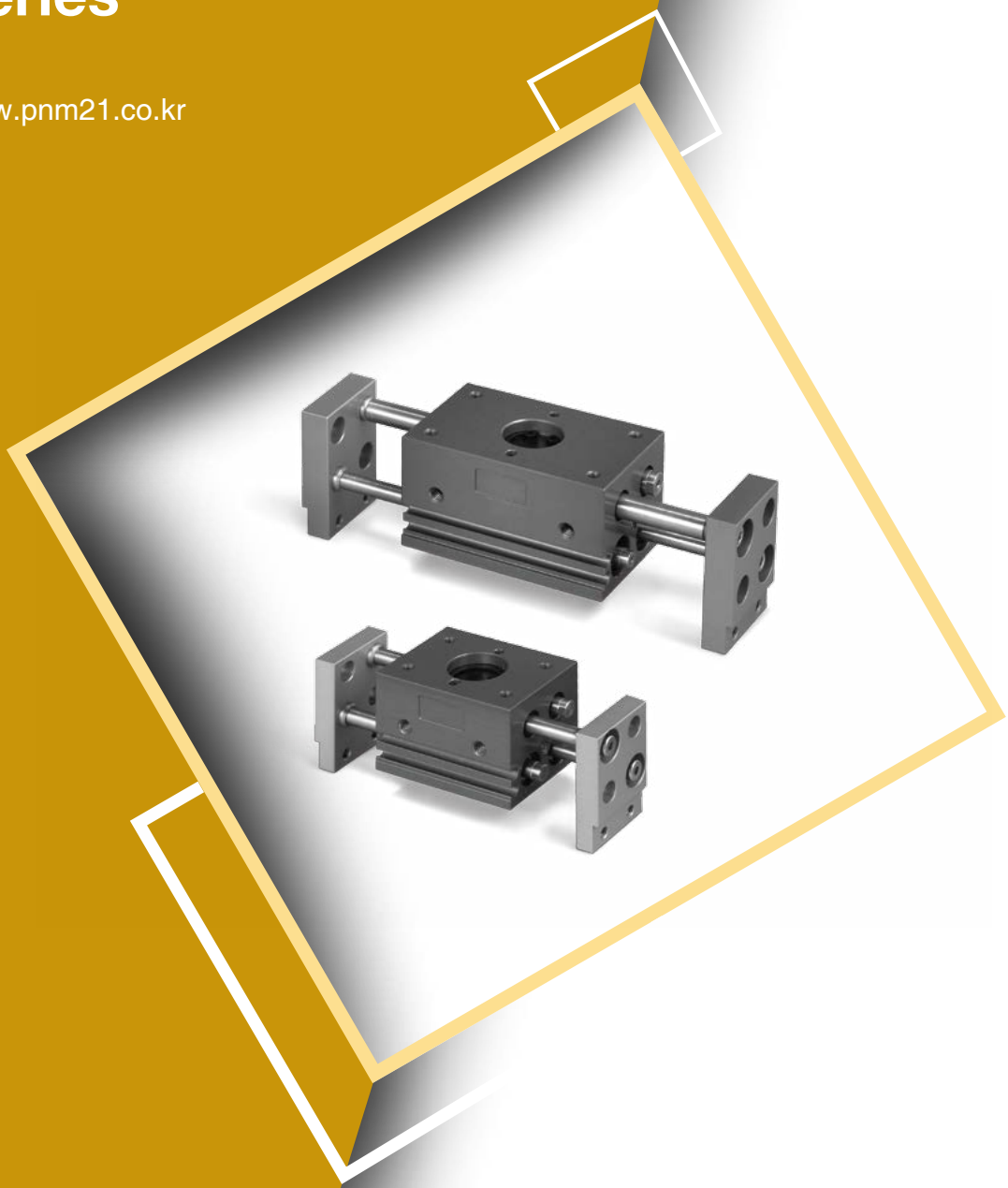
PROTEC

PH06-L2

series

www.pnm21.co.kr



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Content

PH06-L2 Series

Year 2020, **PROTEC** PNEUMATIC DIVISION is divided as
P & M INCORPORATED for more superior and specialized service.

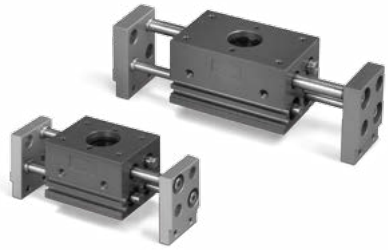
Please understand the specification on this catalogue can be changed without pre-notice for quality improvement.

GENERAL HAND / Parallel Open & Close

PH06-L2 Series

Features

- Parallel open & close type by Rack & Pinion
- Stable gripping force by double cylinder type.
- Long stroke-parallel operation suitable for various different size work-piece handling.
- Auto switch for the detection of position can be attached.



Order Form

PH06 - 16L2 - E - A2 L S

① ② ③ ④ ⑤ ⑥

① Name

② Bore Size & Stroke

Name	CYL Bore(mm)	Stroke(mm)
10L2	10	40
12L2	12	60
16L2	16	80
20L2	20	100
30L2	30	160

③ Special Options

Name	Special Options
Blank	General Options
E	Secondary Battery Field

⑤ Cable Length

Name	Cable Length
Blank	1 M
L	3 M

⑥ Number of Auto Switch

Name	Quantity
Blank	2 EA
S	1 EA

④ Auto Switch Specification

Name	Switch Type	Sensor Cable		Voltage		Currency		Protection Level	Response Time
		Wire	Direction	AC	DC	AC	DC		
Blank	No Auto Switch Sensor								
A2	DSC	2Wire	Horiz	100V	24V	5~20mA	5~40mA	IP 67	1ms
A2C	DSC	2Wire	Horiz	100V	24V	5~20mA	5~40mA	IP 67	1ms
A2V	DSC	2Wire	Verti	100V	24V	5~20mA	5~40mA	IP 67	1ms
B2	PLC	3Wire	Horiz	-	24V(4.5~28V)	-	Less than 50mA	IP 67	1ms
B2B	PLC	2Wire	Horiz	-	24V(10~28V)	-	Less than 50mA	IP 67	1ms
B3B	PLC	2Wire	Verti	-	24V(20~30V)	-	Less than 50mA	IP 67	1ms
B3C	PLC	3Wire	Verti	-	24V(5~30V)	-	Less than 50mA	IP 67	1ms

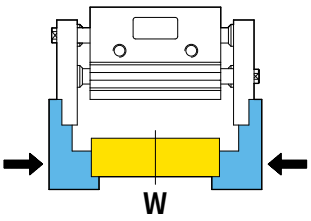
Specification

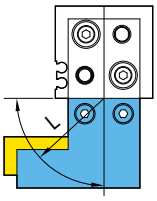
Model		PH06-10L2	PH06-12L2	PH06-16L2	PH06-20L2	PH06-30L2
Bore Size(mm)		2 X 10	2 X 12	2 X 16	2 X 20	2 X 30
Stroke(mm)		40	60	80	100	160
Gripping Force(kgf) Note 2) Air pressure : 5kgf/㎠	Close	2.9	5.1	9.1	14.2	30.8
Air Port Size		M5				PT 1/8
Main Body Weight(kgf)		0.27	0.44	0.79	1.63	4.65
Allowable Length of Attachment L(mm)		30	35	50	60	70
Fluid		Clean Air Note 1)				
Air Pressure(kgf/㎠)		3 ~ 7 (Guarantee resistance pressure : 10.5) Note 3)				
Lubrication		Not need (If need, use one sort of turbine oil : SPEC ISOVG 32) Note 4)				
Temperature(℃)		5 ~ 60				
Accuracy(mm)		±0.05				
Max. Cycle Per Minute(C.P.M)		60				
Motion Type		Double Acting Type				
Tolerance of Open & Close(mm)		Open : -0.5 ~ +1.5, Close : -1.5 ~ +0.5				

Note 1) Clean Air : Fresh air containing solid matters with 0.3% of supersaturated moisture and 99.9% of liquid oil that passed through the 3~10㎛ degree of filtering.
Note 2) The position of gripping point for gripping force is the end point of the Finger.
Note 3) For the base point of tolerable length and displacement in attachment, refer "Technical information of General Hand".(Tolerable value with 5kgf/㎠ of Air pressure.)
Note 4) Guaranteed capacity of resist pressure: A pressure that does not cause an abnormality in parts when it is applied for 1 minute without any weight loaded.

Work Outer Diameter Gripping Force Graph

▶ Refer to <Product selection guide for General Hand> for how to read the graph.

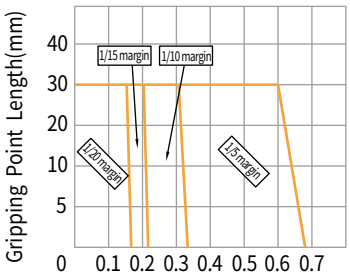




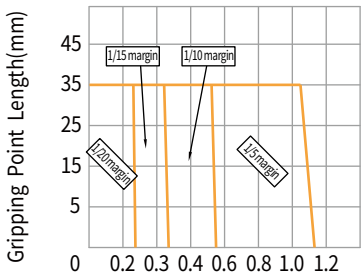
Outer Diameter Gripping State

W: Work weight
L : Gripping point length

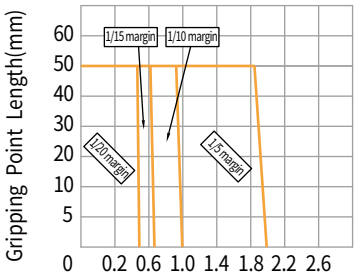
◆ PH06-10L2



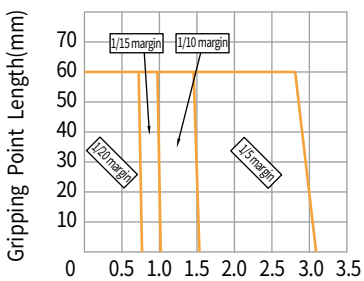
◆ PH06-12L2



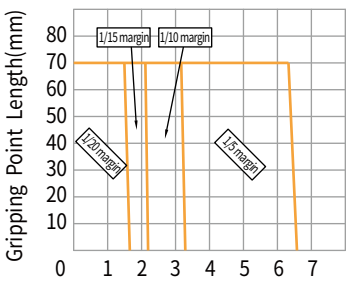
◆ PH06-16L2



◆ PH06-20L2



◆ PH06-30L2



⚠ Caution If using the attachment longer than allowable length as specified in the graph, it may have an adverse effect on the guide and cause problem to durability. Always use the gripping force within the specified length.

Product selection guide for GENERAL HAND ❶

Model Selection

Condition Checking

- Work Weight
- Gripping method (inner/outer diameter grip)
- The friction factor of parts Feed rate

Margin Decision

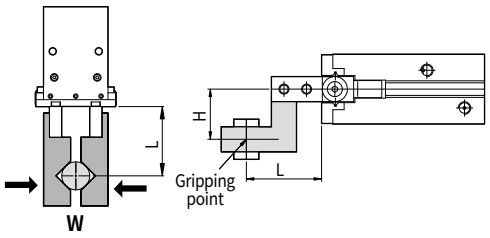
- Decide work feed rate and margin according to the fraction factor of the work piece (Refer to [Table.1] margin table.)

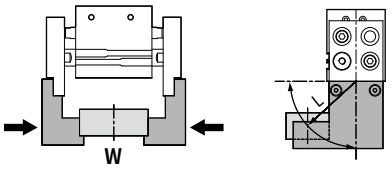
Gripping Force Check by Each Model

- Select model from gripping graph by model
- Allowable gripping point checking → attachment length setting
- Check external force by each direction (review allowable moment)

Gripping Point Checking

- The gripping force of gripping force graph represents the gripping force by all numbers of fingers (Gripping force for one finger× the number of finger) when the attachment is contact to work, as shown in below figure.
- Gripping point length (L) and displacement (H), when the attachment is attached, are as follows.

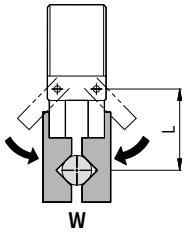




■ Parallel open & close type HAND

(PH01-A, PH01-D, PH01J-C, PH02, PH04, PH08, PH12, PH14, PH15, PH21, PH22, PH23, PH25)

→ Gripping point length (L) is taken from the end point of body to the center of gravity of work, and displacement (H) is taken from the center of guide to the center of gravity of work.



■ Angular open & close type HAND (PH05, PH09)

→ Gripping point length (L) is taken from the hinge point of finger to the center of gravity of work.

■ Parallel open & close type HAND (PH06, PH06L, PH07)

→ Gripping point length (L) is taken from the end point of body to the center of gravity of work.

Product selection guide for GENERAL HAND ❷

Relationship Between the Gripping Force of Hand and the Weight of Work

■ **In general, 1/10 or less of gripping force is applied as the work weight for the gripping force of hand. But it can be changed by following factors according to work style.**

❶ The more fraction factor of work piece material and attachment are increased, the more weight can be gripped.

❷ In case of moving work piece with linear or rotational movement, the more the stopping shock is reduced; the more gripping force (inertial resistance according to acceleration) is increased in the hand.

❸ In the state of gripping a work, horizontal motion affects gripping force less than vertical movement.

❹ The gripping force of parallel open & close type HAND is relatively superior to that of angular open & close type.

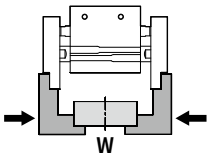
❺ Using the length of attachment longer than the allowable length of the gripping force graph will have an adverse effect on guide unit and may cause problem to durability, so use the allowable length as specified in the gripping force graph.

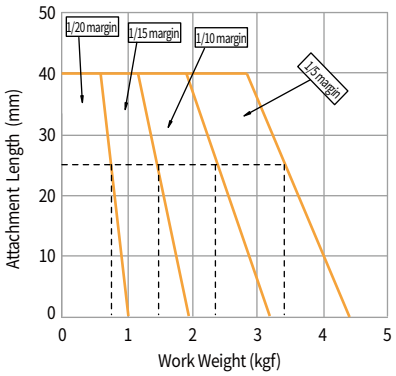
How to Check Attachment - Gripping Force Graph

■ **Below gripping capacity graph shows the correlation of attachment length according to the weight of work when air pressure of 5kgf/㎠ is supplied.**

■ **Because the gripping force of work can be varied according to the 5 items mentioned above, determine the margin of gripping force as shown in the right table.**

■ **For work gripping, gripping capacity margin can be up to 1/5 of the capacity in a low speed return.**





[Gripping Force Graph]

■ **Gripping capacity margin table according to feed rate and work friction factor**

Feed Rate		Friction factor of work and attachment	Gripping capacity margin value
Low-speed	100mm/sec or less	Big	1/5
		Small	1/10
Medium speed	100~300mm/sec	Big	1/10
		Small	1/15
	300~500mm/sec	Big	1/15
		Small	1/20
High-speed	500~1000mm/sec	-	1/30

[Table.1 Margin Table]

■ A example of gripping force graph interpretation (Refer to the gripping force graph in the left side)

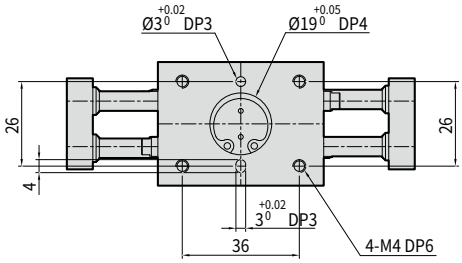
❶ When Work weight (W) = 0.8kgf and margin is 1/20, attachment length (L) shall be set as 25mm or less. If 1/10 is applied as margin, attachment length shall be set as 40mm or less.

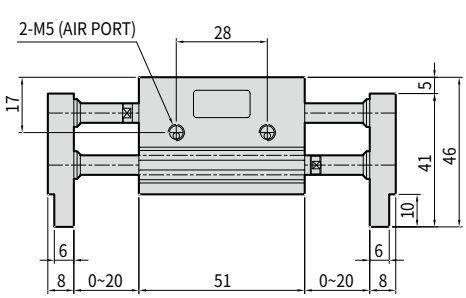
❷ When the margin is 1/20, 1/15, 1/10, and 1/5 under the condition that maximum attachment length is 25mm, maximum work weight for gripping is 0.8kgf, 1.5kgf, 2.3kgf and 3.4kgf respectively

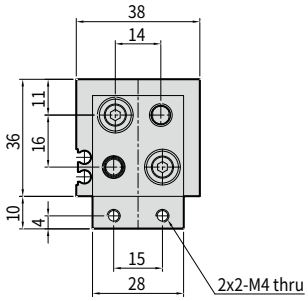
PH06-L2 Series

10L 12L 16L 20L 30L

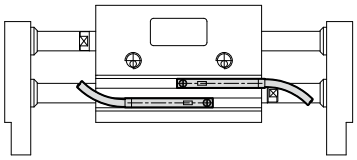
PH06-10L2

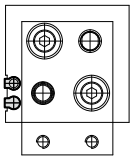




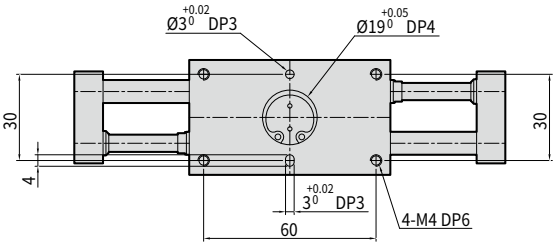


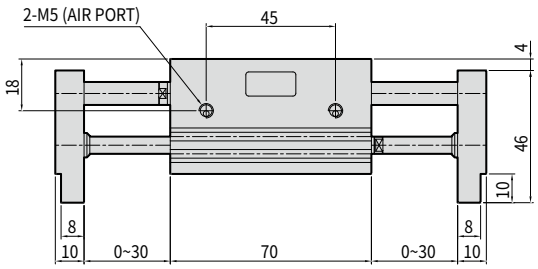
PH06-10L2 Example of Auto Switch Installation

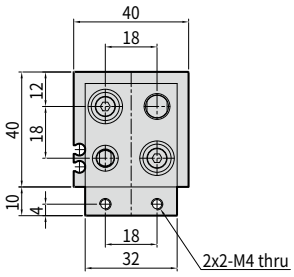




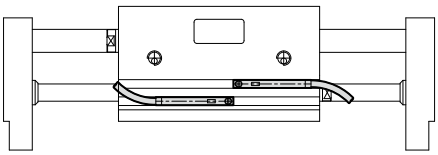
PH06-12L2

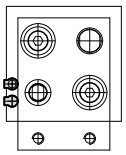






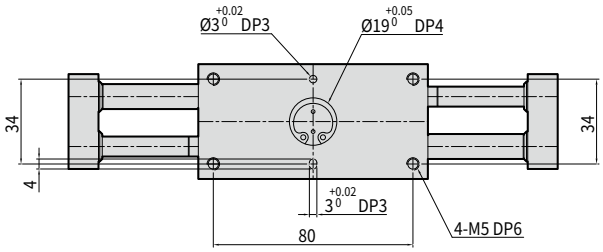
PH06-12L2 Example of Auto Switch Installation

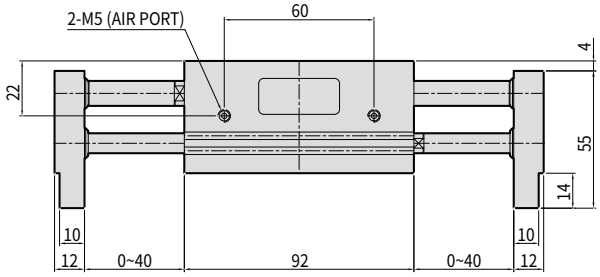


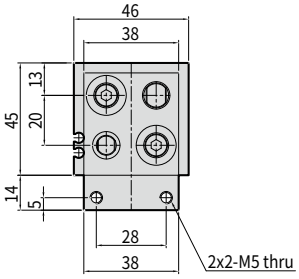


PH06-L2 Series

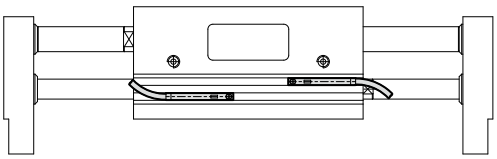
PH06-16L2

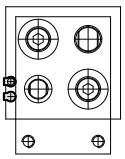






PH06-16L2 Example of Auto Switch Installation





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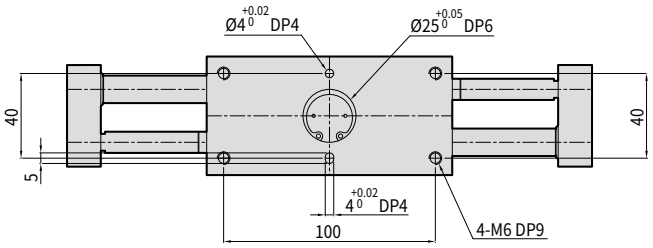
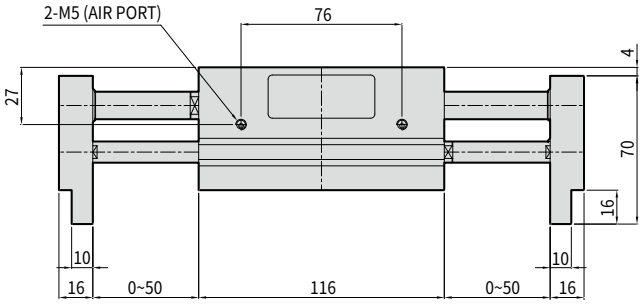
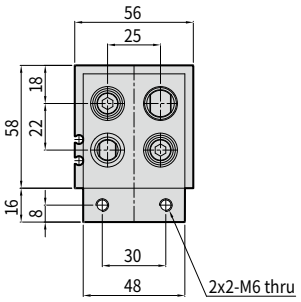
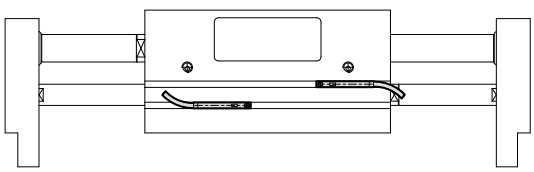
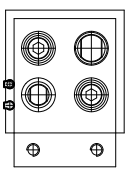






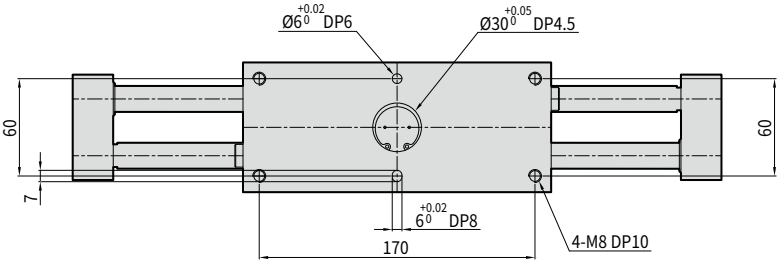
PH06-20L2 Example of Auto Switch Installation

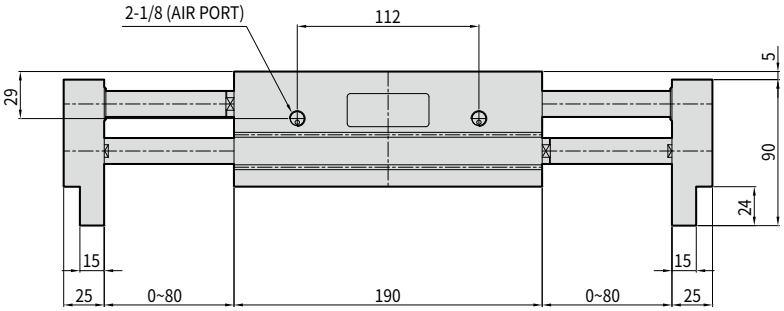


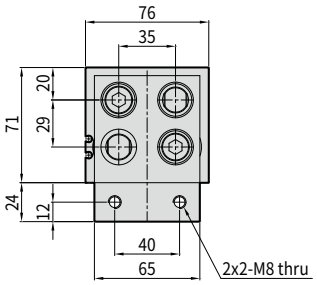


PH06-L2 Series

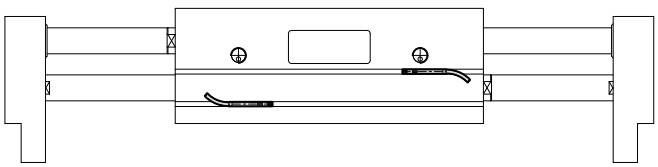
PH06-30L2

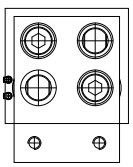






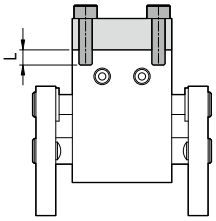
PH06-30L2 Example of Auto Switch Installation





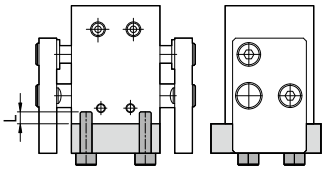
Installation Information

1. Cylinder body tap installation



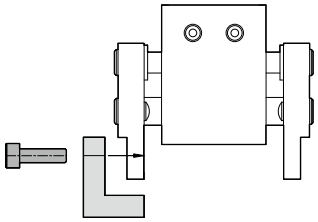
Specification	Bolt	Specified Tightening Torque (kgf·cm)	Maximum Screw Length L (mm)
PH06-10L2	M4×0.7	25	5
PH06-12L2	M4×0.7	25	5
PH06-16L2	M5×0.8	51	7
PH06-20L2	M6×1	81	8
PH06-30L2	M8×1.25	157	9

2. Cylinder body tap installation



Specification	Bolt	Specified Tightening Torque (kgf·cm)	Maximum Screw Length L (mm)
PH06-10L2	M4×0.7	25	5
PH06-12L2	M4×0.7	25	5
PH06-16L2	M5×0.8	51	7
PH06-20L2	M6×1	81	8
PH06-30L2	M8×1.25	157	9

3. Fix the attachment to cylinder



Specification	Bolt	Specified Tightening Torque (kgf·cm)	Maximum Screw Length L (mm)
PH06-10L2	M3×0.5	11	6
PH06-12L2	M4×0.7	25	8
PH06-16L2	M5×0.8	51	12
PH06-20L2	M6×1	81	10
PH06-30L2	M8×1.25	157	15

Please read the followings before use.

⚠ For the safe use of pneumatic devices

⚠ Caution **Safety note**

The purpose of notes presented here is to use the product correctly and safely, and prevent any damage or risk in advance for user and others. In order to prevent accident, the notes are classified into three categories (caution, warning, and danger) according to the size and urgency of risk or damage. Please be well-informed with these notes, as they are critical for safety.

⚠ Caution	The case considered as risky status as wrong handling may cause minor injury or physical damage.
⚠ Warning	The case considered as risky status as wrong handling may cause human death or severe injury.
⚠ Danger	The case considered as urgent risky status as it will, if not avoid, cause human death or severe injury, or physical damage.

Even an item stated under “Caution”may create serious result depending on situation. Therefore, all of them contain critical information, so please be informed in advance thoroughly. In addition, please understand that the safety notes may be changed without pre-notification.

⚠ Warning **Warning note**

❶ This product is designed and manufactured as the standard industrial equipment or component. Therefore it shall be handled by a person who has full prior knowledge.

Compressed air is very dangerous when it is incorrectly handled. Therefore, the assembling or maintenance of mechanical equipments using pneumatic devices shall be handled by a qualified person who has sufficient knowledge and experience.

❷ The product shall be used within the specified range.

The product stated on this catalogue is designed to be used only in air compression system.

Otherwise, it may cause damage to the equipment.

❸ For the safety of compressed air, comply with the following legal regulations.

KS B 6376 (General rules of pneumatic system),

JIS B 8370 (General rules of pneumatic system),

ISO 4414 (Pneumatic fluid power)

❹ Select pneumatic devices properly.

The usage conditions of products stated on this catalogue are so variety that the determination of system acceptability shall be made by pneumatic system designer or person who determines its specification after complete analysis or test.

Responsibility about system safety assurance belongs to the person who decides its specification.

❺ Do not handle or dissemble this product before its safety is confirmed.

If starting or re-starting the machine or equipment using pneumatic devices, make sure that system safety, such as preventive measures against the drop of moving object or instant protrusion, is ensured.

⚠ Safety Note for Pneumatic Actuator ❶

⚠ Warning — Notes in Design

■ **Pneumatic cylinder may have malfunction due to the change of power caused by abnormal operation by mechanical frictional surfaces.**

If it may create injury in human body including hand or foot jam, or damage on the equipment, it is need to adjust actuator system to move smoothly to avoid any injury in human body.

■ **If there is a possibility to lead any danger in human body, please attach safety devices such as protective cover.**

If the load or the motional area in cylinder may lead danger in human body, change the structure not to contact that dangerous area directly by human body.

■ **Make sure the firm connection for fixing or connection area in cylinder to avoid loosening.**

When the cylinder is used in the place that is frequently operated or has big vibration, make sure the connection to avoid its loosening.

■ **Shock buffer or decelerator may be required.**

When the motion speed of load is fast or its mass is big, absorbing shock with a cushion in cylinder may be difficult. Therefore, installing shock buffer or structuring deceleration circuit just before cushion may be required. In this case, the hardness of mechanical equipment shall be fully reviewed.

■ **The possibility of circuit pressure deterioration due to power failure shall be considered as well.**

When the cylinder is used as clamp device, the deterioration of circuit pressure due to power failure may cause the breakout of load because of declined power in clamp. Therefore safety equipment shall be considered and installed so as to prevent injury to human body or damage to mechanical equipment.

■ **The possibility of failure in power source shall be considered.**

It is needed to set up the measures for equipments controlled with power source including air pressure, oil pressure, and electricity, to prevent injury to human body or damage to mechanical equipment, even when such power sources are in failure.

■ **Prepare structure to prevent the load from sticking out.**

When direction control valve for exhaustion center is used in cylinder operation, re-starting after release can pressurize on the one side of piston and may cause driving object to protrude in high-speed with the air of cylinder discharged. On this occasion, it may cause injury to human body including hand & food jam or damage to mechanical equipment. Therefore, measures to prevent sudden start shall be established.

■ **Operation in emergency stop shall be considered.**

Please be careful not to cause injury to human body or damage to mechanical equipment during cylinder operation, while the mechanical stop is operated as the safety equipment due to system abnormality such as power failure or intentional stop by people.

■ **Re-operation after emergency stop or abnormal stop shall be considered.**

Make sure no injury to human body or damage to mechanical equipment occurs by re-starting. In addition, when the cylinder needs to be reset to the original position, safe manual controller shall be prepared.

⚠ Safety Note for Pneumatic Actuator ❷

⚠ Caution — Notes in Selection

■ Full review of the specification of product is required.

In case of review the usage that requires special safety, such as when injury in human body or damage to property is expected from the use of air facilities, research equipment, leisure tools, safety equipment as well as from the use of condition and environment not specified in this catalogue or handling manual, apply this product only after sufficient specification review.

■ Please use it within the allowable maximum stroke range

Using over the maximum stroke of product specified in this catalogue may damage to piston rod. Please follow the allowable maximum stroke specified in this catalogue.

■ To control the drive speed of cylinder, please use speed controller.

For drive speed control, increase it from low-speed to re-quired speed gradually.

■ In the cylinder with long stroke, install reinforcing bar at the center.

For long stroke cylinder, reinforced bar shall be installed at the center to prevent the deflection of piston rod and cylinder chamber, and damage to rod due to vibration or external weight.

■ Use the piston within the range where it is not crashed and damaged at the end of stroke.

When a piston with inertia force is crashed to cover at the end of stroke, and stopped, make the use within the specified range.

For the specified range, please refer to the model selection method for cylinder.

⚠ Warning

■ Full review of the specification of product.

Products included in this catalogue are designed to be used as compressed air source only. Pressure or temperature out of the specified range shall be forbidden as it may cause damage or malfunction. In addition, please contact us for the use of fluid other than compressed air.

■ Check for vibration or shock.

Do not use the cylinder as a buffer of vibration of shock for mechanical equipment. Such use may create injury or damage to mechanical equipment.

■ Check for intermediate stop.

In 3 position exhaustion center type direction control valve, holding cylinder at the center does not allow accurate middle control due to the compressed air.

In addition, neither valve nor cylinder assures air leakage completely, so long time stop position would be avoided. If you need middle stop position for long, please contact us.

⚠ Danger

■ Do not use for following purposes.

① When very high stability is required in mechanical equipment.

② For medical instruments related to maintain or manage human body and life.

⚠ Safety Note for Pneumatic Actuator ❸

⚠ Caution — Notes in Installation

■ **Avoid overcharge beyond torsion and bending strength to piston rod.**

It may cause degradation in the life of product, and disorder, abrasion, and damage to the piston rod or tube.

■ **Be careful not to crash or create damage to cylinder inner diameter & piston rod motion unit.**

Cylinder inner diameter is managed with precise allowance, and any small wound or transform may cause malfunction.

In addition, any defect of wound on motion units such as piston rod will lead damage in packing stuffs, and the cause of malfunction from air leakage.

■ **Do not exceed eccentric or lateral load to piston rod.**

If an eccentric or lateral load is effect on the cylinder rod directly, malfunction or air leakage from damaged packing will occurs.

■ **When using external guide, make sure the connection between piston rod fore-end and load without any torsion at every position of stroke.**

■ **Notes in work.**

Do not seat on, step on or put other object on the product. It may drop or fall over.

■ **During process, install indication board.**

Install indication board that shows it is in progress, so as to avoid unexpected air or electric supply, and to avoid injury to human body from sudden accident.

■ **Please read the product manual carefully.**

Understand product-handling manual for respective series, and use it correctly.

⚠ Warning

■ **Maintenance space shall be secured.**

For product installation, proper working space shall be secured near the installation site. Insufficient space may give difficulty in daily checking and maintenance work, and results in a product malfunction or damage.

■ **Be careful not to damage on the lead line sensor.**

Damage on the lead line of sensor or bending it will cause current leakage or defect on connection, which may cause electric shock, fire, or abnormal function.

■ **Do not put the switch equipped to the cylinder in external magnetic field area**

Any trouble in switch operation by external magnetic field may lead injury to human body and damage to mechanical equipment, with accidental moving.

■ **Perform trial driving test before use.**

If the equipment hasn't been operated for more than 48 hours, or stored for a long time, its motion may be limited. Therefore, trial driving test is required before operation.

■ **Be careful to handle heavy work piece.**

In the transportation or installation of heavy work piece, install reinforced bar for safe work.

■ **Do not apply impractical lateral load to cylinder rod.**

In the bush unit of cylinder rod, if the inner diameter of cylinder is not over 16mm, do not apply the lateral load more than1/40 of cylinder thrust generated from given pressure, and if the inner diameter of cylinder is 20mm or more, do not apply the lateral load more than 1/20 of cylinder thrust generated from given pressure.

■ **Install safety valve.**

Not to exceed constant pressure when the pressure is increased in cylinder by external force, install safety valve. Excessive pressure may lead damage on cylinder.

■ **Screw fastening and tightening torque shall be followed.**

Fasten screw to the specified torque in installation.

⚠ Safety Note for Pneumatic Actuator ❹

⚠ Warning — Notes in Installation

■ **Be careful to prevent product from water contact.**

Spay water on the product, wipe it with water, otherwise, it may cause malfunction and result in human injury, electric shock, or fire.

■ **Make sure the attached product is firmly and safely fixed.**

Dropping the product or unstable operation may cause injury to human body.

■ **Do not touch or approach to the product while it is in operation.**

When the product is in operation, do not make any control on internal attached devices. Actuator may move suddenly and hurt you.

⚠ Caution — Notes in Installation

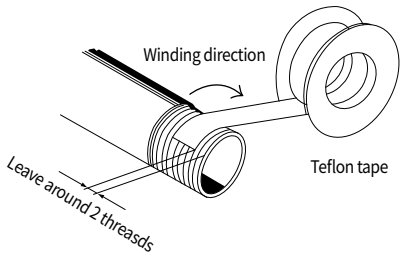
■ **Preventive action before piping.**

Insert enough air before piping for thorough cleaning. This will allow removal of chip debris, cutting oil, and dust from the inside of pipe, which can cause air leakage.

■ **How to wind Teflon tape.**

Wind the Teflon tape along the pipe connection from 2 grooves inside position from the tip of screw area on pipe in the reverse direction of screw direction.

Putting Teflon tape into the device during piping may cause air leakage.



How to wind Teflon tape

⚠ Caution — Notes in Cushion Adjustment

■ **Re-adjust cushion according to usage environment.**

The cushion in cylinder was adjusted at the time of product delivery; but it shall be adjusted again according to work environment, rod size, and cylinder operation speed.

For cushion adjustment, turning it clockwise will make the orifice hole smaller and cushion effect will be bigger. After adjustment, check the adjusted cushion area for looseness using lock nut.

■ **Do not use when the cushion needle is closed completely.**

It may cause damage to applied packing.

⚠ Caution — Notes in Oil-feeding

■ **In case of oil-feeding type cylinder.**

Install lubricator at the center of circuit, to oil-feed turbine oil SPEC 1 ISOVG 32. Using spindle oil or machine oil may cause damage to packing and lead to air leakage.

■ **In case of oil free type cylinder.**

It can be used in oil free state and also all right to feed oil. But the pre-lubricant may be lost in oil feeding, so consistent lubrication is required. For oil feeding, please use turbine oil SPEC 1 ISOVG 32.

⚠ Caution — Notes in the Use of Shock Absorber & Auto Switch

■ **Notes in the use of shock absorber**

Observe allowable temperature (5~60°C) for cylinder to allow normal shock absorption.

■ **Notes in the use of Auto Switch**

Under excessive external power and shock or in environments with cutting oil or dust, your attention is needed as it may not work properly.

⚠ Safety Note for Pneumatic Actuator ❺

⚠ Caution — Notes for Air Quality

■ **Air filter needs to be equipped.**

Attach an air filter with 5㎛ or less of filtering degree at the upper stream side near the valve.

■ **Air dryer needs to be equipped.**

Compressed air containing lots of drain may be the cause of failure in pneumatic devices. Therefore, install an air dryer or air catch so as to reduce occurring drain.

■ **Temperature needs to be within the specified range.**

Establish counter measure to make sure that the drain or moisture in compressed air is not frozen when you use the pneumatic devices at low temperature less than 5°C, so as not to damage to packing or cause faulty operation.

⚠ Warning — Notes for Usage Environment

■ **Do not use in the place having a risk of corrosion.**

■ **Establish preventive action including protective cover on the piston rod area in the place having much dust, moisture, or oil.**

■ **In the use of auto switch, be careful for the approach of magnetic material.**

⚠ Danger

■ **Inspection for usage environment**

As this product is not proved for preventing explosions, do not use it in the explosive place.

⚠ Warning — Notes in Maintenance

■ **Check for the maintenance sequence.**

Incorrect handling may cause damage or malfunction in mechanical equipment, make sure to check correct handling.

■ **Checklists before maintenance.**

Check if there is preventive measure for load from drop, deflection, and projection, and conduct inspection after block compressed air and power, and exhaust remained air in system. If air pressure is remained in cylinder, the actuator may cause injury to human body due to accidental operation.

■ **Checklists after maintenance**

Check anti-protrusion action for re-starting, and inspect leakage and appropriate function by supplying compressed air or power to the pneumatic system. If the machine is not operated due to leakage, stop using it and check if the installation is correct.

■ **No dissembling and overhauling of cylinder.**

Do not dissemble or overhaul this cylinder other than given purpose. Abnormal operation due to such change may cause injury to human body, electric shock and fire.

⚠ Caution

■ **Frequent inspection item.**

With daily frequent inspection, check the deterioration of durability and function in pneumatic devices to prevent accident in advance.

⚠ Common Notes for GENERAL HAND ❶

⚠ Warning — Notes in Design

■ When there is a risk of human body, install protective cover and set up safety measures.

When there is a risk of bodily injury by moving parts or a concern of finger jam in the finger unit, install protective cover and set up safety measures.

■ Establish measures for power failure.

Set up safety measures in case of power failure, for devices powered by air pressure or electricity.

■ Emergency stop should be considered during cylinder operation.

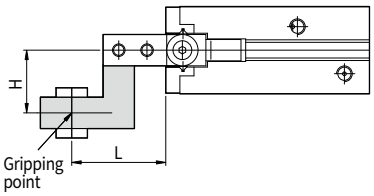
When the machine makes an emergency stop, cylinder may cause risk to mechanical equipment depending on usage environment, so appropriate measures should be taken.

■ Re-operation of cylinder after emergency stop needs to be considered.

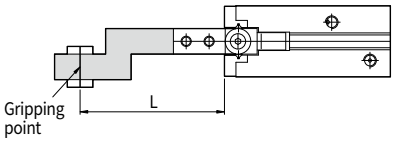
Resuming operation after emergency stop may cause damage to human body or machine, so appropriate measures shall be taken.

■ Gripping point should be used within limited range of cylinder.

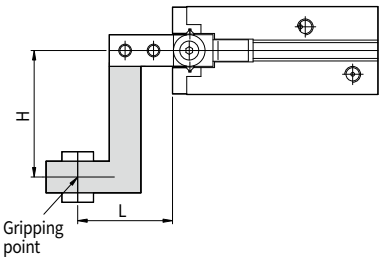
In case of the maximum limit range, excessive moment load may affect open & close unit and the life of cylinder; therefore refer to the limited range for respective series.



<Situation 1> The lengths of L and H are appropriate.



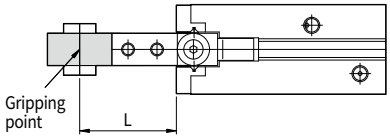
<Situation 2> The length of L is too long



<Situation 3> The length of H is too long.

■ Attachments installed on cylinder shall be short and light.

When attachments connected to cylinder is heavy or long, inertia force effecting on the open & close of cylinder is too large that it may have an adverse impact on lifespan.
Therefore, short and light attachments should be used within the limited range of gripping point.
In addition, for more stability, use attachments whose cylinder is long and heavy, increase the size of applied cylinder and apply 2 or more cylinders.



<Situation 4> An attachment is installed lightly and shortly.

⚠ Common Notes for GENERAL HAND ❷

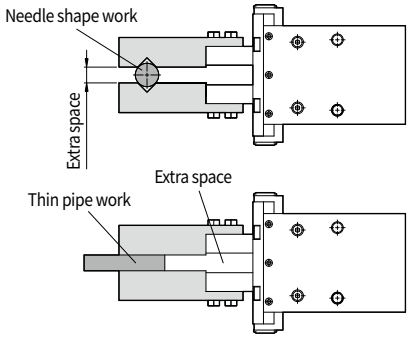
⚠ Warning — Notes in Design

■ **When the work is too slender, install attachments with extra space.**

Without extra space, the gripping is unsafe that it may cause dislocation or faulty gripping.

■ **Do not allow excessive external force or shock.**

Impractical operation may cause failure in cylinder or adverse effect on mechanical equipment.



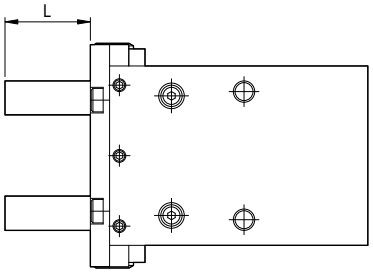
⚠ Caution

■ **To control the drive speed of cylinder, please use speed controller.**

For drive speed control, increase it from low-speed to required speed gradually.
Increasing open & close speed in cylinder will cause bigger shock effect on the cylinder, and the degree of repetition will be worse in the grip of work piece.

■ **The gripping force of cylinder represents the force applied to open & close direction for Length L.**

Making the work gripping length L longer may reduce the life of guide, so design it short as possible.



⚠ Warning — Notes in Selection

■ **Select the model with sufficient gripping force for work weight.**

Using a model having insufficient gripping force may cause work piece to drop. In the selection of model for respective series, select the device only after full review of theoretical gripping force and work weight for the series.

■ **Select the model with sufficient open & close width for the work.**

The stroke of cylinder may not be stable due to its own deviation or work diameter difference. If using auto switch, it may cause detection error. Refer to the allowable tolerance of each series' auto switch before using stroke.

■ **Refer to the specifications in this catalogue for the selection of respective series.**

Refer to the specification in this catalogue for the selection of cylinder, and correct use of cylinder within usable temperature and pressure range reduces malfunction and failure.

■ **Check optimal gripping type for each process to reduce overload applied to cylinder.**

■ **For the gripping of peculiar work piece, please contact us for further review.**

⚠ Common Notes for GENERAL HAND ❸

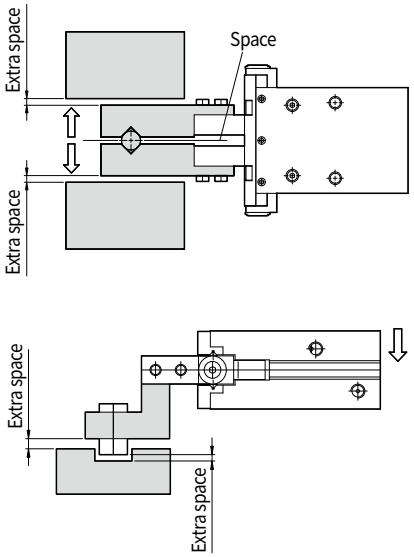
⚠ Caution — **Notes in Installation**

■ **In the installation of attachments to cylinder, make sure that the cylinder is not twisted.**

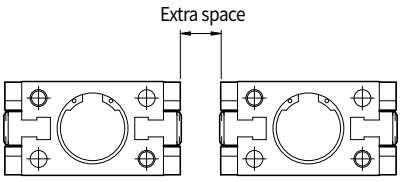
Any small distortion may cause deterioration or malfunction.

■ **Make sure that there is no external force that gives the cylinder a shock.**

The repeated application of lateral or shock load on the cylinder may cause damage or clattering. Put a clearance (space) at the open & close stroke tip of cylinder to avoid contact to the work piece or other attachments.

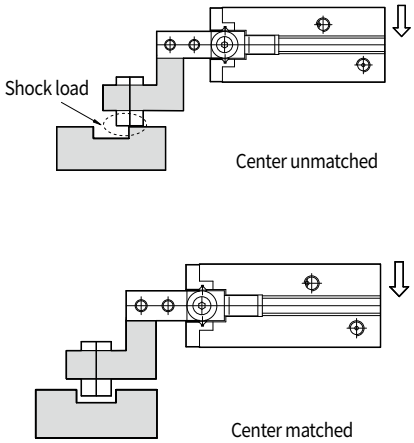


■ **If cylinders are too close, there is a possibility of malfunction with the cylinder built-in switch, so install them with sufficient extra space in between.**

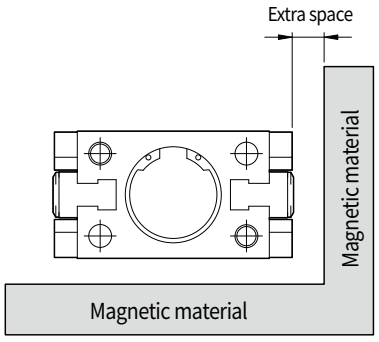


■ **When you insert a work, position it at the center of hole, so that no impractical force is applied in the master jaw of general hand.**

During the trial test of cylinder, make sure there is no shock caused by careless processing, by operating it in low-speed with manual operation or by lowering the injected pressure.



■ **When there are magnetic materials like steel plate near the switch in cylinder, most likely they may cause malfunction in the switch, therefore they need to be designed and installed with sufficient space from the surface of cylinder.**



⚠ Common Notes for GENERAL HAND ❹

⚠ Warning

■ **In the installation of cylinder, make sure that the cylinder is not damaged by dropping it or crashing it.**

Any small distortion may cause deterioration or malfunction.

■ **After confirming the smooth operation of equipment, start the system.**

Perform air leakage test after installing the cylinder. After starting the system, confirm whether it is operating correctly.

■ **Secure a space as sufficient as possible for maintenance and inspection.**

■ **When fastening the screws for installation of cylinder or fixing attachments (work piece) to cylinder, use the proper torque value within the limited range.**

Otherwise, it may cause defects during operation. Also, insufficient fastening in fixing area may result in dislocation or cause attachments to drop.

⚠ Warning — Notes for usage environment

■ **Avoid using it in the places with serious vibration or shock.**

■ **Install protective cover to protect against dropping dust and cutting oil due to vibration.**

⚠ Danger

■ **Do not use cylinder in the places where there is risk of explosion.**

⚠ Caution

■ **To maintain the quality of inserted air, exhaust drains in filter periodically.**

⚠ Caution — Notes for maintenance

■ **Add lubricant at the frictional surfaces of cylinder periodically.**

Adding lubricant periodically at the frictional surfaces of cylinder can extend lifespan.

⚠ Warning

■ **Do not put your finger into the jaw area or between attachments in cylinder.**

■ **To remove cylinder from fixing unit, check if there is work gripping, remove compressed air, and then dissemble it.**