

Power Arm

Palletizing specifications PAW-A* Series

Instruction Manual

SM-A30196-A/4

ORIGINAL INSTRUCTIONS



- Please read this instruction manual before using the product.
- Please carefully read the safety instructions.
- Keep this manual in an easily accessible location for future reference.

CKD Corporation

Introduction

Thank you for selecting our **Power Arm Palletizing specifications PAW-A* Series**.

The Power Arm Palletizing specifications is general industrial assist device that retains the advantages of the conventional PAW Series, including the compact size, light weight, and user-friendly operations. It is equipped with a highly rigid vertical axis on the arm end to improve the workability in the palletizing and depalletizing process.

This instruction manual is intended for Power Arm Palletizing specifications PAW-A* Series. It does not apply to other series.

If the product is improperly used or handled, it cannot fulfill its function and may cause an unexpected accident, and its life may be reduced.

To maintain its performance and use it without trouble, carefully read this instruction manual and fully understand the contents before operating. Please understand that we are not liable for any compensation for damage caused by ignorance of this warning.

And, keep the instruction manual in an easily accessible location for future reference.

If you have any questions about this manual, please contact us.

Note that information in this instruction manual, specifications and appearance are subject to change without prior notice.

When designing and manufacturing equipment using Power Arm Palletizing specifications PAW-A* Series, you are required to manufacture safe equipment ensuring the safety of the equipment mechanisms, pneumatic control for these mechanisms and electrically controlled system.

To safely use our product, it is necessary to select a suitable model and use, handle and maintain the product appropriately.

To ensure the safety of the product and equipment, follow DANGER, WARNING and CAUTION instructions.

Fully understand the contents of international standards (ISO/IEC) applicable in the user's country or region, Japanese Industrial Standards (JIS) and other safety laws (Industrial Safety and Health Act, etc.), and design the equipment to comply with the standards.

The specifications for any special model may differ from those stated in this instruction manual. Check the specifications on the specification drawing, etc. of each product.

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Safety instructions

When equipment using this product is designed and manufactured, it is required to manufacture safe equipment. For this purpose, ensure the safety of the equipment mechanisms, pneumatic control circuit or hydraulic control circuit and system for electrically controlling them.

For the safety of the equipment design and management, follow the organization standards and laws.




To use our product safely, it is important to select a suitable model and use, handle and maintain the product appropriately.

To ensure the safety of the equipment, strictly observe the warnings and precautions stated in this instruction manual.

Although this product has various safety measures, improper handling by the user may result in accidents. To prevent this,




thoroughly read and understand this instruction manual prior to use.

To explicitly indicate the severity and likelihood of a potential harm or damage, precautions are classified into three categories: “DANGER”, “WARNING”, and “CAUTION”.

 DANGER	Indicates an imminent hazard. Improper handling will cause death or serious injury to people.
 WARNING	Indicates a potential hazard. Improper handling may cause death or serious injury to people.
 CAUTION	Indicates a potential hazard. Improper handling may cause injury to people or damage to property.

Precautions classified as “CAUTION” may still lead to serious results depending on the situation. All precautions are equally important and must be observed.

Other general precautions and tips on using the product are indicated by the following icon.

	Indicates prohibited actions that must not be performed in any case.
	Indicates mandatory actions that must be performed.
	Indicates general precautions and tips on using the product.

The following symbols are added to facilitate understanding of warning messages.



Indicates that there are mechanical hazards, such as fractures and injuries caused by pinching. Do not insert your fingers or hands into any gaps on the product or equipment.



Indicates that there is an obstacle at head level, and there is a risk of bumping head.



Indicates that there are electrical hazards, such as electric shock, death, burn and fire.

To use this product safely

This product has been designed placing the first priority on the safety of the operators. However, improper use or operation outside of the specifications may cause personal injuries or property damage.

Positioning of this manual

This manual contains important safety information for handling this product.

Before transporting, storing, installing, inspecting, maintaining and disposing of this product, thoroughly read and understand this manual.

Keep the manual in an easily accessible location for future reference.

Training on risk perception and safety measures

Persons who work with or near this product must receive sufficient training in risk perception and safety measures specific to the product.

Confirmation of suitability

The suitability of our product for your system, machine or equipment shall be confirmed on your own responsibility.

Definition of Workers who Handles the Product

This Instruction Manual is intended for all workers who handle this product. However, the workers are classified depending on their ability and experience in operation to ensure the safety.

CKD defines the following three categories of workers and only the relevant workers are allowed to perform the described operation.

- **Operator**

This person is allowed to operate the product. The operator is required to acquire sufficient knowledge and operating skills to use this product. The operator shall carefully read this Instruction Manual and sufficiently understand the operation procedures and safety precautions before operating this product.

- **Maintenance person**

In addition to the work permitted to the operator, this person is allowed to perform periodic maintenance work such as periodic inspection and replenishment and replacement of consumable parts. The maintenance person is required to acquire sufficient knowledge, operating skills and maintenance skills for this product. The maintenance person shall carefully read this Instruction Manual and sufficiently understand the operation procedures, equipment characteristics, details of all operations and safety precautions before maintaining this product.

- **Repair person** (refer to the manufacturer that designs, manufactures and installs the equipment containing this product)

This person is the manufacturer that designs, manufactures and installs the piece of equipment incorporating this product and is allowed to perform work requiring special knowledge and skills such as installation, assembly, adjustment, and repair of this product. The repair person is required to have basic knowledge about pneumatic devices including materials, piping, electrotechnique and mechanics (level conforming to JIS B 8370 “General rule of design of pneumatic systems”), as well as knowledge of assembly of general machines. The persons shall carefully read this Instruction Manual and sufficiently understand the safety precautions before installing, assembling, adjusting and repairing this product.

Wearing protective equipment

Operator Safety shoes

Maintenance person Hard hat, protective goggles and safety shoes

Repair person Hard hat, protective goggles, safety shoes and other required protective equipment appropriate to their operations

Environmental consideration

Improper handling of the product may cause an impact on the environment. Install and use the product paying attention to the followings.

- When receiving and unpacking the product, dispose of unnecessary packaging materials in accordance with local laws and government ordinances.
- Failure to maintain the product and equipment may cause not only personal injuries and product or equipment troubles, but also environmental pollution. Implement the periodic maintenance of the product and equipment systematically, and efficiently operate them. When disposing of any consumable or periodic replacement parts, follow the local laws and government ordinances.
- When disposing of the product, follow the local laws and government ordinances.

Notes on using the product

DANGER

- No hanging. No climbing. Danger of tipping over.

WARNING

- This product is a pneumatically driven assist device to be used as a mechanical device with a jig or attachment fitted to the arm end. Before using the product, perform the risk assessment of the whole equipment to ensure the safety. The end user shall perform the risk assessment from the user's standpoint based on the information on residual risk of the whole equipment, and establish the safe operating procedures.

WARNING

- When any abnormality, such as vibration and noise, occurs, ensure your own safety first, and lock the arm in the vertical and rotation directions only when it is possible to do so safely. Failure to do so may cause a fatal accident or serious damage to the product and equipment.
- Do not modify the product or equipment without manufacturer's permission.
- Do not insert your fingers or hands into any gaps on the product or equipment.
- When placing (suspending) the objects to be transferred on the device end (including the fitted attachment or jig, etc.), do not stack (suspend) them unevenly or in such a state that they may collapse.
- When manufacturing an attachment and designing a control circuit, provide an interlock circuit that can detect a workpiece to avoid unintended movement of the device.
- Never leave the product or equipment in the middle of operation or transfer. When releasing your hand from the product, lock it even if it is in a balanced state.
- Do not operate it in the state where the rotation lock has been manually released.
- Do not remove the rotation preventing bolt. If it is operated without the bolt, the internal piping may be distorted and damaged.
- The product is shipped with lifting members used for lifting the product with a crane or lifting with a forklift. Remove the lifting members after installation is completed.
Do not operate the product with these lifting members attached.
The removed lifting members are used when moving the product. Store them where they will not be misplaced.
- When connecting the air piping (electric wiring) from the piping outlet to the air circuit (electric circuit), take care not to crush the air piping and electric wiring or apply tension stress to them.
- Fit all covers before using.
- The operators, maintenance personnel and service persons shall wear the specified protective equipment.

**WARNING****[Risk of falling]**

- Do not use the product as a personnel lifting platform or a ladder

[Risk of overturning]

- Do not use the product with a load exceeding the maximum weight capacity or moment load.

[Risk of collision]

- In the workplace, check that there are no obstacles or any other hazardous articles on the product or equipment.
- Persons other than the operator must not enter the movement range while the product is in use. When operating the carrying section, the arm moves separately and may hit people other than the operator.
- Do not enter under the product or system when lifting the arm end (including the fitted attachment or jig, etc.),
- Before lowering equipment end (including the fitted attachment or jig), make sure that there are no persons or obstacles under the product or equipment

[Risks in the case of use of the product installed on a cart]

- Do not use the product with a load exceeding the overturning moment load.
- Ground the four adjusters on a flat, paved ground before use.
- Provide the cart casters with brake mechanisms, and apply the brakes when operating the product or equipment.
- When using a cart with outriggers, provide an interlock so that the product and equipment can be operated only in the state where the outriggers are completely extended.
- When moving the cart, lower the arm end to the lowermost position, and, in the case of a multi-axis model, fold the arm into the most compact size.
- Do not move the cart with a load on equipment end (including the fitted attachment or jig).
- When moving the cart on a slope, take measures, for example, increasing the number of workers as needed, in consideration of the inertia force.



CAUTION

- Vertical lock of Power Arm is adopted Air brock system that seals cylinder chamber. If leave Power Arm unattended in the middle of stroke for a long time, the arms are fallen slowly because of small leakage.
Therefore, set all arms to lower end position when leave it.
If could not avoid to leave it unattended in the middle of stroke, please contact us.
- Do not lift up or carry the product at a section other than the lifting member (such as the arm section).
- Each unit of this product must not be disassembled. If the units are disassembled, their original performance and accuracy may not be restored. Do not disassemble them.
- Do not collide against the upper, lower or rotation end.
Rubber cushions are built in at the upper, lower and rotation ends for moveable range control (vertical, rotation range). However, the rubber cushions can not absorb severe shock. Do not use the arm in such a way that it collides against the upper, lower or rotation end.
- Do not stop rotating Power Arm by Rotation Lock unit.
Rotation Lock unit of Option is just for holding the static position of Power Arm. Do not stop rotating motion of Power Arm because the mechanism is not for stopping rotating force.
- Select Lock unit option when there is a risk that Power Arm is not kept in position due to inclination of the tip or swing caused by unlevelled.
- Select Lock unit option to keep Power Arm orientation. If not select Lock unit option, Power Arm may not keep the orientation

If any unit must be overhauled, contact us.

■ Specific hazard sources

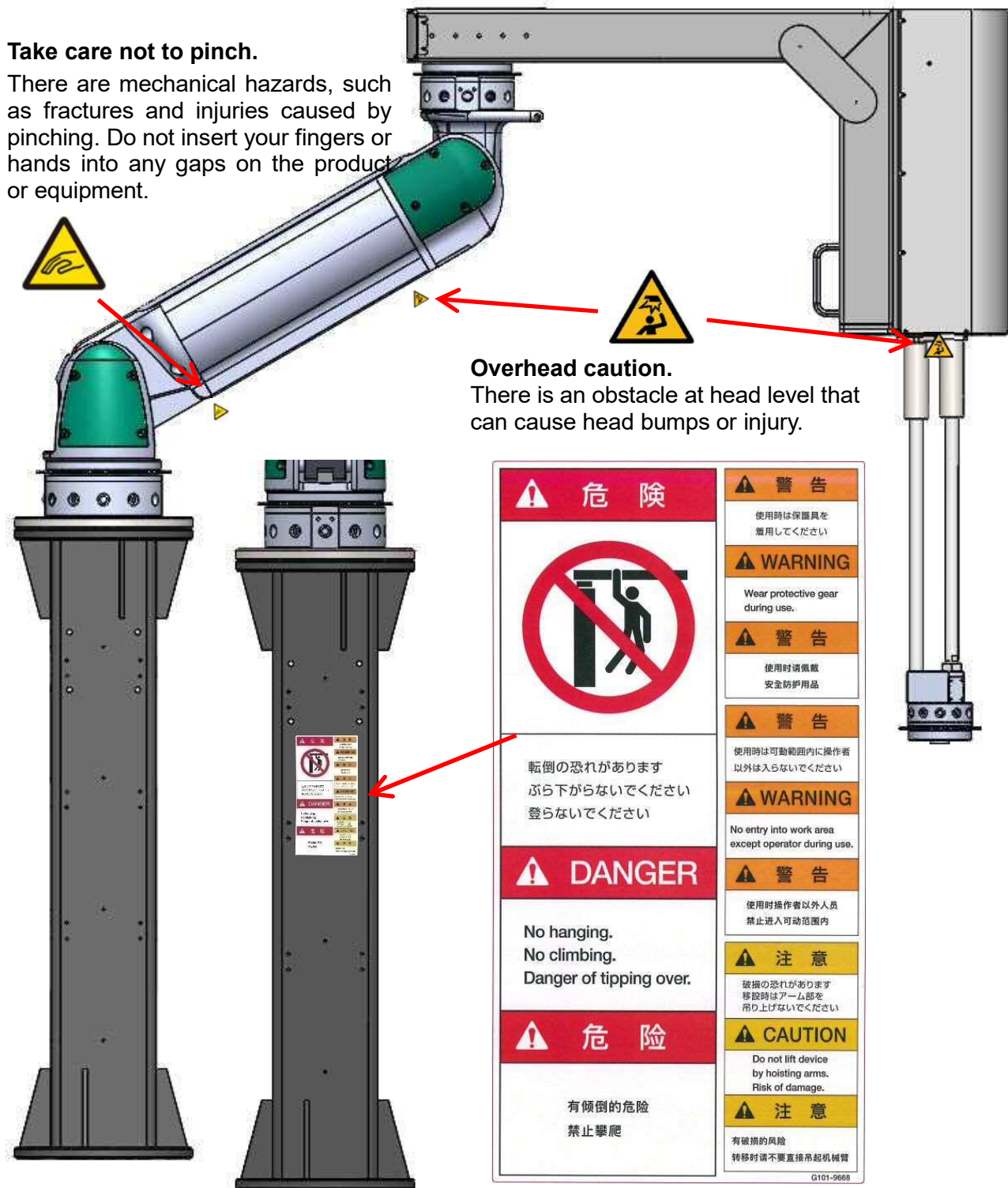
There are structural and operational hazards specific to the product and equipment. The workers shall carefully read this section and thoroughly understand the hazards and methods of avoiding them before operating and maintaining the product.



Warning labels are applied to the following positions before shipment. To use the product safely, do not remove, stain or damage the labels.

Take care not to pinch.

There are mechanical hazards, such as fractures and injuries caused by pinching. Do not insert your fingers or hands into any gaps on the product or equipment.



DANGER No hanging. No climbing. Danger of tipping over.

WARNING Wear protective gear during use.

WARNING No entry into work area except operator during use.

CAUTION Do not lift device by hoisting arms. Risk of damage.

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1. Product outline

1.1 Indication of model number

How to order

PAW - AS-45 - LC

A Vertical operating range / maximum rotational radius

B Option

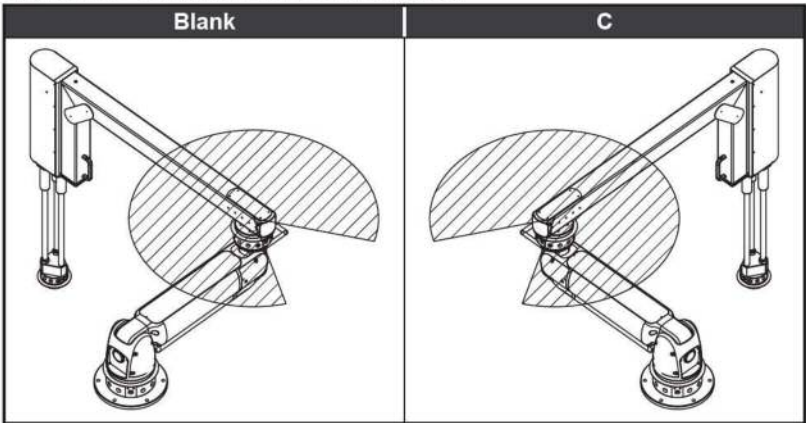
Code	Description	
A Vertical operating range / maximum rotational radius *1		
	Vertical operating range	Maximum rotational radius
AS-45	450 mm	2,000 mm
AS-45-S	450 mm	1,600 mm
AZ-110	1,100 mm	2,100 mm
AZ-110-S	1,100mm	1,700mm
B Option		
L	Rotation lock mechanism *2	
C	Bending directions (see the following illustration)	

*1 If the vertical operating range / maximum rotational radius are exceeded, consult with CKD.

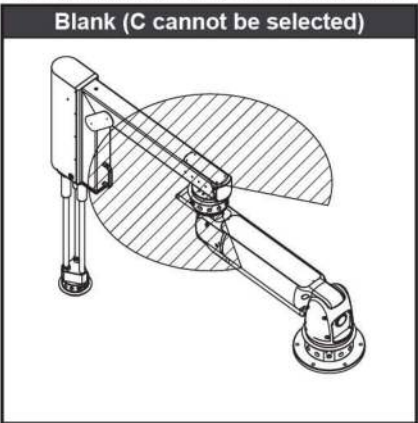
*2 A mechanism designed to hold the force applied in rotational directions. It is not designed to stop dynamic rotation.

B Option: Bending directions

Only PAW-AS-45 and PAW-AZ-110 can be selected



*Bending directions for PAW-AS-45-S and PAW-AZ-110-S



1.2 Specifications

1.2.1 Product specifications

Model number		PAW-AS-45	PAW-AS-45-S	PAW-AZ-110	PAW-AZ-110-S
Item					
Usage environment		Indoor use (degree of contamination: 3 or so, excluding adverse environment with water, dust, etc.)			
Applicable fluid		Clean air ([Standard air circuit] Compressed air quality grade: equivalent to 1.5.1 to 1.6.1)			
Max. working pressure	MPa	0.7			
Min. working pressure	MPa	0.25 (0.35 when the option L (with rotation lock) is selected)			
Proof pressure	MPa	1.05			
Ambient temperature	°C	5 to 50			
Temperature during transportation and storage	°C	-10 to 60 (non freezing)			
Lubrication		Not available			
Load capacity (When pressurized at 0.5 MPa)(*1)	kg	55	55	48	51
When the controller (PAW-B*) is in use		49	49	37	40
Air consumption (*2)	ℓ/min(ANR)	11		35	
Product weight (*3)	kg	164	161	183	180
Vertical movable range of the transport section	mm	450		1100	
Maximum movable radius of the transport section	mm	2000	1600	2100 (*4)	1700 (*4)

*1: The weight capacity varies depending on the supply pressure. See next page "Weight capacity depending on pressure."

*2: Air consumption represents a value with 1 return/min and 0.7 MPa working pressure.

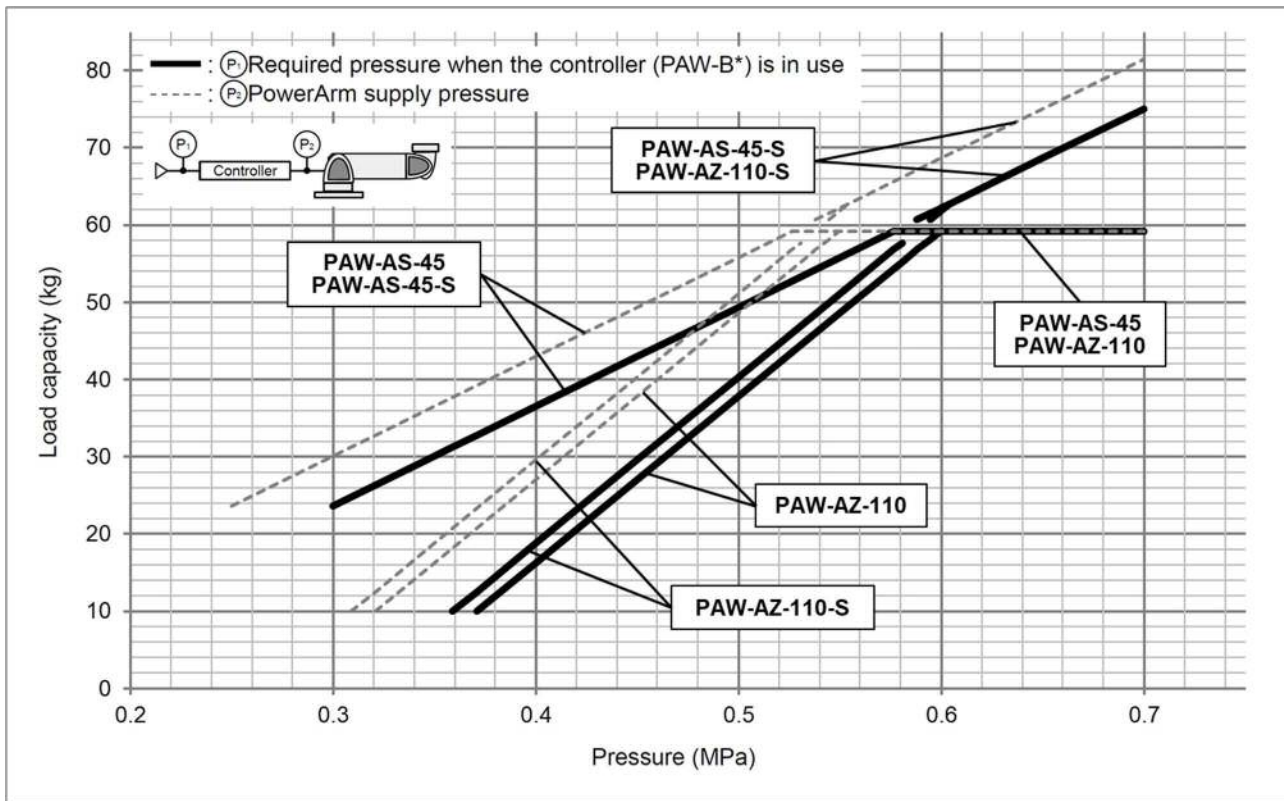
*3: When Option L (with a rotation lock) is selected, an additional 2 kg is added respectively.

The stand, controller, operation box, and attachments (each custom order) are not included.

*4: The maximum movable radius is the maximum value at the lower end of the vertical movable range.

Refer to the outline dimensions in the catalog for details on the movable range.

Weight capacity under pressure



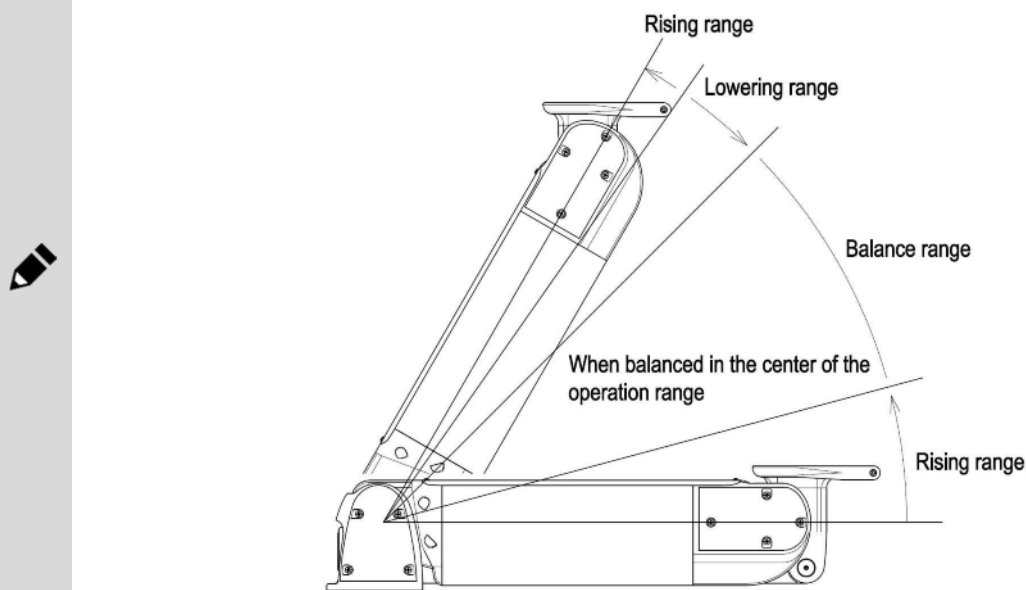
*1: Pressure supplied to the controller should be increased, depending on the operating frequency and speed.

*2: Load capacity is the sum of weights of the workpiece, attachment, and operation box".

*3: While the load capacity properties are such that it alters slightly according to the arm rise angle, this graph shows the lower limit values.

Due to the characteristics of the Power Arm, which is the second axis of the PAW-AZ-110 (-S), there is a difference between raising and lowering forces depending on the angle.

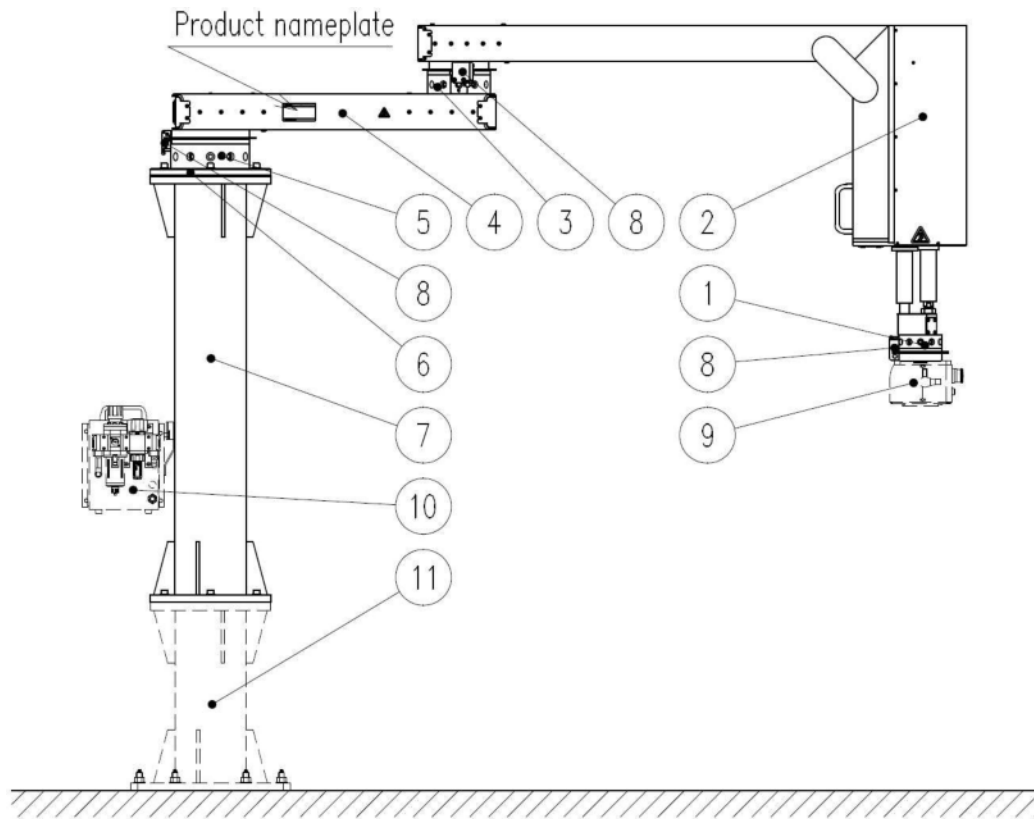
When you release your hand from the operation handle out of the balance range, the arm will slowly move up or down to the balance range or upper end.



If the arm must be held in any position in the vertical direction, discharge the pressure in the piping for unlocking, and lock the arm.

2. Product component list

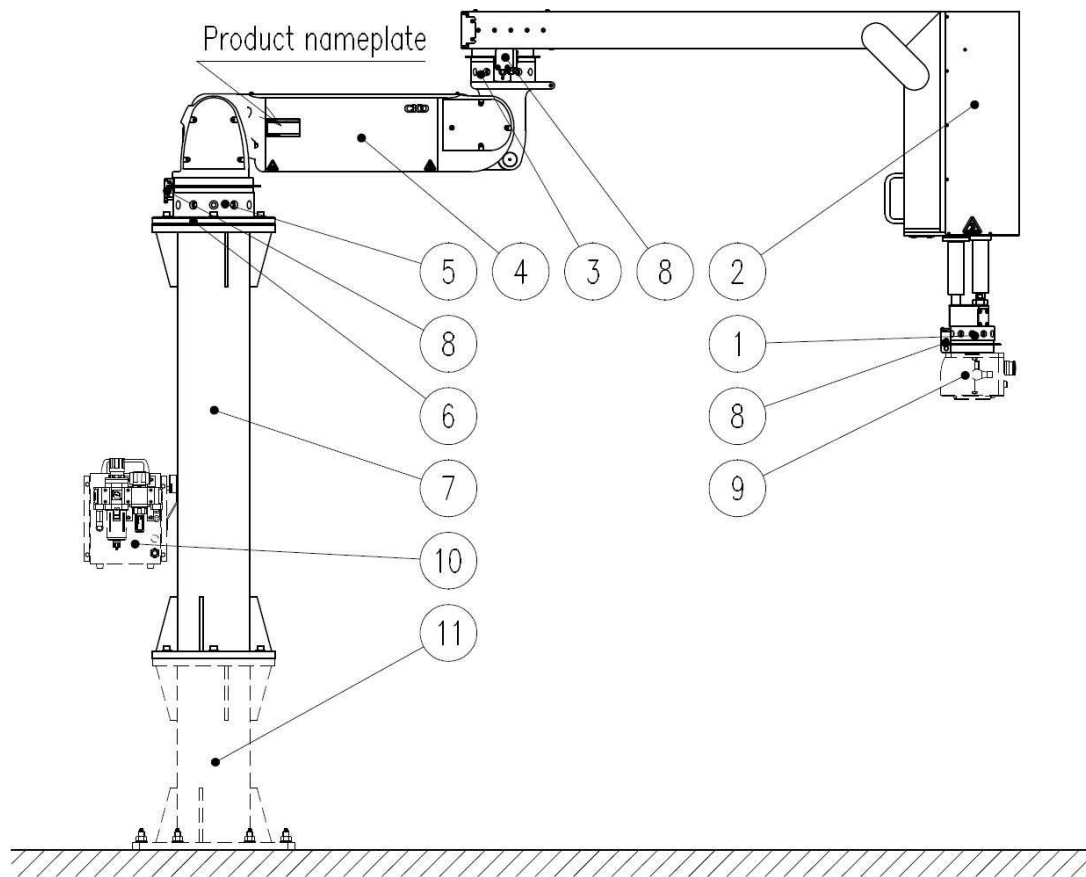
2.1 PAW - AS - 45 (- S)



	Unit name	PAW-AS-45	PAW-AS-45-S	Number of components	Remarks
1	Rotation unit	PAW-RU-T		1	
2	Palletizing Arm unit	PAW-C450 -Z-1300	PAW-C450 -Z-900	1	
3	Rotation unit	PAW-RU-X		1	
4	SCARA arm unit	PAW-SU-XS-FLA30992		1	
5	Rotation unit	PAW-RU-Z		1	
6	Base plate	PAW-BP-Z		1	
7	Stand	PAW-PZ-1200		1	
8	Rotation lock unit	PAW-LU		3	Option
9	(Operation box) Out of system, custom order product			1	
10	(Controller PAW-B*1) Out of system, custom order product			1	
11	(Base) Out of system, custom order product			1	

Note: When using on a dolly, select from PAW- [CA / CP] -H.

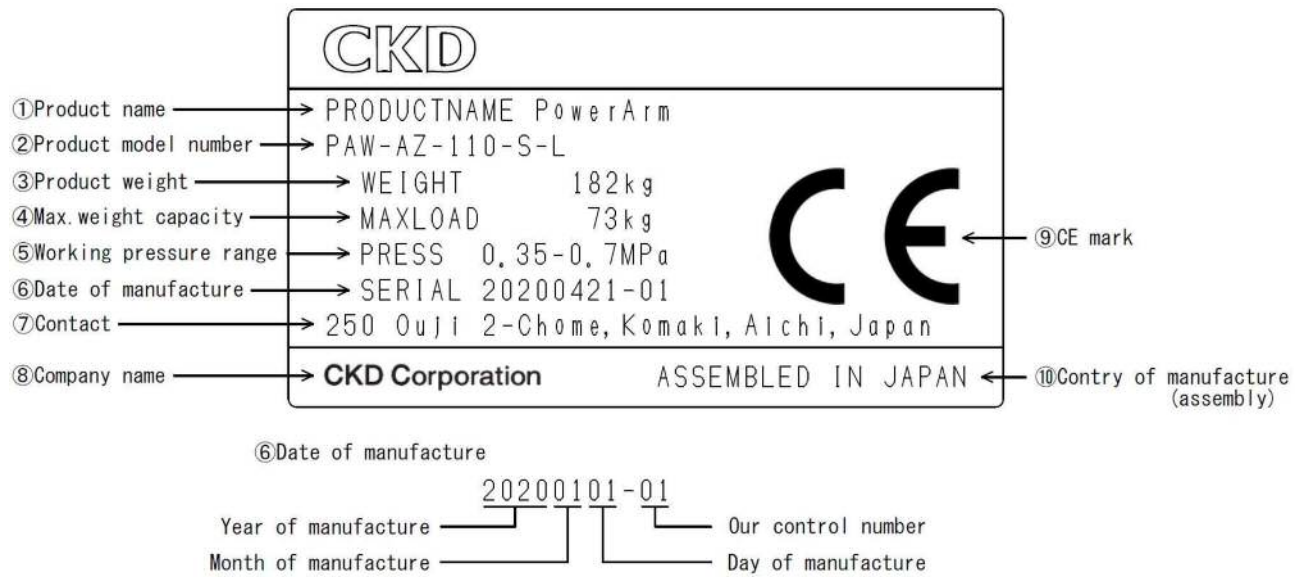
2.2 PAW - AZ - 110 (- S)



	Unit name	PAW-AZ-110	PAW-AZ-110-S	Number of components	Remarks
1	Rotation unit	PAW-RU-T		1	
2	Palletizing Arm unit	PAW-C450 -Z-1300	PAW-C450 -Z-900	1	
3	Rotation unit	PAW-RU-X		1	
4	Power arm unit	PAW-AU-Z		1	
5	Rotation unit	PAW-RU-Z		1	
6	Base plate	PAW-BP-Z		1	
7	Stand	PAW-PZ-1200		1	
8	Rotation lock unit	PAW-LU		3	Option
9	(Operation box) Out of system, custom order product			1	
10	(Controller PAW-B*2) Out of system, custom order product			1	
11	(Base) Out of system, custom order product			1	

Note: When using on a dolly, select from PAW- [CA / CP] -H.

Information shown on product nameplate



The CE mark ⑨ may not be affixed to some custom models.

3. System configuration

3.1 Operation range



- Rubber cushions are built in at the rotation ends for rotation range limit. However, the rubber cushions can not absorb severe shock. Do not use the arm in such a way that it collides against the rotation end.
Therefore, when designing working layout, keep enough operation buffer and prevent colliding against the rotation end.
- This product is exclusively for the Power arm series. Do not use it for any other purpose.

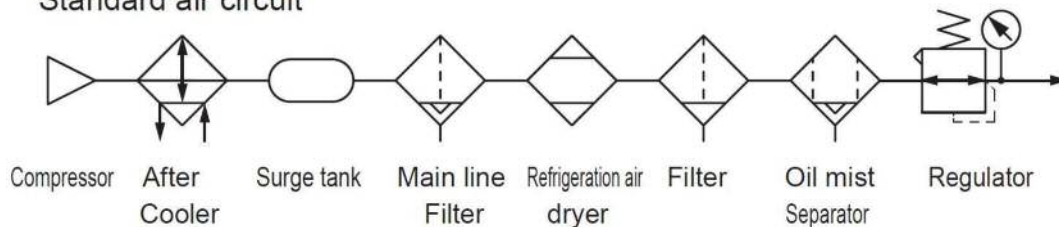


- Select Lock unit option to keep Power Arm orientation. If not select Lock unit option, Power Arm may not keep the orientation if installation surface is not leveled etc.

3.2 Pneumatic pressure source

- When using the product, supply pneumatic pressure in the range from [the required pressure (see the table of weight capacity under pressure on page 4) + 0.05 MPa] to 0.7 MPa.
- Supply clean air ([standard air circuit] compressed air quality grade: equivalent to 1.5.1 to 1.6.1).

Standard air circuit



- It is unnecessary to lubricate the product. Lubrication may cause troubles. Do not lubricate it.
- If carbides (carbon or tarry substances) in the compressor oil enter the circuit, the electromagnetic valves and cylinders may malfunction. Maintain and inspect the compressor with great care.



- Connect the pneumatic piping securely so that it will not be disconnected during use.
- Take care not to crush the piping or apply tension stress to it.

3.3 Air piping

- Piping for cylinder (PAW-AS: tube diameter 10: Quantity 1, PAW-AZ: tube diameter 10: Quantity 2): This piping is connected to the air cylinder in the Palletizing Arm unit and Power Arm unit through the block valve FPV contained in the Palletizing Arm unit and Power Arm unit.

Supply air controlled in a balanced state by the precision regulator (electropneumatic regulator).

- Piping for unlocking (tube diameter 4): This piping is connected to the pilot signal port of the block valve FPV contained in the Palletizing Arm unit and Power Arm unit.

When air is supplied, the valve will open, and the air controlled in a balanced state by the precision regulator (electropneumatic regulator) will be supplied to the air cylinder in the Palletizing Arm unit and Power Arm unit.

When air is discharged, the valve will close, and the air will be enclosed in the air cylinder, which will function as a lock in the vertical direction.



- The locking position may change in the vertical direction to a certain degree due to compression and expansion of the enclosed air.



- Supply air to the piping for unlocking 1 second or more after supplying the air controlled in a balanced state to the piping for cylinder.
If air is supplied simultaneously, Palletizing Arm unit and Power Arm will be unlocked before the pressure in the air cylinder in the Palletizing Arm unit and Power Arm unit increases, and the arm may fall.
- Take care not to crush the piping or apply tension stress to it.

[Only in the case of model with rotation lock (option: L)]

- The piping is branched in the Palletizing Arm unit and Power Arm unit and connected to the unlocking port of the rotation lock unit.

When air is supplied, the arm will be unlocked and can rotate freely.

When air is discharged, it will function as a lock in the rotation direction.



- The arm is locked mechanically by inserting the lock shoe, and almost no backlash will occur in the rotation direction.

3.4 Recommended air circuit



CAUTION

- Vertical lock of Power Arm is adopted Air brock system that seals cylinder chamber. If leave Power Arm unattended in the middle of stroke for a long time, the arms are fallen slowly because of small leakage.

Therefore, set all arms to lower end position when leave it.

If could not avoid to leave it unattended in the middle of stroke, please contact us.

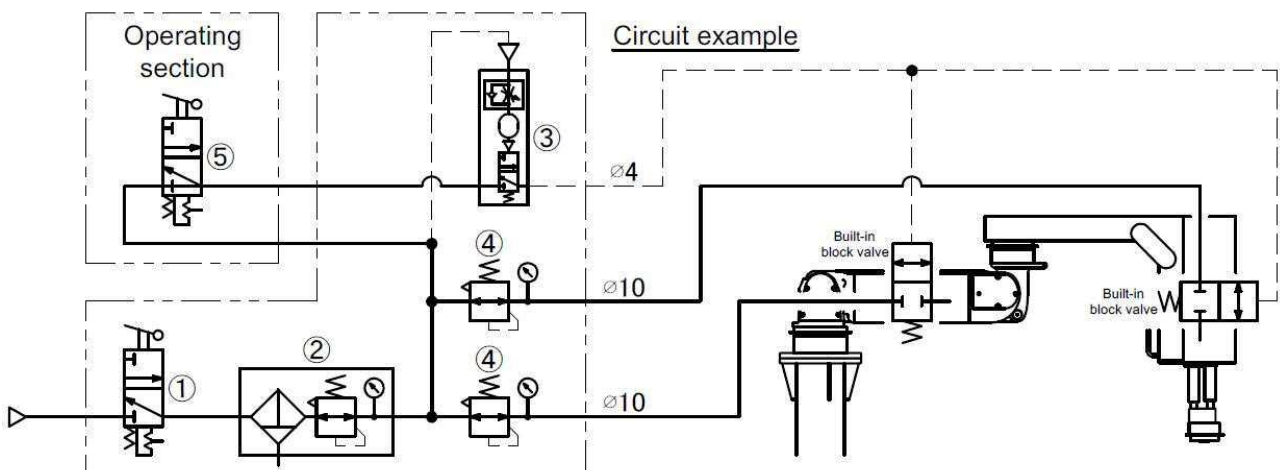


- The locking position may change in the vertical direction to a certain degree due to compression and expansion of the enclosed air.

3.4.1 Control at constant operating pressure (air circuit with one pressure mode)

One precision regulator is set, and a certain weight is constantly maintained in a balanced state.

This control is suitable for assisting a jig or tool that will not change in weight.



	Recommended equipment		Remarks	
①	Shut-off valve	V3000-10-W		
②	Filter/regulator	W3100-10-W		
③	Timer (on-delay)	PRT-E12	For operation preparation, Set time 1 second or more	
④	Precision regulator *	RP2000-10-08	Balance pressure adjustment	
⑤	select	Select valve	[Switch between operation and stop]	[Selection example] User selected
		Mechanical valve	[Drive only while pressing]	

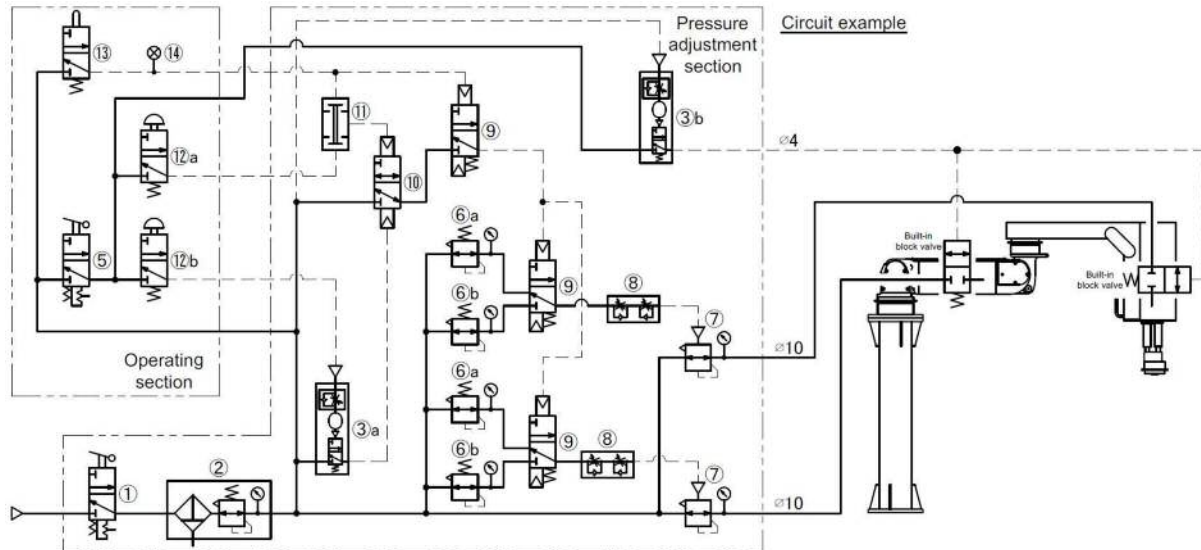
* PAW-AS-45(-S): Quantity 1

PAW-AZ-110(-S): Quantity 2

3.4.2 Control at constant operating pressure (air circuit with two pressure modes)

Two modes of balanced state are set in advance with two precision regulators for the presence and absence of transfer object, and the mode can be changed with a switch.

This control is suitable for lot production, etc. requiring continuous transfer of the same product.



		Recommended equipment		Remarks	
①		Shut-off valve	V3000-10-W		
②		Filter/regulator	W3100-10-W		
③	a	Timer (on-delay)	PRT-E12	Switch to "No" balancer status with long press	
	b			For operation preparation、Set time 1 second or more	
⑥	a	Precision regulator *1	RP1000-8-07	Transport item "ON" balance pressure regulation	
	b			Transport item "OFF" balance pressure regulation	
⑦		Precision regulator *2	RP2000-10-FL316286		
⑧		In-out speed controller	SCD2-04-H44	Changeover speed adjustment of the transport item "ON" and "OFF"	
⑨		Master valve *3	3KA111-M5		
⑩		Master valve	3KA121-M5		
⑪		AND valve	PLL-B12		
⑤	Select	Select valve	MS-00-SE1	[Switch between operation and stop]	[Selection example] User selected
		Mechanical valve	MS-00-PP	[Drive only while pressing]	
⑫	a	Push button valve	MS-00-PB1	Transfer item "ON" switching	
	b			Transfer item "OFF" for switching (long press)	
⑬		Roller lever valve	MS-00-RL	Seated switch for Transport item	
⑭		Air lamp	PXV-M151	ON indication when seated	

*1 PAW-AS-45(-S): Quantity 2

PAW-AZ-110(-S): Quantity 4

*2 PAW-AS-45(-S): Quantity 1

PAW-AZ-110(-S): Quantity 2

*3 PAW-AS-45(-S): Quantity 2

PAW-AZ-110(-S): Quantity 3



- The circuit shown above contains safety mechanisms, such as a transfer object seating switch and balanced state switching by long press of a button.



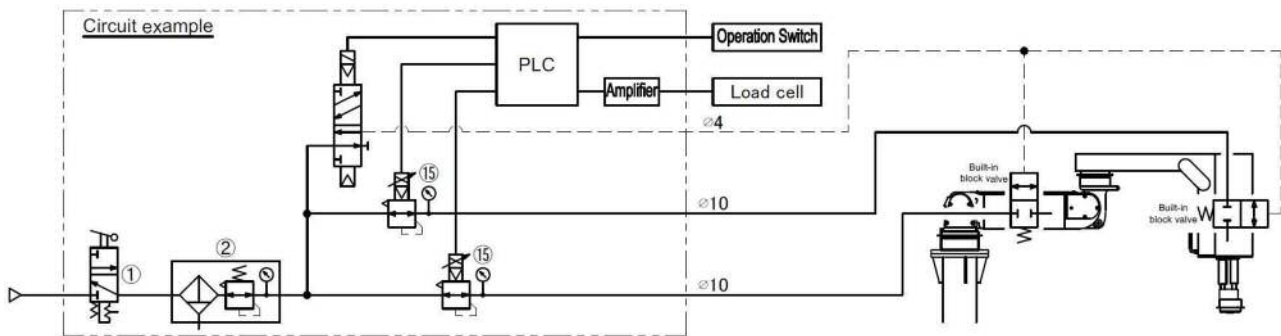
WARNING

- If the safety mechanisms are not contained in the circuit, serious accidents may be caused by jumping up due to fall of transfer object or sudden lowering due to switching operation failure.
- When creating the circuit, install safety mechanisms without fail, and perform risk assessment of the equipment.
- Design safe equipment and circuit to avoid unexpected malfunctions.

3.4.3 Control by automatic operating pressure regulation

The weight of the transfer object is detected by the load cell installed at the end of the arm, and the pressure is regulated by the electropneumatic regulator according to the weight.

This control is suitable for handling various kinds of transfer objects differing in weight.



	Recommended equipment		Remarks
①	Shut-off valve	V3000-10-W	
②	Filter/regulator	W3100-10-W	
⑮	Digital electro pneumatic regulator *	EVD-3900-110	For Transfer item balance adjustment
⑯	Valve	3GA210R-C4	Switch between operation and stop

* PAW-AS-45(-S): Quantity 1

PAW-AZ-110(-S): Quantity 2

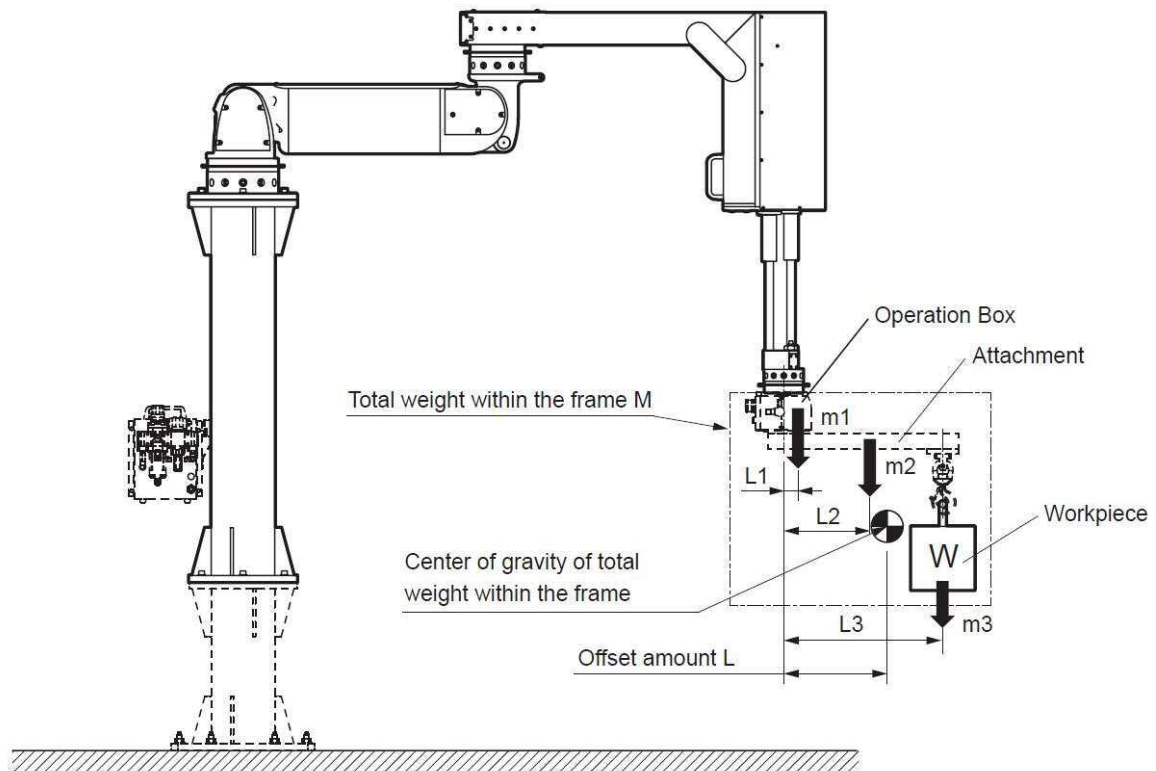
	<ul style="list-style-type: none"> The electrical wiring to the arm end can be laid within Palletizing Arm and Power Arm.
	<ul style="list-style-type: none"> When laying the electrical wiring within Palletizing Arm and Power Arm, use a robot cable (movable cable) for machine use with an outside diameter of 12 mm or less. When laying the cable, take care not to twist or bend it or entangle it with the air piping. When the electrical wiring is laid in Power Arm, use the product at 24 V AC/DC or less. Arrange and secure the electrical wiring separately from the air piping.
 WARNING	<ul style="list-style-type: none"> When creating the circuit, install safety mechanisms without fail, and perform risk assessment of the equipment. Design safe equipment and circuit to avoid unexpected malfunctions.

3.5 Operation

	<ul style="list-style-type: none"> When creating the circuit, install safety mechanisms without fail, and perform risk assessment of the equipment. Rubber cushions and Shock absorber are built in at the upper, lower and rotation ends. However, the rubber cushions are designed only for angular control and cannot absorb severe shock. Do not use the arm in such a way that it collides against the upper, lower or rotation end.
	<ul style="list-style-type: none"> If the arm is left at the lower end with no pressure in the cylinder chamber, the internal cushion rubber may adhere. When applying pressure after leaving, gradually apply pressure while lifting up the operation handle to separate the adhering rubber.

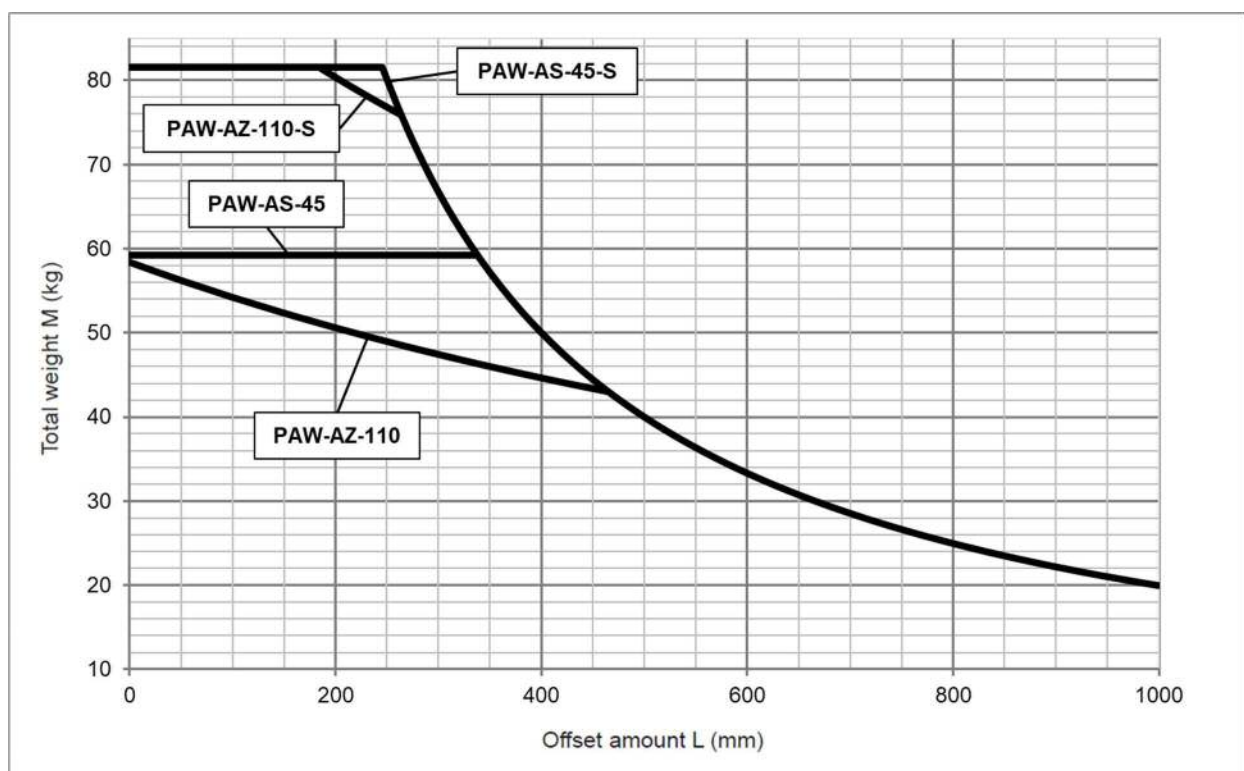
3.6 Moment load

- When using the jig and workpiece attached to the arm end with an offset, design so that the total weight is less than the value given below.



*Total weight: $M = \text{Operation Box weight: } m_1 + \text{Hook Attachment weight: } m_2 + \text{Workpiece: } m_3$

$$L = \frac{m_1 \times L_1 + m_2 \times L_2 + m_3 \times L_3}{M}$$



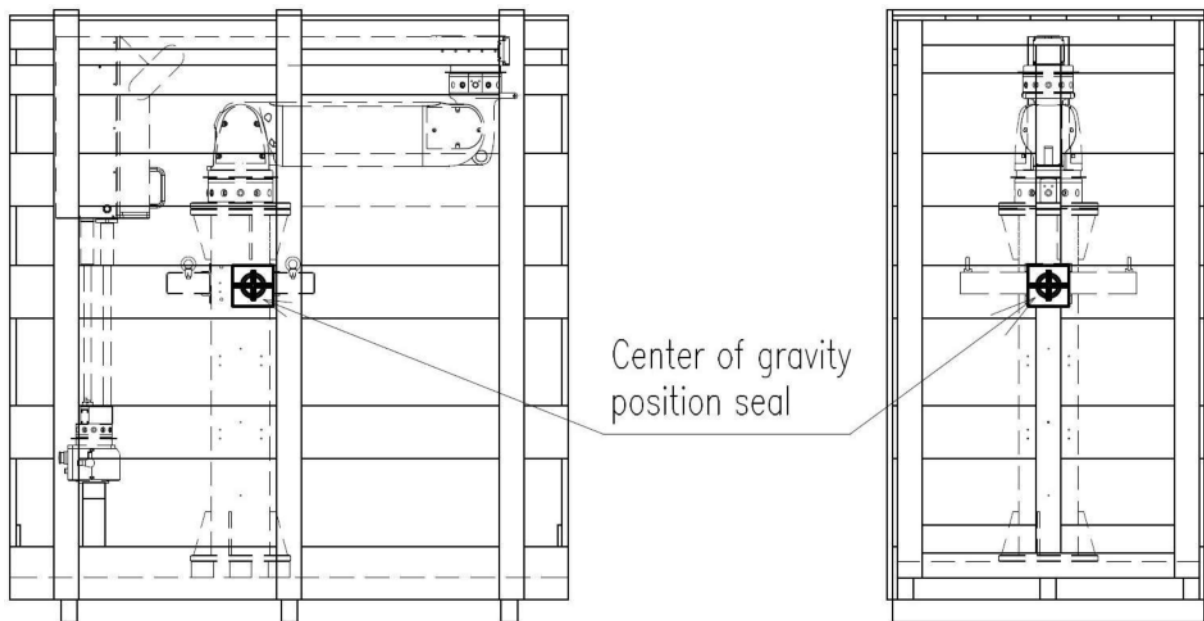
4. Installation procedure

4.1 Transportation method

- The product is packaged in a wooden crate.

The center of gravity position is high, and the package could tip over.

A center of gravity position label is attached onto the wooden crate as a guide for transportation. Take special care to prevent the package from tipping over when transporting the product with a forklift, etc.



- Crated items shall be transported by any of the following methods.

1. Craning
2. Hoisting by forklift or handlift



- The crane, forklift and handlift shall be operated by experts (the crane and forklift shall be operated by qualified experts) wearing protective equipment, such as helmets and safety shoes, and the hoisting height shall be the minimum necessary.
- When hoisting or forklifting the product, support the lowermost surface. Hoist or lift it in a well-balanced state (at first, hoist or lift it slightly, and make sure that it is well-balanced before transporting).



- Never transport the product by any other method other than the above two methods. It is prohibited to manually transport.
- It is prohibited to stack crates.

4.2 Unpacking method

- The product shall be unpacked by a service person.
- Unpack each crate or box after confirming that the top side is up.



- For the crates, nails and staplers are used. When handling the crates, wear protective equipment, such as a helmet, safety shoes, long-sleeved work clothing and protective gloves.
- After unpacking, dispose of unnecessary packing materials in accordance with the local laws and government ordinances.

4.3 Storage procedure

- During storage, the ambient temperature shall be -10 to 60°C (non freezing)

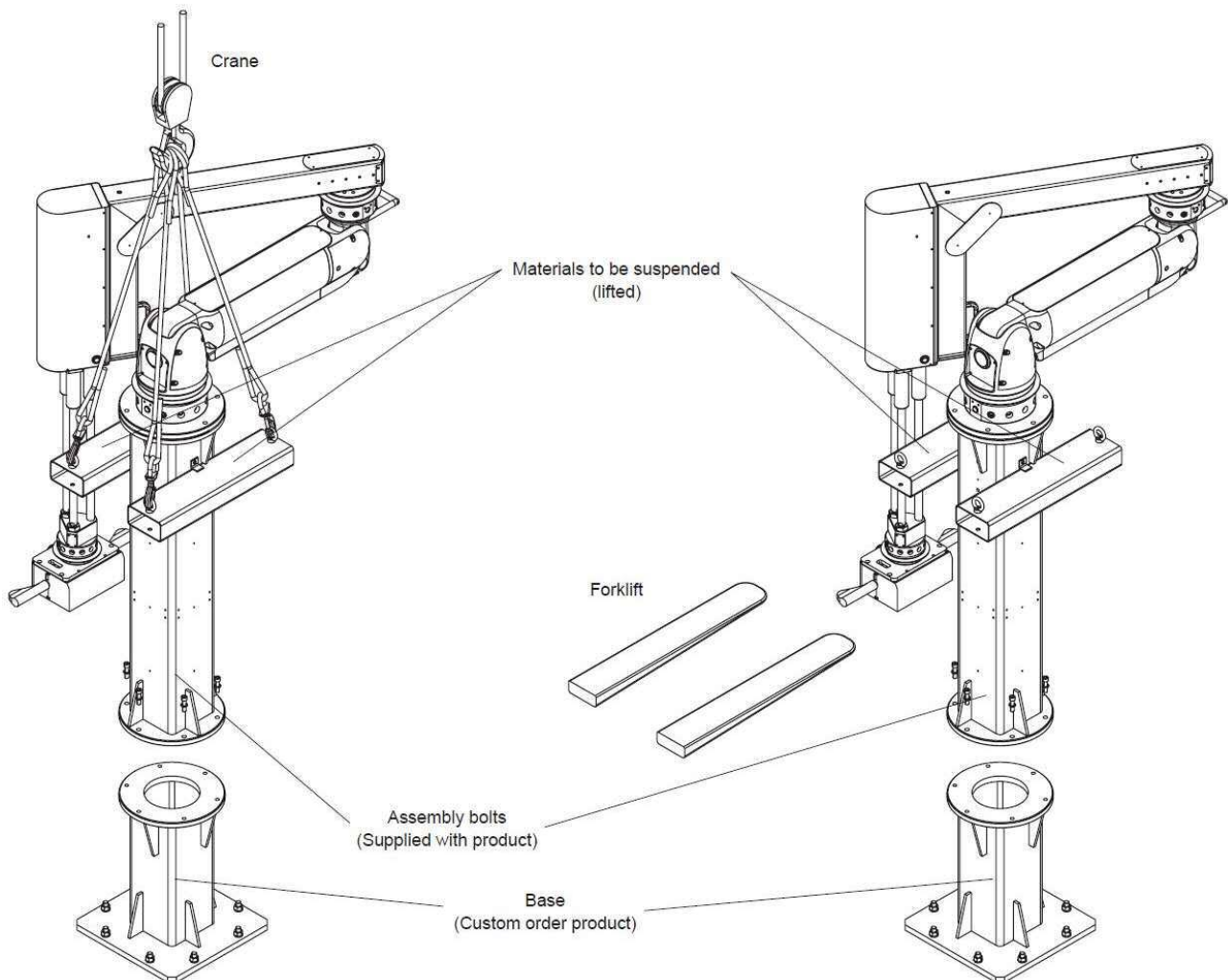
The ambient humidity shall be 30 to 85%RH (non condensing).



- Avoid storing the product under the following environmental conditions.
 - Place where the product may be exposed to direct sunlight or radiation heat
 - Place close to fire
 - Place where the product may be splashed with water or oil
 - Place with chips, garbage or dust
 - Place where corrosive gas or combustible gas may generate
 - Place where vibration or shock may be applied to the product
 - Place where X-ray is used
 - Place with salty air or many organic solvents

4.4 Installation method

- A crane or forklift, etc., that supports the product weight is required for setting and installation.
- Lifting (carrying) members are attached to the shipped product. Lift the product with a crane or carry with a forklift, set it on the stand, and install and assemble it.



	<ul style="list-style-type: none"> ▪ Products shall be set and installed by any of the following two methods. <ol style="list-style-type: none"> 1. Craning 2. Hoisting by forklift or handlift ▪ The crane, forklift and handlift shall be operated by experts (the crane and forklift shall be operated by qualified experts) wearing protective equipment, such as helmets and safety shoes, and the hoisting height shall be the minimum necessary. ▪ Use wire rope and belt slings, etc., that have a sufficient safety load in respect to the weight of the axis combination product. ▪ When lifting the product with a crane, lift it so that the weight is balanced and evenly applied on the four eyebolts. (Lift slightly first and confirm that it is balanced before setting and installing the product.) ▪ Eyebolt threads and nuts are provided on the inner side of the lifting members (square steel pipes). If the forklift claws are inserted into the openings, it may make the load unstable. Lift from under the lifting members.
	<ul style="list-style-type: none"> ▪ Never set or install the product by any other method than the above two methods. It is prohibited to manually set or install. ▪ Do not carry inserting the forklift claws into the openings of the lifting members (square steel pipes). ▪ Do not lift up or carry the product at a section other than the lifting member (such as the arm section). The product could be damaged.

- Set the product on the stand, and assemble with the enclosed hexagon socket bolts and washer. Tighten the bolts evenly.

Tightening torque: $43\text{N}\cdot\text{m} \pm 10\%$

- Confirm that the product is securely fixed before removing the wire rope, belt sling, or forks.
- Remove the lifting members after installation is completed. Do not use the equipment with the lifting members attached.
- The removed lifting members, bolt, resin washer are used when moving the product. Store them where they will not be misplaced.

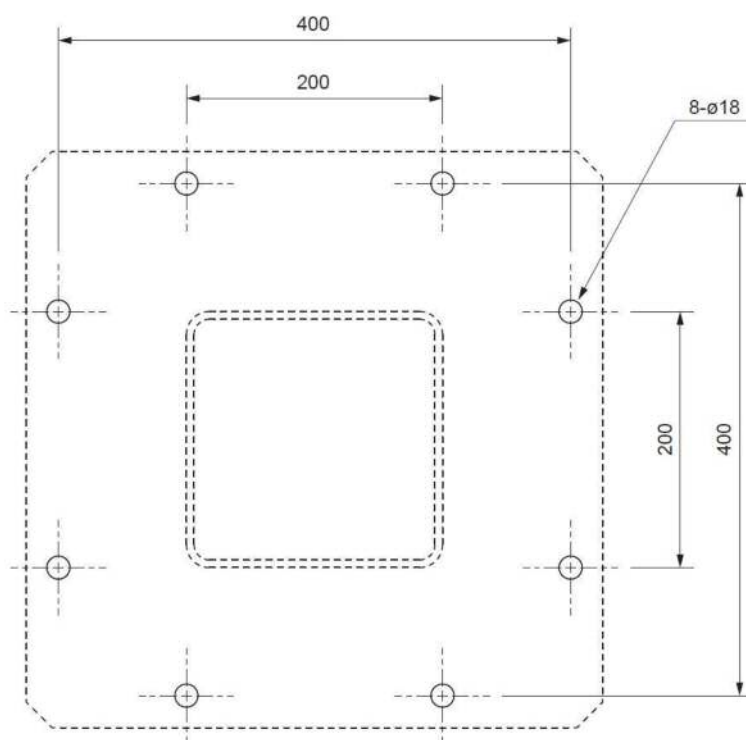
4.5 Installation method of Base (Custom order product)

4.5.1 Installation environment

- When installing the product on an existing concrete floor (the floor shall be reinforced (with bars with a diameter of 6 or more)), use chemical anchors (made by Nihon Decoluxe Co., Ltd.).
 - For the type of chemical anchor, anchor reinforcing bar size, quantity and installation dimensions, see the following table and figure. The construction method (drilling method) shall conform to the instruction manual for the chemical anchor.

Chemical anchor type	Anchor reinforcing bar size	Quantity
R-16N or R-16LN	W5/8" or M16	8

Placement dimensions



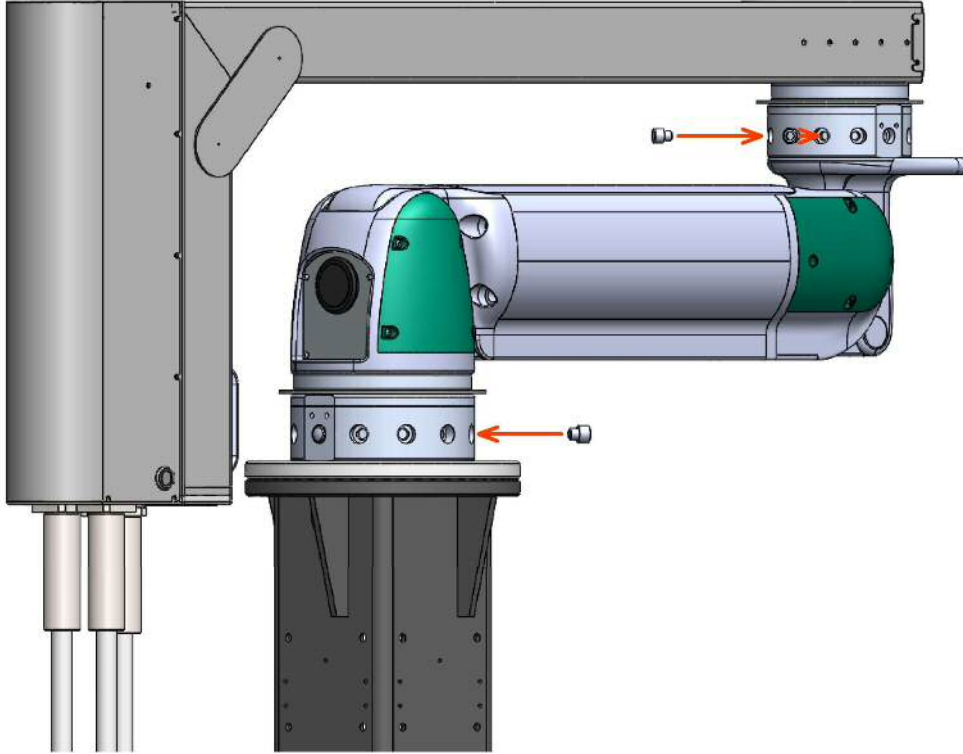
- When installing the product, make sure that the installation surface is leveled correctly. If the surface is not leveled, the arm may not be held in position due to inclination of the tip of the arm or swing of the arm when the rotation lock is not used.
- Make sure to have the base installed by a professional contractor.

- The dedicated Base (custom order product) is available for installation on a dolly and Base. When installing the product on a mount or a cart, use bolts of strength class 10.9 or 12.9, and ensure a screw-in depth of 1.5D or more.
- Select the dolly from PAW- [CA / CP] -H.

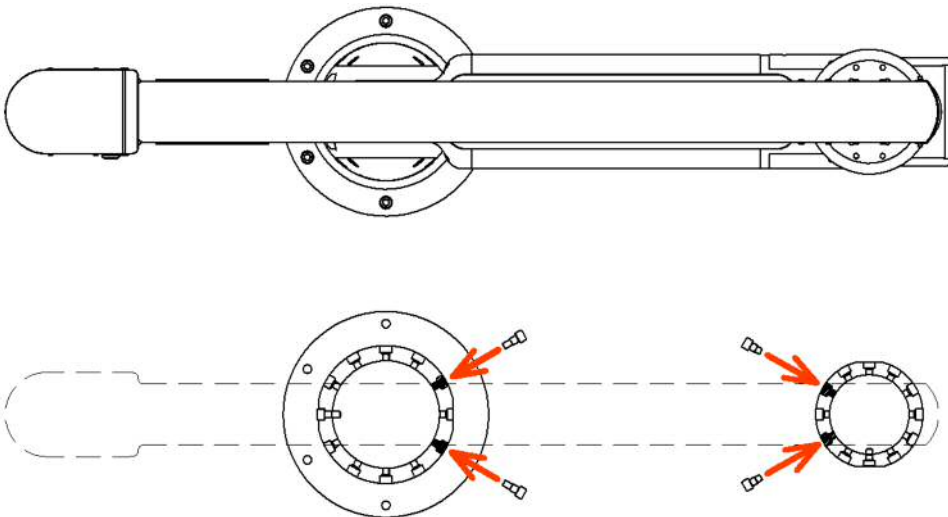
4.6 Relocation of product in use

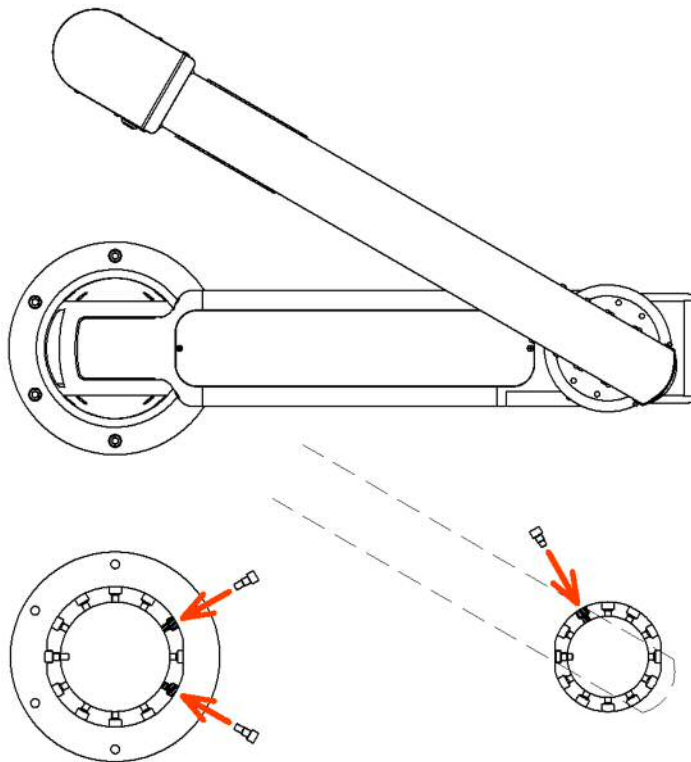
- When relocating the product in use, observe the following procedure.

1. Move the movement range controlling stopper bolts of all rotation units to the following positions to prevent rotation of all shafts.



PAW-AS-45, PAW-AZ-110



PAW-AS-45-S, PAW-AZ-110-S

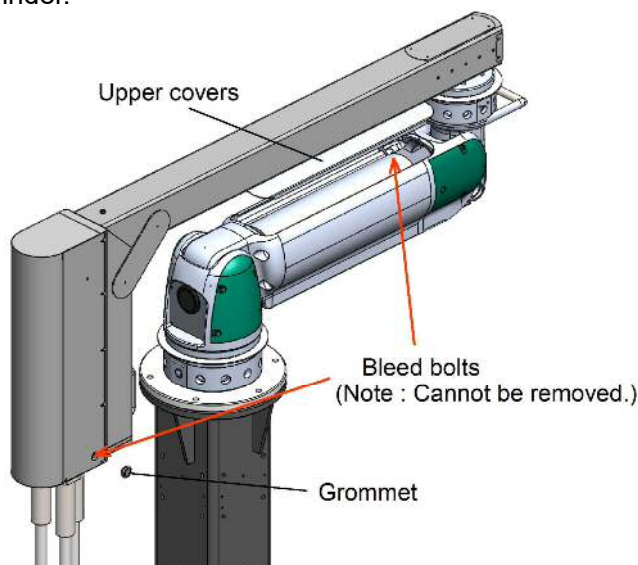
2. Move all shafts to the lower end, and stop air supplied to the equipment.

- When the product is electrically controlled, shut off the power supply to the electric system.



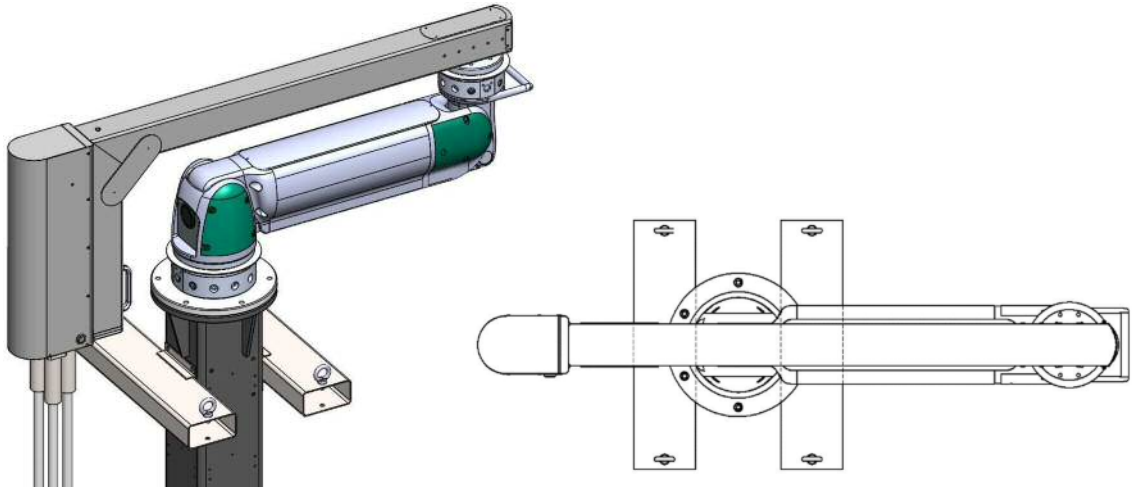
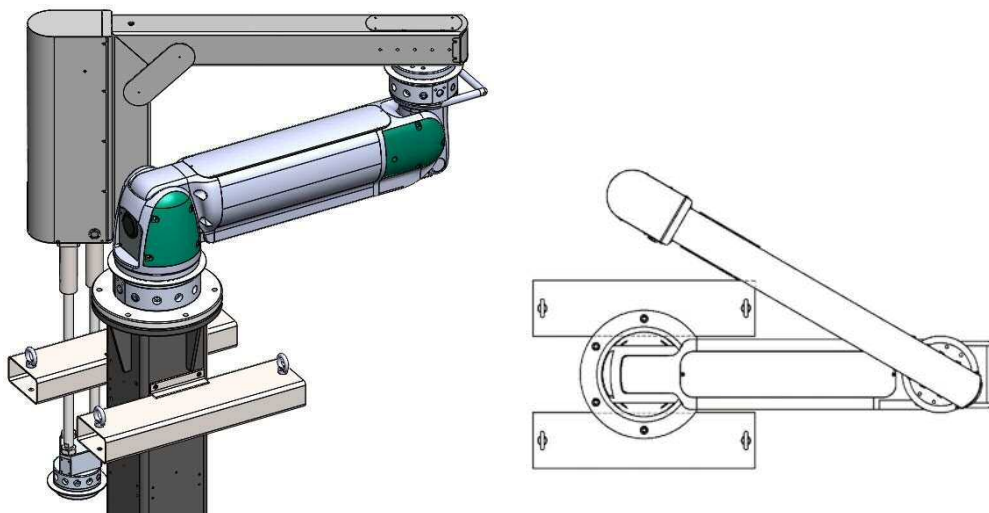
- Be sure to shut off the power supply to the electric system. If the electric wiring is disconnected without shutting off the power supply, electric shock may be caused.

3. Remove the grommet of the Palletizing Arm unit and the upper covers of the Power Arm unit, and loosen the bleed valves marked in yellow two or three turns to discharge the residual pressure in the cylinder.



- The bleed bolts cannot be removed. If they are forcibly removed, they may be damaged. Do not remove them.

4. When there are any jigs or attachments on the shaft end, remove all of them to handle only the product.
5. Attach the lifting member, bolt, and resin washer.

PAW-AS-45, PAW-AZ-110**PAW-AS-45-S, PAW-AZ-110-S**

6. Move and install the product by lifting it with a crane or forklift in the same manner as section 4.4 Installation method.



- Do not lift up or carry the product at a section other than the lifting member (such as the arm section).
The product could be damaged.

5. How to use

5.1 Method for controlling the rotation range



- Rubber cushions and shock absorber are built in at the upper, lower and rotation ends. However, the rubber cushions are designed only for rotation angular control and cannot absorb severe shock.

Do not use the arm in such a way that it collides against the upper, lower or rotation end



- If the arm is left at the lower end with no pressure in the cylinder chamber, the internal cushion rubber may adhere. When applying pressure after leaving, gradually apply pressure while lifting up the operation handle to separate the adhering rubber.

5.1 Rotation Range

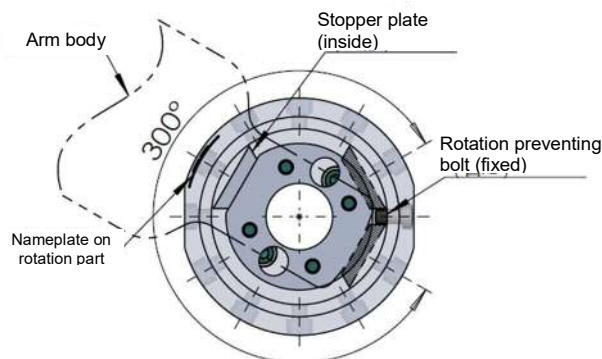
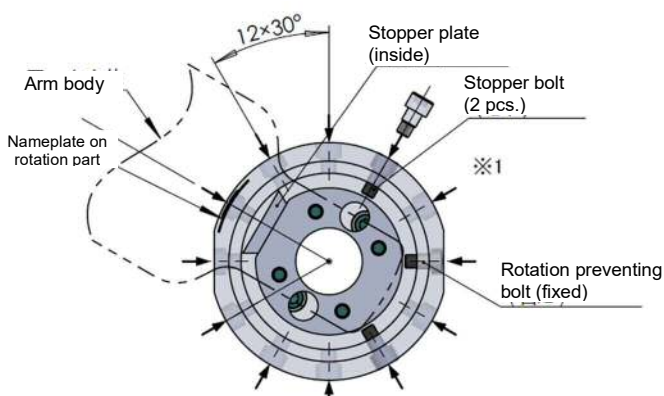


- The adjustment of the rotation range must be performed by a repair person.

5.1.1 Restricting the rotation range

- The rotation range of each rotation part can be controlled by screwing the stopper bolts into the adjustment holes.

The range can be adjusted by a pitch of 30°. When the stopper bolts are removed, the part can rotate up to 300°.

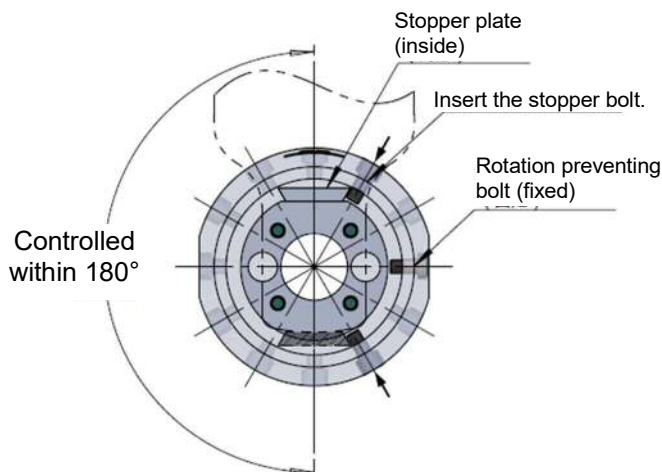


The stopper bolt cannot be inserted in the position *1 on Tip rotation unit (PAW-RU-T) provided with the lock unit.

[Method for adjusting the rotation range]

A stopper plate is contained in the nameplate position of each rotation part.

Screw the stopper bolt into the adjustment hole according to the desired rotation angle.



Point

It is recommended that the rotation range of the rotation part onto which the Palletizing Arm, Power Arm, or SCALA arm is connected, is less than 150° (the axis motion can be easily controlled).

6. Assembly of unit product

- The units shall be assembled by a service person who has sufficient knowledge of machine assembly and pneumatic equipment assembly.
 - Some of the Palletizing Arm unit, Power Arm unit, rotation units, SCARA arm unit and base plate are heavy. Assemble the heavy units using a crane.



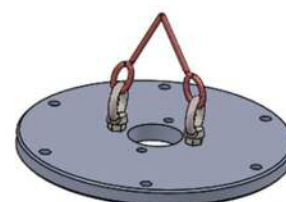
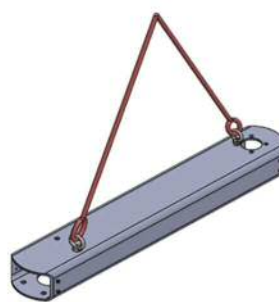
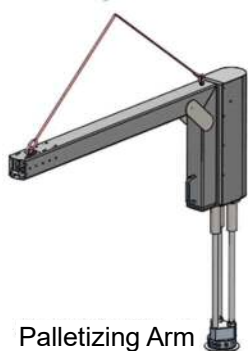
- The crane shall be operated by a qualified, skilled person wearing safety equipment, such as a helmet and safety shoes, and the hoisting height shall be the minimum necessary.
- Use wire ropes or belt slings having sufficient safety load for the weight of the multi-axis product.
- When moving and installing the product, hoist or lift in a well-balanced state (at first, hoist or lift it slightly, and make sure that it is well-balanced before transporting).

- The Power Arm unit is provided with four eyebolts for hoisting before shipment. Other units are not provided with hoisting attachments. Prepare necessary parts before assembly.

	Required parts
Palletizing Arm unit PAW-C[stroke]-Z-[Inter-axis length]	M10 eyebolt: 1 pc. M12 eyebolt: 1 pc. M10 hexagon nut (type 1): 1 pc. M12 hexagon nut (type 1): 1 pc.
Rotation unit PAW-RU-Z	M12 eyebolt: 2 pcs. M12 hexagon nut (type 1): 2 pcs.
SCARA arm unit PAW-SU-XS-FLA30992	M10 eyebolt: 1 pc. M12 eyebolt: 1 pc. M10 hexagon nut (type 1): 1 pc. M12 hexagon nut (type 1): 1 pc.
Base plate PAW-BP-Z	M12 eyebolt: 2 pcs. M12 hexagon nut (type 1): 2 pcs.

* Use eyebolts and hexagon nuts (type 1) (made of steel) conforming to the standards (ISO/IEC, JIS, etc.) in the user's country and region.

- Hoisting method



- Units not shown above weigh 15 kg or less and do not need hoisting attachments. Handle the units taking great care not to drop them or pinch your fingers.

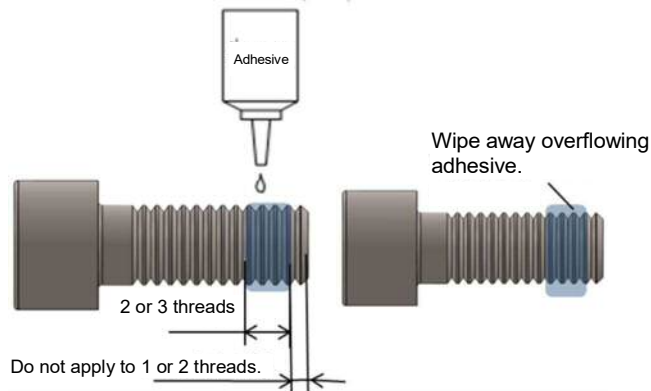
- Pneumatic equipment will be required in the assembly process. Prepare one changeover valve (miniature mechanical selector valve MS-01-SE1 or the like.) that can be kept in a state and one precision regulator RP2000 unit for PAW-AS-45 (-S) and two for PAW-AZ-110(-S).
- When tightening each part, use a torque wrench, and tighten the part to the specified tightening torque.



- Tighten to the specified tightening torque. If the specified tightening torque is not achieved, malfunction may be caused by looseness of bolts, etc. during use.

- If it is instructed to apply adhesive to the bolts, apply a small amount as shown right. Wipe away overflowing adhesive.

Recommended adhesive: Medium strength type, Loctite 243 (Henkel)
Scotch-Weld TL43J (3M)



- Pay attention to the application quantity of the adhesive. If a large quantity is applied, the overflowing adhesive may enter the inside, thereby causing malfunction.

6.1 Preparation

6.1.1 Required parts

■ Materials required for all models

- Spiral tube:
Recommended product: Polyethylene, OD 10 to 12
TS-9 (Hellermann Tyton)
- Binding band:
Recommended product: Appropriate quantity
AB80 (Hellermann Tyton)
- [In the case of model with rotation lock (option: L)]: 0.2-mm shim, 2 pcs.
(To be used for positioning during assembly of the rotation lock unit)

6.1.2 Required parts

- Prepare parts appropriate to the model number (combination of axes), and cut the tube to the specified length (tolerances $^{+5}_0$).



- Cut the tube at right angles with the dedicated cutter.

Dedicated cutter: AZ-1200 (Aoi Co., Ltd.)

Common to PAW-AS-45 models	Wear-resistant tube ARU-10 x 6.5 (Aoi Co., Ltd.)	4936 mm
	Fitting Y-shaped tee GWY44-0	2 pcs.
	Soft nylon tube F-1504 (CKD Corporation)	2427 mm
	Soft nylon tube F-1504 (CKD Corporation)	899 mm
	Soft nylon tube F-1504 (CKD Corporation)	1580 mm
In addition to the above		
PAW-AS-45	Fitting blank plug GWP4-B	3 pcs.
PAW-AS-45-L	Soft nylon tube F-1504 (CKD Corporation)	424 mm
	Soft nylon tube F-1504 (CKD Corporation)	400 mm
	Soft nylon tube F-1504 (CKD Corporation)	1920 mm

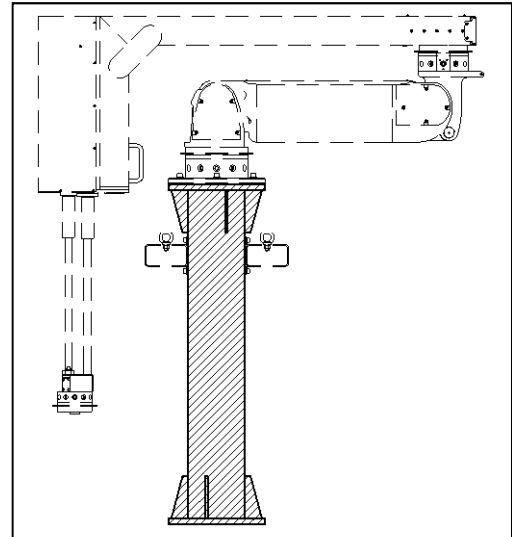
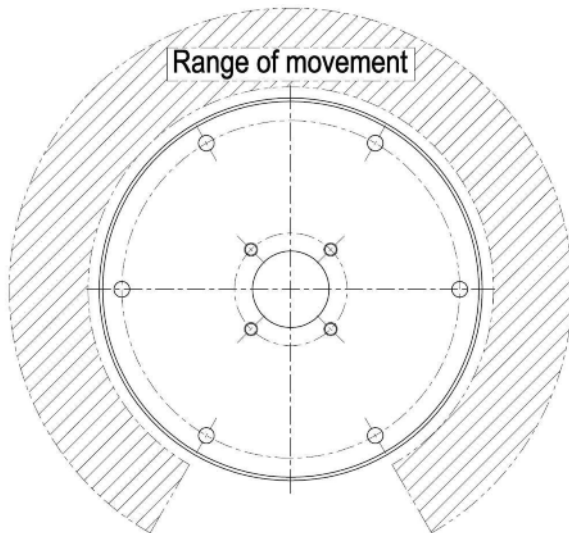
Common to PAW-AS-45-S models	Wear-resistant tube ARU-10 x 6.5 (Aoi Co., Ltd.)	4936 mm
	Fitting Y-shaped tee GWY44-0	2 pcs.
	Soft nylon tube F-1504 (CKD Corporation)	2827 mm
	Soft nylon tube F-1504 (CKD Corporation)	899 mm
	Soft nylon tube F-1504 (CKD Corporation)	1180 mm
In addition to the above		
PAW-AS-45-S	Fitting blank plug GWP4-B	3 pcs.
PAW-AS-45-S-L	Soft nylon tube F-1504 (CKD Corporation)	424 mm
	Soft nylon tube F-1504 (CKD Corporation)	400 mm
	Soft nylon tube F-1504 (CKD Corporation)	1920 mm

Common to PAW-AZ-110 models	Wear-resistant tube ARU-10 x 6.5 (Aoi Co., Ltd.)	5105 mm
	Fitting Y-shaped tee GWY44-0	1 pc.
	Soft nylon tube F-1504 (CKD Corporation)	2296 mm
	Wear-resistant tube ARU-10 x 6.5 (Aoi Co., Ltd.)	2626 mm
	Soft nylon tube F-1504 (CKD Corporation)	970 mm
	Soft nylon tube F-1504 (CKD Corporation)	1580 mm
In addition to the above		
PAW-AZ-110	Fitting blank plug GWP4-B	3 pcs.
PAW-AZ-110-L	Soft nylon tube F-1504 (CKD Corporation)	797 mm
	Soft nylon tube F-1504 (CKD Corporation)	400 mm
	Soft nylon tube F-1504 (CKD Corporation)	1920 mm

Common to PAW-AZ-110-S models	Wear-resistant tube ARU-10 x 6.5 (Aoi Co., Ltd.)	5105 mm
	Fitting Y-shaped tee GWY44-0	1 pc.
	Soft nylon tube F-1504 (CKD Corporation)	2696 mm
	Wear-resistant tube ARU-10 x 6.5 (Aoi Co., Ltd.)	3026 mm
	Soft nylon tube F-1504 (CKD Corporation)	970 mm
	Soft nylon tube F-1504 (CKD Corporation)	1180 mm
In addition to the above		
PAW-AZ-110-S	Fitting blank plug GWP4-B	3 pcs.
PAW-AZ-110-S-L	Soft nylon tube F-1504 (CKD Corporation)	797 mm
	Soft nylon tube F-1504 (CKD Corporation)	400 mm
	Soft nylon tube F-1504 (CKD Corporation)	1920 mm

6.2 Stand

- Note that the direction of the base plate in the possible rotation range has been determined.

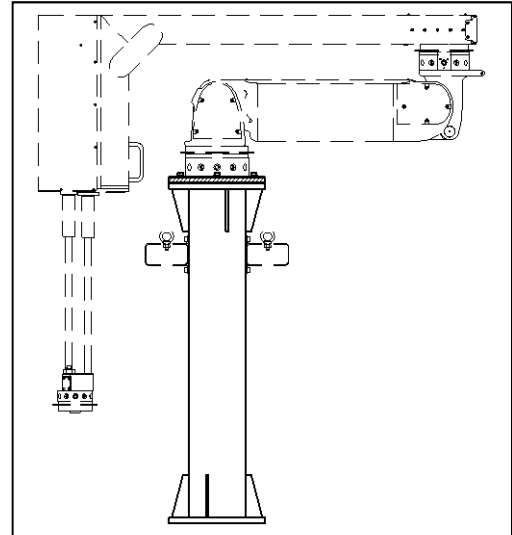
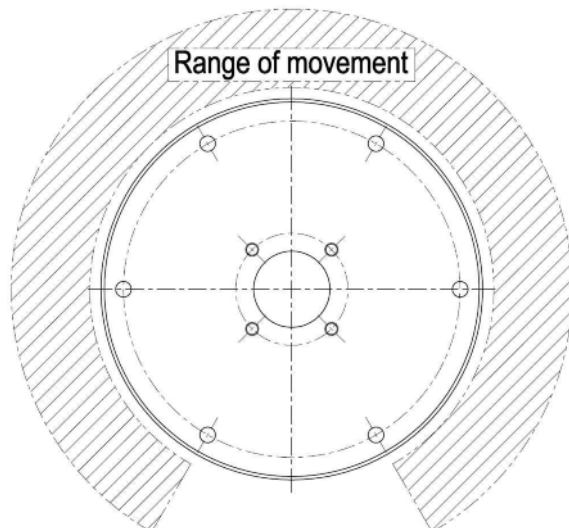


6.3 Base plate

- Set the base plate on the stand, and evenly tighten the bolts and washers enclosed with the stand.

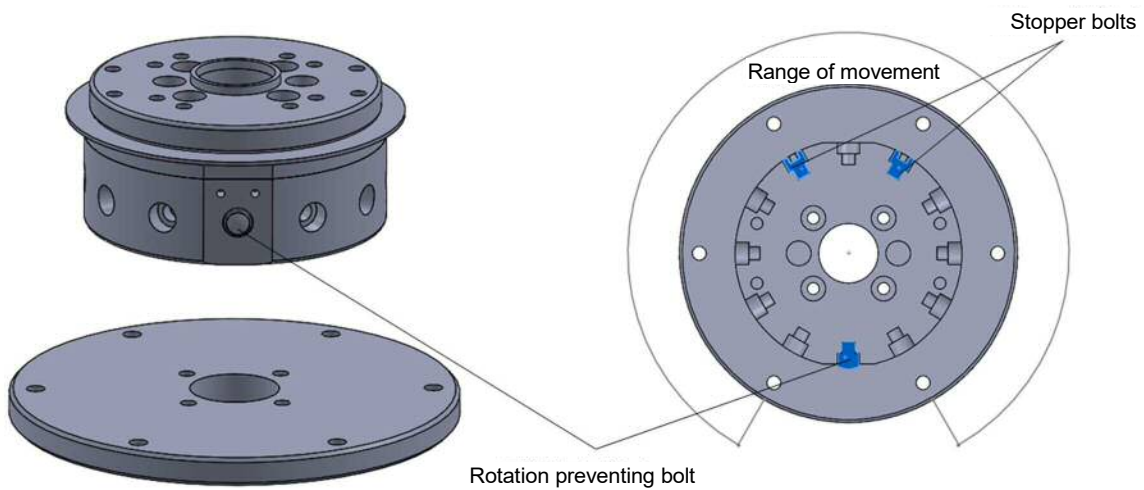
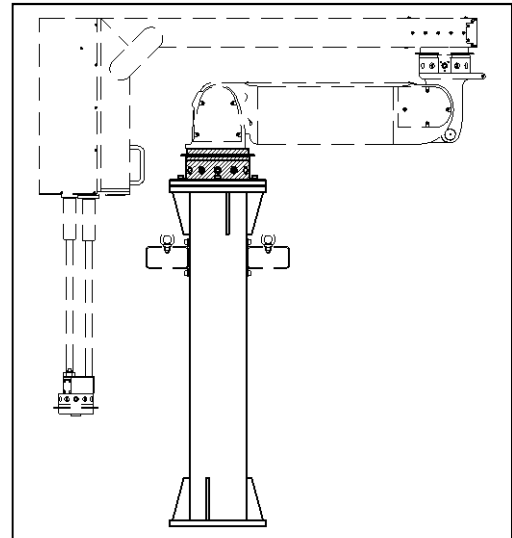
Tightening torque	$43\text{N}\cdot\text{m}\pm 10\%$
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- Note that the direction of the base plate in the possible rotation range has been determined.

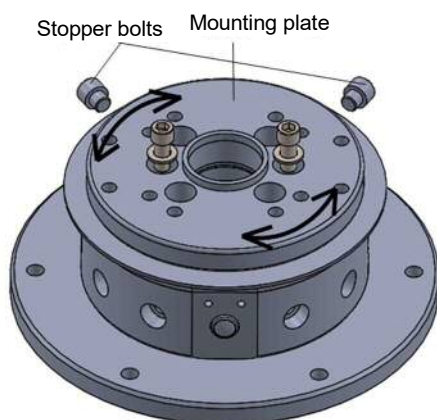


6.4 Rotation unit (lowermost)

- Put the rotation unit inserting the rotation unit boss into the center hole in the base plate.
- Adjust the direction.



- Remove the two stopper bolts, turn the mounting plate, and tighten the supplied bolts and washers in two positions.

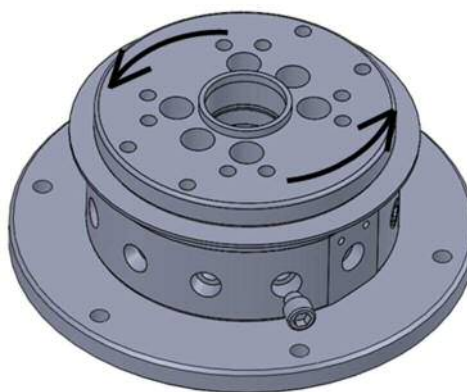


Tightening torque

43N·m±10%

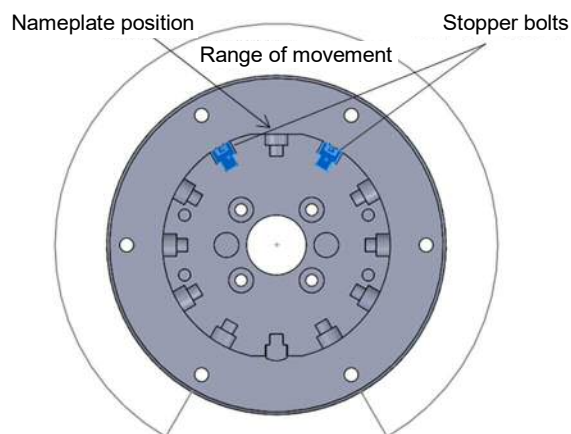
Point

When removing the first stopper bolt, push the mounting plate to the other stopper bolt, and the bolt can be removed easily.

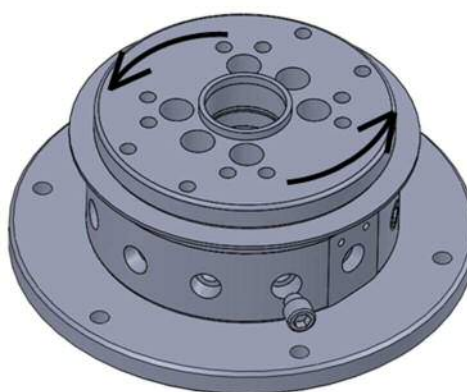


- Fit the washers without fail.
- Apply adhesive to the bolts.

- Return the nameplate to the original position (see the following figure), and insert the removed stopper bolts again.

**Point**

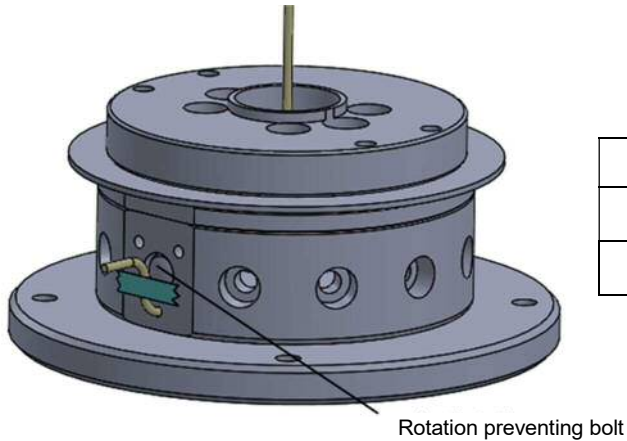
When inserting the second stopper bolt, push the mounting plate to the other stopper bolt, and the bolt can be inserted easily.



- After inserting the stopper bolts, make sure that the mounting plate does not turn. If it turns, correct the stopper bolt positions.

[Only in the case of model with rotation lock (option: L)]

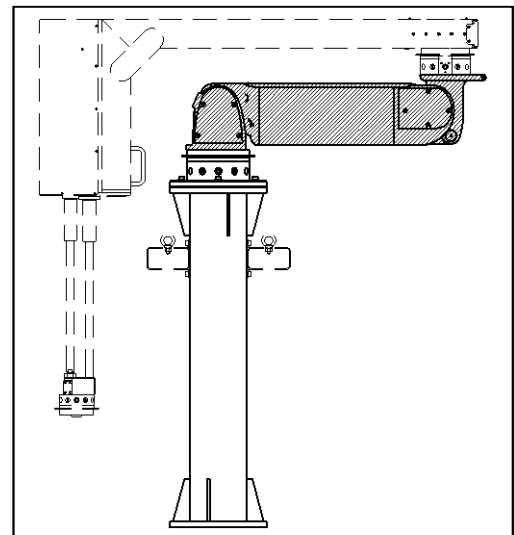
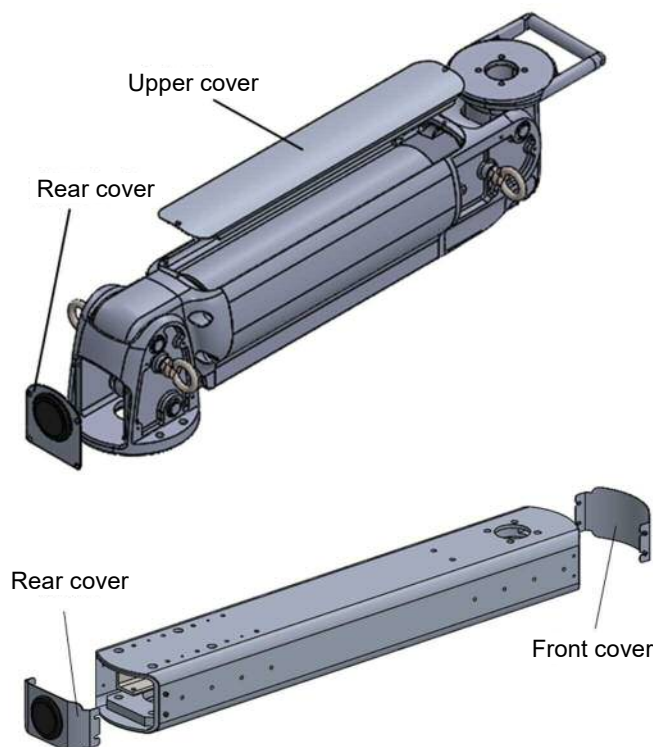
- Insert the 4-diam tube prepared in **6.1.2** into the hole under the rotation preventing bolt as shown in the following figure, and pull it out from the upper surface of the rotation unit.
 - When the length of the tube over the upper surface reaches about 50 mm, temporarily secure the tube with masking tape or the like.



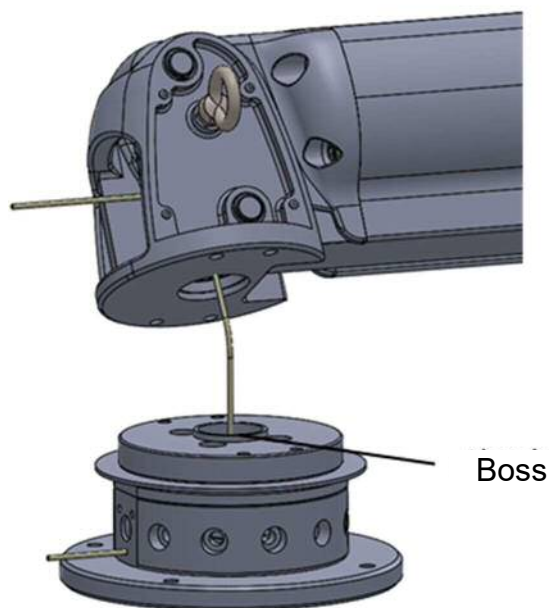
Length of inserted tube	
PAW-AS-45(-S)	424 mm
PAW-AZ-110(-S)	797 mm

6.5 Power Arm unit SCARA arm unit

- Remove the upper cover and rear cover of the Power Arm unit or the front cover and rear cover of the SCARA arm unit.

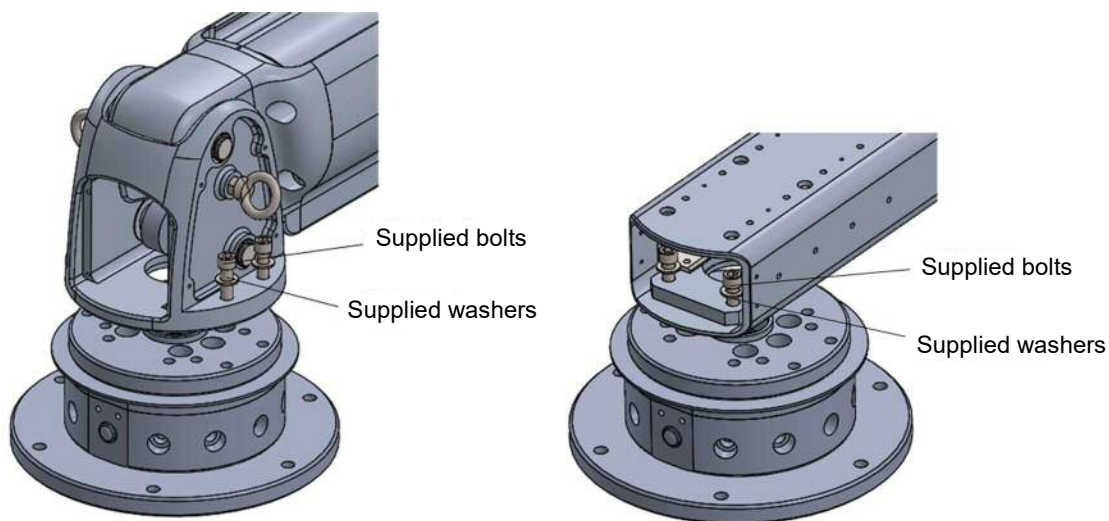


- Place the Power Arm unit or the SCARA arm unit inserting the rotation unit boss into the hole in the arm unit.



- When the unit is provided with the rotation lock (option: L), insert the 4-diam tube pulled out in 6.4 into the mounting hole. Take care not to pinch the tube.

- Tighten the supplied bolts and washers.



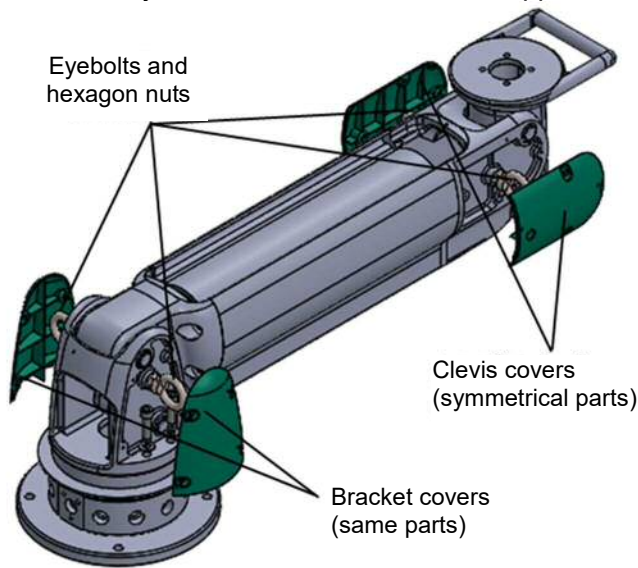
Tightening torque			Supplied bolt
PAW-AZ-110(-S)	Power Arm unit	43N·m±10%	M12 x 45
PAW-AS-45(-S)	SCARA arm unit	43N·m±10%	M12 x 40



- Fit the washers without fail.
- Apply adhesive to the bolts.

[In the case of PAW-AZ-110(-S)]

- Remove the eyebolts and nuts, and fit the supplied covers.



Tightening torque

 $1.2\text{N}\cdot\text{m}\pm 10\%$ 

- Discard the removed eyebolts and nuts. They must not be reused.

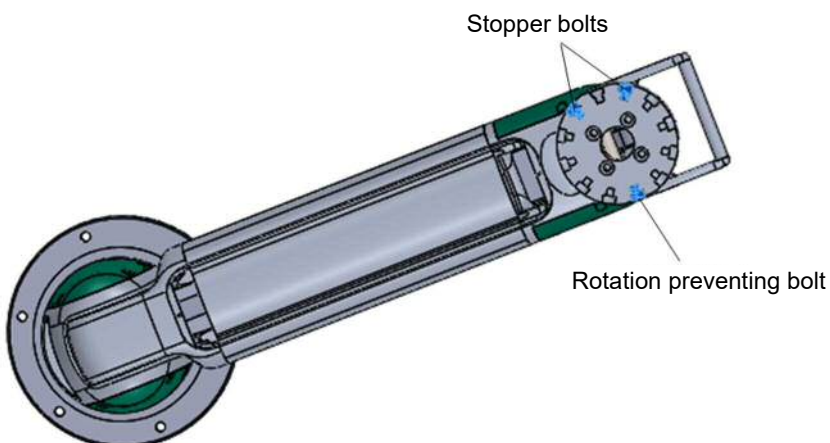
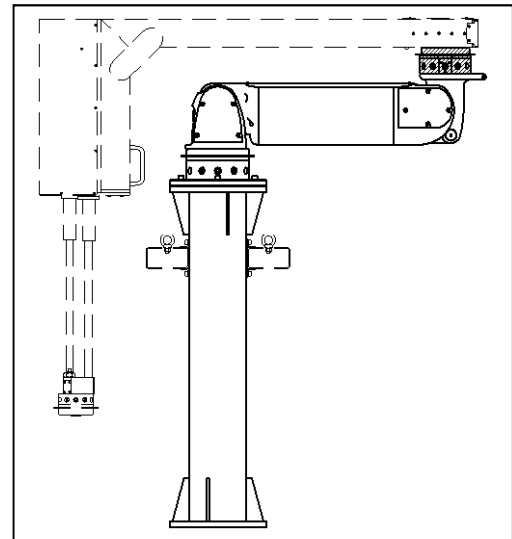
6.6 Rotation unit (middle position)

- Place the Power Arm unit or the SCARA arm unit inserting the rotation unit boss into the center hole in the arm unit.
- Adjust the direction based on the rotation preventing bolt position.

PAW - [AS - 45 , AZ - 110]

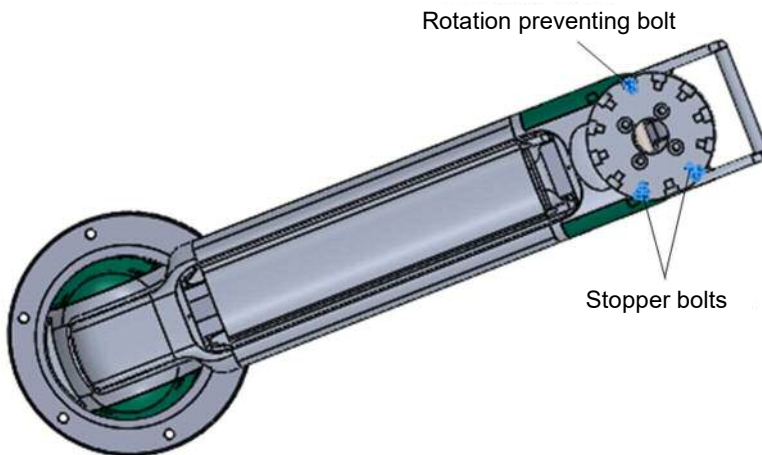
Bending direction: No symbol

-> **The rotation preventing bolt is on the right side when viewed from the base plate.**



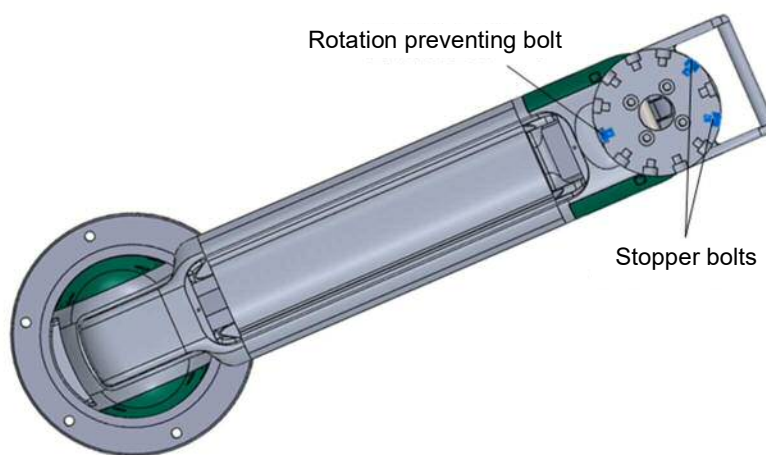
Bending direction: C

-> The rotation preventing bolt is on the left side when viewed from the base plate.



PAW - [AS - 45 , AZ - 110] - S

-> The rotation preventing bolt should come to the front when viewed from the base plate.



- Remove the stopper bolts, turn the mounting plate, and tighten the supplied bolts and washers in the two positions.

(The same work as in **6.4**. See page 26.)

Tightening torque	25N·m±10%
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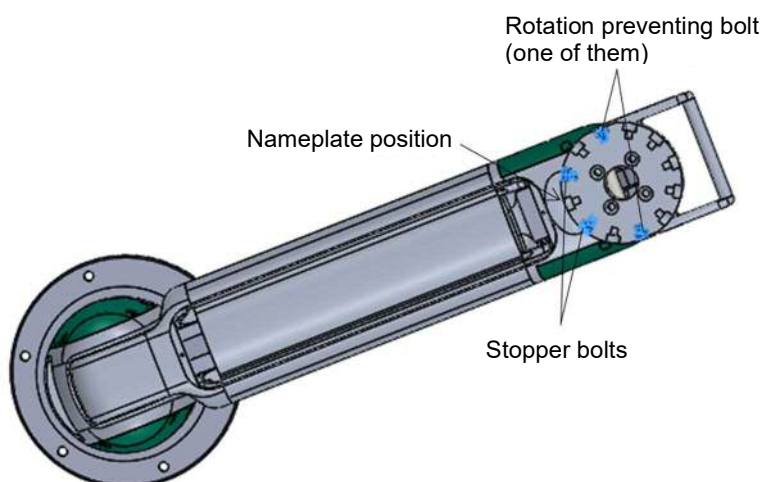


- Fit the washers without fail.
- Apply adhesive to the bolts.

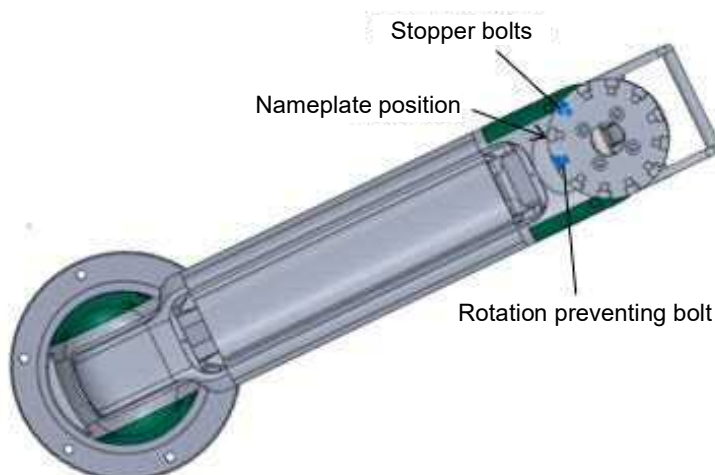
- Set the mounting plate in the position shown below, and insert the removed stopper bolts.

(Similar work to that in **6.4**. See page 27.)

PAW - [AS - 45 , AZ - 110]



PAW - [AS - 45 , AZ - 110] - S



*One stopper bolt is not used.

The stopper bolt and nameplate position can be reversed (reversed from the axis).



- After inserting the stopper bolts, make sure that the mounting plate does not turn. If it turns, correct the stopper bolt positions.

[Only in the case of model with rotation lock (option: L)]

- Insert the 4-diam tube prepared in **6.1.2** into the hole under the rotation preventing bolt, and pull it out from the upper surface of the rotation unit.

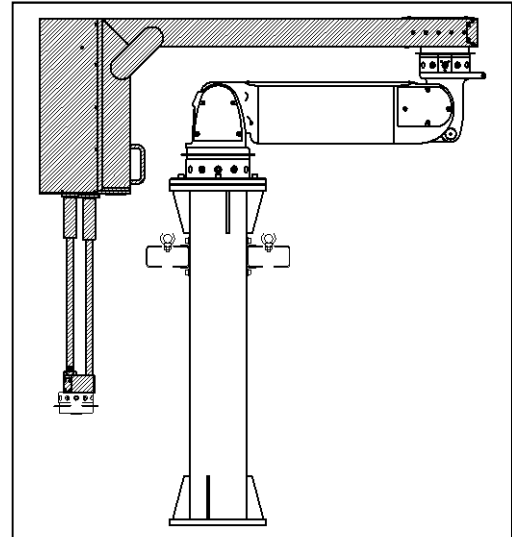
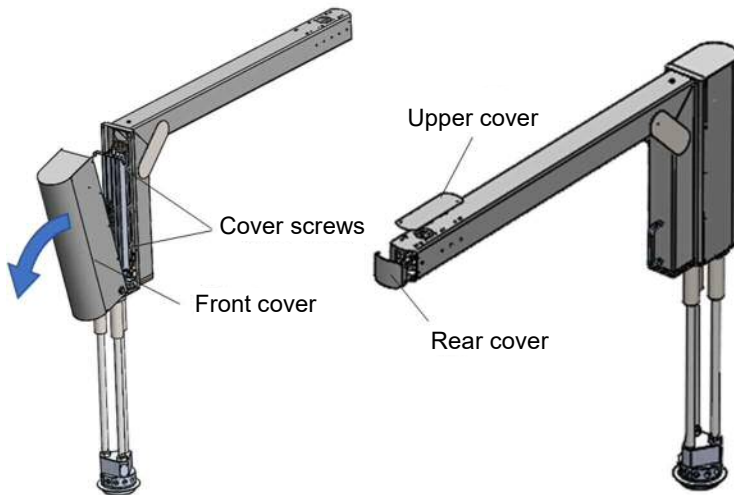
When the length of the tube over the upper surface reaches about 50 mm, temporarily secure the tube with masking tape or the like.

(The same work as in **6.4**. See page 28.)

Length of inserted tube	400 mm
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6.7 Palletizing Arm unit

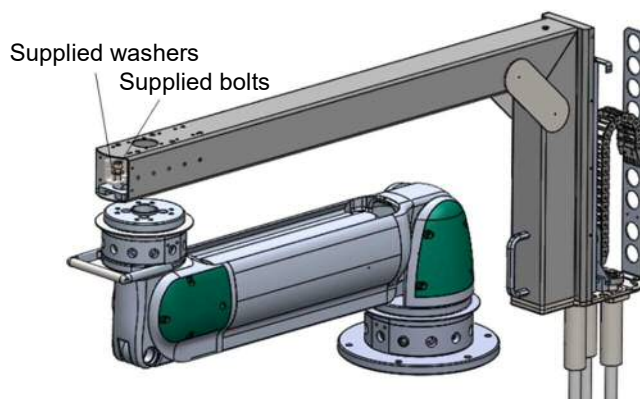
- Remove the front cover and upper cover and rear cover of the Palletizing Arm unit.



Point

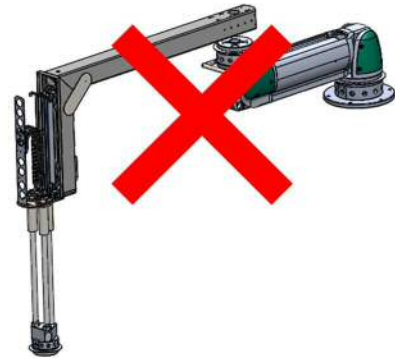
- The front cover and rear cover can be removed by loosening the cover screws.
- The upper cover has dropout prevention screws. Evenly and gradually loosen the screws.

- Place the Palletizing Arm unit inserting the rotation unit boss into the center hole in the arm unit.
(The same work as in 6.5. See page 29.)

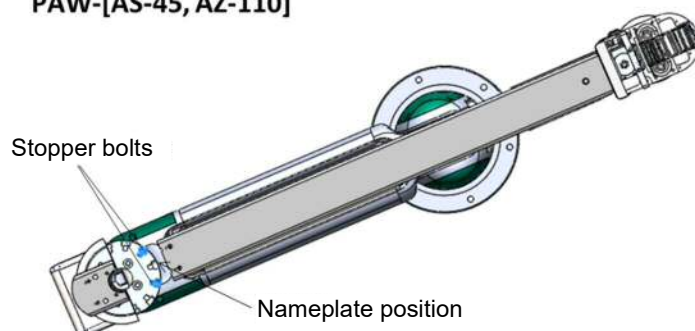


Point

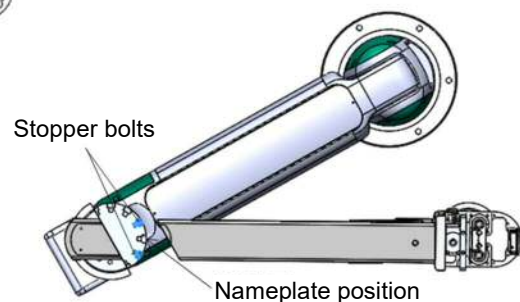
Pay attention to the arm direction. Put the arm just above the lowermost shaft.



PAW-[AS-45, AZ-110]



PAW-[AS-45, AZ-110]-S





- When the unit is provided with the rotation lock (option: L), insert the 4-diam tube pulled out in **6.6** into the mounting hole. Take care not to pinch the tube.

- Tighten the supplied bolts and washers.

(The same work as that in **6.5**. See page 29.)

Tightening torque	Supplied bolt
25N·m±10%	M10 x 40

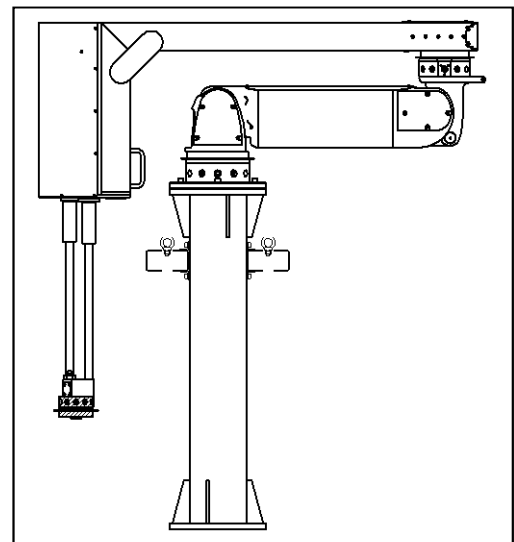
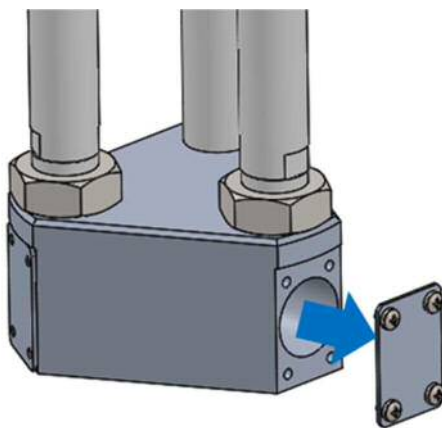


- Fit the washers without fail.
- Apply adhesive to the bolts.

6.8 Rotation unit (rotation mechanism at end)

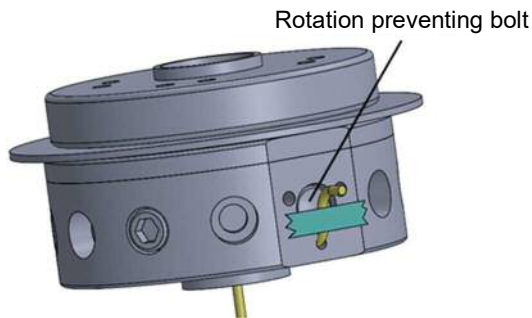
[Only in the case of model with rotation lock (option: L)]

- Remove the connecting block cover attached to the connection block on the end. Dropout prevention screws are used, so evenly and gradually loosen the screws.



[Only in the case of model with rotation lock (option: L)]

- Insert the 4-diam tube prepared in **6.1.2** into the hole under the rotation preventing bolt, and pull it out from the lower surface of the rotation unit.
- When the length of the tube over the upper surface reaches about 50 mm, temporarily secure the tube with masking tape or the like.

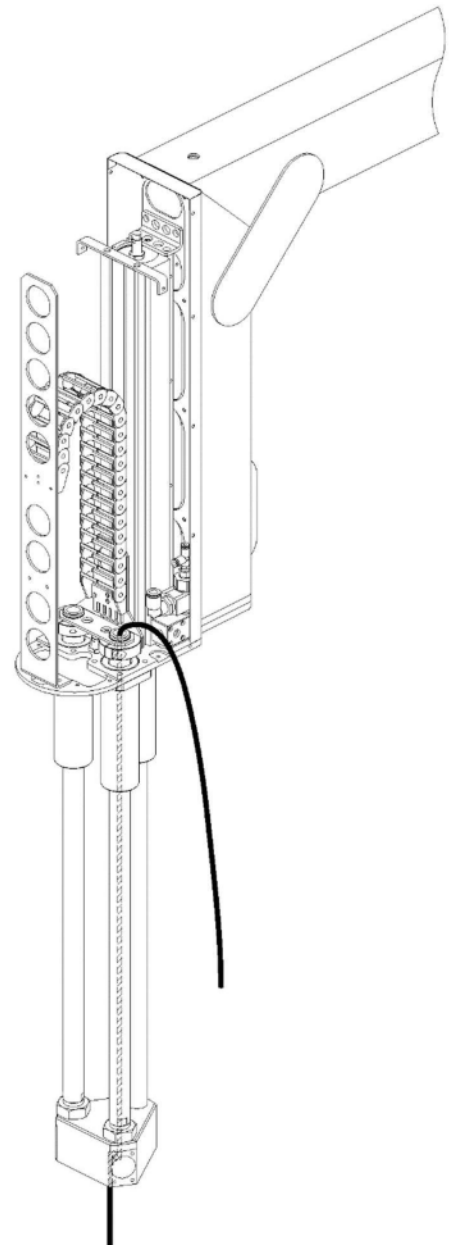


Length of inserted tube

1920 mm

[Only in the case of model with rotation lock (option: L)]

- Insert the pulled 4-diam tube into the center hole at the end of the connecting block, and draw it through the pipe shaft and to the top.

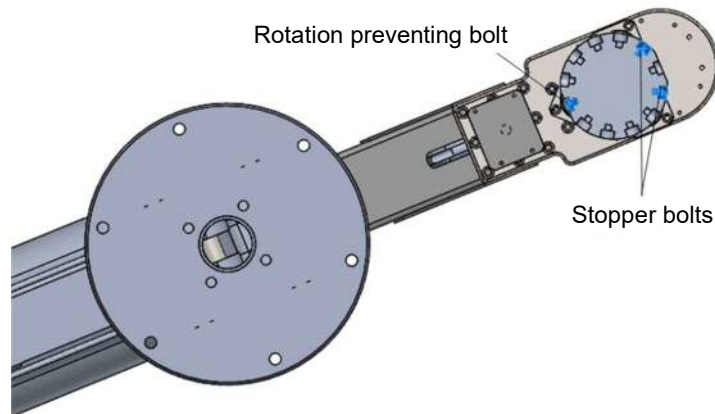


- Place the Power Arm unit inserting the rotation unit boss into the center hole in the arm unit.



- When the arm has the rotation lock (option: L), take care not to pinch the tube.

- Adjust the position of the rotation prevention bolt so that the rotation prevention bolt comes to the back side looking from the end of the Palletizing Arm.



- Remove the stopper bolts, turn the mounting plate, and tighten the supplied bolts and washers in the two positions.

(The same work as in **6.4** See page 26)

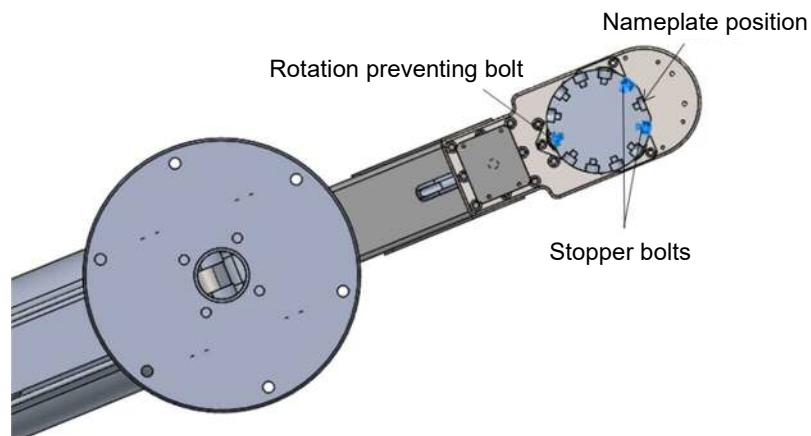
Tightening torque	13N·m±10%
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- Fit the washers without fail.
- Apply adhesive to the bolts.

- Set the mounting plate in the position shown below using the nameplate as a guide, and insert the removed stopper bolts again.

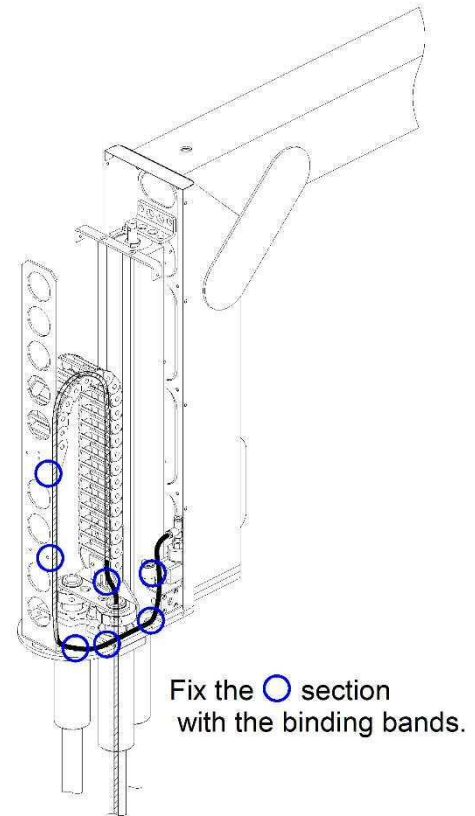
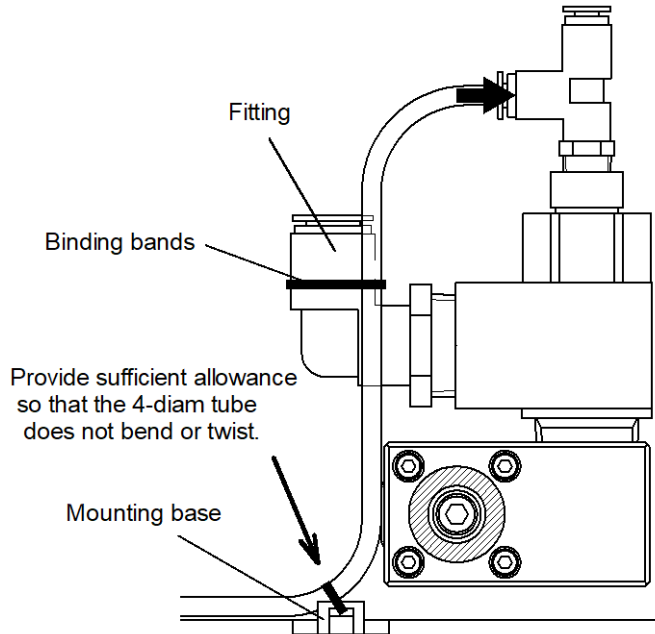
(Similar work to that in **6.3**. See page 35.)



- After inserting the stopper bolts, make sure that the mounting plate does not turn. If it turns, correct the stopper bolt positions.

[Only in the case of model with rotation lock (option: L)]

- Pass the 4-diam tube through the cable conduit, and insert it into the side of the fitting at the top of the block valve.
- Confirm that the 4-diam tube is not excessively pulled or loose. Fix it onto the mounting base and fitting with the binding bands.



- Insert the tube surely until it touches the tube end of the joint, and make sure that the tube cannot be disconnected from the joint.



- Do not tighten the binding bands too tightly. Doing so may collapse the tubes and disturb the air flow.

[In the case of model without rotation lock]

-> To Step 6.10 (Tubing, page 40)

[In the case of model with rotation lock (option: L)]

-> To Step 6.9 (Installation of rotation lock unit, page 38)

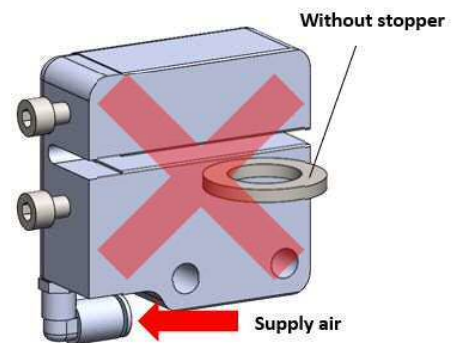
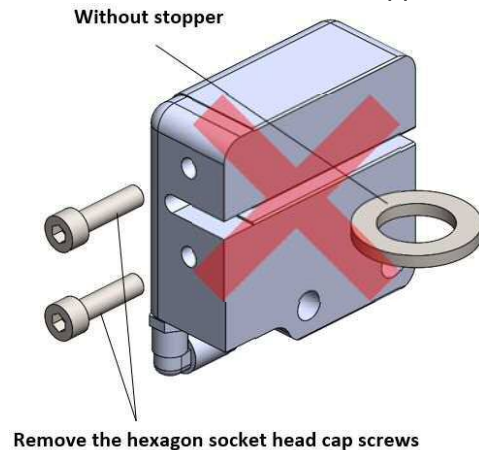
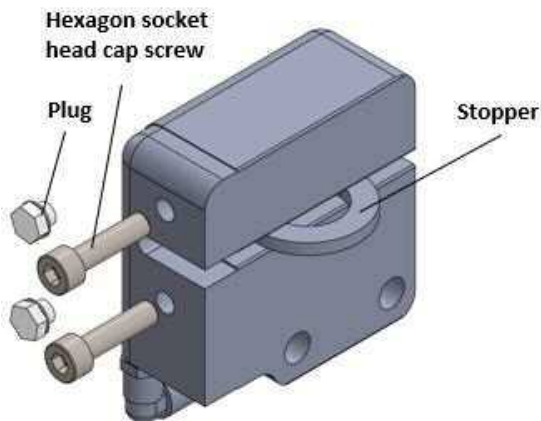
6.9 [Only in the case of model with rotation lock (option: L)] Installation of rotation lock unit



- Be sure to release lock (Supplying air or manual release) when removing stopper .
And do not lock without lock disc or stopper.
- Do not supply air after manually releasing the lock.

* The rotation lock unit can be installed in the same manner on all types of lock unit mounts.

- Remove the two plugs (FPL-M5) of the rotation lock unit, and screw the supplied hexagon socket head cap screws (M5 x 20) into the unit. Then, the lock will be released. Remove the stopper.

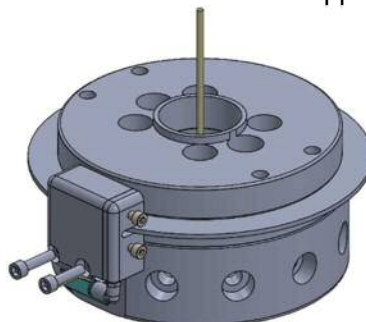


- Do not screw the bolts for manual release by tool (Hexagonal bar wrench).
- Do not turn the screws too tightly. The rotation lock unit will be damaged.
Do not screw until less than 2-3mm.



- Removed stopper is necessary for Lock unit maintenance or replacement.
Keep the stopper after installing Lock unit.

- Temporarily fit the rotation lock unit to the rotation unit with the supplied two M6 x 25 bolts.

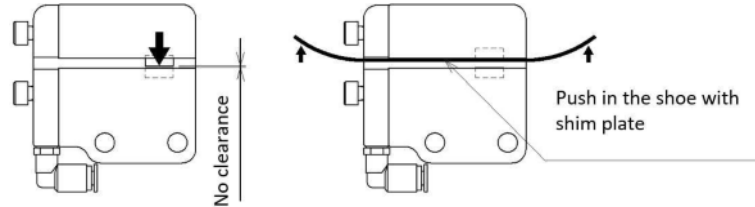




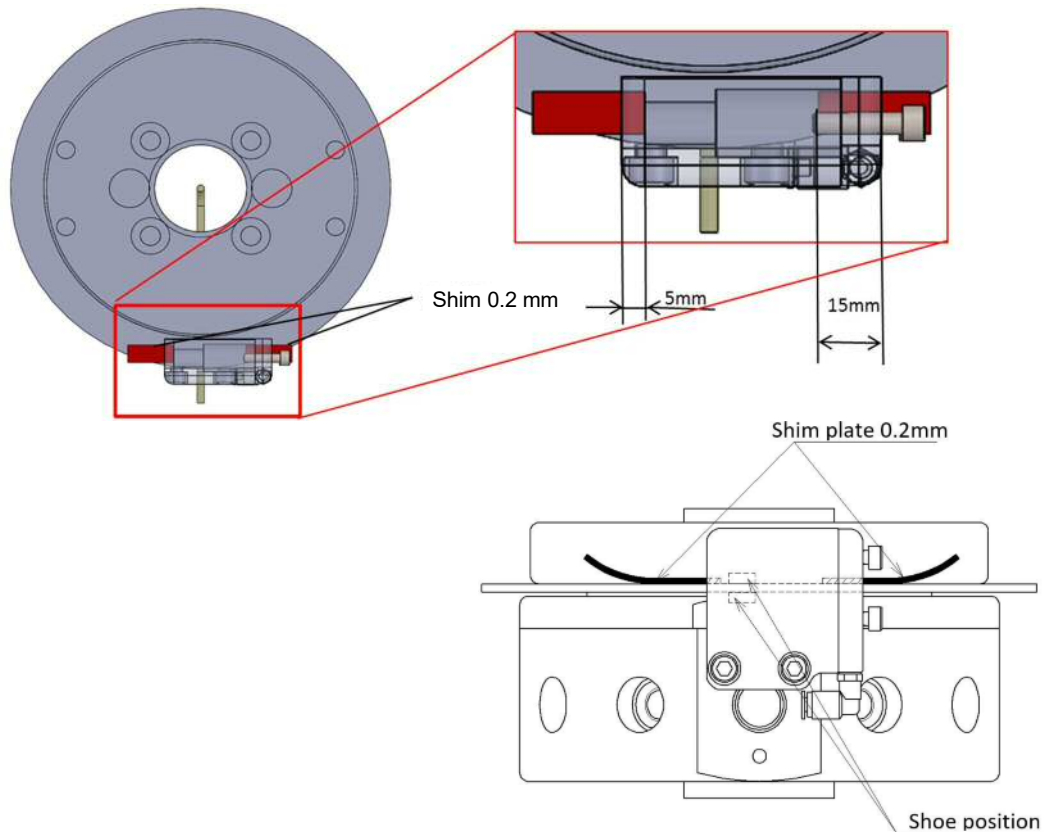
- Before temporarily fitting the unit, apply adhesive to the bolts. After applying the adhesive, immediately fit and tighten the bolts. Do not leave the unit in the temporarily installed state.



- Brake shoe of Lock unit might come out because it is floating. In that case, it is hard to insert the brake shoe into Rotation lock unit because there is no clearance between upper and lower brake shoe. Push in the brake shoe using around 0.1mm shim plate, and insert the brake disk.



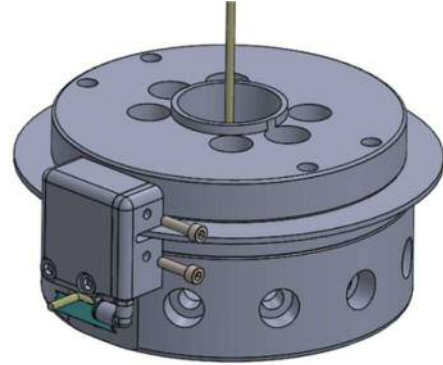
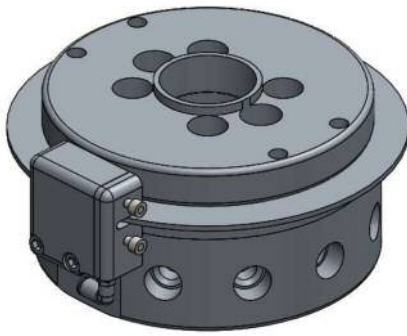
- Insert the 0.2-mm shims into the two positions on the right and left sides on the retaining disk as shown below.



- Lightly press down on the rotation lock unit to uniform the gap between the retaining disk and rotation lock unit, tighten the two temporarily fitted bolts, and remove the shims.

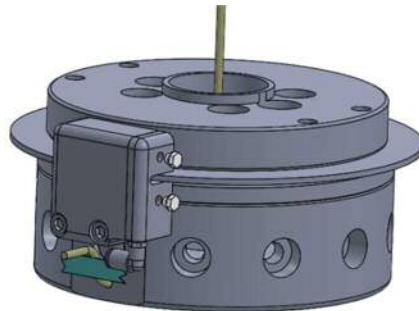
Tightening torque	5N·m±10%
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- Loosen and remove the two hexagon socket head cap screws that have been screwed into the unit.



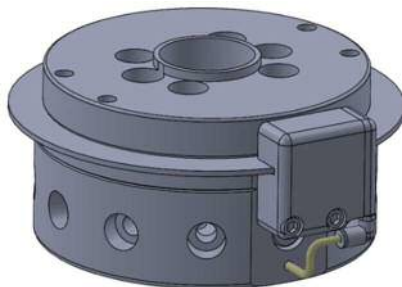
- The remove hexagon socket head cap screws will be required to manually release the lock. Keep them for future use.
- If they are lost, use hexagon socket head cap screws M5 x 20 of strength class 10.9 to 12.9 to manually release the lock.

- Screw the removed two plugs (FPL-M5) into the threaded holes without the hexagon socket head cap screws, and tighten the plugs.



Tightening torque
1.3N·m±10%

Insert the 4-diam tube temporarily secured on the rotationn unit into the Fitting.



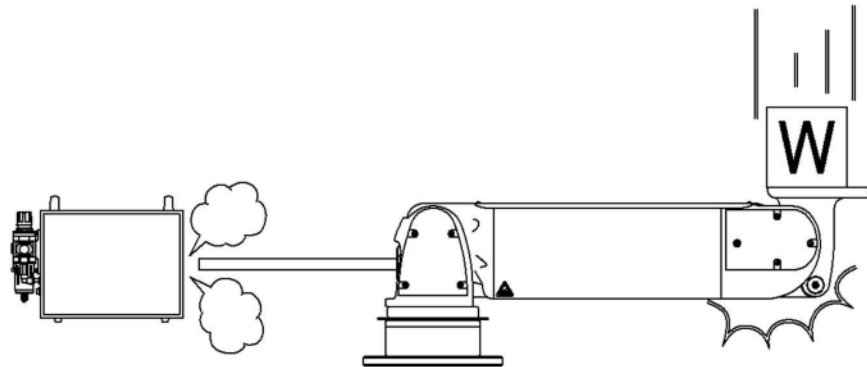
- Insert the tube surely until it touches the tube end of the joint, and make sure that the tube cannot be disconnected from the joint.

6.10 Tubing



WARNING

Connect Air piping certainly. If the piping come out, dangerous situation will happen because Power Arm is fallen.

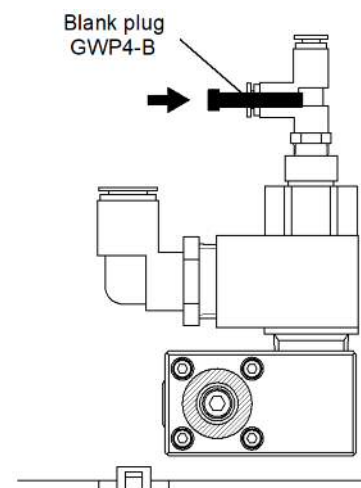


- Insert the tube and the blank plug securely all the way into the tube end and make sure that it does not come disconnected from the fitting before use.

6.10.1 Selection according to option

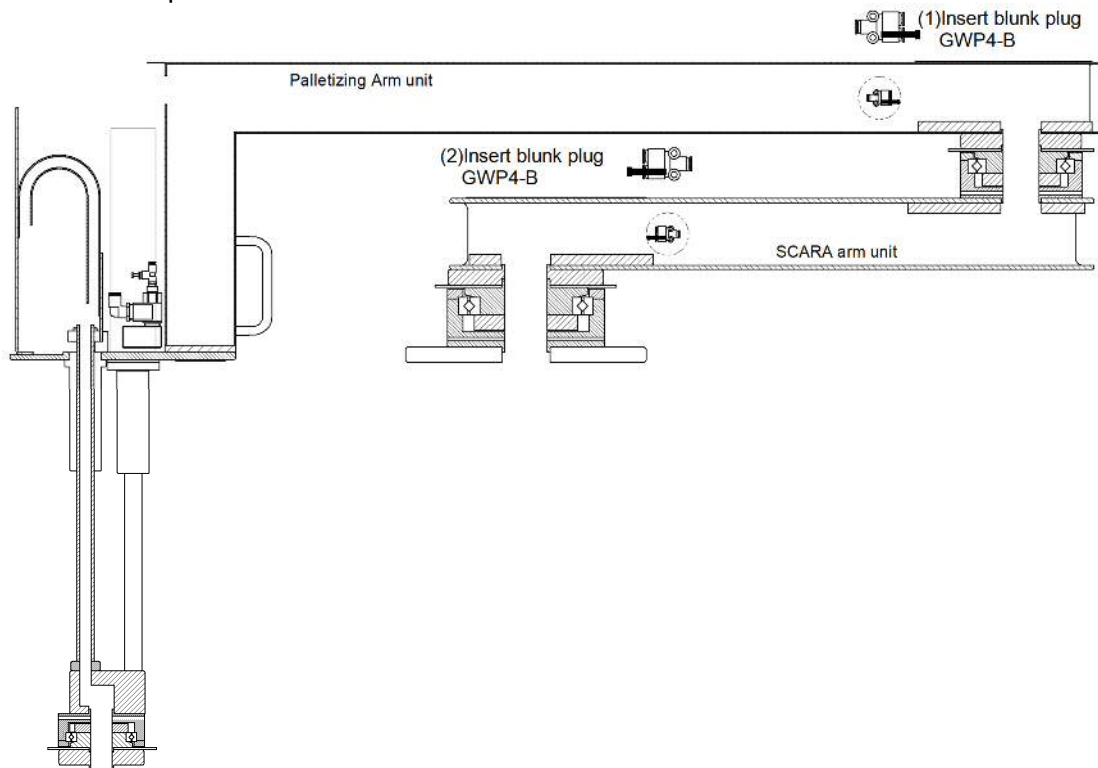
1. [In the case of model without rotation lock]

- Insert a blank plug GWP4-B at the side of the fitting at the top of the block valve in the Palletizing Arm unit.

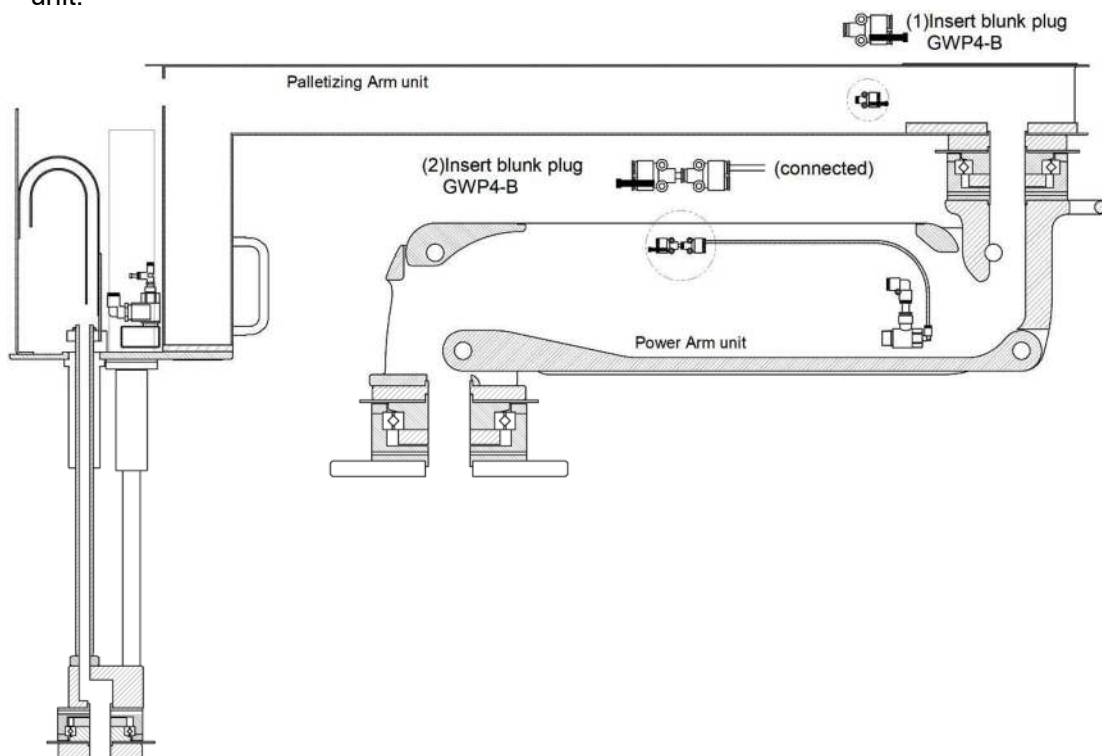


PAW - AS - 45 (- S)

- (1) Place the fitting Y-shaped tee GWY44-0 in the Palletizing Arm unit, and insert a blank plug into one the insertion port.
- (2) Place the fitting Y-shaped tee GWY44-0 in the SCARA arm unit, and insert a blank plug into one the insertion port.

**PAW - AZ - 110 (- S)**

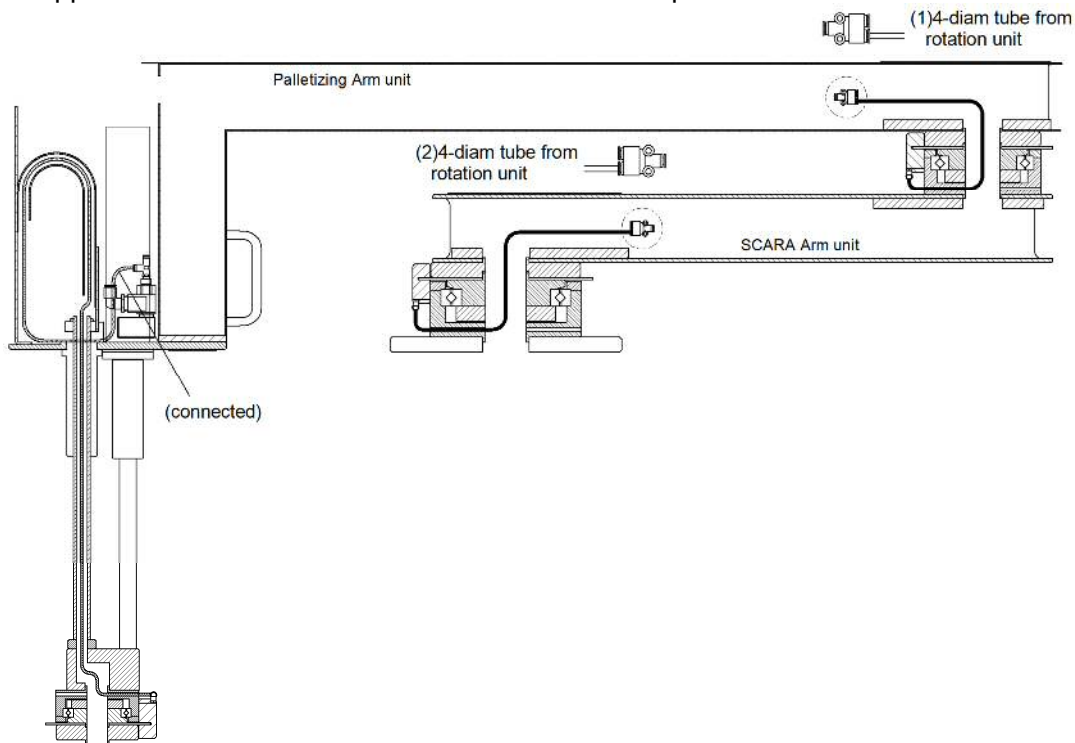
- (1) Place the fitting Y-shaped tee GWY44-0 in the Palletizing Arm unit, and insert a blank plug into one the insertion port.
- (2) Insert the blank plug GWP4-B to the rear of the fitting on the upper surface of the Power Arm unit.



2. [In the case of model with rotation lock (option: L)]

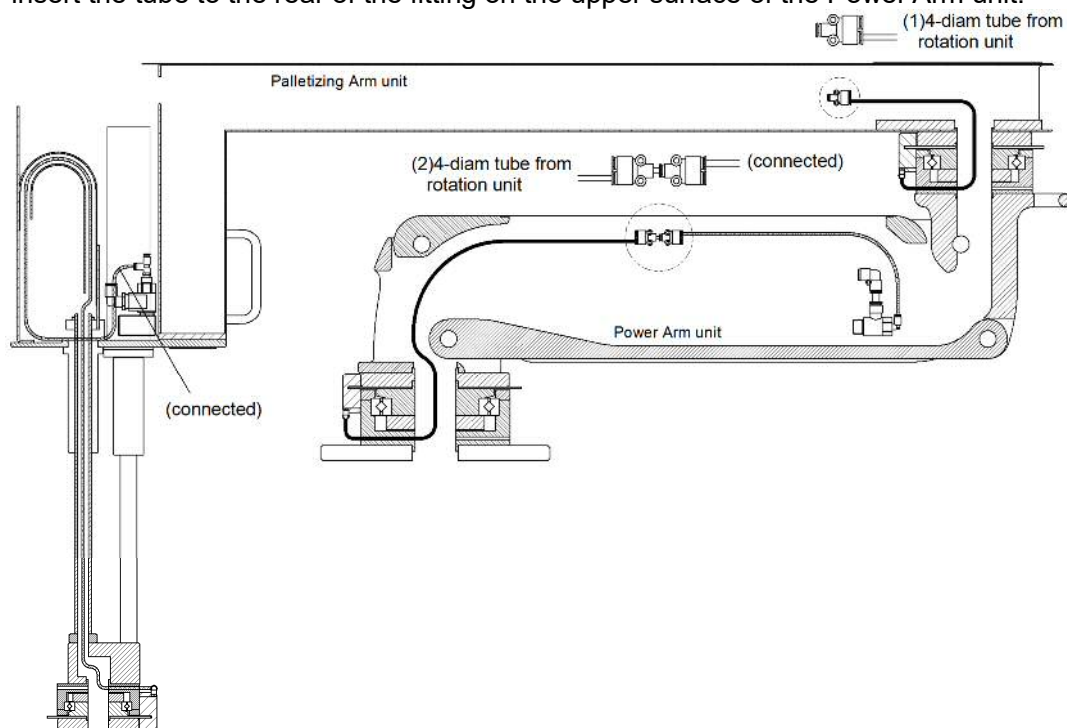
PAW - AS - 45 (- S) - L

- (1) Place the fitting Y-shaped tee GWY44-0 on the Palletizing Arm unit, and insert the 4-diam tube from the upper surface of the rotation unit into one insertion port.
- (2) Place the fitting Y-shaped tee GWY44-0 on the SCARA arm unit, and insert the 4-diam tube from the upper surface of the rotation unit into one insertion port.



PAW - AZ - 110 (- S) - L

- (1) Place the fitting Y-shaped tee GWY44-0 on the Palletizing Arm unit, and insert the 4-diam tube from the upper surface of the rotation unit into one insertion port.
- (2) Draw the 4-diam tube from the upper surface of the rotation unit into the Power Arm unit, and insert the tube to the rear of the fitting on the upper surface of the Power Arm unit.

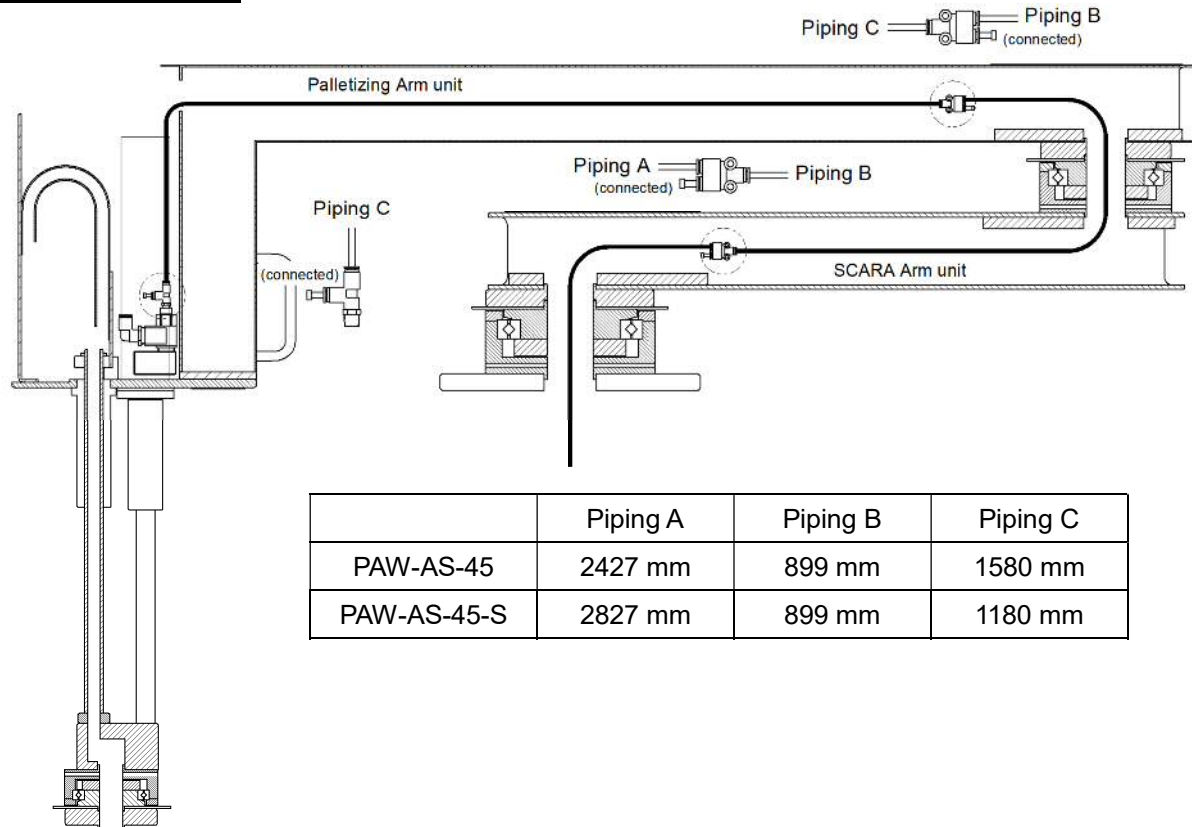


6.10.2 Common to all models

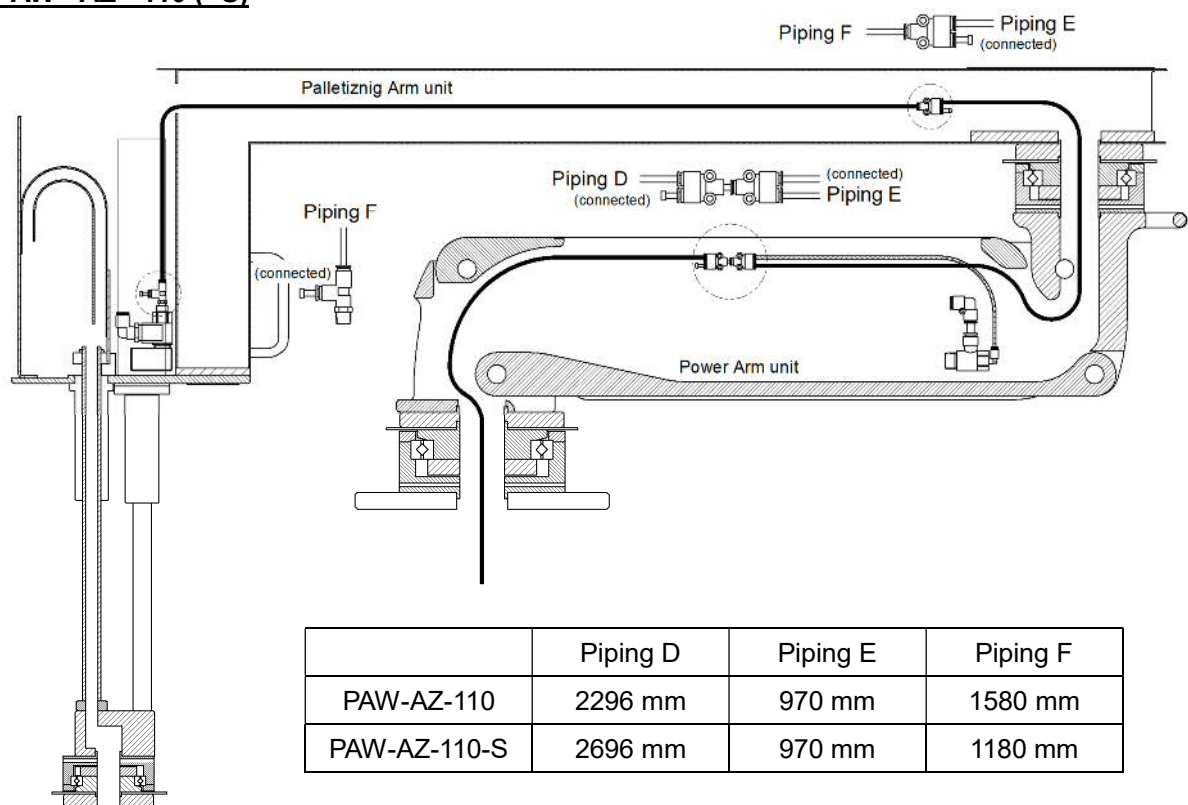
[Piping for unlocking (4-diam)]

- Lay the 4-diam tube on each model as shown in each figure.

PAW - AS - 45 (- S)



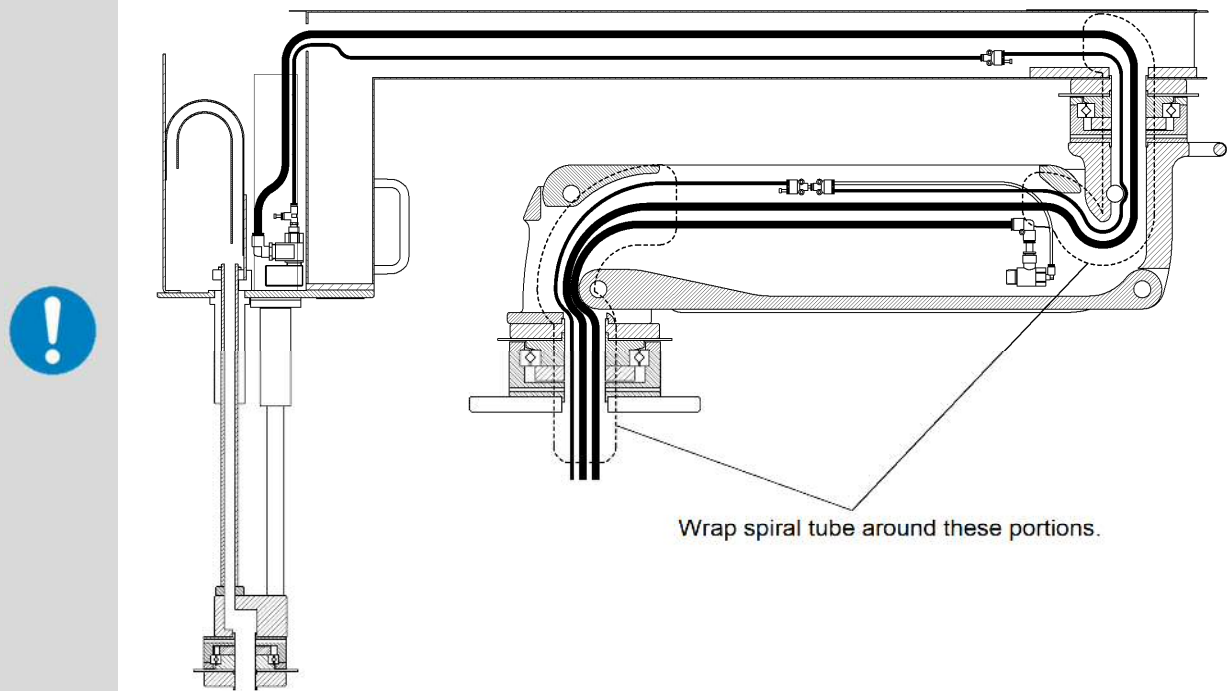
PAW - AZ - 110 (- S)



[Piping for cylinder (10-diam tubes)]

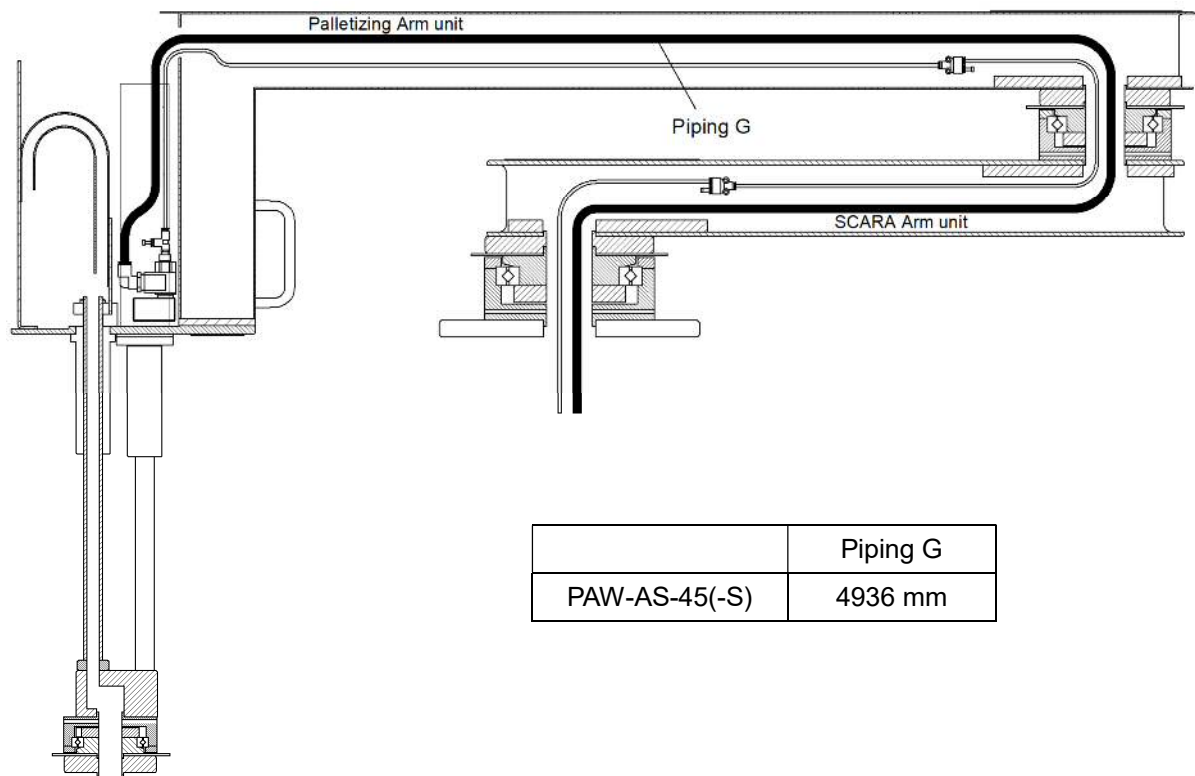
- Connect the 10-diam wear-resistant tubes on each model as shown in each figure.

- When tubing, wrap a spiral tube around the piping for cylinder to protect the piping from friction and wear referring to the following figure (the piping in the Power Arm unit and the center hole in the rotation unit).

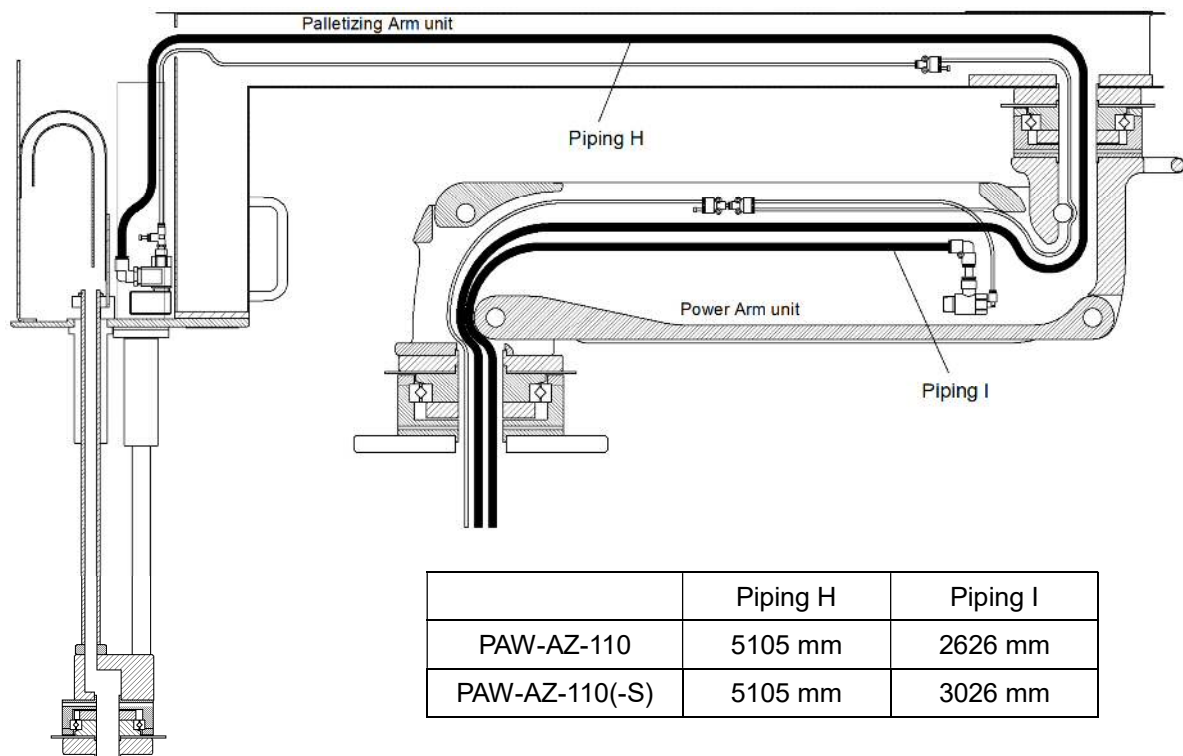


- For the recommended spiral tubes, see page 23.

PAW - AS - 45 (- S)



	Piping G
PAW-AS-45(-S)	4936 mm

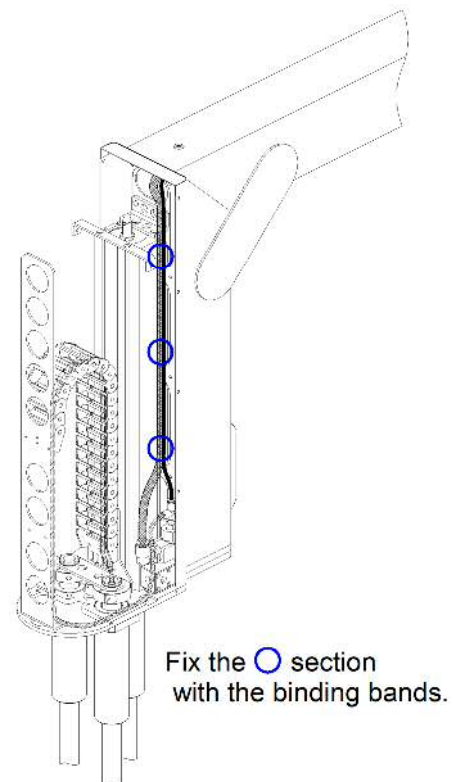
PAW - AZ - 110 (- S)

- When laying the tubes, take care not to twist or bend them or entangle them with other tubes.

- Confirm that the 4-diam and 10-diam tubes are not excessively pulled or loose. Fix them onto the mounting base and fitting with the binding bands.

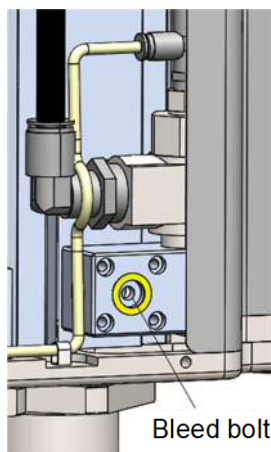


- Do not tighten the binding bands too tightly. Doing so may collapse the tubes and disturb the air flow.



6.10.3 Supplying air

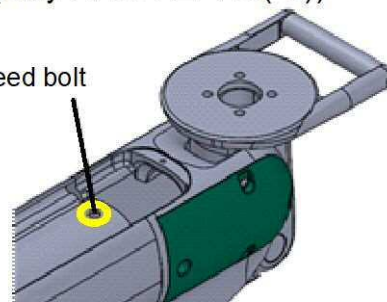
- Loosen, by two to three turns, the bleed bolt marked in yellow located on the top of the Power Arm unit (**only PAW-AZ-110(-S)**) under the Palletizing Arm unit's block valve. And leave the unit to sit for 1 to 2 minutes to discharge the residual pressure in the cylinder. Then, tighten the bleed bolt to the following tightening torque to close the bolt.



Tightening torque
$1.3\text{N}\cdot\text{m}\pm 10\%$

(only PAW-AZ-110(-S))

Bleed bolt

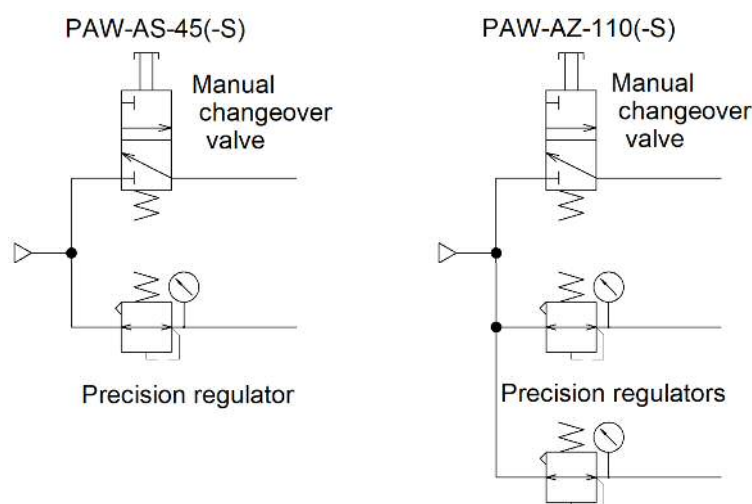


- If the bleed bolt is excessively tightened, it may be damaged. Tighten it to the specified tightening torque.



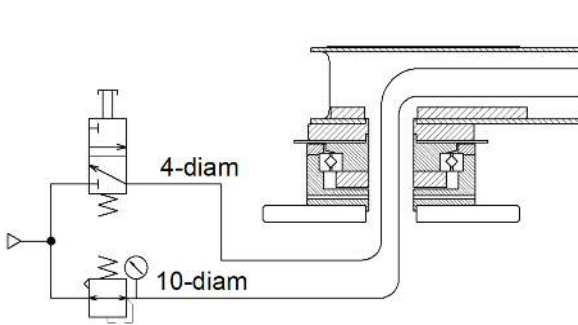
- The bleed bolts cannot be removed. If they are forcibly removed, they may be damaged. Do not remove them.

- Connect the air devices (refer to page 22 for applicable air devices) as shown below, make sure that the manual changeover valve is NC and the secondary pressure of each precision regulator is 0. Then, supply clean compressed air of 0.5MPa to the primary side.

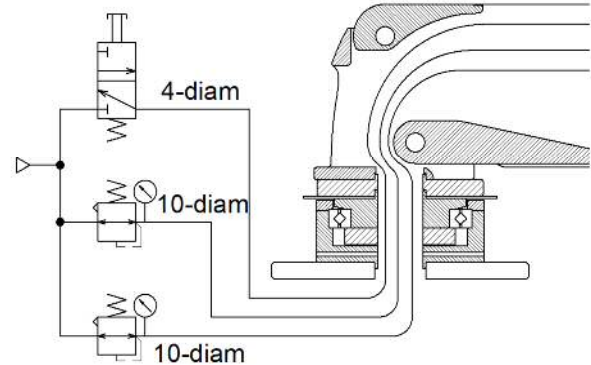


- Connect the piping for unlocking (4-diam) to the manual changeover valve, and connect the piping for cylinder (10-diam) to the precision regulator.

PAW-AS-45(-S)



PAW-AZ-110(-S)



- Switch the manual changeover valve to release the lock.
- Gradually open the pressure adjustment knob of the precision regulator connected to the piping for cylinder of the Palletizing Arm unit until the arm end moves up.



- The arm end will move up. Before opening the knob, make sure that there are no persons, machines, tools, etc. above the arm end.



- Do not quickly open the pressure adjustment knob. The arm will move up suddenly, thereby causing a hazardous situation.

- When moving up and down the arm by the arm end, adjust the pressure with the precision regulator so that the upward and downward operating forces are equal to each other.

After the completion of pressure adjustment, tighten the lock nut of the precision regulator to secure the knob.

- **(Only for PAW-AZ-110(-S))** Gradually open the pressure adjustment knob for the precision regulator connected to the piping for the cylinder of the Power Arm unit until the arm moves up.



- The arm will move up. Before opening the knob, make sure that there are no persons, machines, tools, etc. above the arm.



- Do not quickly open the pressure adjustment knob. The arm will move up suddenly, thereby causing a hazardous situation.

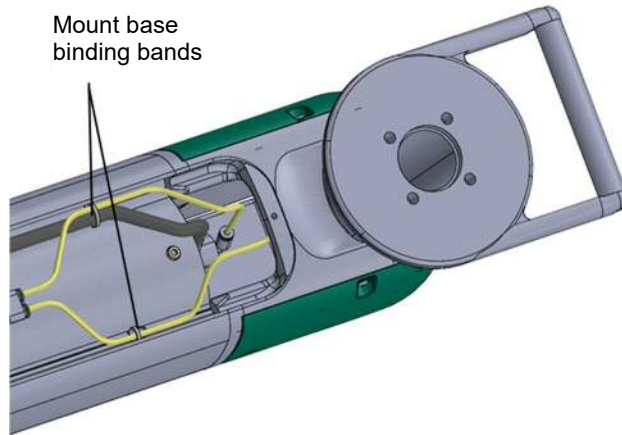
- **(Only for PAW-AZ-110(-S))** When moving up and down the arm by the Power arm unit handle, adjust the pressure with the precision regulator so that the upward and downward operating forces are equal to each other at an arm angle of 30 to 40°.

After the completion of pressure adjustment, tighten the lock nut of the precision regulator to secure the knob.



- When the pressure has been adjusted appropriately, the arm is apt to move up near the lowermost position, move down in the range from the center to the upper position and move up near the uppermost position.

- **(only PAW-AZ-110(-S))** Secure the piping on the mount base with binding bands starting from the upper tube while operating the arm continuously from the upper most position to the lowermost position by the handle to confirm that the piping for unlocking and piping for cylinder are not excessively pulled or loosened.



- Do not tighten the binding bands too tightly. Doing so may collapse the tubes and disturb the air flow.

- Gradually close the pressure adjustment knobs of the precision regulators (PAW-AS-45(-S): 1 unit, PAW-AZ-110 (-S): 2 units) to set the secondary pressure to 0.



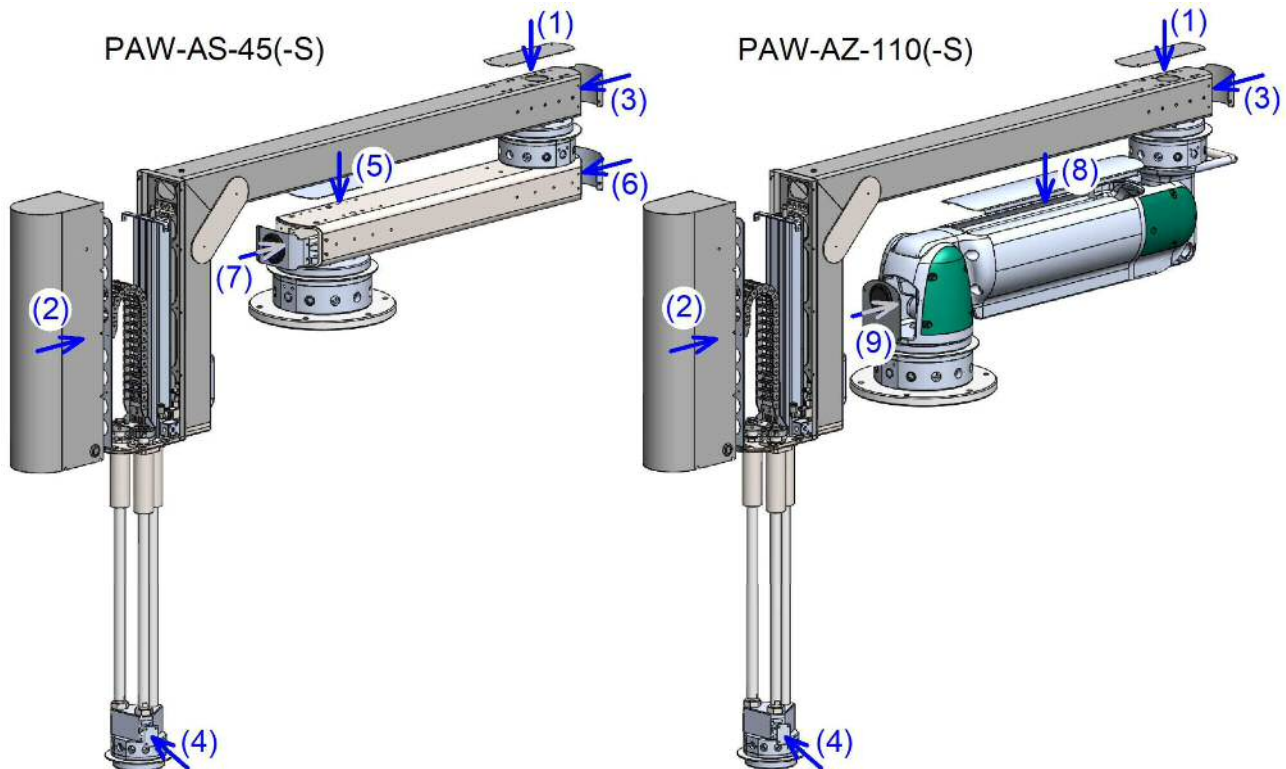
- The arm end and arm will move down. Before closing the knobs, make sure that there are no persons, machines, tools, etc. under the arm end or arm.
- Before switching the manual changeover valve in the next process, set the secondary pressure to 0. Otherwise, residual pressure will remain in the cylinder.



- Do not quickly close the pressure adjustment knobs. The arm will move down suddenly, thereby causing a hazardous situation.

- Switch the manual changeover valve to lock the arm.
- Disconnect the piping for unlocking from the manual changeover valve, and disconnect the piping for cylinder from each precision regulator.

- Fit each cover.

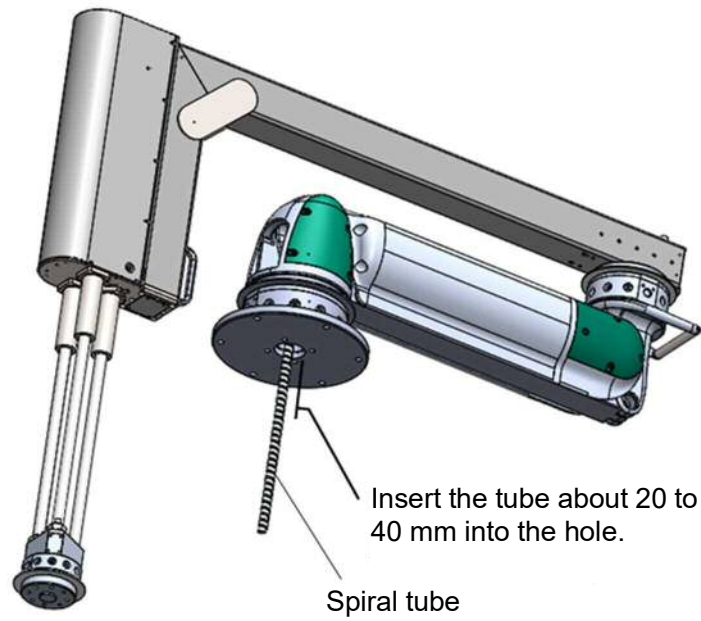


Palletizing Arm unit		Tightening torque
(1)	Upper cover	$1.3\text{N}\cdot\text{m}\pm 10\%$
(2)	Front cover	$3.2\text{N}\cdot\text{m}\pm 10\%$
(3)	Rear cover	$3.2\text{N}\cdot\text{m}\pm 10\%$
(4)	Connecting block cover	$1.3\text{N}\cdot\text{m}\pm 10\%$

SCARA Arm unit		Tightening torque
(5)	Upper cover	$1.3\text{N}\cdot\text{m}\pm 10\%$
(6)	Front cover	$3.2\text{N}\cdot\text{m}\pm 10\%$
(7)	Rear cover	$3.2\text{N}\cdot\text{m}\pm 10\%$

Power Arm unit		Tightening torque
(8)	Upper cover	$1.3\text{N}\cdot\text{m}\pm 10\%$
(9)	Rear cover	$3.2\text{N}\cdot\text{m}\pm 10\%$

- Bundle the piping for unlocking and piping for cylinder, and wrap the spiral tube around them.



- When wrapping the spiral tube, push the tube to insert the tube about 20 to 40 mm into the piping outlet cover.



- Take care not to crush the piping or apply tension stress to it.

7. Measures against troubles

7.1 Method of manually unlocking

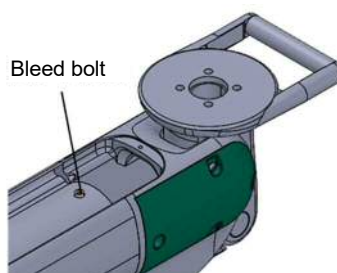
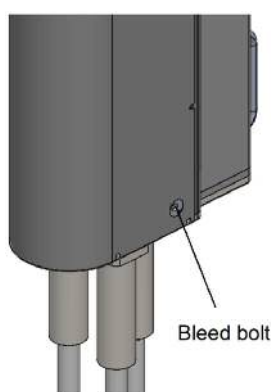
- When a trouble occurs (in the state where air is not supplied), the arm can be manually unlocked.



- The manual unlocking operation shall be performed by a service person who has sufficient knowledge of machines and air circuits.
- If possible, remove the transfer object or workpiece at the end before unlocking.

7.1.1 In the vertical direction

- Stop the supply of air to the system and equipment (close the residual pressure discharge valve, and discharge the residual pressure).
When the arm is electrically controlled, shut off the power supply to the electric system.
- Remove the Palletizing Arm grommet and upper cover of the Power Arm unit (only PAW-AZ).
- Loosen the bleed bolt marked in yellow on the upper surface two or three turns.



- The bleed bolts cannot be removed. If they are forcibly removed, they may be damaged. Do not remove them.

- The air in the air cylinder will be gradually discharged, and the arm will slowly move down under its own weight.



- The arm will slowly move down for safety. It cannot be lowered rapidly.

- After the air in the air cylinder is completely discharged, tighten the bleed bolt.

Tightening torque	1.3N·m±10%
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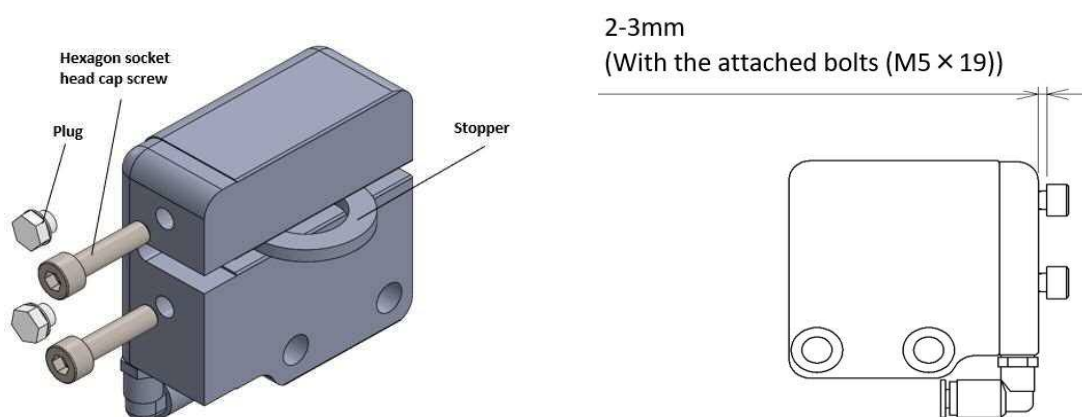


- If the bleed bolt is excessively tightened, it may be damaged. Tighten it to the specified tightening torque.

- Fit the grommet and upper cover (PAW-AZ only).

7.1.2 Rotation direction [Only in the case of model with rotation lock (option: L)]

- Stop the supply of air to the system and equipment (close the residual pressure discharge valve, and discharge the residual pressure).
When the arm is electrically controlled, shut off the power supply to the electric system.
- Remove the two plugs (FPL-M5), and screw two hexagon socket head cap screws into the threaded holes without the plugs. Then, the lock in the rotation direction will be released.



- Do not use tools, such as a hexagon wrench.
- Do not turn the screws too tightly. The rotation lock unit will be damaged.
- Do not screw until less than 2-3mm.



- For the hexagon socket head cap screw for manual release, use the hexagon socket head cap screw M5 x 20 with strength class 10.9 to 12.9.
- (If M5x20 is used, the remaining amount of screws shown in the above figure will be 3 to 4 mm.)

- After the completion of work in the manually released state, loosen and remove the two hexagon socket head cap screws that have been screwed into the holes.
- Screw the two plugs (FPL-M5) into the threaded holes, and tighten them.

Tightening torque	1.3N·m±10%
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7.2 Troubleshooting

- When any trouble occurs during use of the product, stop using, and ask a maintenance personnel (or a service person depending on the item) to check the situation and take measures.

Problem	Cause	Remedy
The product does not operate.	No pressure or insufficient pressure	Connect a pressure source.
	The arm is not unlocked.	Supply air to the piping for unlocking.
The arm does not move up.	The weight capacity is exceeded.	Reduce the weight of the transfer object.
		Increase the pressure in the piping for cylinder.
The upward and downward operating forces are uneven.	The pressure adjusted by the precision regulator (electropneumatic regulator) is high or low.	Re-adjust the precision regulator (electropneumatic regulator).
The arm cannot be held in a position in the rotation direction.	The installation surface is not horizontal.	Ask a service person to level the installation surface.

8. Maintenance

8.1 Routine inspection

- To use this product safely and in optimum condition, the operator or maintenance personnel shall perform routine inspection every day.

- Inspection items

- (1) Looseness of the base plate installation bolts
- (2) Looseness of the fixing bolts of jig, etc. at the end
- (3) Contamination and peeling of warning labels
- (4) Dents and defects of the product
- (5) Smooth operation (no abnormal resistance or noise during upward/downward movement and turning)
- (6) No abnormalities in the operation range
- (7) No abnormal locking operation (whether the arm is held in a position in the vertical and rotation directions in the locked state)
- (8) Air leakage from piping parts and deterioration of piping materials and tubes

Check the above points, and, if any abnormality is found, stop using the product, and ask a service person to check the product and take measures or repair it.

Problem	Cause	Remedy
Looseness of bolts		Tighten to the appropriate torque.
Contamination and peeling of warning labels		Clean and re-apply the warning labels.
Dents and defects of the product		Replace the unit (*).
Operating not smoothly	Damaged or deformed parts	Replace the unit (*).
Abnormalities in the operation range	Damaged or deformed parts	Replace the unit (*).
The arm cannot be held in a position in the locked state.	Damaged or deformed parts	Replace the unit (*).
Air leakage from piping parts and deterioration of piping materials and tubes		Replace the piping materials and tubes.

(*) It is not allowed to disassembly any unit. If the units are disassembled, their original performance and accuracy may not be restored. Do not disassemble them.

If any unit must be overhauled, contact us.



- Before replacing any part, shut off the air supply, and switch the residual pressure discharge valve to discharge the residual pressure. During replacement, lock the residual pressure discharge valve in the “Discharge position.”

8.2 Periodic maintenance parts

- Any periodic maintenance parts shall be replaced by a service person.

Part name	Model number of part	Model number of relevant unit	Standard replacement time
Stopper bolt	PAW-RU-T-STB-KIT	PAW-RU-T	20,000 times or 1 year
	PAW-RU-X-STB-KIT	PAW-RU-X	
	PAW-RU-Z-STB-KIT	PAW-RU-Z	
Rotation preventing bolt	PAW-RU-T-ARB-KIT	PAW-RU-T	100,000 times or 5 years (20,000 times or 1 year when used as a rotation stopper without use of the stopper bolt)
	PAW-RU-X-ARB-KIT	PAW-RU-X	
	PAW-RU-Z-ARB-KIT	PAW-RU-Z	
Spiral tube Binding band	See 6.1.1.		100,000 times or 5 years
Tube	See 6.1.2.		

* Standard replacement time

The number of times of use calculated as 80 times/day (up-and-down movement) x 240 days/year is shown for your reference. It varies depending on the frequency and conditions of use. These values are not guaranteed values.



- Before replacing any part, shut off the air supply, and switch the residual pressure discharge valve to discharge the residual pressure. During replacement, lock the residual pressure discharge valve in the "Discharge position."

9. Disposal

9.1 Dismantling

- When dismantling the product, at first, remove all jigs and attachments from the end, and dismantle it in order from the top in the reverse procedure to 6 “Assembly of unit product.”
- The units shall be dismantled by a service person who has sufficient knowledge of machine assembly and pneumatic equipment assembly.
- Some of the Power Arm units, rotation units, SCARA arm units and base plates are heavy. Dismantle the heavy units with a crane.



- The crane shall be operated by a qualified, skilled person wearing safety equipment, such as a helmet and safety shoes, and the hoisting height shall be the minimum necessary.
- Use wire ropes or belt slings having sufficient safety load for the weight of the multi-axis product.
- When moving and installing the product, hoist or lift in a well-balanced state (at first, hoist or lift it slightly, and make sure that it is well-balanced before transporting).

- Prepare hoisting attachments as needed.

	Required parts
Palletizing Arm unit PAW-C[stroke]-Z-[Inter-axis length]	M10 eyebolt: 1 pc. M12 eyebolt: 1 pc. M10 hexagon nut (type 1): 1 pc. M12 hexagon nut (type 1): 1 pc.
Rotation unit PAW-RU-Z	M12 eyebolt: 2 pcs. M12 hexagon nut (type 1): 2 pcs.
SCARA arm unit PAW-SU-XS-FLA30992	M10 eyebolt: 1 pc. M12 eyebolt: 1 pc. M10 hexagon nut (type 1): 1 pc. M12 hexagon nut (type 1): 1 pc.
Base plate PAW-BP-Z	M12 eyebolt: 2 pcs. M12 hexagon nut (type 1): 2 pcs.

* Use eyebolts and hexagon nuts (type 1) (made of steel) conforming to the standards (ISO/IEC, JIS, etc.) in the user's country and region.

- Units not shown above weigh 15 kg or less and do not need hoisting attachments. Handle the units taking great care not to drop them or pinch your fingers.

9.2 Disposal

- When disposing of the product, follow the local laws and government ordinances.

10. WARRANTY PROVISIONS

10.1 Warranty Conditions

■ Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified below, CKD will promptly repair the faulty product at one of CKD's facilities free of charge.

However, following failures are excluded from this warranty:

- Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or this Instruction Manual.
- Failure caused by use or management that violates the "DANGER", "WARNING", and "CAUTION" precautions and other instructions stated in the catalog, the Specifications, or this Instruction Manual.
- Failure not caused by the product.
- Failure caused by use not intended for the product.
- Failure caused by modifications/alterations or repairs not carried out by CKD.
- Failure that could have been avoided if the machinery or device of another manufacturer, which is attached to the product when in use, had been subjected to risk assessments that are defined and required in the product safety standards such the basic safety standards, the group safety standards, and the individual machinery safety standards classified according to ISO/IEC Guide 51 and had functions and structures for securing safety.
- Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
- Failure caused by acts of nature and disasters beyond control of CKD.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

■ Confirmation of product compatibility

It is the responsibility of the customer to confirm compatibility of the product with any system, machinery, or device used by the customer.

■ Others

The terms and conditions of this warranty stipulate basic matters.

When the terms and conditions of the warranty described in individual specification drawings or the Specifications are different from those of this warranty, the specification drawings or the Specifications shall have a higher priority.

10.2 Warranty Period

The product is warranted for one (1) year from the date of delivery to the location specified by the customer.

10.3 Remarks

- Warranty period specified in 6.2 is based on the assumption that the number of operations does not exceed 100,000 in one (1) year. If the number of operations reaches 100,000 within one (1) year, the warranty shall expire at that time.
- If the product is exported outside Japan by the customer, it shall be repaired if returned to CKD's facility or a company or plant specified by CKD. Work and cost associated with the return shall not be covered by the warranty. The repaired product shall be delivered to a place in Japan specified by the customer in a package appropriate for delivery in Japan.



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●Specifications are subject to change without notice.