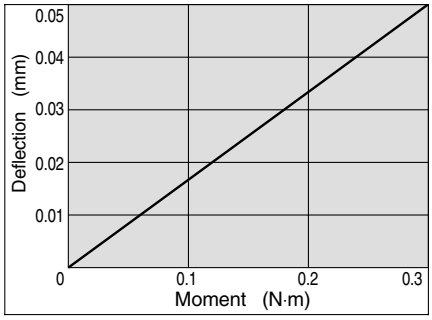
$M_3 = F \times L$

Note) Displacement of Section A when force acts on Section F

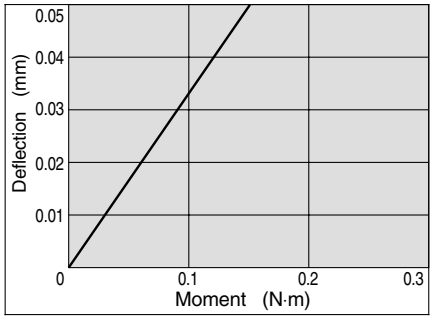
CYP15 (M_1)



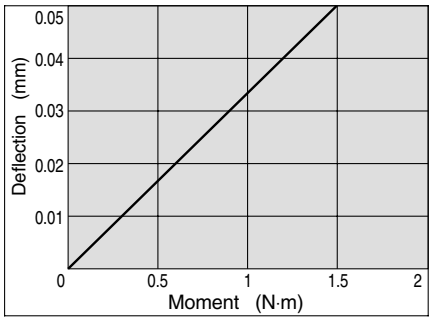
CYP15 (M_2)



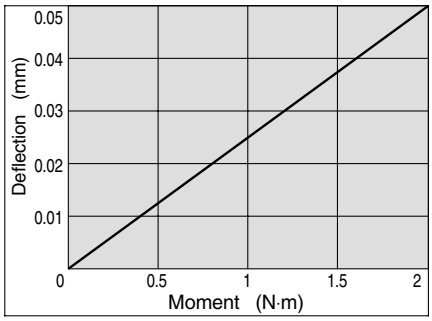
CYP15 (M_3)



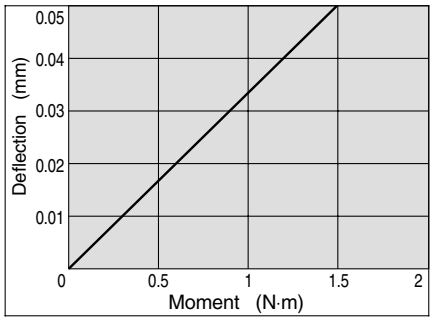
CYP32 (M_1)



CYP32 (M_2)



CYP32 (M_3)



Vertical Operation

When using in vertical operation, prevention of workpiece dropping due to breaking of the magnetic coupling should be considered. The allowable load mass and maximum operating pressure should be as shown in the table below.

Model	Allowable load mass mv (kg)	Maximum operating pressure Pv (MPa)
CYP15	1	0.3
CYP32	5	

Intermediate Stop

The cushion effect (smooth start-up, soft stop) exists only before the stroke end in the stroke ranges indicated in the table below.

The cushion effect (smooth start-up, soft stop) cannot be obtained in an intermediate stop or return from an intermediate stop using an external stopper, etc.

When using an intermediate stop considering the above information, implement measures to prevent particulate generation and set the operating pressure to no more than 0.3 MPa.

Cushion Stroke

Model	Stroke (mm)
CYP15	25
CYP32	30

Clean Room Rodless Cylinder

Series CYP

ø15, ø32

How to Order

CYP 15 — 200 □ — Z73 □

Bore size

15	15 mm
32	32 mm

Standard stroke

Bore size (mm)	Standard stroke (mm)
15, 32	**100, 150, 200, 250, 300, 350 400, 450, 500, 600, 700**

Note 1) Please consult with SMC if the maximum stroke is exceeded.
Note 2) Intermediate strokes are available as a special order.

Piping port location

Nil	a	Operating direction: Right
	b	Operating direction: Left
L	c	Operating direction: Right
	d	Operating direction: Left
R	e	Operating direction: Right
	f	Operating direction: Left
S	g	Operating direction: Right
	h	Operating direction: Left

Auto switch

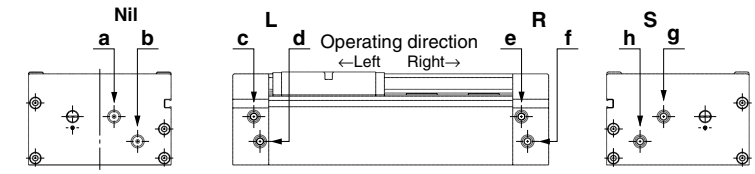
Nil	Without auto switch

For the applicable auto switch model, refer to the table below.

Number of auto switches

Nil	2 pcs.
S	1 pc.
n	"n" pcs.

Piping Port Locaition



Note) Plugs are installed in ports other than those indicated for the model.

Applicable Auto Switch/Refer to page 8-30-1 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage DC		Load voltage AC	Auto switch model: Electrical entry direction Perpendicular	Auto switch model: Electrical entry direction In-line	Lead wire length (mm)* 0.5 (Nil)	3 (L)	5 (Z)	Applicable load	
Reed switch	—	Grommet	Yes	3-wire	—	5 V	—	—	**Z76**	●	●	—	IC circuit	—
				2-wire	24 V	12 V	100 V	—	**Z73**	●	●	●	—	Relay, PLC
			No			5 V, 12 V	100 V or less	—	**Z80**	●	●	—	IC circuit	
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	**Y69A**	**Y59A**	●	●	○	IC circuit	Relay, PLC
				3-wire (PNP)				**Y7PV**	**Y7P**	●	●	○	IC circuit	
				2-wire		12 V		**Y69B**	**Y59B**	●	●	○	—	
	Diagnostic indication (2-color indication)			3-wire (NPN)		5 V, 12 V		**Y7NWV**	**Y7NW**	●	●	○	IC circuit	
				3-wire (PNP)				**Y7PWV**	**Y7PW**	●	●	○		
				2-wire		12 V		**Y7BWV**	**Y7BW**	●	●	○	—	

∗ Lead wire length symbols: 0.5 m ····· Nil (Example) Y69B
3 m ····· L Y69BL
5 m ····· Z Y69BZ

∗∗ Auto switches marked with a "○" symbol are produced upon receipt of order.

Specifications

Bore size (mm)	15	32
Fluid	Air/Inert gas	
Action	Double acting	
Proof pressure	0.5MPa	
Operating pressure range	0.05 to 0.3MPa	
Ambient and fluid temperature	–10 to 60°C	
Piston speed	50 to 300mm/s	
Lubrication	Non-lube	
Stroke adjustment	±1mm on each side (±2mm total)	
Cushion	Sine cushion (Air cushion)	
Port size	M5 x 0.8	Rc 1/8

Weight

(kg)

Model	Standard stroke (mm)										
	100	150	200	250	300	350	400	450	500	600	700
CYP15	1.2	1.4	1.6	1.7	1.9	2.0	2.2	2.4	2.5	2.8	3.2
CYP32	4.2	4.6	5.0	5.5	5.9	6.3	6.7	7.1	7.5	8.3	9.1

Magnetic Holding Force

Bore size (mm)	Magnetic holding force (N)
15	59
32	268

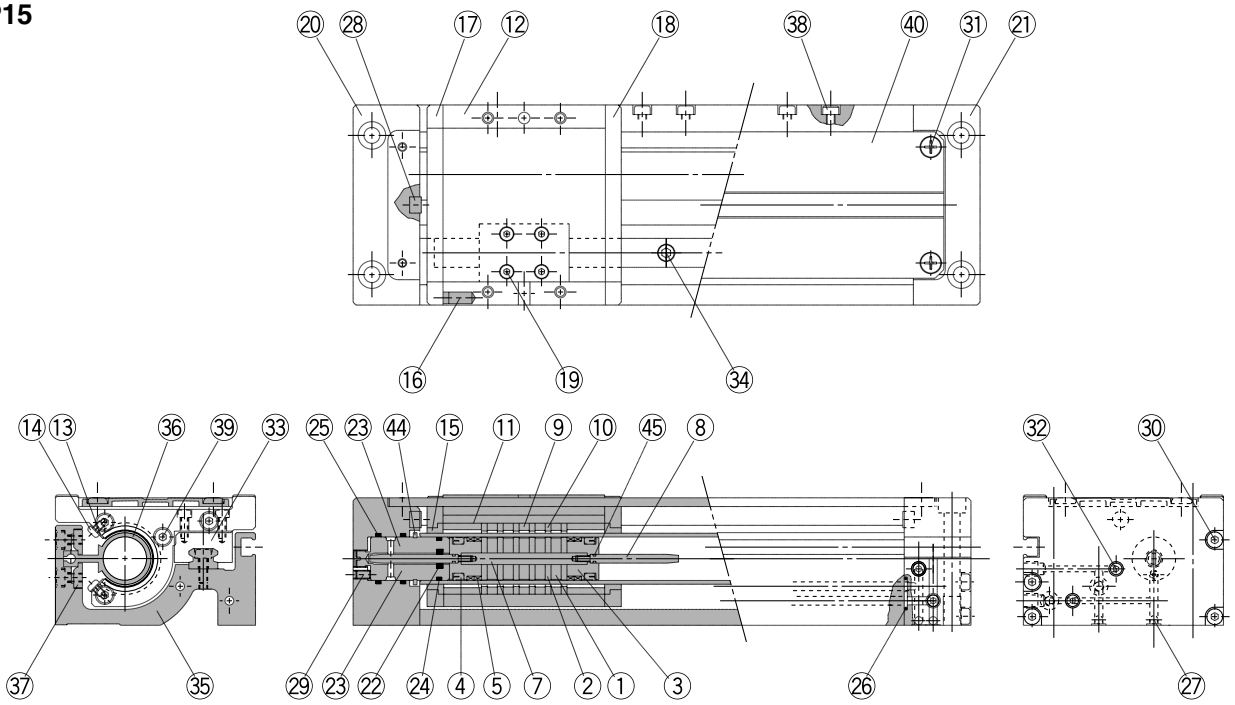
Theoretical Output

(N)

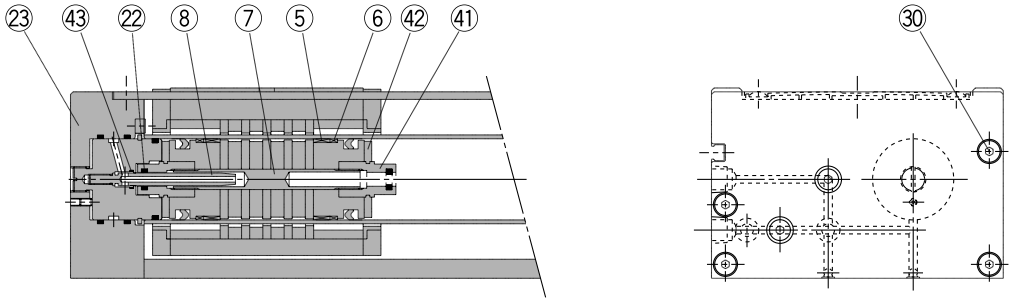
Bore size (mm)	Piston area (mm)	Operating pressure (MPa)		
		0.1	0.2	0.3
15	176	18	35	53
32	804	80	161	241

Construction

CYP15



CYP32

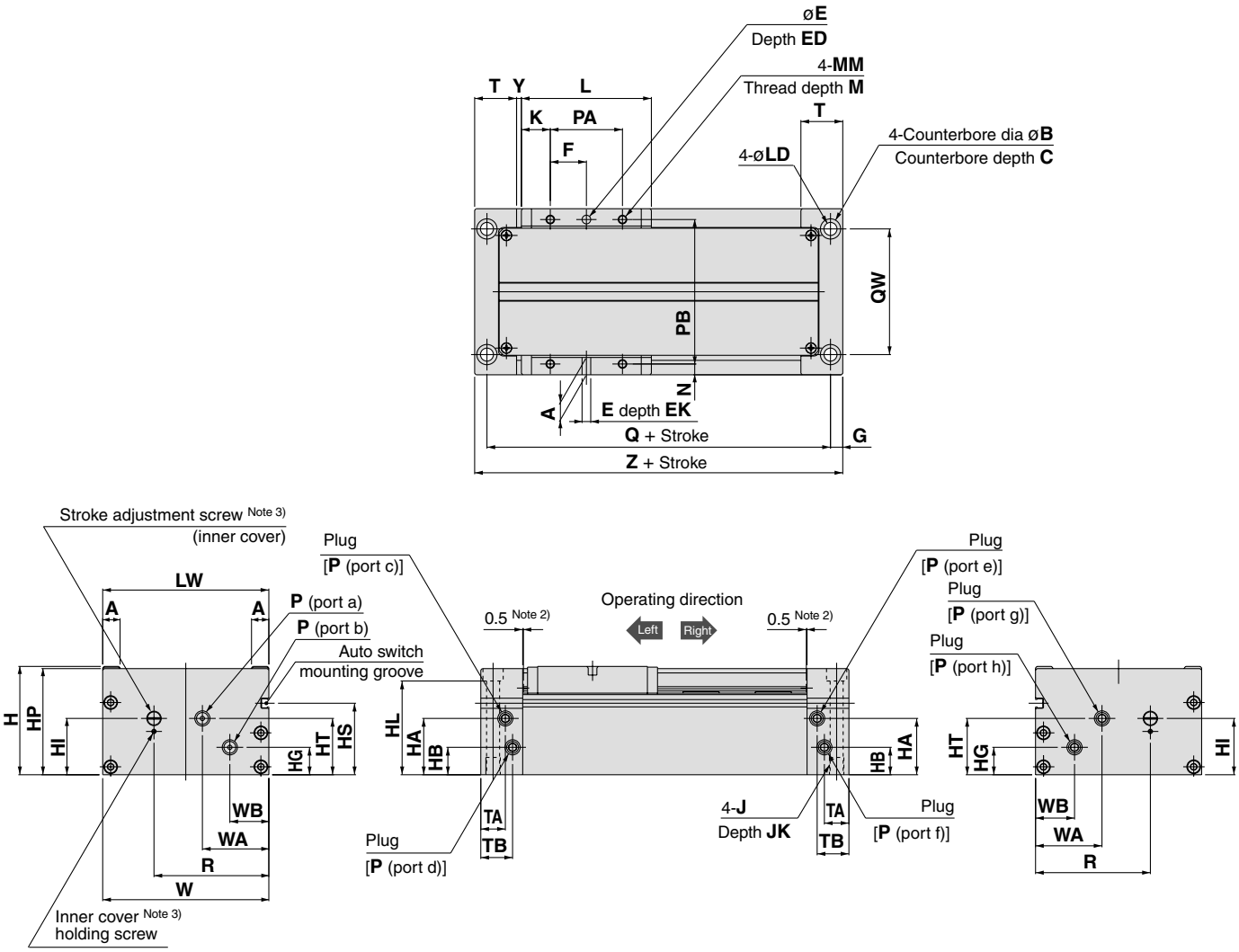


Component Parts

No.	Description	Material	Note
①	Magnet A	Rare earth magnet	
②	Piston side yoke	Rolled steel plate	Zinc chromated
③	Piston	Brass/Aluminum alloy	ø15: Electroless nickel plated, ø32: Chromated
④	Piston seal	NBR	
⑤	Wear ring A	Special resin	
⑥	Wear ring	Special resin	
⑦	Shaft	Stainless steel	
⑧	Cushion ring	Stainless steel/Brass	ø15: Electroless nickel plated
⑨	Magnet B	Rare earth magnet	
⑩	External slider side yoke	Rolled steel	Electroless nickel plated
⑪	External spacer	Aluminum alloy	Electroless nickel plated
⑫	Slide table	Aluminum alloy	Electroless nickel plated
⑬	Insertion guide plate	Stainless steel	
⑭	Round head Phillips screw	Carbon steel	Nickel plated
⑮	Hold spacer	Aluminum alloy	Electroless nickel plated
⑯	Magnet	Rare earth magnet	
⑰	Side plate A	Aluminum alloy	Electroless nickel plated
⑱	Side plate B	Aluminum alloy	Electroless nickel plated
⑲	Hexagon socket head cap screw	Chrome molybdenum steel	Nickel plated
⑳	Plate A	Aluminum alloy	Clear hard anodized
㉑	Plate B	Aluminum alloy	Clear hard anodized
㉒	Cushion seal	NBR	

No.	Description	Material	Note
㉓	Inner cover	Aluminum alloy	Clear hard anodized
㉔	Cylinder tube gasket	NBR	
㉕	O-ring	NBR	
㉖	O-ring	NBR	
㉗	Steel ball	Carbon steel	
㉘	Bumper	Polyurethane	
㉙	Hexagon socket head set screw	Chrome molybdenum steel	Nickel plated
㉚	Hexagon socket head cap screw	Chrome molybdenum steel	Nickel plated
㉛	Round head Phillips screw	Stainless steel	Nickel plated
㉜	Hexagon socket head plug	Chrome molybdenum steel	Nickel plated
㉝	Linear guide	Stainless steel	
㉞	Hexagon socket head cap screw	Chrome molybdenum steel	Nickel plated
㉟	Body	Aluminum alloy	Clear hard anodized
㊱	Cylinder tube	Aluminum alloy	Hard anodized
㊲	Tube attaching bracket	Aluminum alloy	Clear hard anodized
㊳	Hexagon socket head cap screw	Chrome molybdenum steel	Nickel plated
㊴	Hexagon socket head cap screw	Chrome molybdenum steel	Nickel plated
㊵	Top cover	Aluminum alloy	Clear hard anodized
㊶	Cushion seal holder	Aluminum alloy	Chromated
㊷	Bumper	Urethane	CYP32 only
㊸	O-ring	NBR	
㊹	C type snap ring for shaft	Carbon tool steel	
㊺	O-ring	NBR	

Dimensions



(mm)

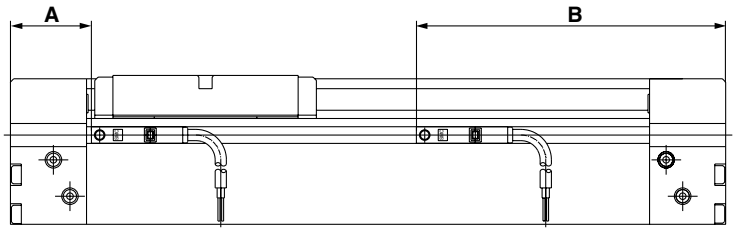
Model	A	B	C	E	ED	EK	F	G	H	HA	HB	HG	HI	HL	HP	HS	HT	J	JK	K
CYP15	8	9.5	5.4	4H9 $^{+0.030}_{0}$	9.5	4	12.5	6.5	45	19.5	8.5	8.5	23	38.6	44	27	19.5	M6 x 1	10	21
CYP32	12	14	8.6	6H9 $^{+0.030}_{0}$	13	6	25	8.5	75	39	19	19	39	64.9	73.5	49.5	39	M10 x 1.5	12	20

Model	L	LD	LW	MM	M	N	P	PA	PB	Q	QW	R	T	TA	TB	W	WA	WB	Y	Z
CYP15	67	5.6	69	M4 x 0.7	6	4.5	M5 x 0.8	25	60	105	48	45	23	13	18	69	32	17	2.5	118
CYP32	90	8.6	115	M6 x 1	8	7.5	Rc 1/8	50	100	138	87	79.5	29	17	22	115	46	27	3.5	155

Note 1) These dimension drawings indicate the case of piping port location “Nil”.
Note 2) These dimensions indicate the protruding portion of the bumper.
Note 3) Refer to “Specific Product Precautions” [Cushion Effect (Sine Cushion) and Stroke Adjustment] on page 8-17-13.

With Auto Switch

Proper Auto Switch Mounting Position Detection (Detedtion at stroke end)



Proper Auto Switch Mounting Position

Cylinder model \ Auto switch model	A			B		
	D-Z7□ D-Z80	D-Y7□W D-Y7□WV	D-Y5□ D-Y6□ D-Y7P D-Y7PV	D-Z7□ D-Z80	D-Y7□W D-Y7□WV	D-Y5□ D-Y6□ D-Y7P D-Y7PV
CYP15	24.5			93.5		
CYP32	33			122		

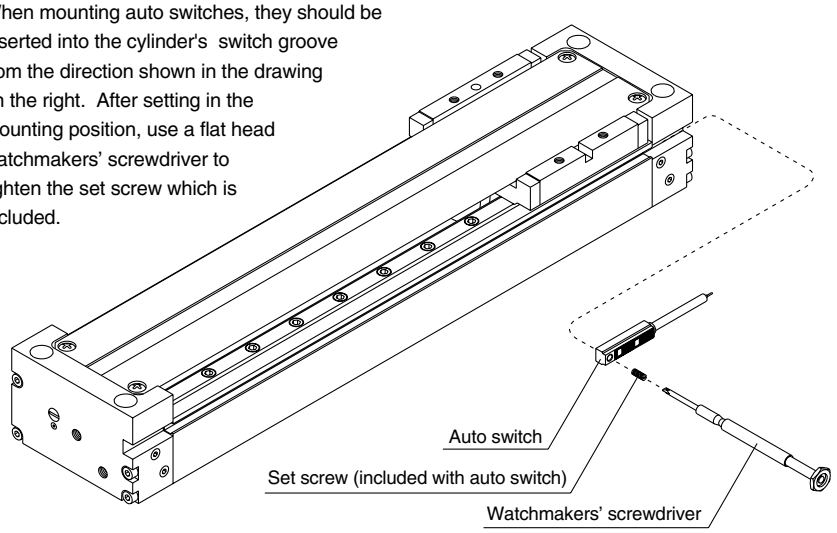
Operating Range

Cylinder model \ Auto switch model	D-Z7□ D-Z80	D-Y7□W D-Y7□WV D-Y5□ D-Y6□ D-Y7P D-Y7PV
CYP15	6.5	2.5
CYP32	9.5	3

Note) Operating ranges are standards including hysteresis, and are not guaranteed. (variations on the order of ±30%)
Large variations may occur depending on the surrounding environment.

Mounting of Auto Switch

When mounting auto switches, they should be inserted into the cylinder's switch groove from the direction shown in the drawing on the right. After setting in the mounting position, use a flat head watchmakers' screwdriver to tighten the set screw which is included.



Note) When tightening the auto switch set screw (included with the auto switch), use a watchmakers' screwdriver with a handle about 5 to 6 mm in diameter. The tightening torque should be approximately 0.05 to 0.1 N·m.

Specific Product Precautions 1

Be sure to read before handing.

Handling

⚠ Caution

1. Open the inner package of the double packaged clean series inside a clean room or other clean environment.

2. Perform parts replacement and disassembly work in a clean room after exhausting compressed air in the piping outside the clean room.

Mounting

⚠ Caution

1. Take care to avoid striking the cylinder tube with other objects or handling it in a way that could cause deformation.

The cylinder tube and slider units have a non-contact construction. For this reason, even a slight deformation or slippage of position can cause malfunction and loss of durability, as well as a danger of degrading the particulate generation characteristics.

2. Do not scratch or gouge the linear guide by striking it with other objects.

Since the linear guide is specially treated for maximum suppression of particulate generation due to sliding, even a slight scratch can cause malfunction and loss of durability, as well as a danger of degrading the particulate generation characteristics.

3. Since the slide table is supported by precision bearings, do not apply strong impacts or excessive moment when mounting workpieces.

4. Be sure to operate the cylinder with the plates on both sides secured.

Avoid applications in which the slide table or only one plate is secured.

5. When changing the ports to be used, be sure that unused ports are securely sealed.

Take sufficient care in sealing unused ports, because if ports are not properly sealed air can leak from the ports and particulate generation characteristics can be degraded.

Operation

⚠ Caution

1. The maximum operating pressure for the clean rodless cylinder is 0.3 MPa.

If the maximum operating pressure of 0.3 MPa for the clean rodless cylinder is exceeded, the magnetic coupling can be broken, causing a danger of malfunction or degradation of particulate generation characteristics, etc.

2. The product can be used with a direct load applied within the allowable range, but careful alignment is necessary when connecting to a load having an external guide mechanism.

Since alignment variations increase as the stroke gets longer, use a connection method which can absorb these variations and consider measures to control particulate generation.

Operation

⚠ Caution

3. When used for vertical operation, use caution regarding possible dropping due to separation of the magnetic coupling.

When used for vertical operation, use caution as there is a possibility of dropping due to separation of the magnetic coupling if a load (pressure) greater than the allowable value is applied.

4. Do not operate with the magnetic coupling out of position.

If the magnetic coupling is out of position, push the external slider by hand (or the piston slider with air pressure) back to the proper position at the stroke end.

5. Do not supply lubrication, as this is a non-lube product.

The interior of the cylinder is lubricated at the factory, and lubrication with turbine oil, etc., will not satisfy the product's specifications.

6. Never reapply lubricant.

Never reapply lubricant, as there may be a degradation of particulate generation or operation characteristics.

Speed Adjustment

⚠ Caution

1. A throttle valve for clean room use is recommended for speed adjustment. (Please consult with SMC regarding equipment and methods to be used.)

Speed adjustment can also be performed with a meter-in or meter-out type speed controller for clean room use, but it may not be possible to obtain smooth starting and stopping operation.

Throttle Valves and Dual Speed Controllers for Recommended Speed Adjustment of CYP Cylinders

Throttle valve \ Series		Model	
		CYP15	**CYP32**
Metal body piping type	Elbow type	10-AS1200-M5-X216	10-AS2200-01-X214
	In-line type	10-AS1000-M5-X214	10-AS2000-01-X209
Resin body with One-touch fitting	Elbow type (throttle valve)	10-AS1201F-M5-04-X214	10-AS2201F-01-04-X214
		10-AS1201F-M5-06-X214	10-AS2201F-01-06-X214
			10-AS2201F-01-06-X214
	Universal type (throttle valve)	10-AS1301F-M5-04-X214	10-AS2301F-01-04-X214
		10-AS1301F-M5-06-X214	10-AS2301F-01-06-X214
			10-AS2301F-01-06-X214
	In-line type (throttle valve)	10-AS1001F-04-X214	10-AS2001F-04-X214
		10-AS1001F-06-X214	10-AS2001F-06-X214
	Dual type (speed controller)	10-ASD230F-M5-04	10-ASD330F-01-06
		10-ASD230F-M5-06	10-ASD330F-01-08

2. In the case of vertical mounting, a system with a reduced pressure supply circuit installed on the down side is recommended. (This is effective against upward starting delays and for conservation of air.)

Specific Product Precautions 2

Be sure to read before handing.

Cushion Effect (Sine Cushion) and Stroke Adjustment

⚠ Caution

1. A sine cushion (smooth start, soft stop) function is included in the standard specifications.

Due to the nature of a sine cushion, adjustment of the cushion effect is not possible. There is no cushion needle adjustment as in the case of conventional cushion mechanisms.

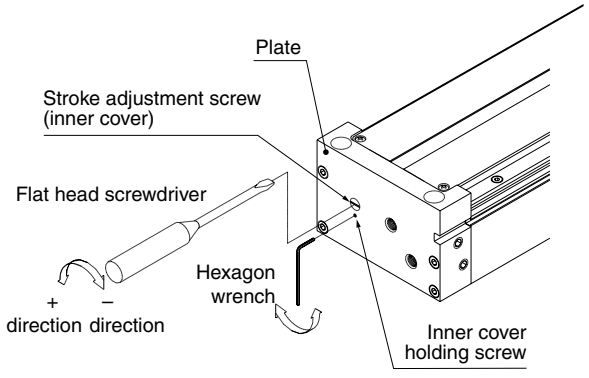
2. The stroke end adjustment is a mechanism to adapt the slide table's stroke end position to a mechanical stopper on other equipment, etc.

(Adjustment range: Total of both sides ±2 mm) To ensure safety, perform adjustment after shutting off the drive air, releasing the residual pressure and implementing drop prevention measures, etc.

1) Loosen the inner cover holding screw with a hexagon wrench, etc.
2) To match the position with a mechanical stopper on other equipment, etc., rotate the stroke adjustment screw (inner cover) to the left or right with a flat head screwdriver to move the inner stopper back and forth. Approximately 1 mm of adjustment is possible with one rotation.
3) The maximum adjustment on one side is ±1 mm. A total adjustment of approximately ±2 mm is possible using both sides.
4) After completing the stroke end adjustment, tighten the inner cover holding screw with a hexagon wrench, etc.

Inner Cover Holding Screw Tightening Torque [N·m]

Model	Screw size	Tightening torque
CYP15	M3 x 0.5	0.3
CYP32	M6 x 1	2.45



Maintenance

⚠ Caution

1. Never disassemble the cylinder tube or linear guide, etc.

If disassembled, the slide table may touch the outside surface of the cylinder tube resulting in a degradation of particulate generation characteristics.

2. Please consult with SMC when replacing seals and bearings (wear rings).

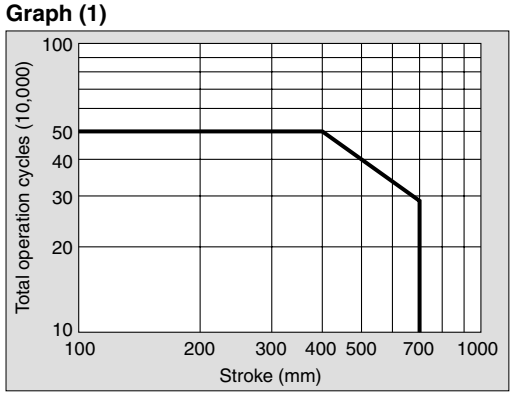
Particulate Generation Characteristics

⚠ Caution

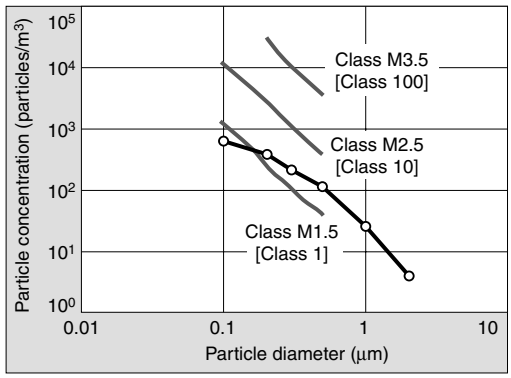
1. In order to maintain the particulate generation grade, use operation of 500 thousand cycles or travel distance of about 400 km as a standard. (Graph (1) below)

If operation is continued beyond the recommended values, lubrication failure of the linear guide and loss of particulate generation characteristics may occur.

Graph (1)



Graph (2)



Note 1) This chart indicates the level of cleanliness inside the measurement chamber.

Note 2) The vertical axis shows the number of particles per unit volume (1 m^3) of air which are no smaller than the particle size shown on the horizontal axis.

Note 3) The gray lines show the upper concentration limit of the cleanliness class based on Fed. Std. 209E-1992.

Note 4) The plots indicate the 95% upper reliability limit value for time series data up to 500 thousand operation cycles.
(Cylinder: CYP32-200, Workpiece weight: 5 kg, Average speed: 200 mm/s)

Note 5) The data above provides a guide for selection but is not guaranteed.