SM-25

Shuttle mover

ø25

Rodless

Overview

The air-driven 3D transport P&P system shuttle mover [SM-25] employs a rodless cylinder that combines air with magnetic force. 3D transport which was not possible in the past has been realized. Use of a sleeve and O-ring in the connecting portion of the cylinder tube eliminates leakage of air and also enables easy assembly. This configuration enables free layout.

Features

Free layout is possible

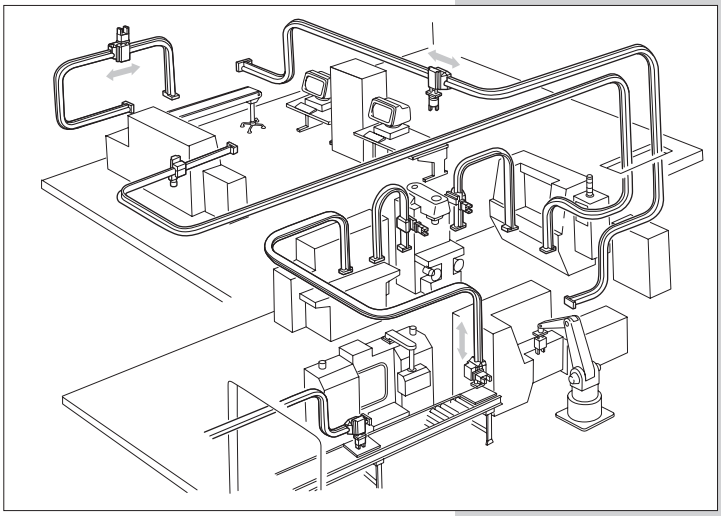
Unit combinations (lateral curve/vertical curve/straight) enable freely arranged 3D transport that fits workability and various conditions between processes.

O-ring used in unit connecting parts

A simple structure enables easy assembly and prevents leakage of air.

■ Applications

- ● Connections between each process
- ● Removal and supply of parts from processing machinery
- ● Transportation of parts in assembly lines



CONTENTS

Shuttle mover standard/high load

SM-25 Series

Air-driven three-dimensional P&P system that enables flexible layout

RoHS CAD

Specifications

Model No. / Item		Standard	High load
Working fluid		Compressed air	
Max. working pressure	MPa	0.6 (≈87 psi, 6 bar)	
Min. working pressure	MPa	0.3 (≈44 psi, 3 bar)	
Ambient temperature	°C	5 (41°F) to 40 (104°F)	
Bore size	mm	ø25	
Port size		Rc3/8	
Magnet holding force	N	120	240
Max. load capacity	kg	2 (total load weight to be mounted)	4 (total load weight to be mounted)
Max. transporting distance	m	20	
Stroke end adjustment length	mm	±10	
Cushion	Piston	Rubber cushion	
	Carrier	Shock absorber	
Lubrication		Not required (use turbine oil class 1 ISO VG32 if necessary for lubrication)	

Weight

Model	Weight (kg)	
	Standard	High load
Carrier	1	1.7
Rail end	2 x 2 pcs.	3.6 x 2 pcs.
Lateral curve unit 90° Lateral curve unit 45°	4 2.4	Same as left
Vertical (in) curve unit 90° Vertical (in) curve unit 45° Vertical (out) curve unit 90° Vertical (out) curve unit 45°	3 1.8 3 1.8	Same as left
Air supply unit (2 or 3 nozzles)	0.3 (end mount) x 2 pcs. 0.2 (carrier mount) x 2 pcs.	0.4 (end mount) x 2 pcs. 0.4 (carrier mount) x 2 pcs.
Air supply unit (4 nozzles)	1.6 (end mount) x 2 pcs. 0.3 (carrier mount) x 1 pcs.	Same as left
Joint	0.3	0.4
Straight unit	0.4 0.8 to 8 * Additional 0.4 per 100 mm of stroke	Same as left

How to order

SM-25- ST-H 100

A B

A Model No.		Description
Standard	High load	
CA	CA-H	Carrier
RE *1	RE-H *1	Rail end
ST	ST-H	Straight unit *2
SC90	SC-H90	Lateral curve unit 90°
SC45	SC-H45	Lateral curve unit 45°
VC90-IN	VC-H90-IN	Vertical (in) curve unit 90°
VC45-IN	VC-H45-IN	Vertical (in) curve unit 45°
VC90-OUT	VC-H90-OUT	Vertical (out) curve unit 90°
VC45-OUT	VC-H45-OUT	Vertical (out) curve unit 45°
PP *3	PP-H *4	Air supply unit
PR *5	PR-H *5	Air supply unit
RJ	RJ-H	Fitting

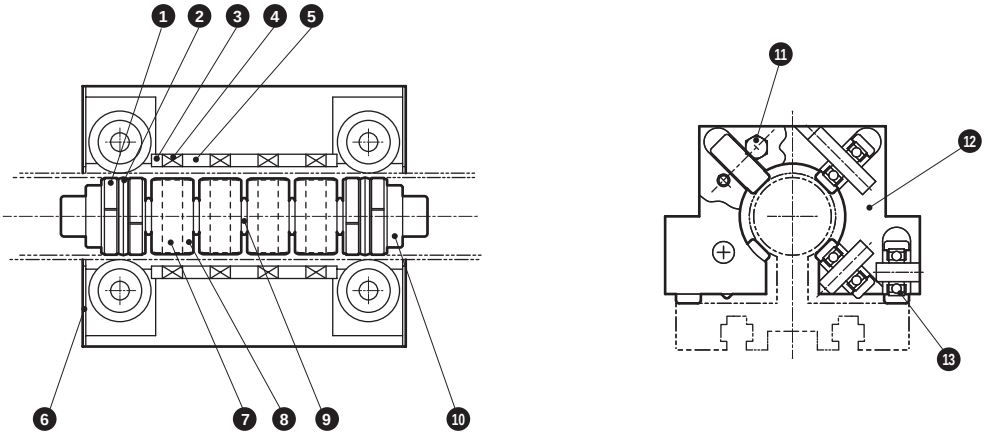
B Stroke (mm) *2
100 to 2000 *6

*1: With 1 set of fittings (2 pcs.) and a shock absorber.
*2: It is necessary to provide instructions on the stroke only with the straight unit.
*3: For 2 nozzles.
1 set includes 2 sets for the rail end and 2 sets for the carrier.
*4: For 3 nozzles.
1 set includes 2 sets for the rail end and 2 sets for the carrier.
*5: For 4 nozzles.
1 set includes 2 sets for the rail end and 1 set for the carrier.
*6: The max. stroke is 2000 mm.
Standard products are available in 10 mm increments between 100 to 190 and 100 mm increments between 200 to 2000.
Available in 1 mm increments, as made to order.
*7: Each rail unit comes with 1 fitting.

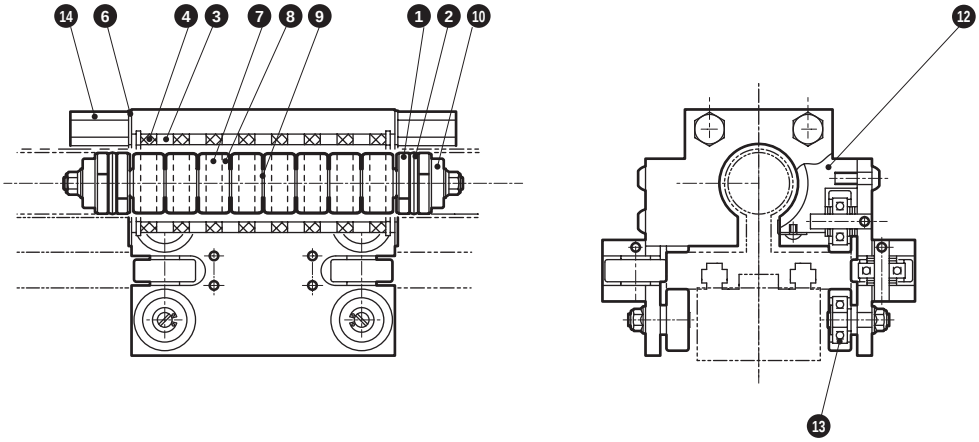
The SKH series of shock absorbing valves is recommended for the valves. Refer to “Pneumatic Valves (No. CB-023SA)” for details on the valves.

Internal structure and parts list ø25

● Carrier (CA)



● Carrier/high load (CA-H)



Parts list

No.	Part name	Material	Remarks	No.	Part name	Material	Remarks
1	Wear ring	Acetal resin		8	Interior/yoke	Steel	
2	Piston packing	Nitrile rubber		9	Flexible shaft	Nylon	
3	Exterior/outer yoke	Steel		10	Piston	Aluminum alloy	
4	Exterior/magnet	Rare-earth magnet		11	Stop pin	Steel	
5	Exterior/inner yoke	Steel		12	Housing	Aluminum alloy	
6	Side cover	Stainless steel		13	Roller	Polyurethane rubber	
7	Internal/magnet	Rare-earth magnet		14	Stopper bolt	Steel	

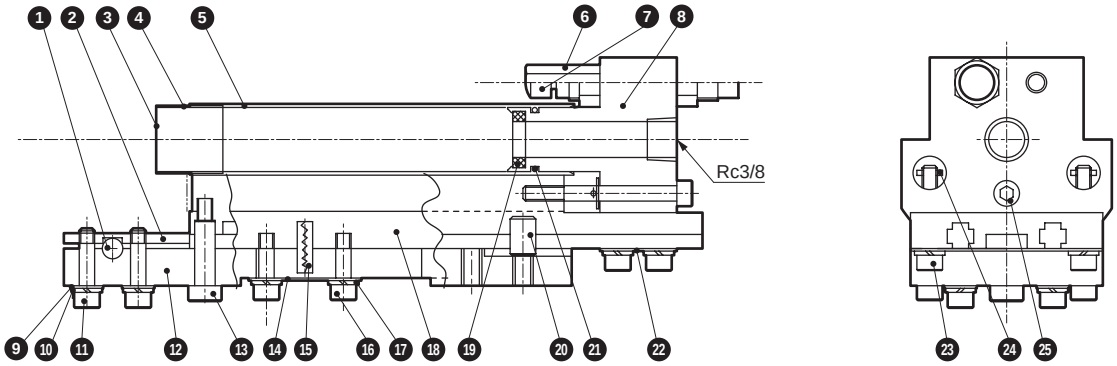
Repair parts list

Part name	Series	Set No.	Repair parts No.
Piston set	Standard	SM-25-CA-PS	❶❷❼❽❾❿
	High load	SM-25H-CA-PS	
Carrier set	Standard	SM-25-CA-S	❸❹❺❻⓫⓬⓭
	High load	SM-25H-CA-S	❸❹❻⓬⓭⓮
Packing set (*1)	Standard	SM-25-CA-PK	❶❷
	High load		

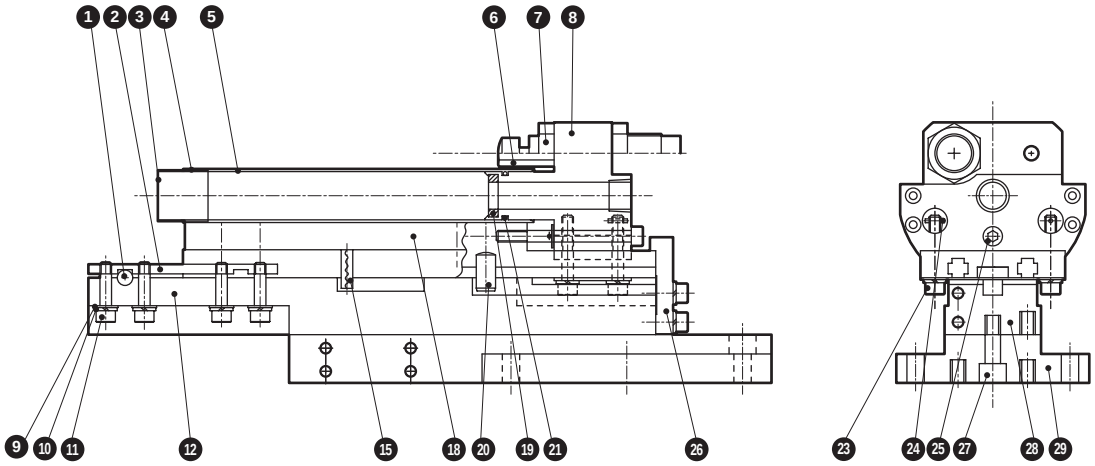
*1: 4 wear rings and 2-piston packings are included in the set.

Internal structure and parts list

● Rail end (RE)



● Rail end/high load (RE-H)



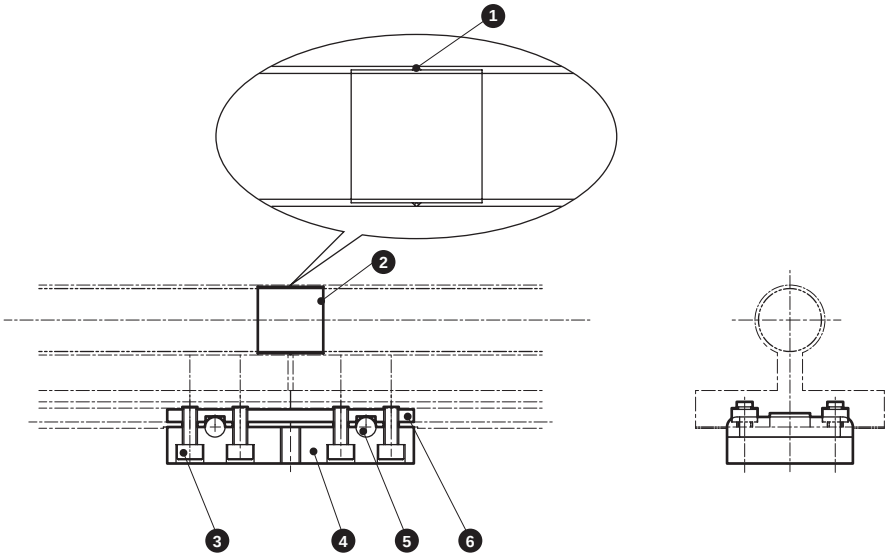
Parts list

No.	Part name	Material	Remarks	No.	Part name	Material	Remarks
1	Positioning pin	Stainless steel		16	Hexagon socket head cap screw	Steel	
2	Flat nut	Steel		17	Spring washer	Steel	
3	Fitting sleeve	Stainless steel		18	End rail	Aluminum alloy	
4	Tube packing	Nitrile rubber		19	Cushion rubber	Synthetic rubber	
5	End pipe	Stainless steel		20	Pin	Steel	
6	Stopper bolt	Steel		21	O-ring	Nitrile rubber	
7	Shock absorber (Note)			22	Stopper washer	Stainless steel	
8	End block	Aluminum alloy		23	Safety bolt	Steel	
9	Plain washer	Steel		24	Spring pin	Stainless steel	
10	Spring washer	Steel		25	Adjusting bolt	Steel	
11	Hexagon socket head cap screw	Steel		26	Holding bracket	Steel	
12	Fitting plate	Aluminum alloy		27	Hexagon socket head cap screw	Steel	
13	Shoulder bolt	Steel		28	Fitting plate	Aluminum alloy	
14	Fixing washer	Stainless steel		29	End bracket	Aluminum alloy	
15	Spring pin	Stainless steel					

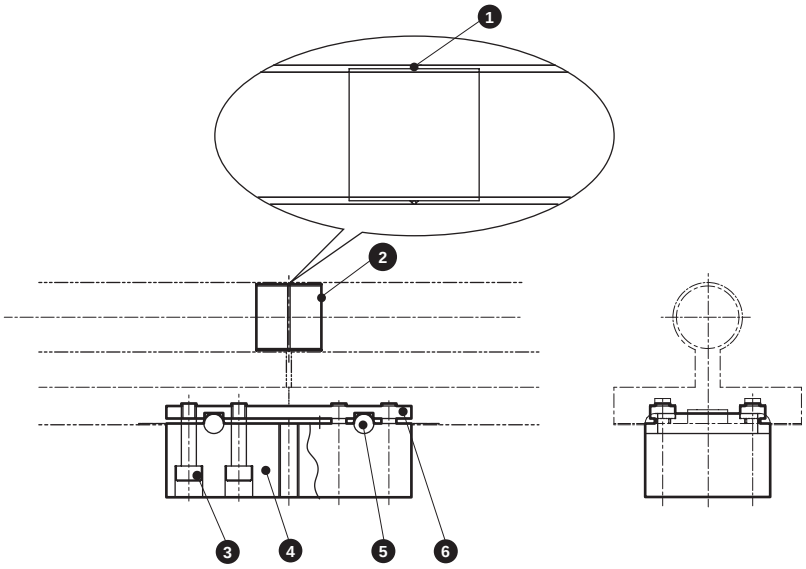
Note: ❼ Shock absorber Standard NCK-00-2.6-C
High load NCK-00-7-C

Internal structure and parts list ø25

● Fitting (RJ)



● Fitting/high load (RJ-H)



Parts list

No.	Part name	Material	Remarks	No.	Part name	Material	Remarks
1	Tube packing	Nitrile rubber		4	Fitting plate	Aluminum alloy	
2	Fitting sleeve	Stainless steel		5	Positioning pin	Stainless steel	
3	Hexagon socket head cap screw	Steel		6	Connecting nut	Steel	

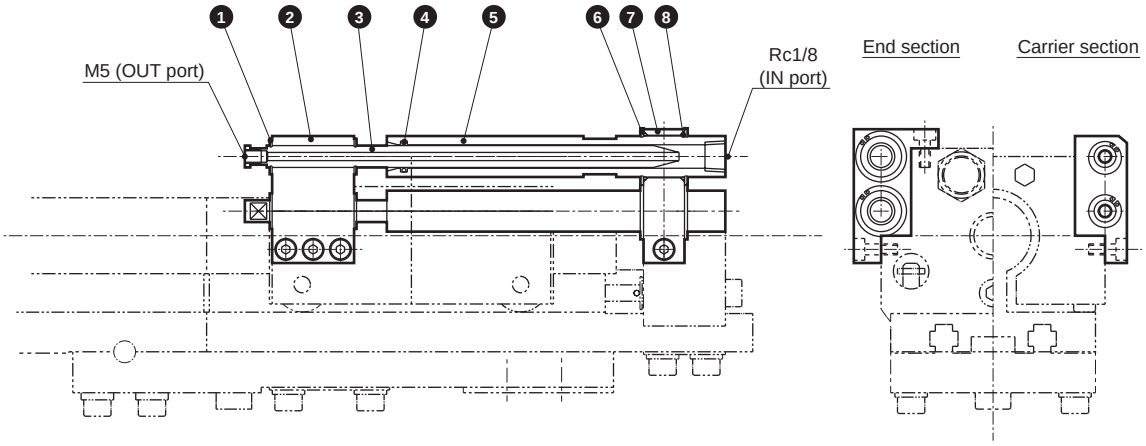
Repair parts list

Part name	Set No.	Repair parts No.
Gasket set (Note)	SM-25-RJ-GS	❶
Grease	SM-25-GR	- 50g

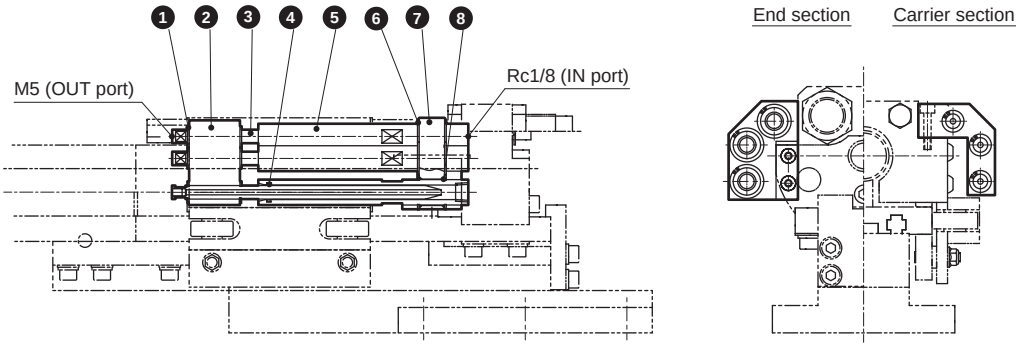
Note: 10 pcs. are included in 1 set.

Internal structure and parts list ø25

● Air supply unit (PP)



● Air supply unit/high load (PP-H)

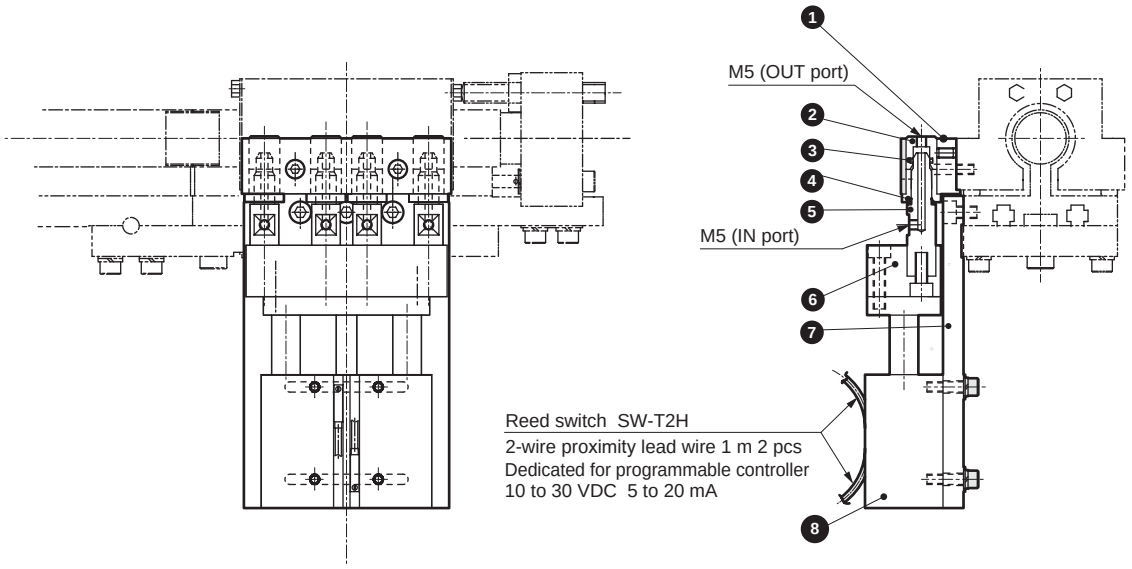


Parts list

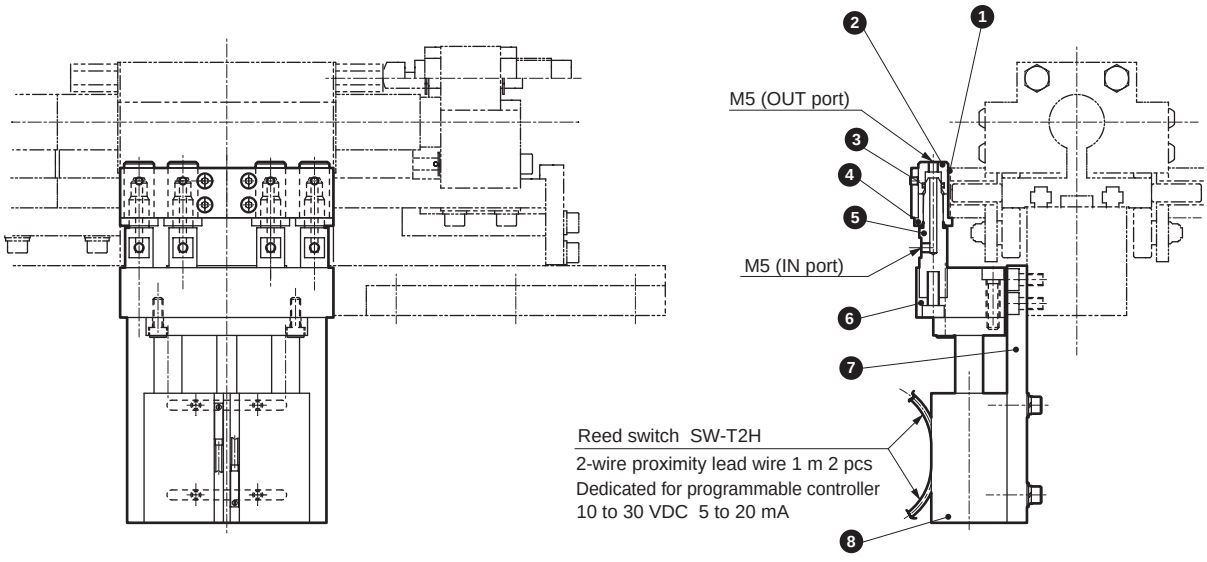
No.	Part name	Material	Remarks	No.	Part name	Material	Remarks
1	C-snap ring	Steel		5	Fixing nozzle	Steel	
2	Nozzle holder	Aluminum alloy		6	C-snap ring	Steel	
3	Nozzle	Steel		7	Fixing holder	Steel	
4	O-ring	Nitrile rubber		8	O-ring	Nitrile rubber	

Internal structure and parts list ø25

● Air supply unit (PR)



● Air supply unit/high load (PR-H)

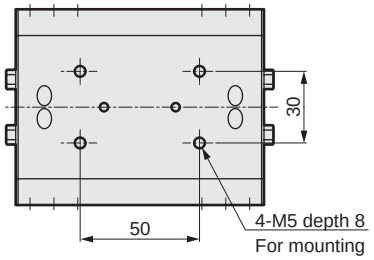


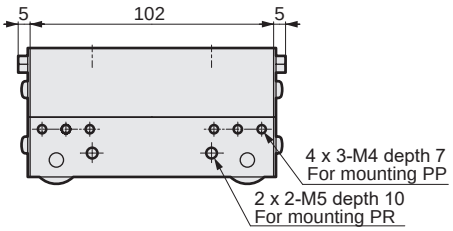
Parts list

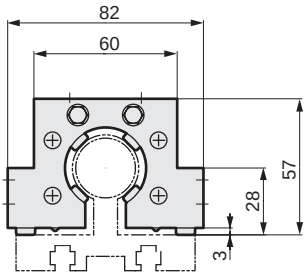
No.	Part name	Material	Remarks	No.	Part name	Material	Remarks
1	Bush holder	Aluminum alloy		6	Pin holder	Aluminum alloy	
2	Bush	Copper alloy		7	Mounting plate	Aluminum alloy	
3	O-ring	Nitrile rubber		8	Air cylinder	STS-M-20-25	
4	Positioning bush	Steel		9	Reed switch	SW-T2H	
5	Pin	Steel					

Dimensions

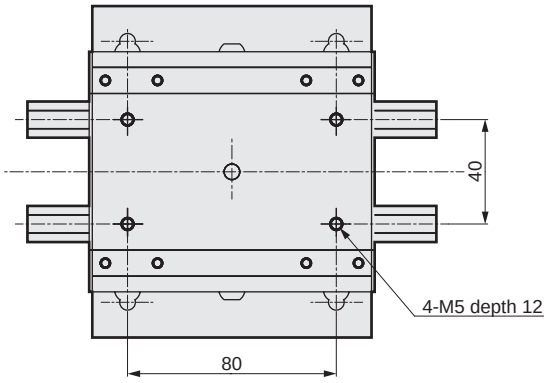
● Carrier (CA)

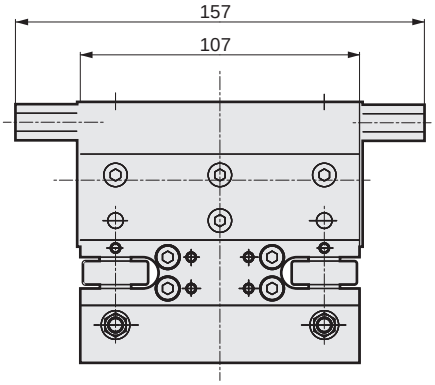


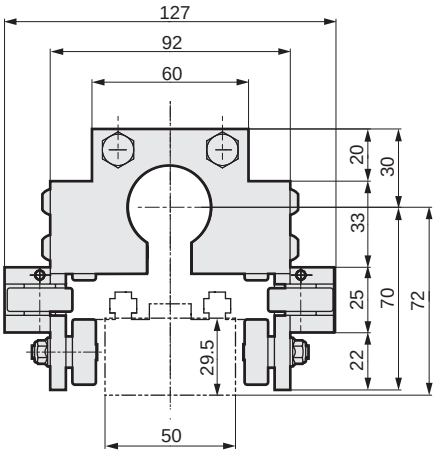




● Carrier/high load (CA-H)

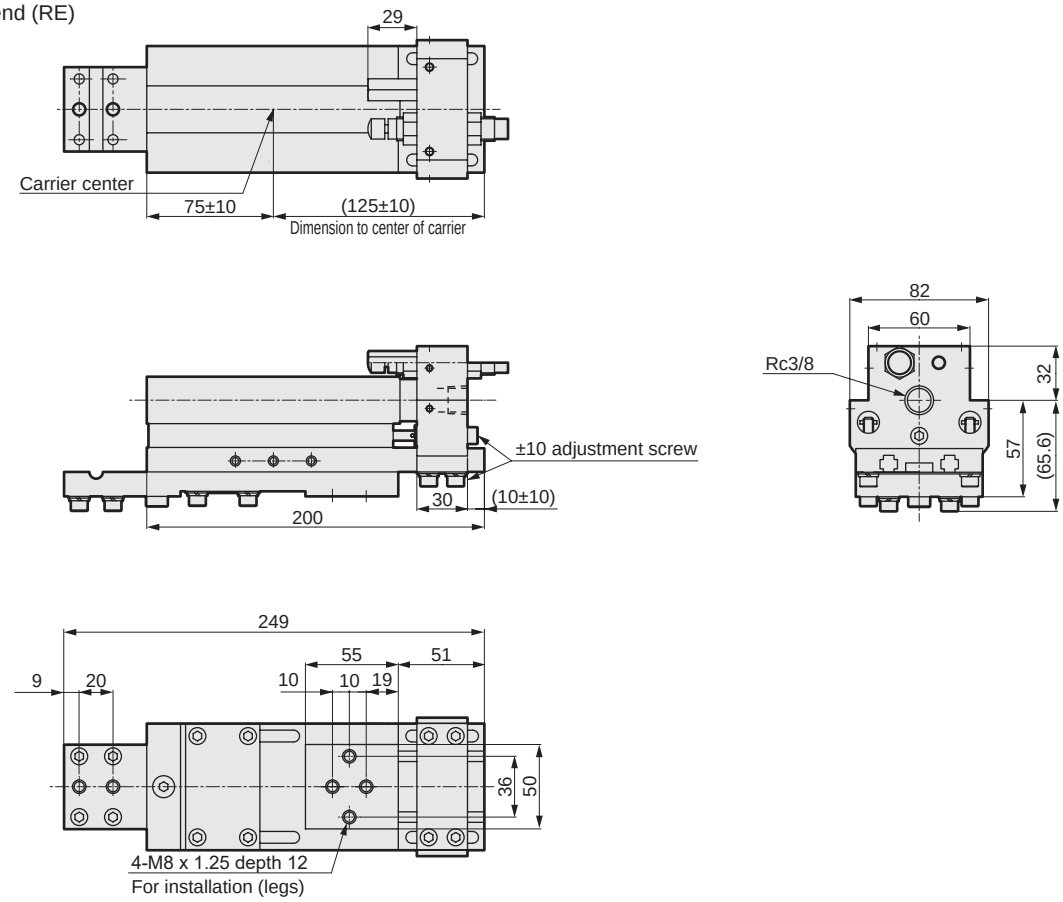




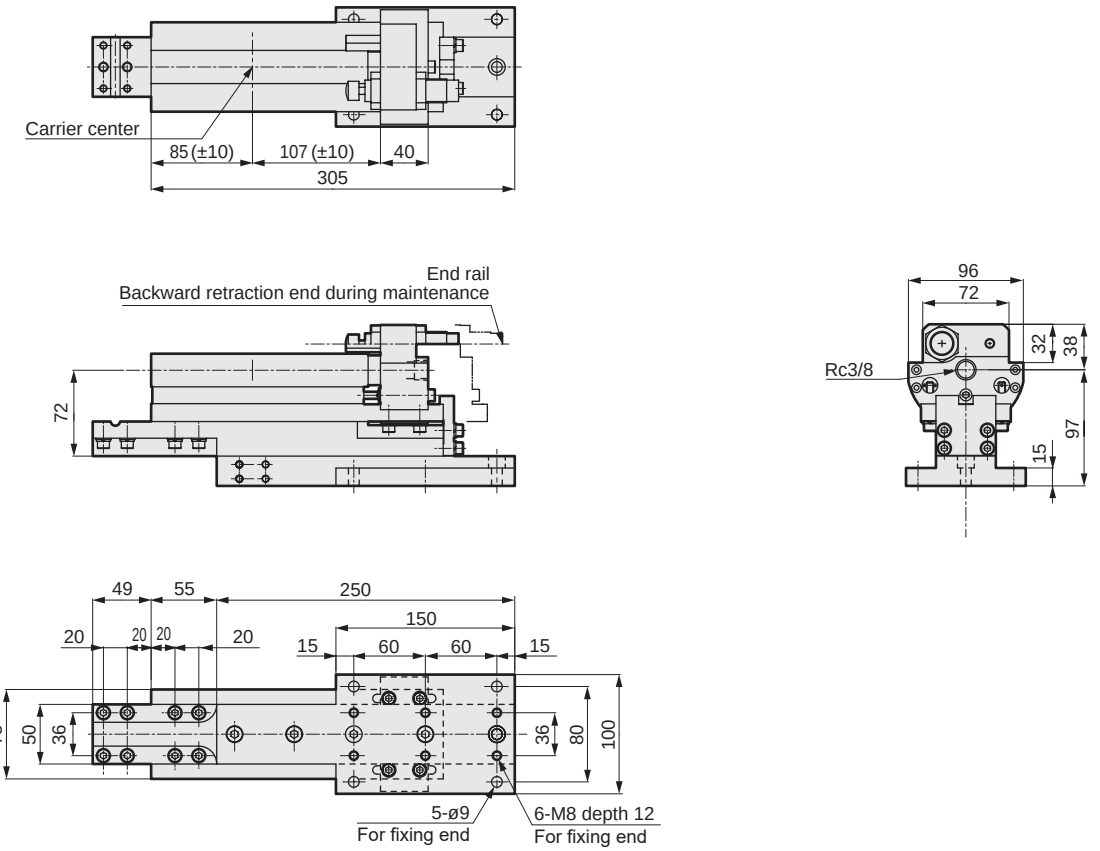


Dimensions

● Rail end (RE)

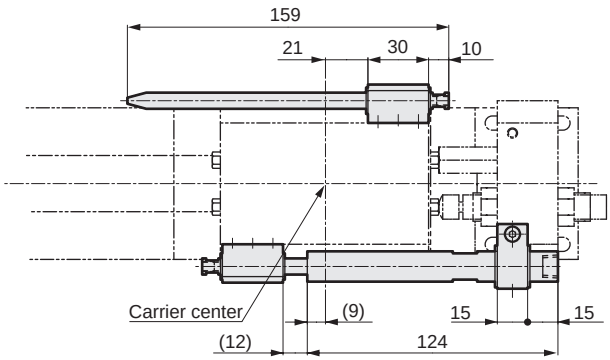


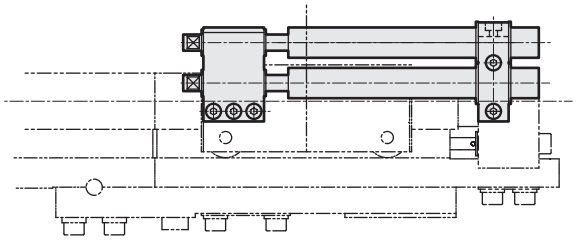
● Rail end/high load (RE-H)

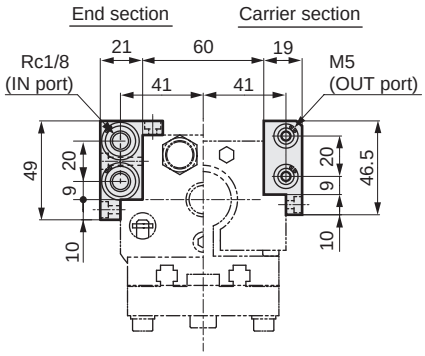


Dimensions

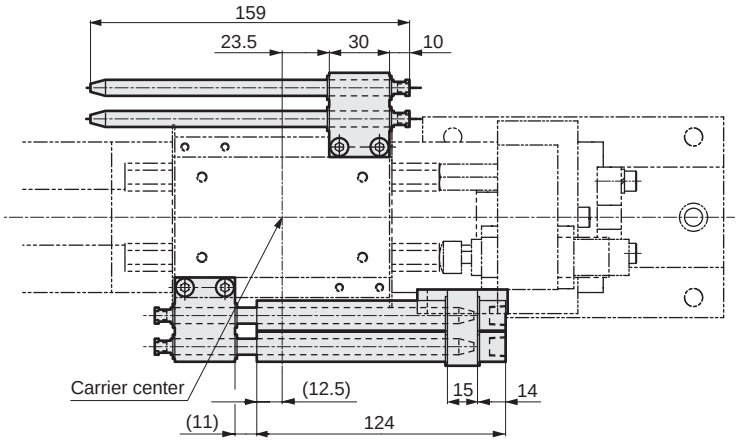
● Air supply unit (PP)

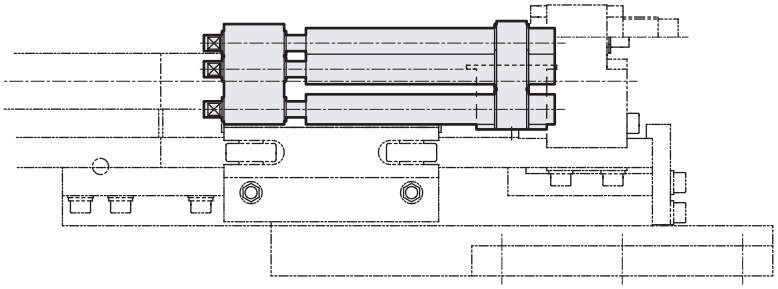


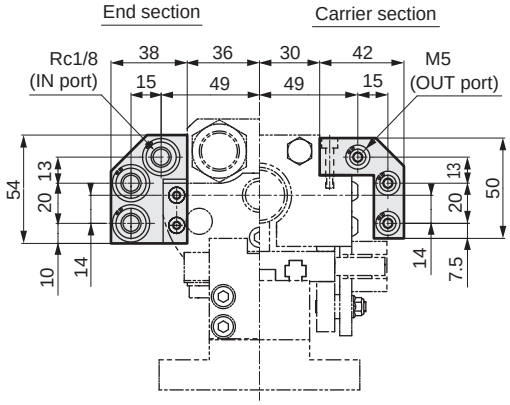




● Air supply unit/high load (PP-H)

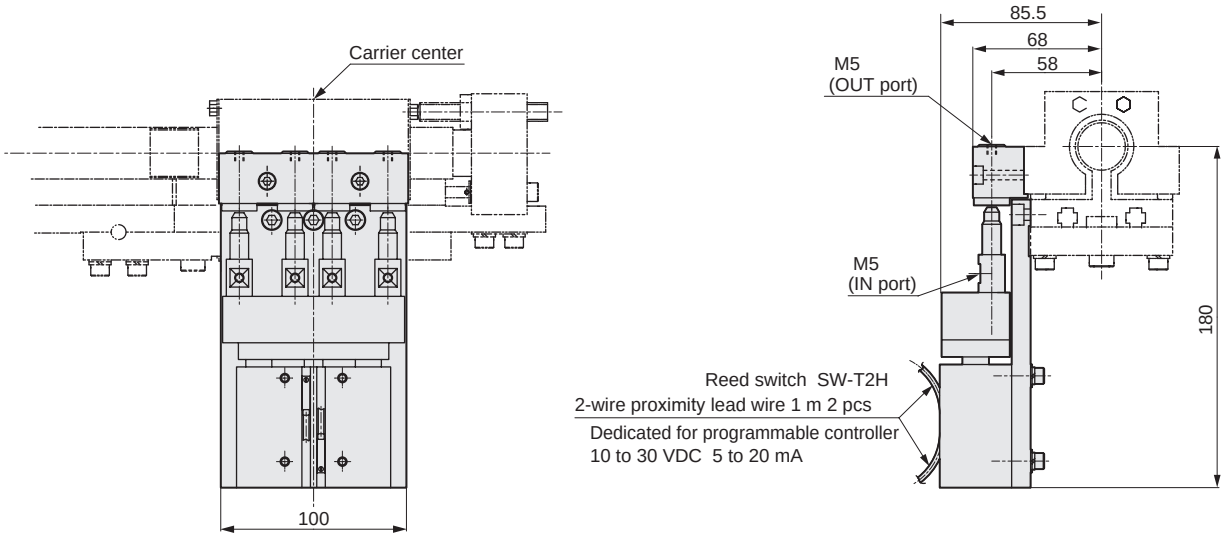




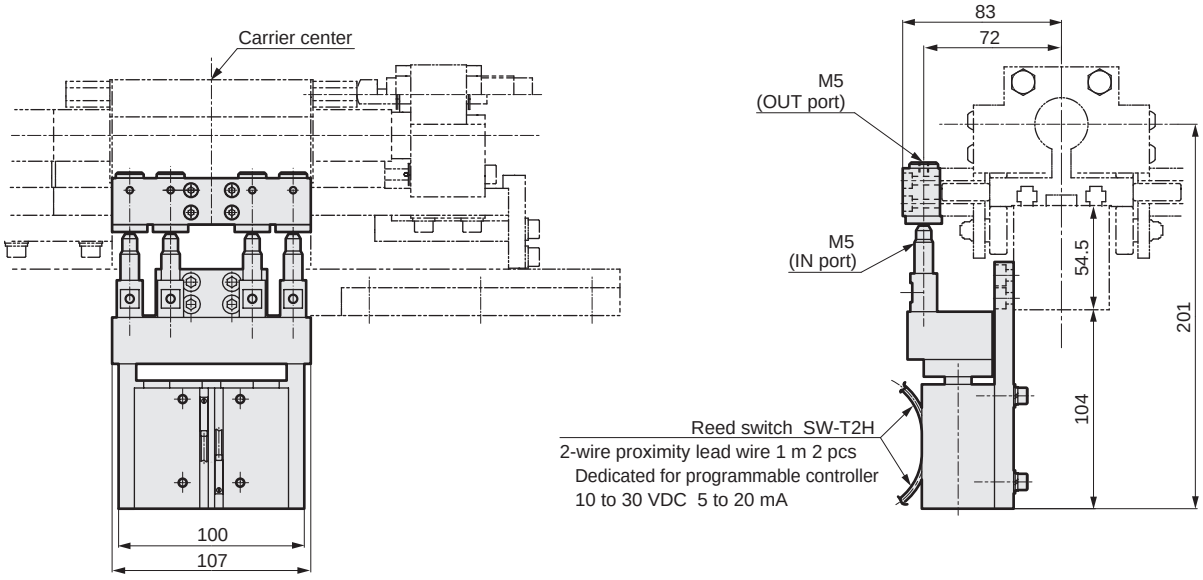


Dimensions

● Air supply unit (PR)

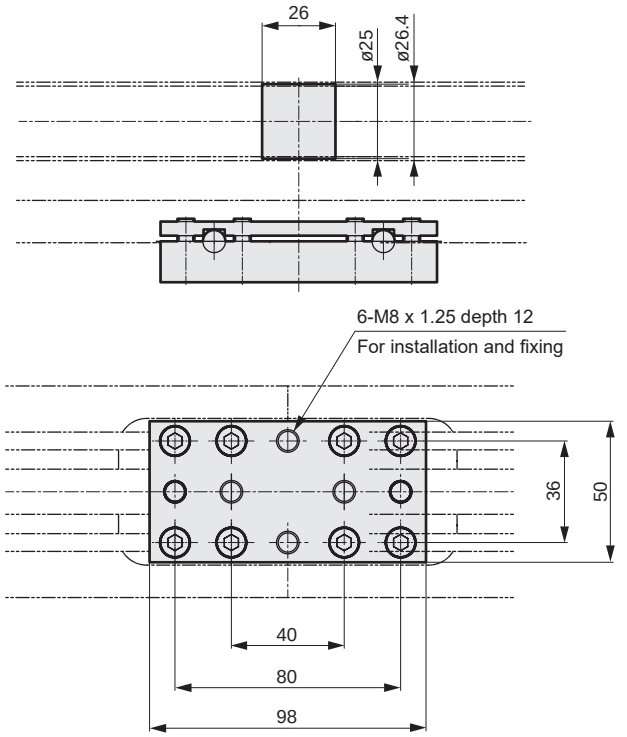


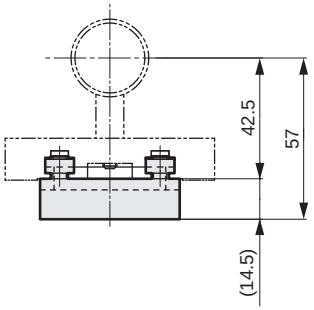
● Air supply unit/high load (PR-H)



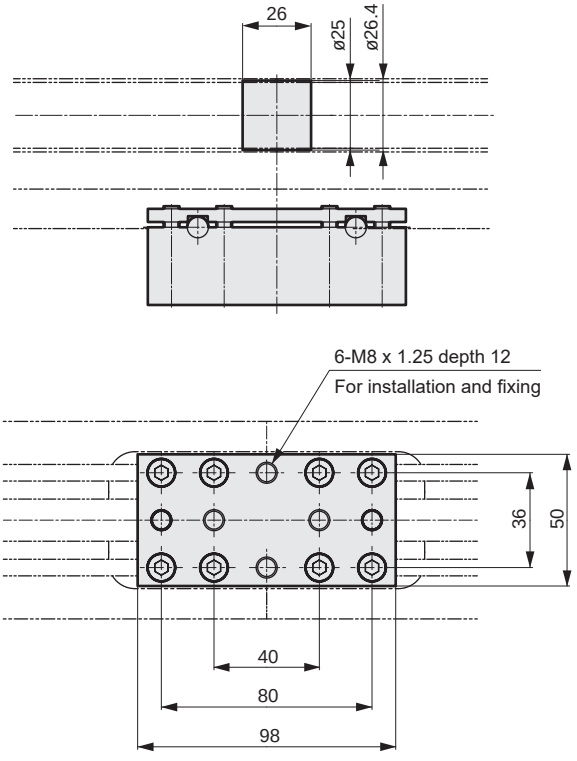
Dimensions

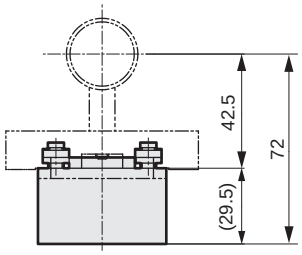
● Fitting (RJ)



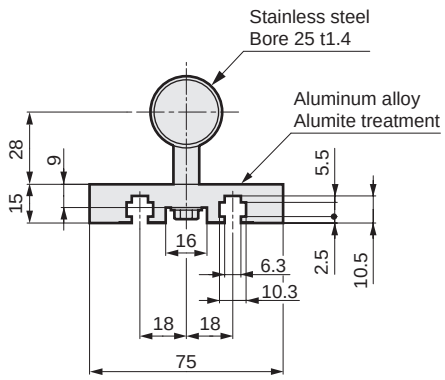


● Fitting/high load (RJ-H)





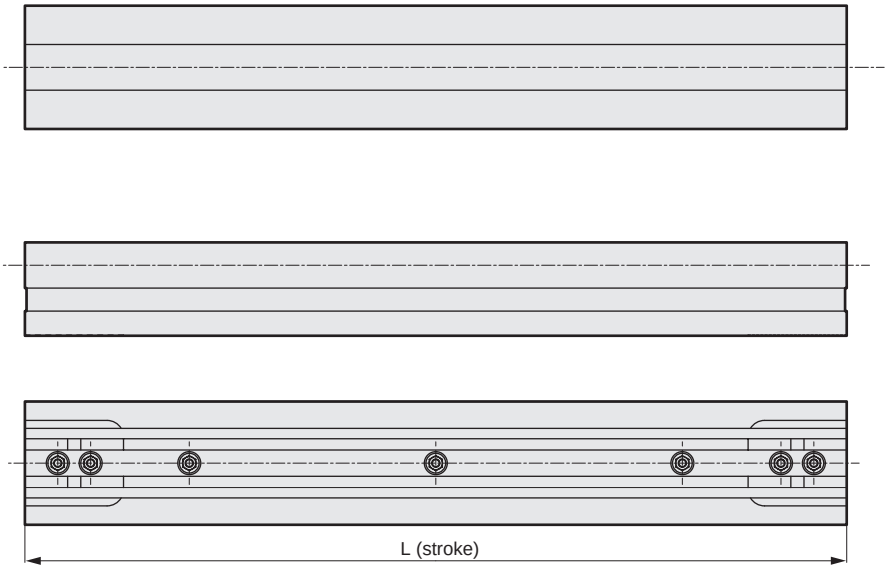
● Basic cross section diagram of rail

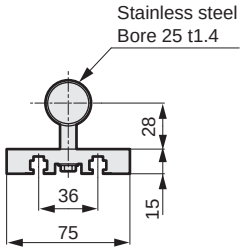


MEMO

Dimensions Only the fittings change between ST (standard) and ST-H (high load). The dimensions of the body of the unit are identical.

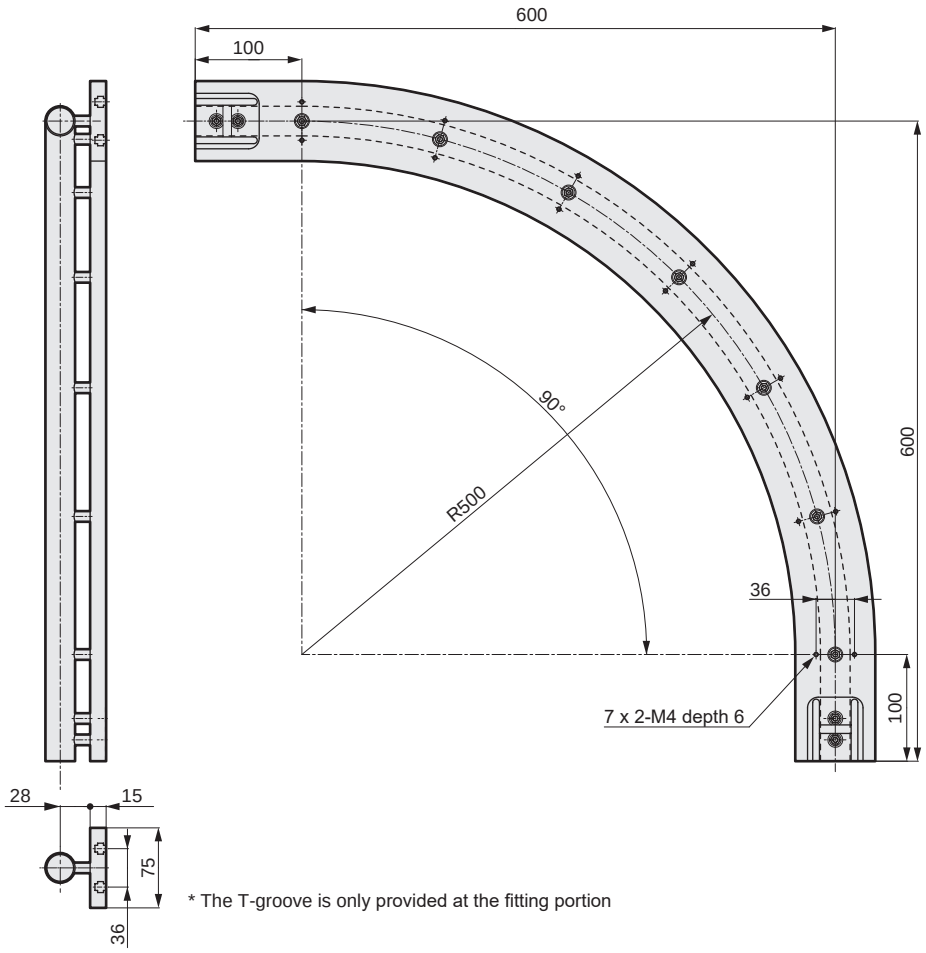
● Straight unit (ST)/high load (ST-H)





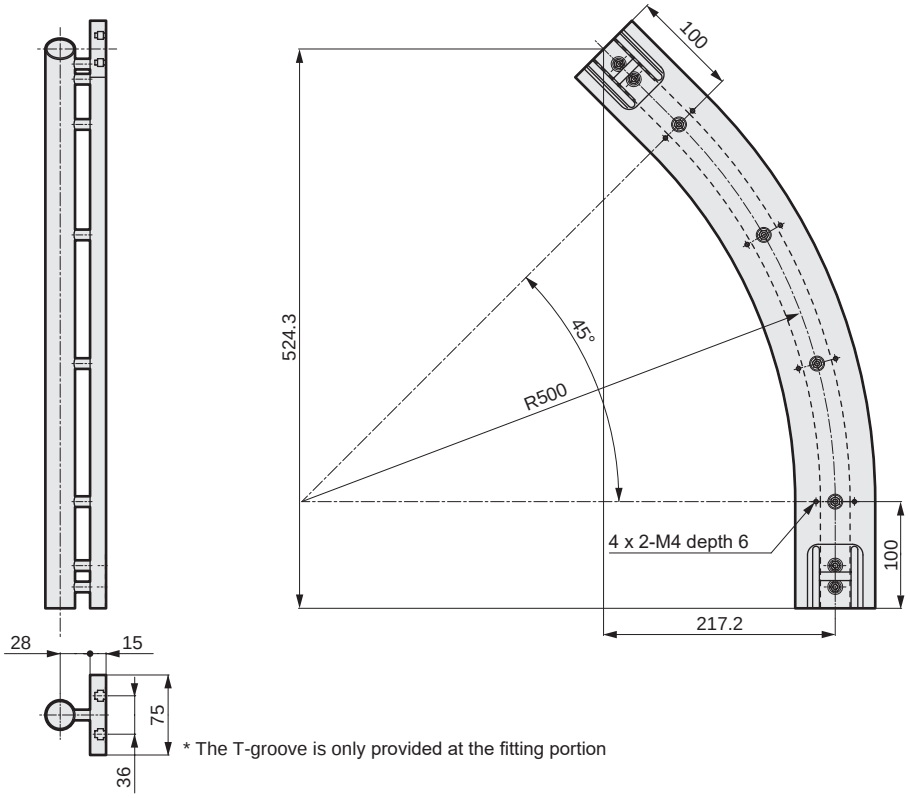
Dimensions Only the fittings change between ST (standard) and ST-H (high load). The dimensions of the body of the unit are identical.

● Lateral curve unit 90° (SC90)/high load (SC-H90)



* The T-groove is only provided at the fitting portion

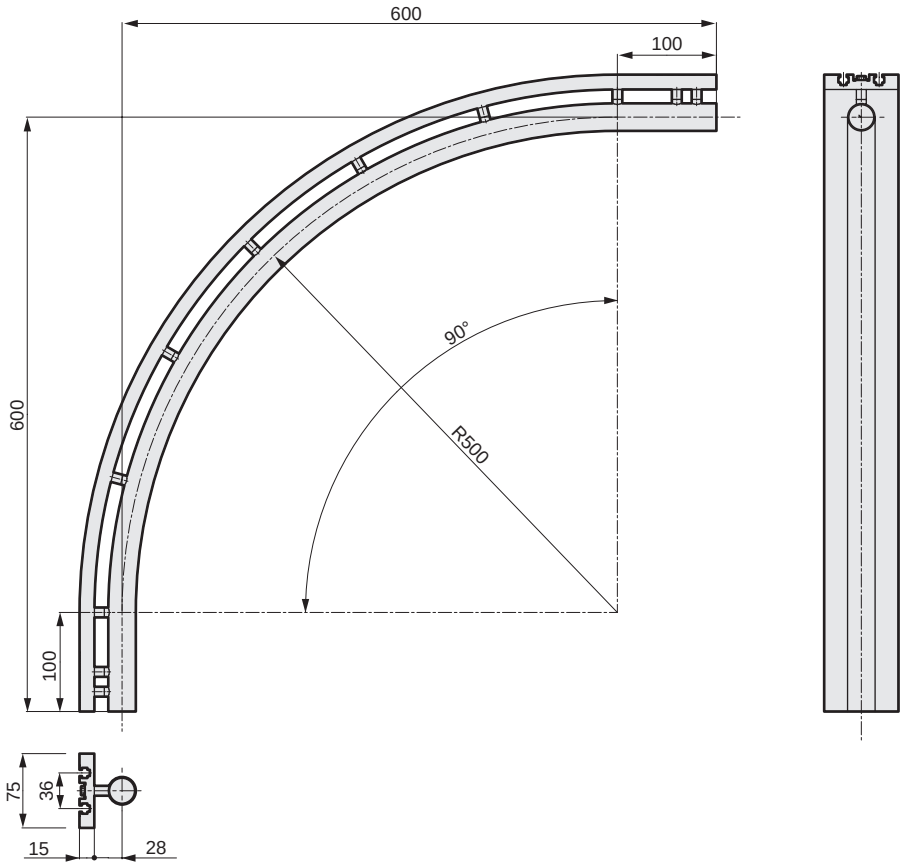
● Lateral curve unit 45° (SC45)/high load (SC-H45)



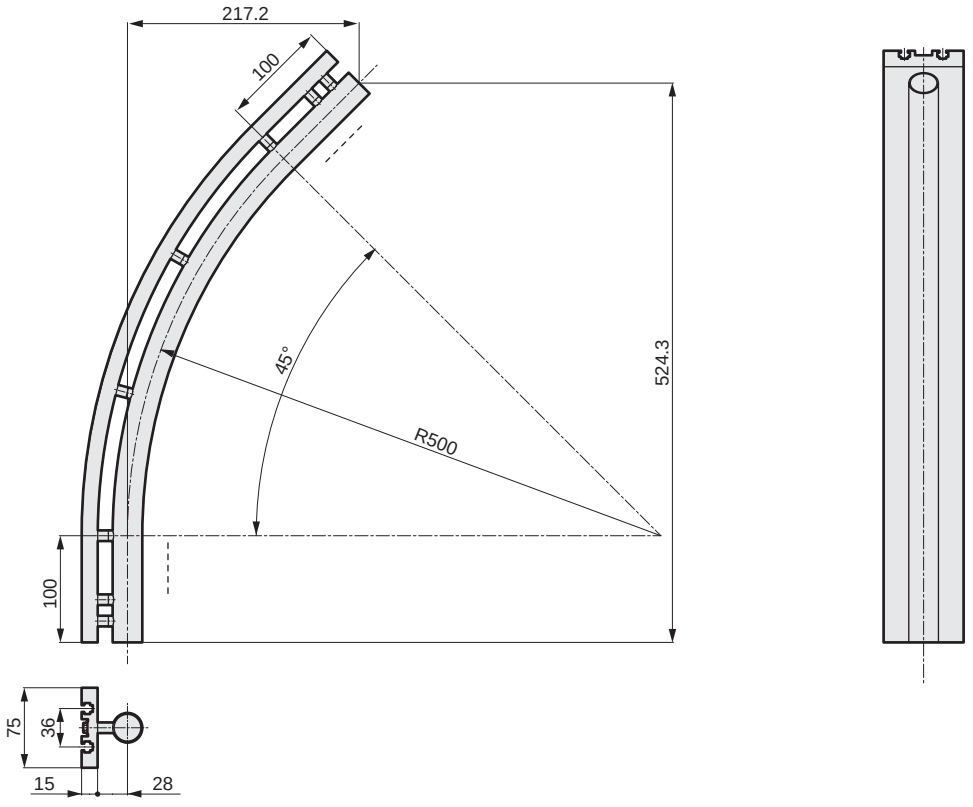
* The T-groove is only provided at the fitting portion

Dimensions Only the fittings change between ST (standard) and ST-H (high load). The dimensions of the body of the unit are identical.

● Vertical (in) curve unit 90° (VC-90-IN)/high load (VC-H90-IN)

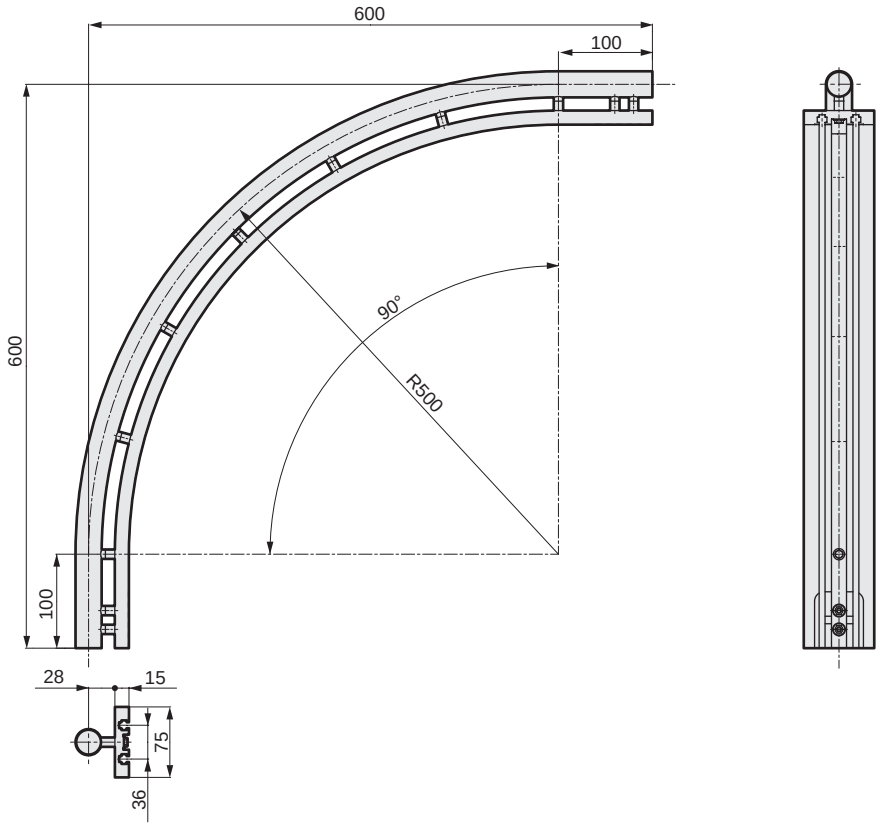


● Vertical (in) curve unit 45° (VC-45-IN)/high load (VC-H45-IN)

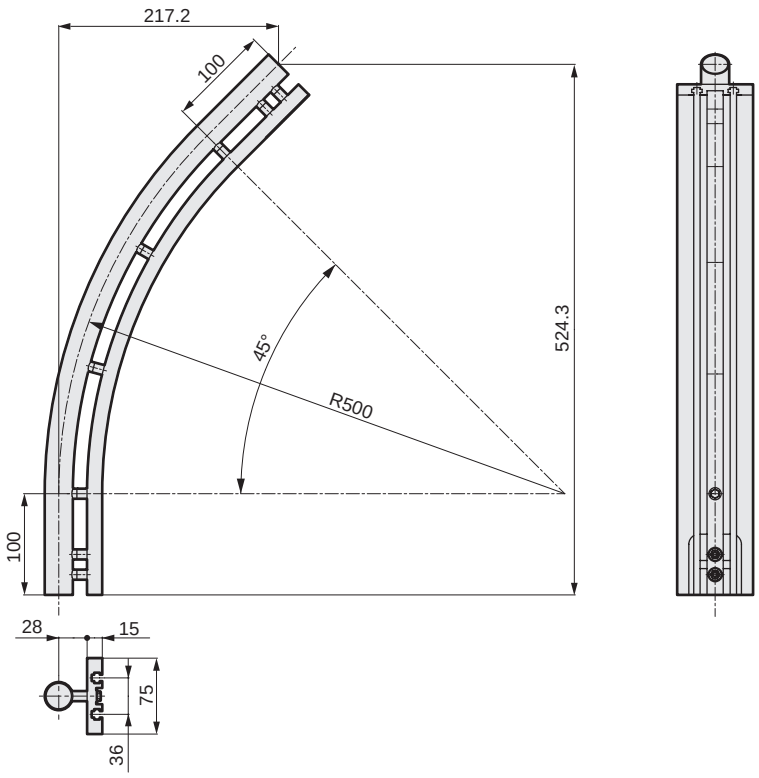


Dimensions Only the fittings change between ST (standard) and ST-H (high load). The dimensions of the body of the unit are identical.

● Vertical (out) curve unit 90° (VC-90-OUT)/high load (VC-H90-OUT)

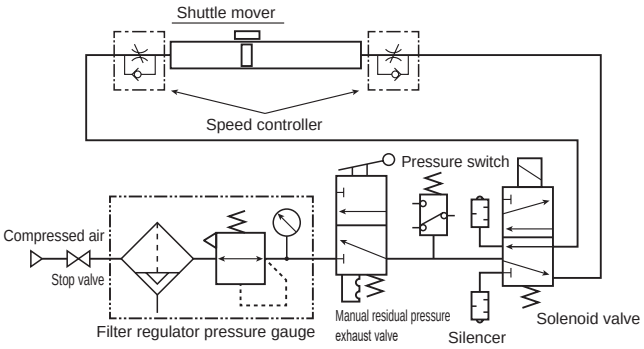


● Vertical (out) curve unit 45° (VC-45-OUT)/high load (VC-H45-OUT)



Technical data

1 Basic circuit

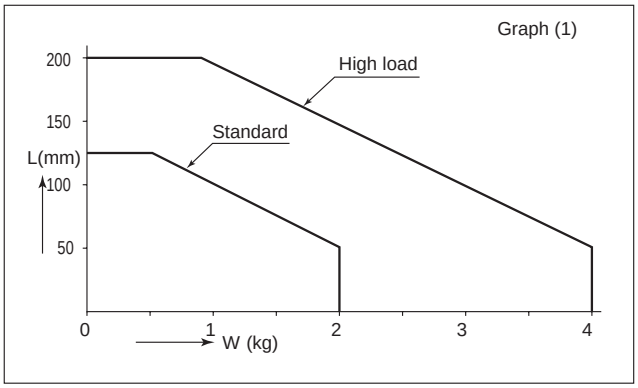


2 Selection guide

The max. allowable load weight will vary depending on the amount of overhang of the center of gravity of the load and the average working speed.
Accordingly, make a selection that satisfies both the following step 1 and step 2.

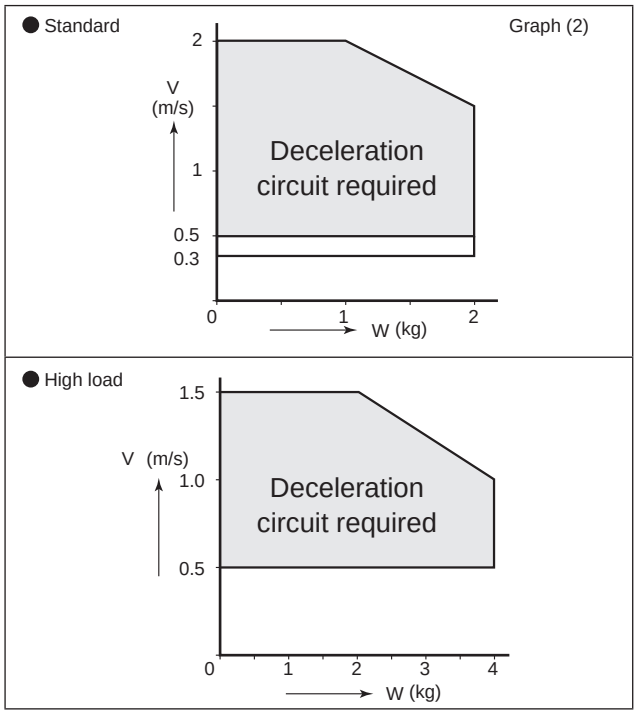
STEP 1 Load weight and amount of overhang

* The allowable load weight will vary depending on the amount of overhang.
  Use this product within the range of the following graph (1).
* Refer to the examples of selection when calculating amount of overhang L.

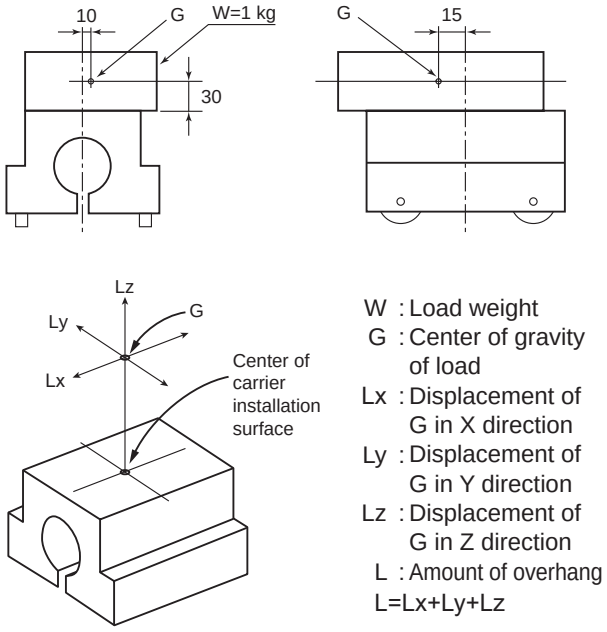


STEP 2 Load weight and average speed

* The average speed available during use will vary depending on the load weight.
  Use this product within the range of the following graph (2).
* When using the product with an average speed of 0.5 m/s or above, it is necessary to provide a deceleration circuit such as a shock absorbing valve (SKH series).
* Refer to the corresponding pages of the catalog for pneumatic valves for selection and use of a shock absorbing valve (SKH series).



● Example of selection



W : Load weight
G : Center of gravity of load
Lx : Displacement of G in X direction
Ly : Displacement of G in Y direction
Lz : Displacement of G in Z direction
L : Amount of overhang
L=Lx+Ly+Lz

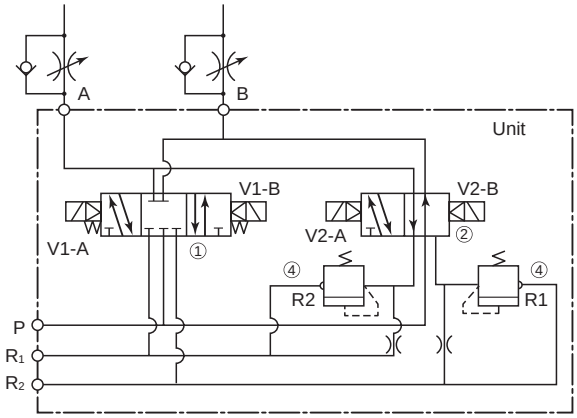
W=1 kg
V=1.5 m/s
Lx=15 mm
Ly=10 mm
Lz=30 mm
L=15+10+30=55 mm

When using the product with a load weight of 1 kg and a speed of 1.5 m/s, according to graph (2) as long as W = 1 kg, the speed is up to 2 m/s which is within the range. However, the use of a deceleration circuit will be necessary.
In relation to the displacement of the position of center of gravity of the load, since up to 100 mm is allowed according to graph (1) as long as W = 1 kg, a displacement of the center of gravity by L = 55 mm is within the allowable range.

Technical data

● Example of deceleration circuit diagram

* An example when a shock absorbing valve is used.



	Part name	Model No.	Qty.	Remarks
1	Solenoid valve	4KB339	1	For high speed
2	Solenoid valve	4KB329	1	For low speed
3	Manifold block		1	
4	Spacer relief valve	SKH-3SR	1	

● Other precautions

(1) A shuttle valve will be necessary when operating a single acting chuck, etc., by using an air supply unit (PP).

(2) Make sure the installation base has a vertical leveling function (leveling bolts, etc.), and fix with anchor bolts after final adjustment.

(3) Use an interval of 2 m as a guide for the pitch between legs upon installation.

(4) When transferring workpieces between the shuttle mover and other facilities of your company (such as a conveyor), be sure to include a transfer position adjustment mechanism in your equipment.

(5) Consult with a sales representative for other detailed designs.

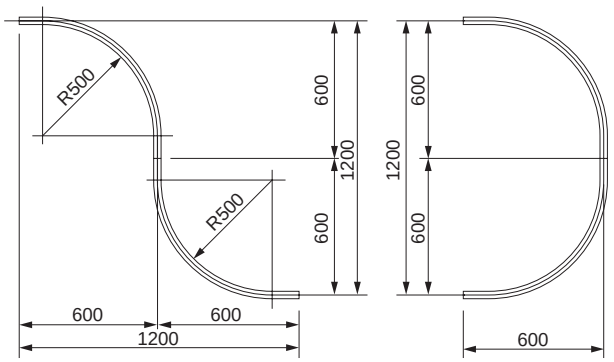
3 Stroke of each unit

Unit name	Model No.	Stroke (mm)
Rail end	RE	75±10
Straight unit	[Example] ST-100	100
	ST-200	200
	ST-1000	1000
	ST-1015	1015
	ST-2000	2000
Curve unit 90°	SC90 VC90-IN VC90-OUT	985
Curve unit 45°	SC45 VC45-IN VC45-OUT	590

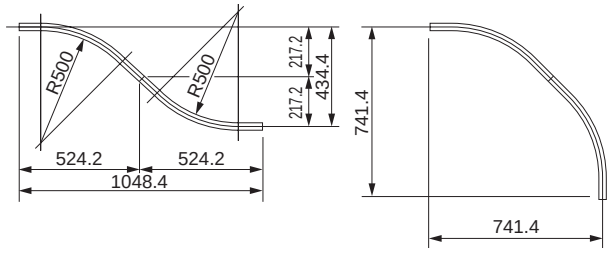
* The strokes are the same with the standard and the high load.

4 Min. dimensions of combination with a curve unit

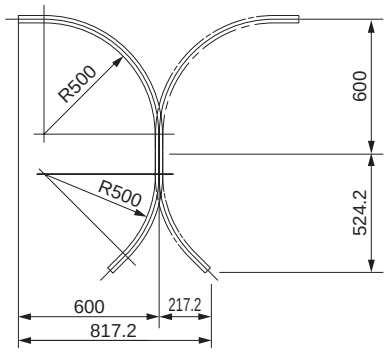
1) 90° and 90°



2) 45° and 45°



3) 90° and 45°



Question & Answer

Notes regarding design

Q Is it possible to stop the carrier midway?

A No, it is not.

Q What is the air consumption of SM-25?

A Same as a standard cylinder with an inner diameter of ø25.

Q What speed should be assumed in m/s when considering the transportation time? (When making an approximation in consideration of the combination of rails, the difference in load weight, and various conditions such as the decelerating time and working pressure)

A Estimate at a speed of 1 m/s.
(Example: With a stroke of 20 m, 20 m ÷ 1 m/s = 20 s; this time does not include workpiece loading time.)

Q Is the max. allowable load weight equivalent to the weight of the workpiece?

A This is the total load weight that is mounted on the carrier.
The hand-chuck and Z-axis cylinder weights are included as well.

Notes regarding safety

Q Is the safety cover necessary?

A Yes, it is. Always install the cover as objects will be transported at high speeds overhead and may fall as they are air cylinders using a joint system.

Q What will happen if the carrier is not slowed down at the stroke end? (given speed of 0.5 m/s or above)

A The shock absorber may be damaged. Always be sure to use a decelerating circuit such as a shock absorbing valve (SKH series).

Notes regarding maintenance

Q Is it possible to replace the carrier rollers?

A Since specially designed tools are necessary, contact CKD as we perform overhauls for a fee.

Q Is it necessary to lubricate the carrier rollers?

A Since it uses shielded metal bearings with urethane rubber, it can be used with no lubrication.

Q How can we adjust the stroke?

A Adjustments of 10 mm forward and 10 mm backward may be made at the rail end. Refer to the instruction manual for details on how to make adjustments.

Notes regarding electric control

Q Is there a reed switch for detection of the carrier?

A No such feature is available.
Prepare a proximity sensor, photoelectric sensor, or photo sensor.

Q How should the electrical signals of the actuator mounted on the carrier be handled?

A This cannot be done as there are no parts available for supplying electricity to the reed switch, etc., for confirming operation.

Safety Precautions

Be sure to read this section before use.
Refer to Intro Page 73 for general information of the cylinder, and to Intro Page 80 for general information of the cylinder switch.

Product-specific cautions: Shuttle mover SM Series

Design/selection

⚠ WARNING

- These products cannot be used in water, oil, or powder, or in places where the unit will be exposed to cutting fluid, coolant, etc., or cutting chips.
- Consider safety by always placing an interlock in the control circuit for moving the carrier.
- It is not possible to fix the carrier and use the rail portion as a mobile unit.
- Avoid scratching the cylinder tube or rail with a workpiece, etc., that has been dropped by mistake during mounting or removal of a workpiece. Otherwise, malfunctions may result.

⚠ CAUTION

- Check that the cross-section of the pipe connecting the cylinder and directional control valve has sufficient effective cross-sectional area to attain specified piston speed.
- Use an interval of 2 m as a guide for the mounting pitch for the legs.
- Consider the space described below near the end unit.
  - Securing of space necessary for mounting and removing workpieces
  - Securing of space for an adjustment of ±10 mm from the stroke end of the carrier
  - Securing of space to enable movement when the tube piping to the piping port of the end is adjusted by ±10 mm, and space for adjustment of the speed controller
  - Securing of space for removal of end rail related components during piston maintenance

Mounting, installation and adjustment

⚠ WARNING

- Be sure to install a safety cover in cases when this unit will be crossing pathways or working areas of people, or as a measure to prevent collapse and protect the operating region in areas where a human hand can reach inside.
- Do not move this unit by striking it with a hammer or hang it directly with wire ropes, etc.
- Immediately after completing installation (before supplying air), manually slide the carrier to make sure that there are no objects that will cause interference within the operating region.
- The adjustments of the stroke end by ±10 mm are to be made by sliding the entire end block. The magnetic connection between the carrier and the piston will become detached if the screw-in volumes of the shock absorber and the stopper are adjusted.

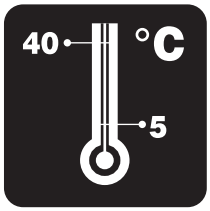
⚠ CAUTION

- The block of the port will slide to enable adjustment of the stroke end by ±10 mm. Use a nylon or urethane tube for piping in these areas and ensure that there is enough slack in length. Use ø12 x ø8 mm as a guide for the tube size.
- When torsion, bending, or tension is applied to the rail due to installation of the legs, air will leak from the fitting areas. Do not apply excessive force.
- Prevent foreign matter, such as cutting chips from drills used during installation work, from entering the cylinder tubes during installation and assembly.

Use/maintenance

⚠ WARNING

■ The most desirable range of the ambient temperature for use of the cylinders is 5 to 40°C. Do not use the unit if the temperature exceeds 40°C, or damage and/or misoperations may occur. If the temperature is less than 5°C, moisture in the circuit may freeze and lead to damage or faults. Take measures to prevent freezing.



■ The shuttle mover is a magnetic rodless cylinder. As a magnet is embedded, do not bring objects that are affected by magnets (magnetic disks, magnetic cards, magnetic tape, testers, etc.) near the unit.

■ When an external force that is greater than or equal to the magnetic holding force is applied, the magnetic connection between the carrier and the piston will become detached.

■ Sandwiching a foreign object between the carrier and the rail will cause defective operation.

■ Grease has been applied within the cylinder tubes. Be careful that foreign matter such as cutting chips does not enter the unit during assembly or disassembly.

⚠ CAUTION

■ When operation becomes unstable due to a shortage of lubrication, remove the piston and apply grease. Refer to the instruction manual for details on applying grease.
Use the driving distance of 2,000 km as a guide for the timing of periodic applications of grease.

■ Regular cleaning is necessary to improve the rotation of the guide rollers when using the product in a place where the rail, etc., is likely to become dirty.