

INSTRUCTION MANUAL MODEL NPL2

Thin 2-jaw Sealed Gripper



DANGER

- This Instruction Manual has been prepared for intended use for production engineers and maintenance persons who operate this product. When the beginners use this product, be sure to receive the guidance from skilled persons, sales agents, or us in advance.
- Before installing, using, or maintaining this product, read carefully the safety precautions given in this manual so as to understand them completely. If you do not heed given instructions or safety precautions, serious human accidents, death, or physical damage may occur.
- Store this manual with care in the specified place at hand, and reread it as necessary for correct use of the product.
- Please contact the sales agent if you have any uncertainty or doubt about this manual.

Preface

This manual provides detailed information on the thin 2-jaw sealed gripper (model NPL2) so that you can understand its performance and functions and use it safely and correctly.

Before using this gripper, read this manual carefully to understand how to use the gripper correctly. Always follow the instructions and warnings given in **“Important Safety Precautions”** and **“Precautions for Use”**. Failure to follow these precautions could result in serious human accidents.

Terms and Symbols Used for Safety Messages

In this manual, handling precautions that are considered especially important are classified and displayed as shown below according to the degree of risk (seriousness of harm) that could result. Please completely understand the meaning of these terms and follow the instructions for safe operation.

Safety Alert Symbol

This triangle is a safety alert symbol used to alert you to potential safety hazards. To avoid death or injuries that could occur, follow the safety messages given with this safety alert symbol.



Failure to follow the safety precautions below will result in death or serious injuries.



Failure to follow the safety precautions below could result in death or serious injuries.



Failure to follow the safety precautions below may result in minor or moderate injuries.



Indicates instructions which, if you do not heed given instructions, could result in damage to the product or shortened service life, or damage to peripheral equipment.

Disclaimer and How to Use Instruction Manual

This product is suitable for gripping a conveyed workpiece by being installed on the robot or loader. The product is equipped with the jaws to grip the conveyed workpiece and they are operated by air pressure. For any other applications, please contact us.

Kitagawa Corporation shall not be held liable for human accidents, death, damage, or loss that occurred due to a failure to follow the safety precautions given in this manual.

This manual does not predict all potential hazards in operation, inspection, and maintenance under all environmental conditions. There will be an infinite number of matters that cannot or must not be done, and it is impossible for the manual to cover all of them.

Therefore, the matters, unless otherwise mentioned clearly as “can be done” or “may be done” in this manual, should be considered as “cannot be done” or “must not be done”.

Please contact us or our agents if you have an uncertainty about safety when you try to perform operation, inspection, or maintenance not mentioned in this manual.

Warranty and Disclaimer

The product is warranted for one year after the date of delivery.

All parts used shall be those delivered by Kitagawa Corporation. Kitagawa Corporation shall not be held liable for human accidents, death, damage, or loss that occurred due to the use of parts which are not genuine parts manufactured by Kitagawa. Also, the use of parts other than Kitagawa’s genuine parts will void the warranty.

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1. Structural Drawing and Parts List

1-1. Model indication

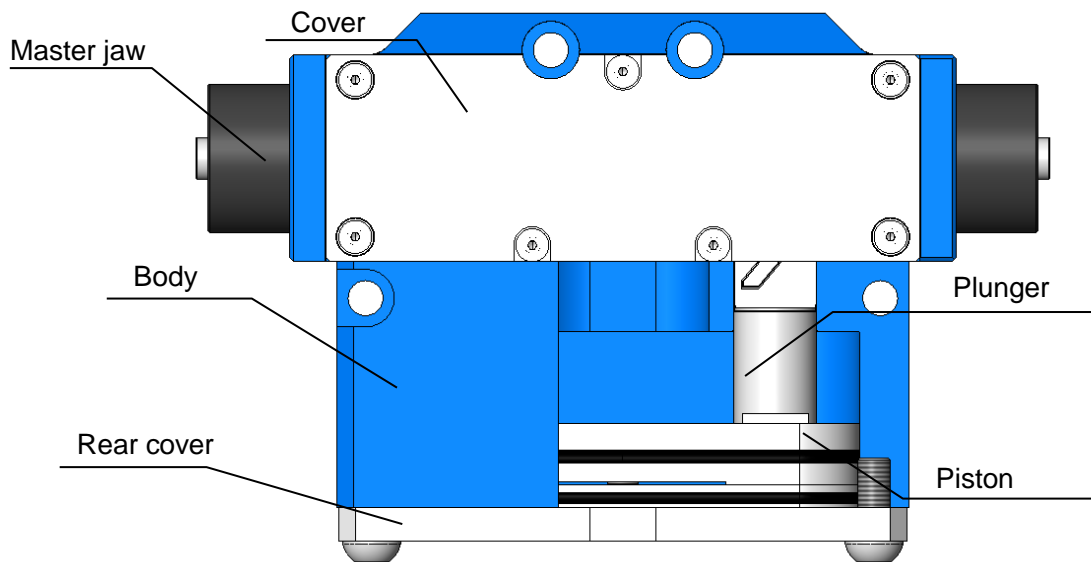
The model indication is as follows:

NPL2 16 S

Series		Size			Length measuring sensor	
NPL2	NBR seal	16			Nil	Not equipped
					S	Equipped

* For the gripper equipped with the length measuring sensor, see also the separately provided instruction manual for it.

1-2. Structural drawing

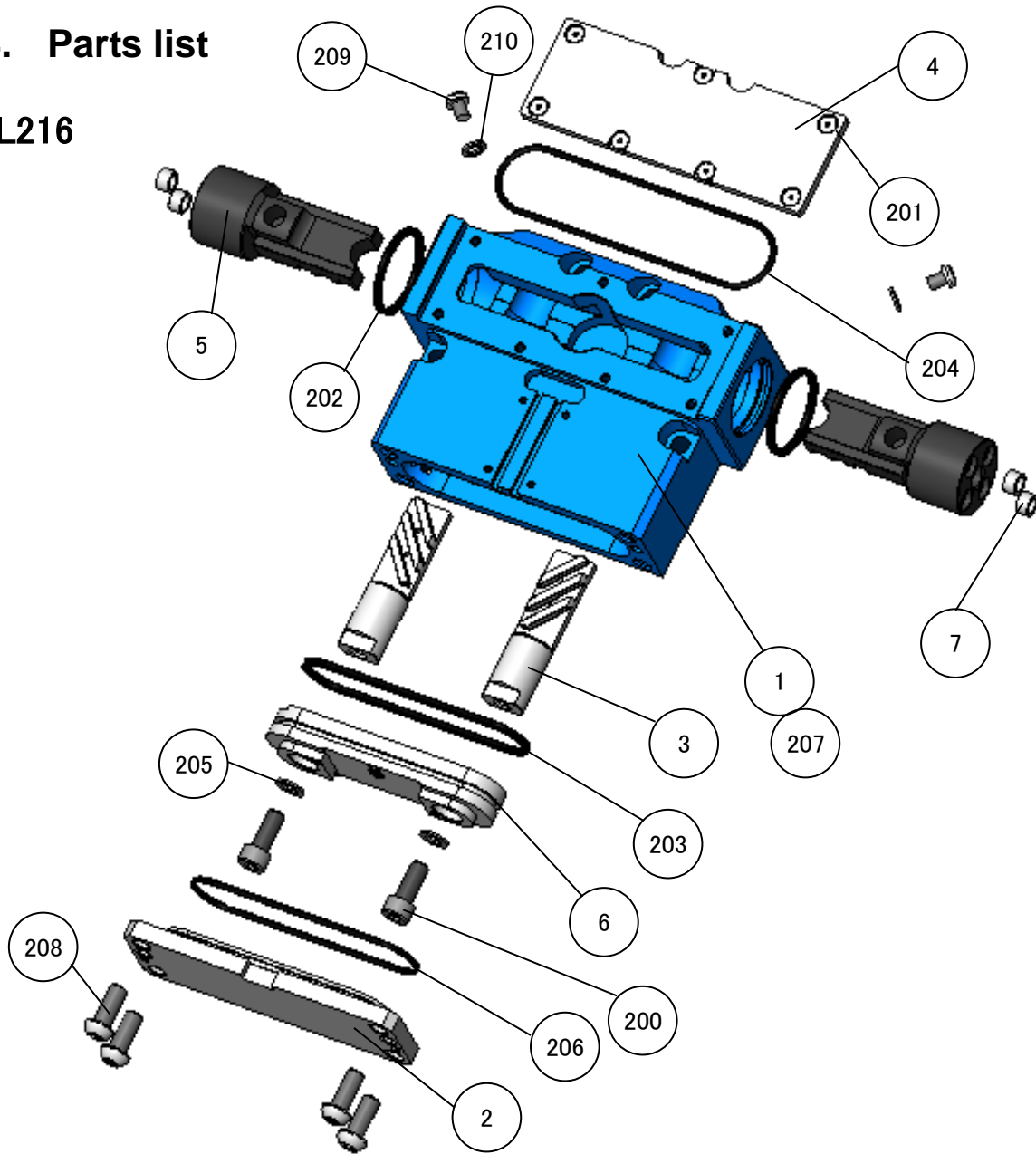


1-3. Seal list

Model	No.					
	202	203	204	205	206	210
NPL216	X-ring X127	X-ring X151	O-ring S95	Seal washer 8S1	O-ring S80	Seal washer SUS 6S1

1-4. Parts list

NPL216



No.	Parts name	Quantity	No.	Parts name	Quantity
1	Body	1	202	Jaw packing	2
2	Rear cover	1	203	Piston packing	1
3	Plunger L (R)	1 (1)	204	O-ring	1
4	Cover	1	205	Seal washer 8S1	2
5	Master jaw L (R)	1 (1)	206	O-ring	1
6	Piston	1	207	Setscrew	8
7	Positioning bushing	4	208	Rear cover fixing bolt	4
200	Plunger fixing bolt	2	209	Hexagon socket head cap screw fine thread	2
201	Cover fixing bolt	4	210	Seal washer SUS 6S1	2

2. Important Safety Precautions

Important safety precautions that particularly you should know or follow are summarized below. Please read them before starting to use the product.



DANGER

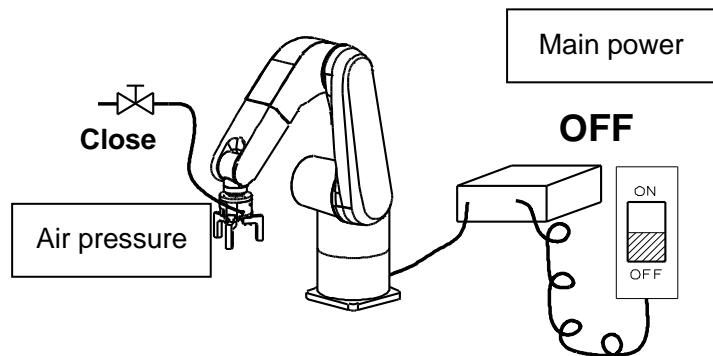
Failure to follow the safety precautions below will result in death or serious injuries.



Be sure to turn off the main power supply when installing, checking, oiling, or replacing the gripper.

Also, shut down the air pressure in the work area.

- During work, the robot or gripper could move abruptly and collide with your body.
- After shutting down the air pressure, release the air pressure remaining inside the gripper.



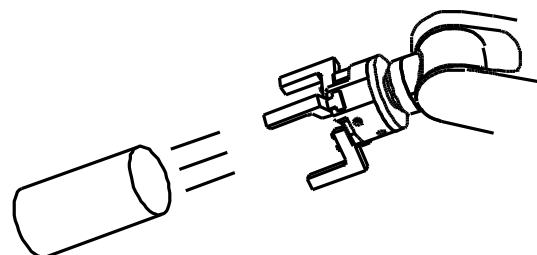
When installing, checking, oiling, or replacing the gripper, post a sign or notice, or provide a fence, and so on to notify people around the machine that work is in progress.

- Notify people around the machine that work is in progress and take measures to keep people other than the operator out of the work area.
Machine motion not predicted by a third party could cause serious danger.



Take safety measures so that the operator is not injured even if the conveyed workpiece flies out due to the reduced air pressure.

- Observe the legal safety standards defined by each country, such as installation of safeguards or fall prevention covers.





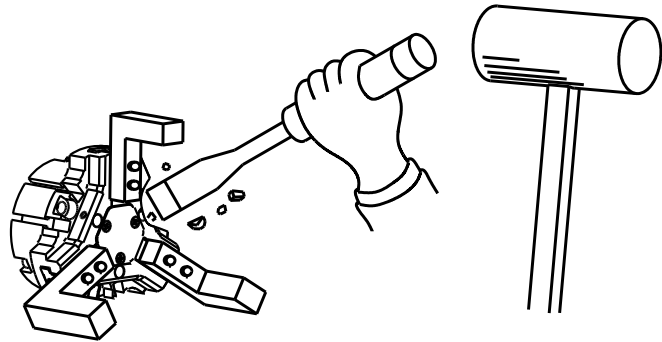
DANGER

Failure to follow the safety precautions below will result in death or serious injuries.



Do not modify the gripper.

- Not only the gripper is damaged but also the gripper and fixed workpiece may fly out.



If using the gripper as a workpiece fixture when the workpiece is drilled, deburred, welded, or modified additionally, confirm the specifications.

- If the gripper is used out of the specifications, not only the gripper is damaged but also the fixed workpiece may fly out.



Be sure to tighten the bolts with the specified torque.

- Lack of bolt quantity or tightening torque, or excessive torque could damage the bolt, causing the gripper or conveyed workpiece to fly out.
- When tightening the bolts, fix the gripper so that it will not rotate. Failure to do so may result in injury by slipping your hands when tightening the bolts.

Gripper body fixing bolt

Bolt size	Tightening torque	
M8	27	N·m
M10	58	N·m

Hexagon socket button head screw

Bolt size	Tightening torque	
M8	10.5	N·m

Plunger fixing bolt

Bolt size	Tightening torque	
M8	33	N·m

Cover fixing bolt

Bolt size	Tightening torque	
M4	2	N·m



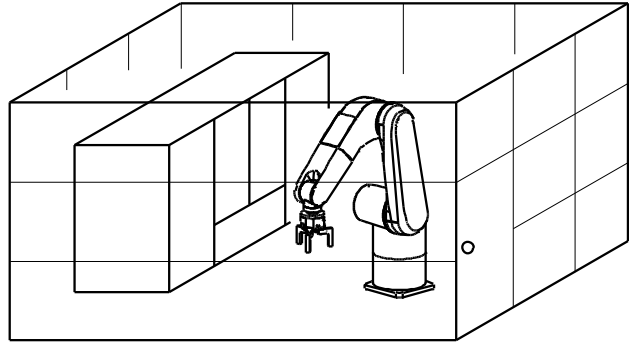
DANGER

Failure to follow the safety precautions below will result in death or serious injuries.



Use the gripper in accordance with the legal safety standards.

- Use the gripper in accordance with the legal safety standards defined by each country, such as installation of safeguards or safety covers.





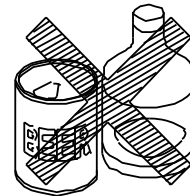
WARNING

Failure to follow the safety precautions below will result in death or serious injuries.



Do not operate the machine after drinking alcohol or taking medicine.

- Impaired judgment or operation mistake may cause serious hazards.



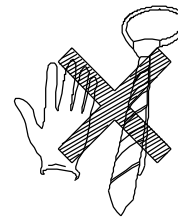
Alcohol

Medicine



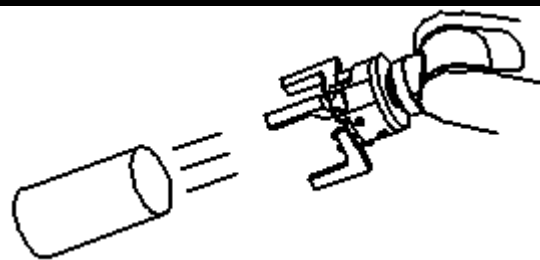
Do not wear clothing or accessories such as a necktie, necklace, etc. which are easy to be caught in.

- You may be caught in the gripper.



Use the gripper within the range of specification values.

- When selecting a gripper, select the model by referring to "Model selection" in page 14.
- Have the gripper grip the conveyed workpiece at the position of its center of gravity.
- If not, not only the gripper is damaged but also the conveyed workpiece may fly out.



3. Specifications

3-1. Specification table

Model		NPL
		216
Fluid used		Air pressure
Operating air pressure	(MPa)	0.2~0.6
Ambient temperature range	(°C)	5~60
Jaw stroke in diameter	(mm)	37
Cylinder internal volume (reciprocation)	(cm ³)	163.8
Repeatability	(mm)	±0.008
Body Mass	(kg)	2.5
Ambient humidity range	(%)	30~95
Storage temperature range	(°C)	5~60
Noise level	(dB)	79

*Noise level is measured at a distance of 1m from the gripper in front, rear, left, and right four positions of the gripper.

3-2. Gripping force

① Standard for selecting a model

Perform the following calculation and select the model that provides a gripping force exceeding the calculation result, though a gripping force varies depending on the shapes of jaws created by the customer and conveyed workpiece or the friction coefficient.

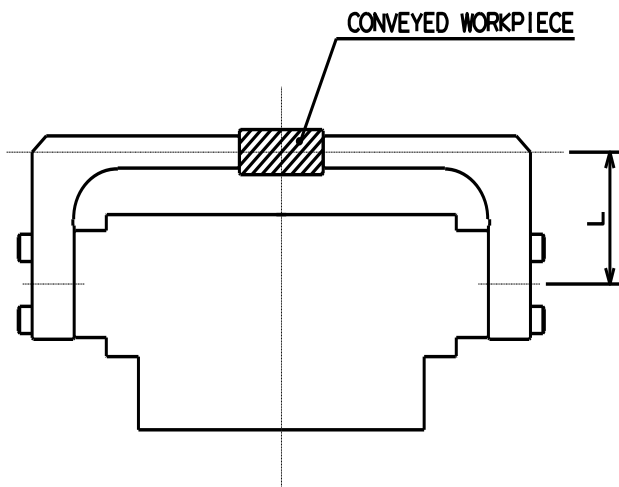
$$F = m(g+a) / \mu$$

(Example) When mass of conveyed workpiece
and robot acceleration = 10m/s^2 :
 $F = 8(9.8+10)/0.1 = 1584\text{ (N)}$

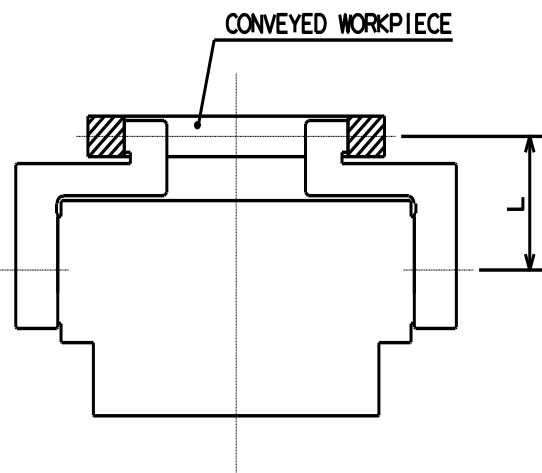
F = Gripping force (N)
m = Mass of conveyed workpiece (kg)
g = Gravitational acceleration (m/s^2)
a = Acceleration of robot/loader (m/s^2)
 μ = Friction coefficient of gripping part

② Gripping force

● External gripping



● Internal gripping



L: Distance up to a grip point(mm)

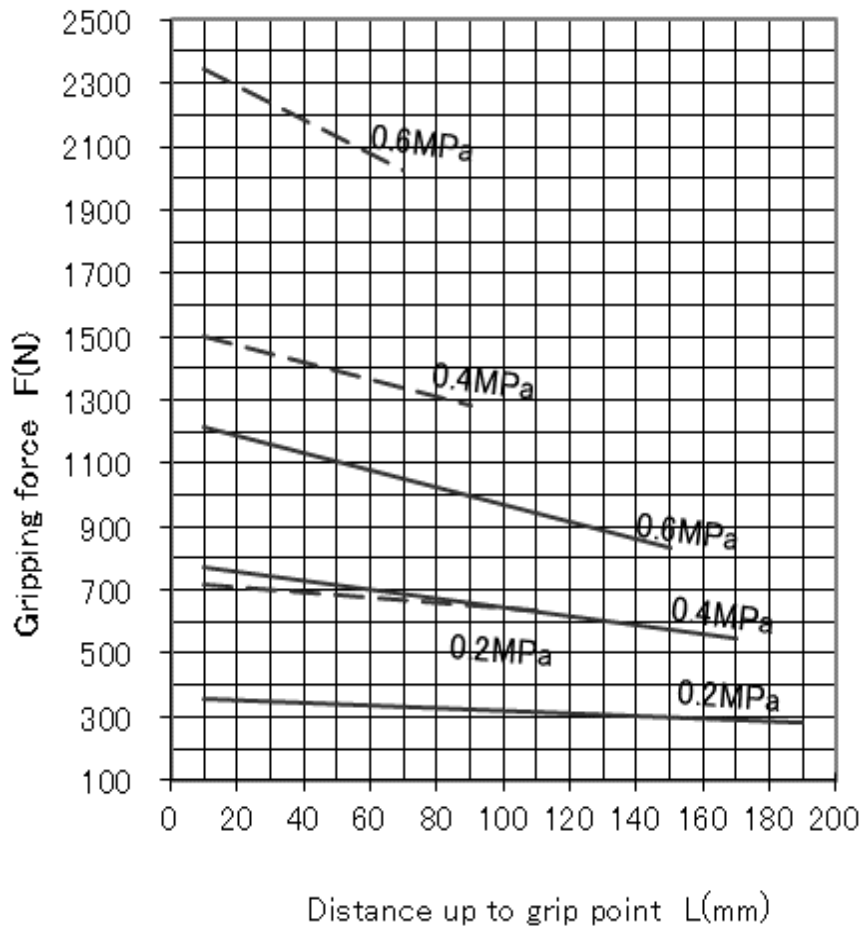
● Expression of gripping force

A gripping force F shown in graph is actually measured gripping force per jaw F1 x the number of jaws.

$$(F = F1 \times 2)$$



———— External gripping
----- Internal gripping



NOTICE

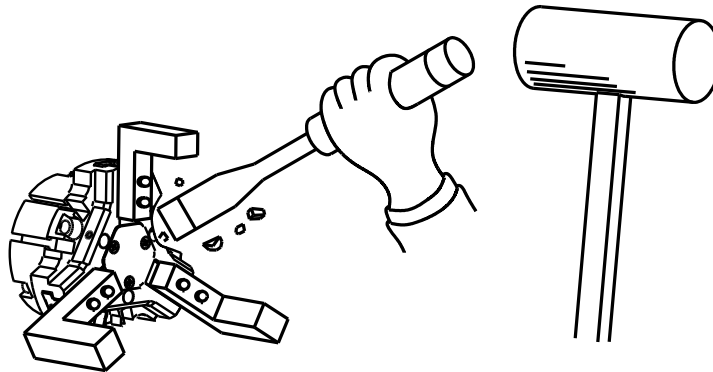
- Determine the distance up to a grip point L as short as possible when designing the jaws. Also, the distance up to a grip point L should be used within a range shown in graph. If it is used out of the range, not only the specified gripping force may not be obtained but also the wear of sliding parts may be increased.

4. Use

This product supplies pneumatic pressure to the unit to move the jaws in the open or close direction for gripping the conveyed workpiece and transfers the conveyed workpiece up to any location. After transfer, the jaws are moved in the close or open direction for removing the conveyed workpiece.

DANGER

- Do not modify the gripper. Using the modified product could cause unexpected accidents. Kitagawa shall not be held liable for human accidents, death, damage, or loss that occurred due to the modification.



- If using the gripper as a workpiece fixture when the workpiece is drilled, deburred, welded, or modified additionally, confirm the specifications. If the gripper is used out of the specifications, not only the gripper is damaged but also the fixed workpiece may fly out.

WARNING

- Wear appropriate clothing suitable for the work and wear gloves, safety glasses, safety shoes, and helmet.
 - Wearing inappropriate clothing causes the clothing to be stuck, resulting in danger.
 - Appropriate clothing will be preventive measures to prevent hazards due to the carelessness or unexpected accidents during work.

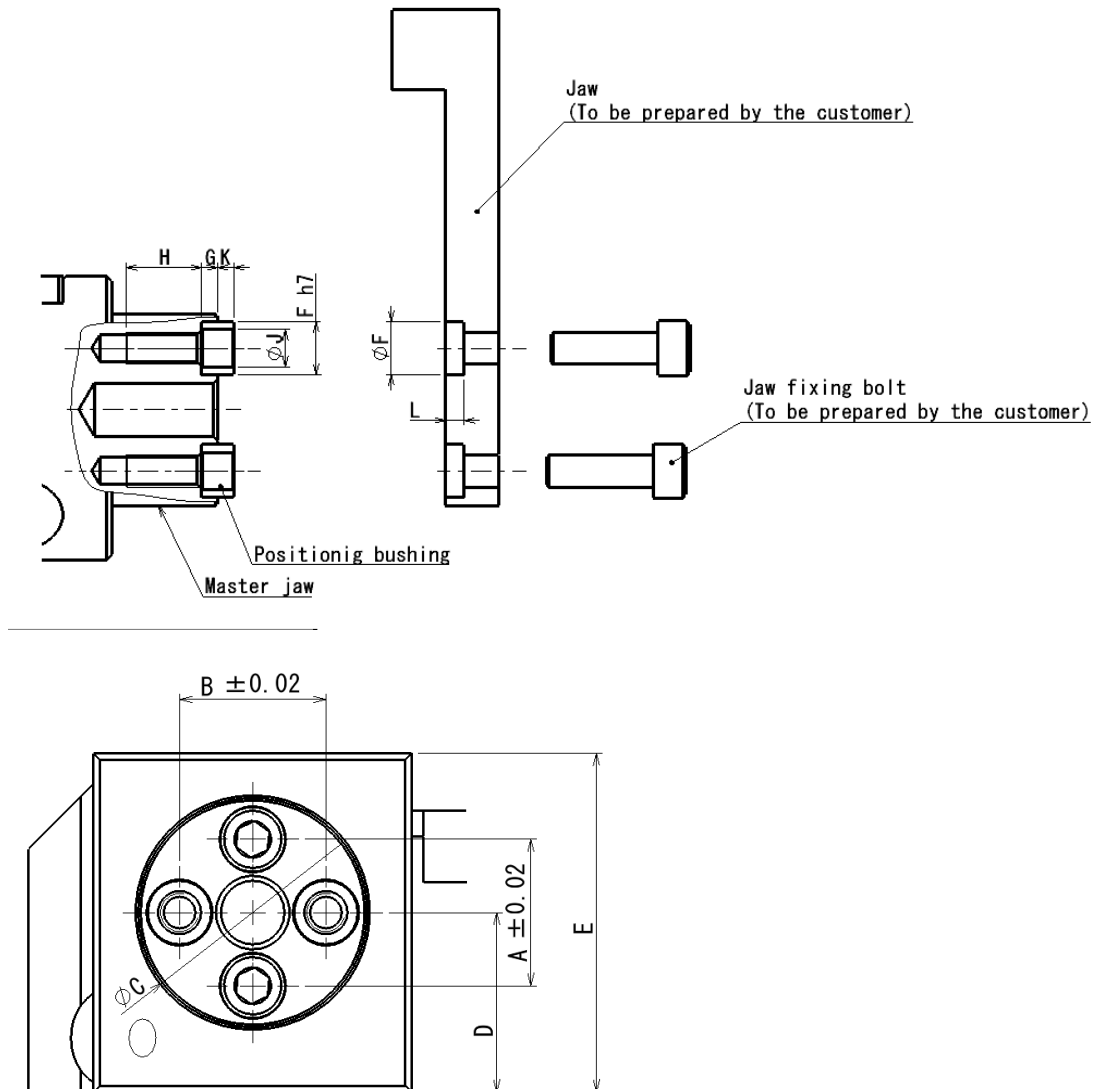
NOTICE

- Do not use the product in the environment of corrosive chemicals, corrosive gas, dust, and vibration, avoiding high temperature or direct sunlight.
- * When storing the product, apply antirust treatment and then store it in a place free from water leakage, dew condensation, or freeze.
- Increase the maintenance frequency when gripper is used in an environment directly exposed to water or oil because the seal life will be reduced.(P20)

5. Design of Jaws

5-1. Designing jaws to be installed on the gripper

When designing jaws to be installed on the gripper, form the installation face to the master jaw as shown below.



Model	A	B	C	D	E	F	G	H
NPL216	23	23	∅36	28.2	53.2	∅10	3	14

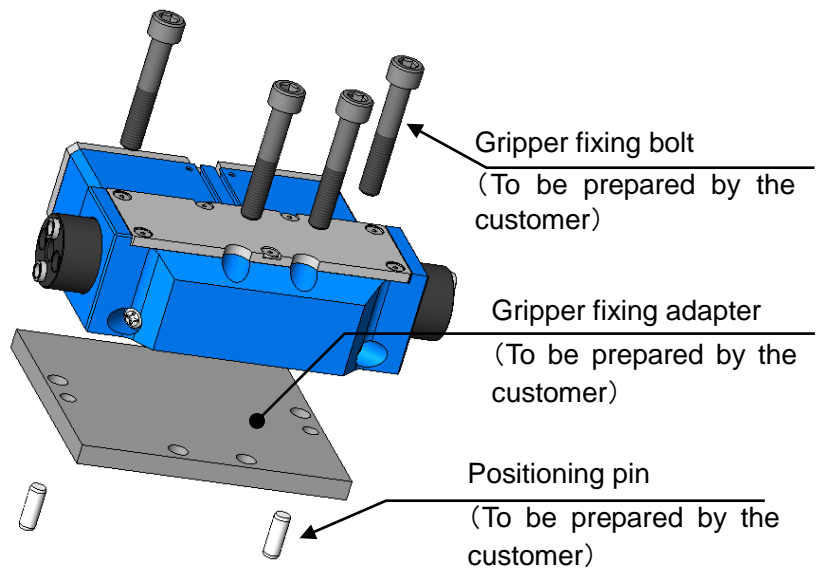
Model	J	K	L	Mounting bolt size
NPL216	∅7	3	4	M6

6. Installation

6-1. Installing the gripper

① Front face installation

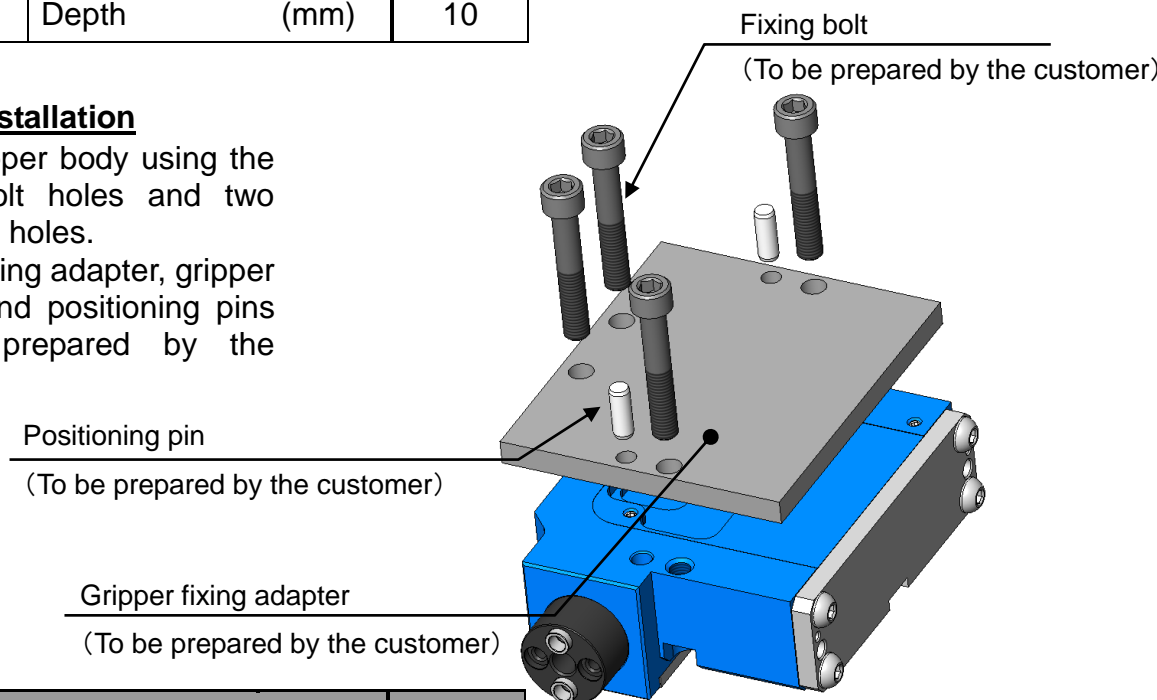
Install the gripper body using the four fixing bolt holes and two positioning pin holes. The gripper fixing adapter, gripper fixing bolts, and positioning pins are to be prepared by the customer.



Model		NPL	216
Gripper fixing bolt size			M8
Positioning pin hole	Diameter ($0^{+0.025}$)	(mm)	$\phi 8$
	Depth	(mm)	10

② Rear face installation

Install the gripper body using the four fixing bolt holes and two positioning pin holes. The gripper fixing adapter, gripper fixing bolts, and positioning pins are to be prepared by the customer.

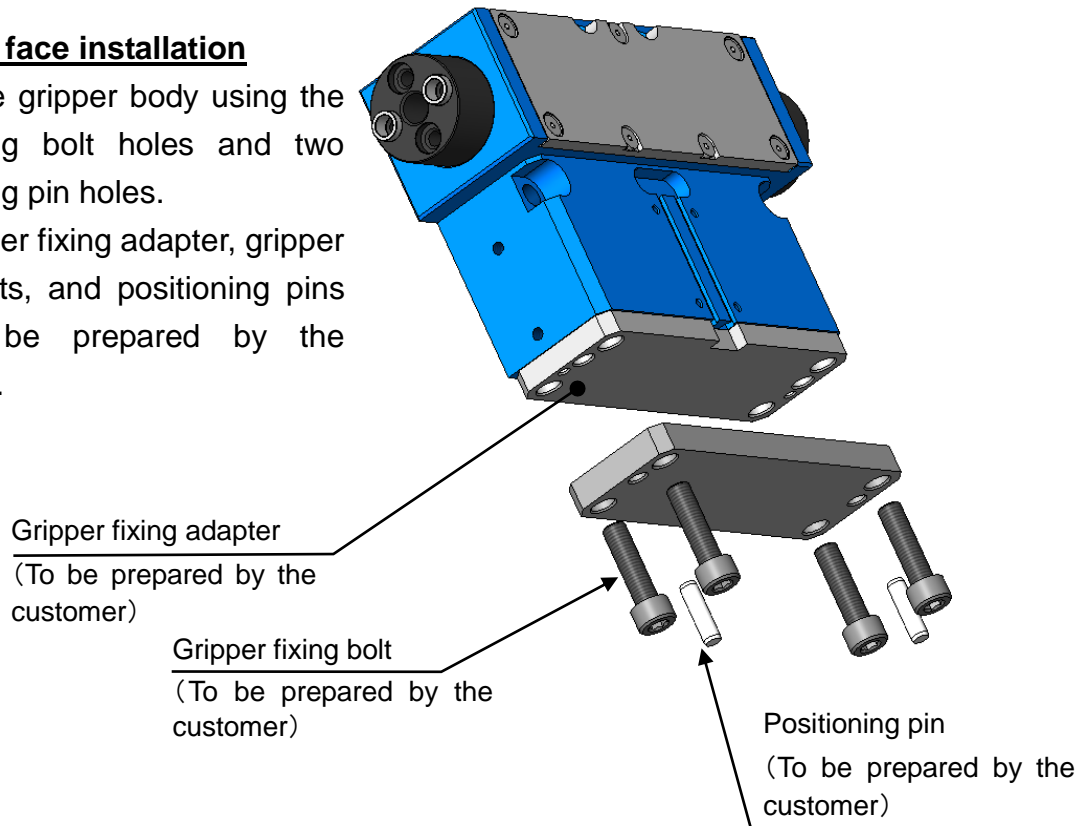


Model		NPL	216
Gripper fixing bolt	Size		M10
	Thread depth	(mm)	18
Positioning pin hole	Diameter ($0^{+0.025}$)	(mm)	$\phi 8$
	Depth	(mm)	10

③ **Bottom face installation**

Install the gripper body using the four fixing bolt holes and two positioning pin holes.

The gripper fixing adapter, gripper fixing bolts, and positioning pins are to be prepared by the customer.



Model		NPL	216
Gripper fixing bolt	Size		M8
	Thread depth (mm)		16(24)
Positioning pin hole	Diameter ($_{0}^{+0.025}$) (mm)		$\phi 6$
	Depth (mm)		8(16)

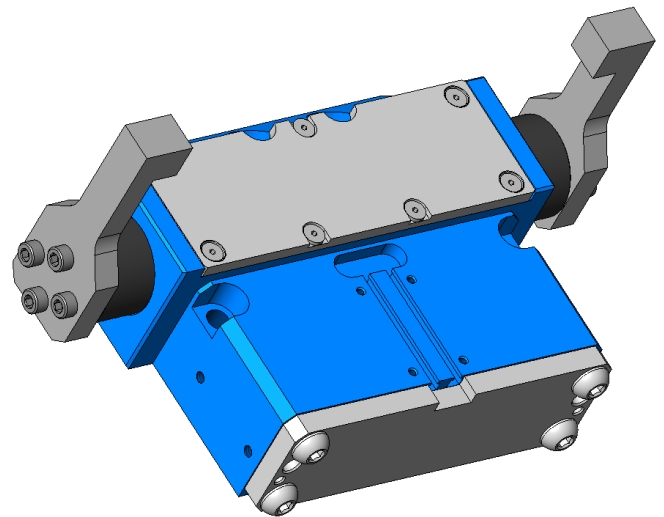
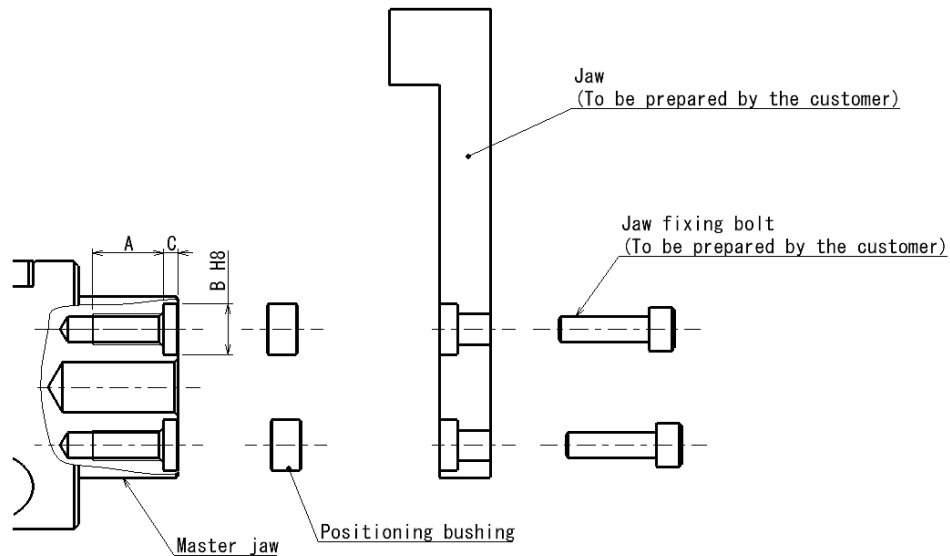
※The dimensions in () indicate the depth from the mounting surface.



- Be sure to tighten the bolts with the specified torque. Lack of tightening torque or excessive torque could break the bolts, causing the gripper or conveyed workpiece to fly out.

6-2. Installing the jaws

Install the jaws using four mounting bolt holes, spigot joint and positioning bushing holes. The jaws, jaw fixing bolts, and positioning bushings are to be prepared by the customer.



Model		NPL	216
Mounting bolt	Size		M6
	Thread depth	A (mm)	14
Positioning pin hole	Diameter (H8)	B (mm)	$\phi 10$
	Depth	C (mm)	3

※Attach the mounting bolts with a tightening torque of 13 N·m.

⚠ DANGER

- Be sure to tighten the bolts with the specified torque. Be sure to tighten the bolts with the specified torque. Lack of tightening torque or excessive torque could break the bolts, causing the jaws or conveyed workpiece to fly out.
- Before installing the jaws, disconnect the air piping.

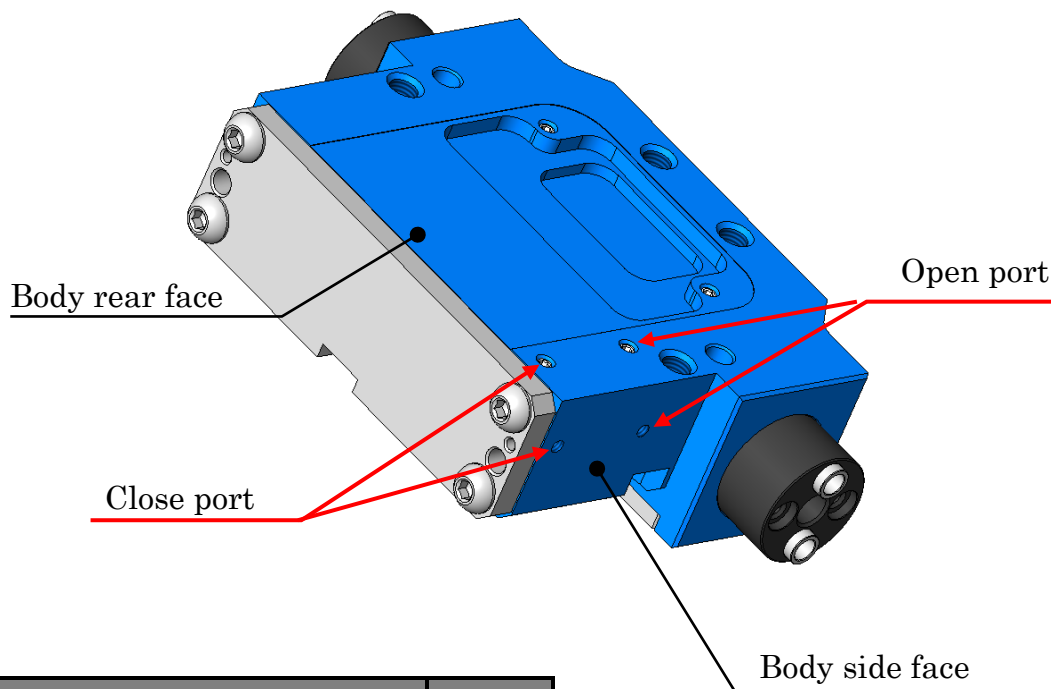
6-3. Connecting the air piping

The air pressure supply ports to open and close the gripper jaws are provided on the side face and rear face of the body.

When using the supply port on the side face of the body, connect the air piping directly.

When using the supply port on the rear face of the body, remove the setscrew, which is attached at the delivery to prevent air leakage, and supply air from the adapter to fix the gripper.

The screws to close the open/close ports on the side face of the body are to be prepared by the customer.



Model	NPL	216
Port size on body side face		M5
Port size on body rear face		M5

NOTICE

- The setscrews in the air pressure supply ports on the body rear face are mounted with adhesive applied to them to prevent air leakage, so it is very difficult to remove them. Therefore, when removing the setscrews, be careful not to damage them.
- After removing the setscrews, take away adhesive fixed to the body screw hole clearly. Be careful not to drip the adhesive into the cylinder.

 **WARNING**

- Be sure to shut off the air pressure before connecting the air piping.
- Use compressed air as the fluid.
- Do not use compressed air that contains chemicals, synthetic oils containing organic solvents, salt, or corrosive gases, as it may cause damage or malfunction.

 **CAUTION**

- Use clean air that has passed through an air filter (filtration of 5 μm or less).
- Keep the fluid temperature and ambient temperature within the range of 5 to 60°C.
- Can be used without lubrication, but if lubricated, please use Class 1 turbine oil (no additives) ISO VG32.
- Select an after cooler, air dryer, mist separator, etc., according to ISO 8573-1 Class 4, and take measures against drainage.
- Adjust with a speed controller, etc. so that the opening/closing speed does not become faster than necessary.

6-4. Installing the switches

Use reed switches of the following models.

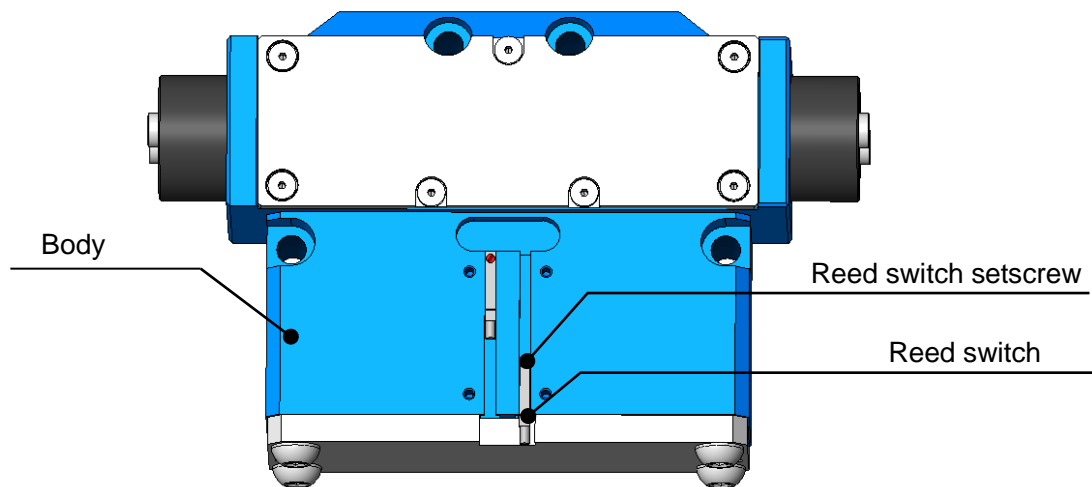
	CKD			SMC	
	Noncontact	2-wire system		Noncontact	2-wire system
Model	F2H	F2V	F2S	D-M9B	D-M9BV
Lead wire pull-out shape	Straight	L-shaped	L-shaped short	Straight	L-shaped

* Using reed switches not shown below may lead to unstable response.

Installing the reed switch

Mount reed switches using the grooves on the body.

When using reed switches, design adaptors so that the adaptors will not interfere with the reed switches.



● Installation procedure for the close end side

- ① Move the master jaws to the close end positions, respectively.
- ② Mount a reed switch using the groove on the body.
- ③ Move up and down the reed switch slowly.
- ④ Tighten and fix the setscrew provided on the reed switch at the position where the reed switch detected.
- ⑤ Repeat the opening/closing operation of the master jaws to confirm that the reed switch can detect.

*In the case of workpiece external gripping, make the above-mentioned adjustment with the workpiece gripped.

● Installation procedure for the open end side

- ① Move the master jaws to the open end positions, respectively.
- ② Mount a reed switch using the groove on the body.
- ③ Move up and down the reed switch slowly.
- ④ Tighten and fix the setscrew provided on the reed switch at the position where the reed switch detected.
- ⑤ Repeat the opening/closing operation of the master jaws to confirm that the reed switch can detect.

7. Maintenance and Checking

7-1. Periodic inspection

- Before work or when resupplying grease, move the jaws to full stroke position to check that the stroke mentioned in the specification table is obtained.
- At the end of work, be sure to clean the gripper main body using an air gun or the like.
- At least every three months, check that the bolts are not loose.
- The cover mounting bolt (No.202) may rust due to deterioration over time or repeated tightening and removal. If rust occurs, replace the bolt immediately.

7-2. Maintenance interval

- The maintenance interval is 1 million cycles, and disassemble the gripper, clean, replace the seals, lubricate, and reassemble the gripper.
- If the gripper is used in a situation where it is directly exposed to water or oil, check for air leaks every 200,000 cycles. If air leaks are found, disassemble the gripper, clean, replace the seals, lubricate, and reassemble the gripper.

7-3. Grease

① Grease used

- Be sure to use the specified grease listed below. If unspecified grease is used, adequate effect may not be obtained.

Brand	Manufacturer
MOLYCOTE BR2 Plus Grease	DuPont de Nemours, Inc. : Whole world

② Grease gun and nozzle

- Supply the grease gun and nozzle using the nozzles recommended below.

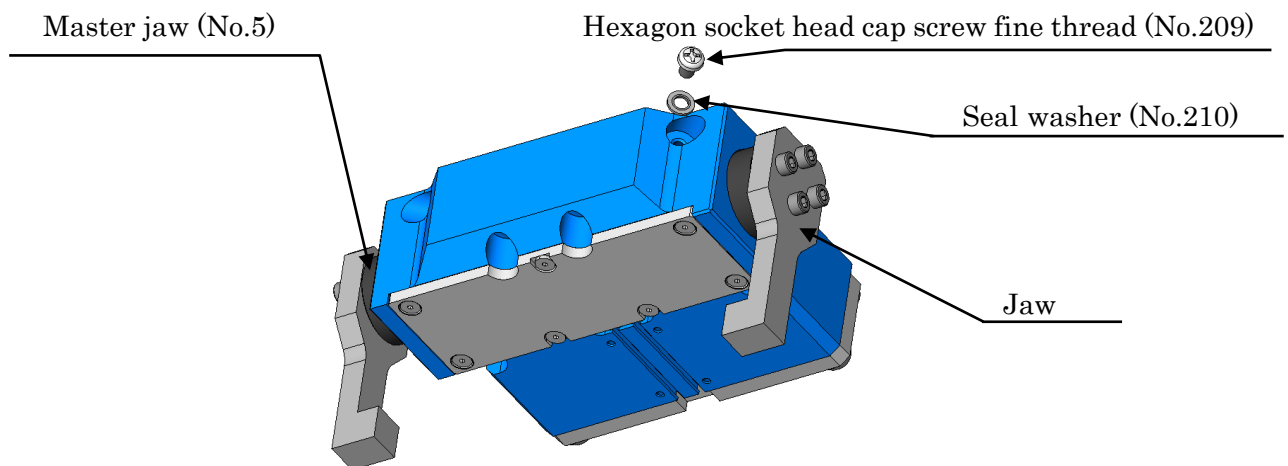
Equipment name	Model	Manufacturer
Grease gun	KH-120	Yamada Corporation
Nozzle	HSP-3	Yamada Corporation

③ Grease resupplying method

- Before starting the operation, stop the supply of compressed air to the gripper and disconnect the compressed air piping connected to the gripper to exhaust the remaining pressure inside the gripper.
- Next, remove the hexagon socket head cap screw fine thread (No. 209).

! WARNING

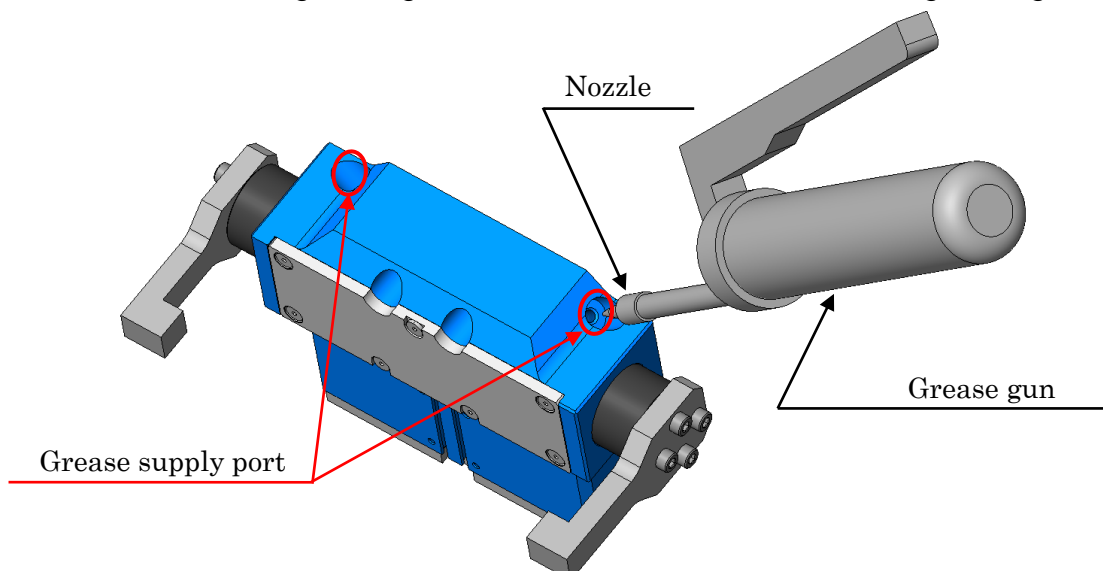
- Removing the Hexagon socket head cap screw fine thread (No. 209) while the gripper is pressurized with compressed air or while there is residual pressure inside the gripper can be extremely dangerous, as it may cause the Hexagon socket head cap screw fine thread (No. 209) to scatter due to the compressed air or result in grease ejection.



- Supply grease while pressing the tip of the nozzle against the grease supply port shown in the figure below. Apply grease to the left and right grease supply ports once in the open state and once in the closed state (4 times in total).

Please resupply 0.5 gram at each place.

* Please contact the grease gun manufacturer for how to use the grease gun.



- Attach the hexagon socket head cap screw fine thread (No.209) to the grease supply port with a tightening torque of 6.0 N·m.

④ **Safety information on grease and antitrust oil**

Applicable range

- Specified grease
- Antitrust agent applied to the product at the delivery

First-aid treatment

- Aspiration: In case of much aspiration, go to a place where there is fresh air, and cover your body with a blanket to keep your body warm. Consult a doctor if necessary.
- Sticking to your skin: Wipe off the oil, and wash your skin with water and soap. If you feel itchy or you get inflamed, consult a doctor immediately.
- Entering your eye: Wash your eye with fresh water for at least 15 minutes, and then consult a doctor.
- Accidental drinking: Consult a doctor immediately without vomiting forcibly.

- For the grease other than the specified one and antitrust oil prepared by the customer, refer to the safety information prepared for respective oils.

7—4. Air circuit maintenance

- Periodically drain the air filter, etc.
- If foreign matter such as carbonized compressor oil enters the circuit, the solenoid valve and robot hand will malfunction, so be careful when performing maintenance and inspection of the compressor.

7-5. Disassembly

Disassembly procedure

By referring to the parts list on page 6, disassemble the product through the procedure below:

- ① Stop the air pressure supplied to the gripper and disconnect the air piping.
- ② Remove the gripper from the robot or the loader.
- ③ Remove the rear cover fixing bolts (No. 208) and the rear cover (No. 2).
- ④ Remove the piston (No. 6) and the plunger (No. 3) together.
- ⑤ Remove the master jaw (No. 5).
- ⑥ Loosen the cover fixing bolts (No. 201) and remove the cover (No. 4).

Assembly procedure

By referring to the parts list on page 6, assemble the product through the procedure below:

- ① Insert the master jaw (No. 5) into the body (No. 1).
- ② Insert the piston (No. 6) and the plunger (No. 3) into the body (No. 1).
(Align the magnet position on the piston (No. 6) with the sensor groove.)
Adjust the engagement between the master jaw (No. 5) and the plunger (No. 3) while changing the position of the master jaw (No. 5).
- ③ Attach the rear cover (No. 2) to the body (No. 1) using the rear cover fixing bolts (No. 208).
- ④ Fix the cover (No.4) using the cover fixing bolts (No.201).
- ⑤ Install the gripper to the robot or the loader.
- ⑥ Connect the air pressure piping.

To reassemble the gripper, apply the specified grease to the sliding parts and the oil treatment to the seal sliding parts, and perform the reverse procedure of disassembly while checking that the seals do not protrude or fall.

Oil treatment used

Be sure to use the specified oil treatment shown below.

Brand	Manufacturer
S-10 Oil treatment	Napolex: Japan



- **Be sure to tighten the bolts with the specified torque. Lack or tightening torque or excessive torque could break the bolts, causing the conveyed workpiece to fly out.**

8. Troubleshooting

8-1. Problems and countermeasures

Check the following, and take corrective actions.

Symptom	Cause	Corrective actions
Gripper does not operate	Gripper internal part is broken.	Replace the gripper with a new one.
	Slideways get seized.	Disassemble, and correct the seized part with an oilstone, or replace the gripper with a new one.
	The piston does not operate.	Check that the air pressure is within the operating pressure range.
		Check for air leakage.
		Check the piping and solenoid valve, and if normal, disassemble and clean the cylinder.
The switch is faulty or installed incorrectly.	Check that the switch can detect normally.	
Lack of master jaw stroke	Much dust exists in master jaws.	Disassemble the gripper, clean it, replace the seals, and apply grease.
Low gripping force	Low air pressure	Check that the air pressure is within the operating pressure range.
	Air leaks from the seal.	Disassemble the gripper, clean it, replace the seals, and apply grease.
	Master jaw movements are not smooth.	Remove the cover and supply grease, and open and close the master jaws several times without gripping any conveyed workpiece.
		Disassemble the gripper, clean it, and apply grease.

WARNING

- If the gripper failed due to a seizure or damage, disassemble the gripper following the disassembly procedure. If the gripper is in the state that you cannot disassemble, do not disassemble it forcibly but please contact us or our agents.
- Stop using the gripper immediately if the situations are not improved though corrective actions given in above table were taken. Continuous use of faulty product or part could cause serious human accidents due to flying gripper or conveyed workpiece.
- The gripper must be repaired only by skilled persons who have received the training course. Repair by unskilled persons or persons other than us or our agents could cause serious human accidents.

8-2. Contact address in case of trouble

Please get in touch with our sales agent from which you purchased the gripper or our office when the gripper troubled.

9. Others

9-1. Standards and directives to which the gripper conforms

This product conforms to the following standards and directives:

- Machinery Directive:2006/42/EC Annex I
- EN ISO 12100:2010

9-2. Disposal of gripper

Dispose of this unit in accordance with the laws and regulations of your country.

Kitagawa Corporation Kitagawa Global hand Company

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The products herein are controlled under Japanese Foreign Exchange and Foreign Trade Control Act.

In the event of importing and/or exporting the products, you are obliged to consult KITAGAWA as well as your government for the related regulation prior to any transaction.