

INSTRUCTION MANUAL

PWS type

Work Gripper



DANGER

- This instruction manual is for production engineers and maintenance personnel in charge of operation of this product. When a beginner uses this product, receive instructions from experienced personnel, the distributor or our company.
- Before installing, operating or maintaining this equipment, carefully read this manual and the safety labels attached to the equipment. Failure to follow these instructions and safety precautions could result in serious injury, death, or property damage.
- Store this manual near equipment for future reference.
- If any questions related to safety arise about this manual, please confirm them with the distributor or our company.

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Preface

This manual provides detailed information about how to safely and correctly use the work gripper (PWS type).

Before starting to use this work gripper, read this manual carefully and always follow the instructions and warnings in "Important Safety Precautions" and "Precautions for Use" at beginning of the manual. Failure to follow these precautions could result in a serious accident.

Terms and Symbols Used for Safety Messages

In this manual, precautions for handling that are considered especially important are classified and displayed as shown below depending on the damage of risk including the seriousness of the harm that could result. Please sufficiently understand the meanings of these terms and follow the instructions for safe operation.

Safety Alert Symbol

The triangle is the safety alert symbol used to alert you to potential safety hazards that could result in injury or death.



Indicates a hazardous situation which, if you not avoided, will result in death or serious injury.



Indicates a hazardous situation which, if you not avoided, could result in death or serious injury.



Indicates a hazardous situation which, if you not avoided, could result in minor or moderate injury.



Indicates instructions which, if not avoided, could result in damage to the equipment or a shortened work life.

Liability and How to Use this Manual

This product is suitable for gripping a workpiece on the rotary tables or machining centers. This product is equipped with the jaws to clamp the workpiece and they operate by means of a built-in cylinder. For any other applications, please contact us.

Our company will not assume responsibility for injury, death, damage, or loss resulting from not following the instructions in this manual.

There are countless things that cannot or should not be done, and it is impossible to cover all of them in this manual.


Therefore, do not perform any actions unless they are specifically allowed in this manual. If any questions related to safety arise about operation, control, inspection and maintenance which are not specified in this manual, please confirm them with our company or distributor before performing them.

Guarantee and Limitation of Liability

The guarantee period of this product is 1 year after delivery.

Use the parts delivered by Kitagawa Corporation for all the parts including consumable parts. We will not assume responsibility for injury, death, damage, or loss caused by usage of parts not manufactured by Kitagawa Corporation. Additionally, if parts other than genuine parts manufactured by Kitagawa Corporation are used, this guarantee will be completely invalid.

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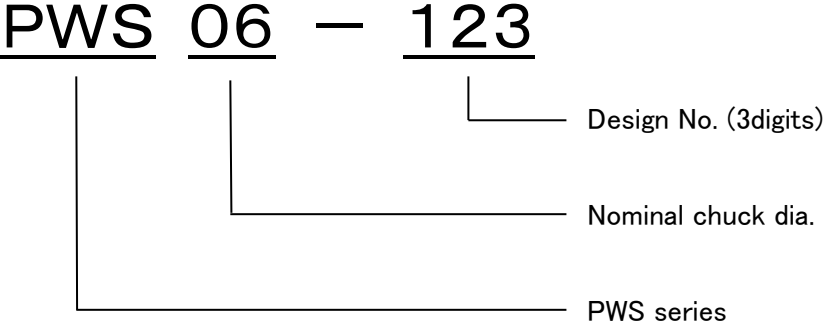
For Machine Tool Manufacturers (Chapter 8)

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1. Structural Drawing and Parts List

1-1. Type display

Type display as shown below



1-2. Structural drawing

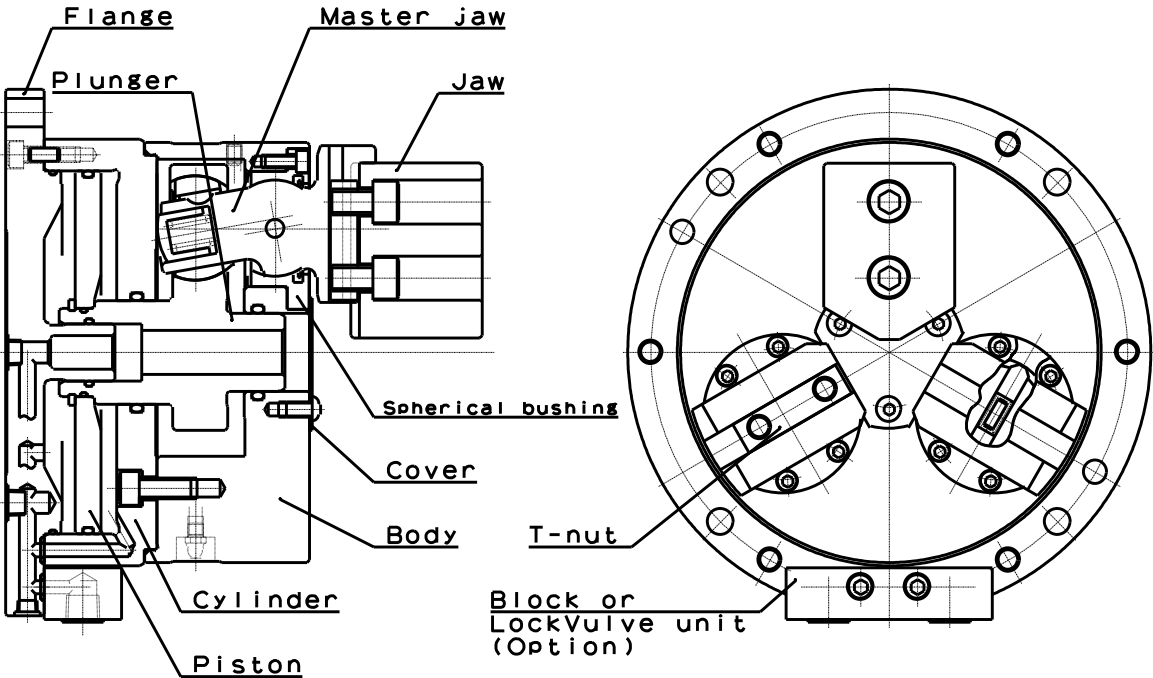


Fig.1-1

1-3. Scope of product

This instruction manual is for the work gripper. Other than information about the work gripper, it is mentioned about optional article (A lock valve unit).

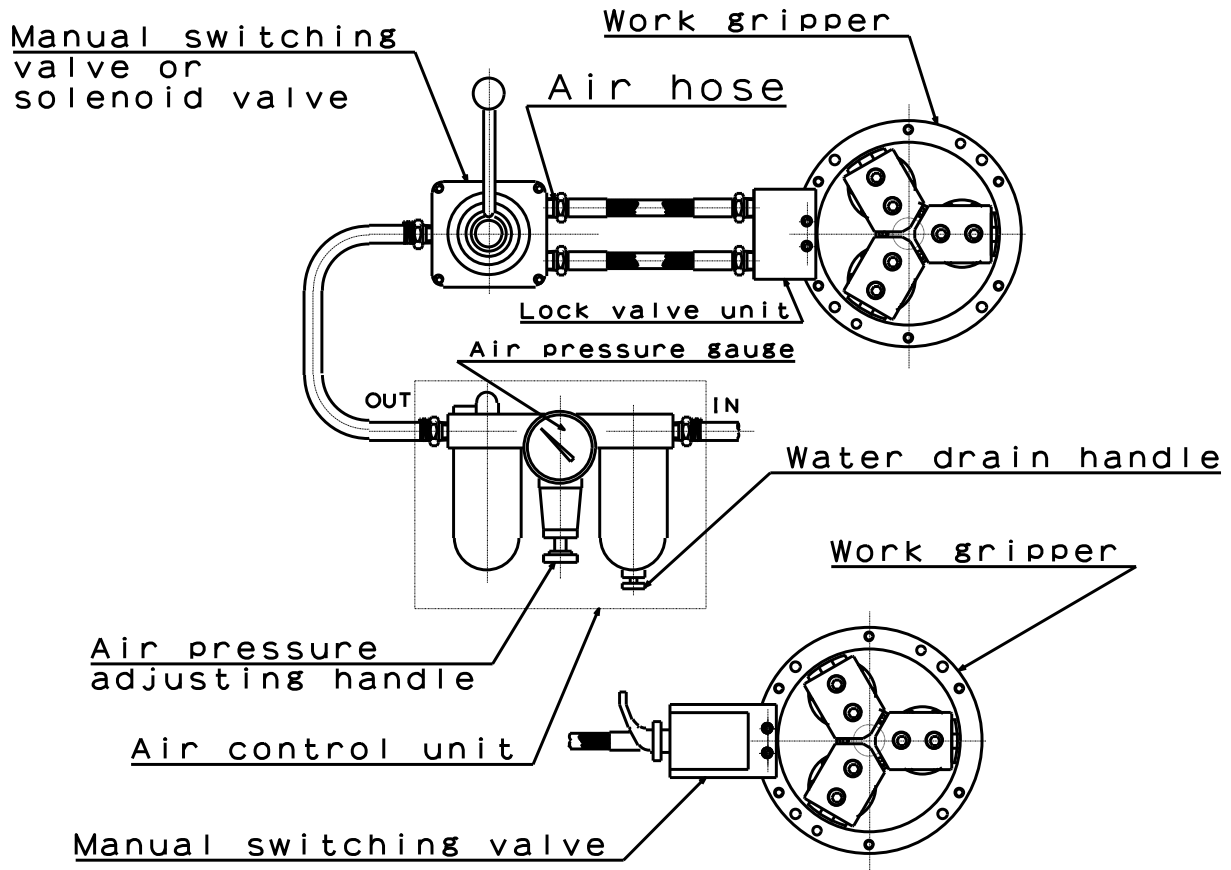


Fig.1-2

! WARNING

- To prevent the work from flying, safe design, maintenance and erroneous action prevention of the pneumatic system to maintain the gripping force of the work gripper is extremely important. Thoroughly read the “Important Safety Precautions” on and after page 10 in this manual.
- As for the other pneumatic products, follow the instruction manual for these products.

1-4. Parts list

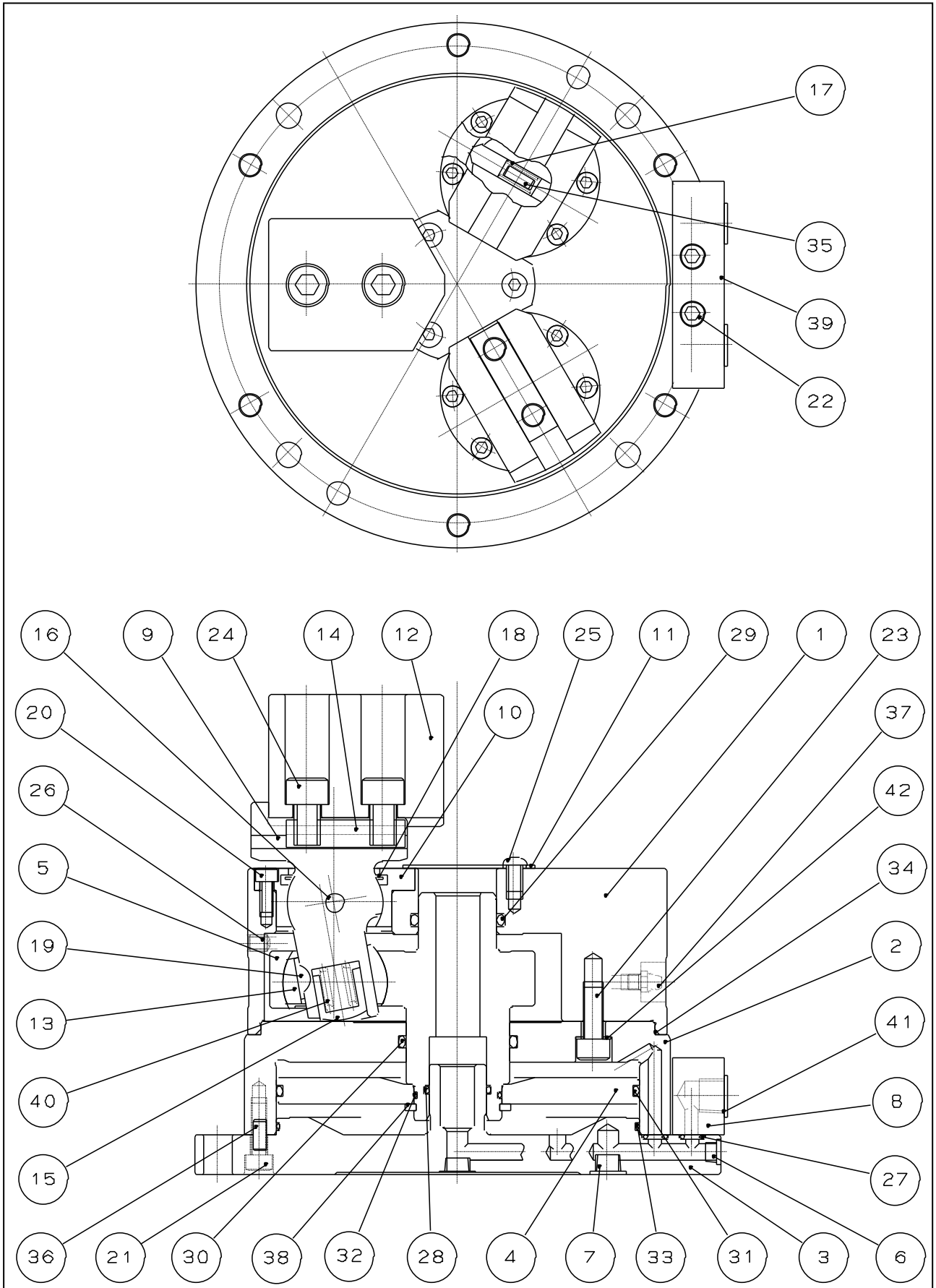


Fig.1-3

Table 1-1

No.	Part name	Quantity	No.	Part name	Quantity
1	Body	1	22	Hex. socket head cap screw	2
2	Cylinder	1	23	Hex. socket head cap screw	3
3	Flange	1	24	Jaw Mounting bolt	6
4	Piston	1	25	Hex. socket button head screw	6
5	Plunger	1	26	Set screw	3
6	Plug C	1	27	O-ring	4
7	Plug D	1	28	O-ring	1
8	Block	1	29	O-ring	1
9	Master jaw	3	30	O-ring	1
10	Spherical bushing	3	31	O-ring	1
11	Cover	1	32	O-ring	1
12	Soft jaw	3	33	O-ring	1
13	Bearing	3	34	O-ring	1
14	T-nut	3	35	Parallel pin	3
15	Spring cap	3	36	Parallel pin	1
16	Pin	6	37	Greace nipple	3
17	Coli Soring	3	38	Retaining ring	1
18	Seal	3	39	Orifice nipple	1
19	Woodruff key	3	40	Coil spring	3
20	Hex. socket head cap screw	12	41	Nylon cap	2
21	Hex. socket head cap screw	8	42	Seal washer	3

Table 1-2 Consumable parts

No.	Part name	PWS06
27	O-ring	JIS2041 P 7
28	O-ring	JIS2041 P 22
29	O-ring	JIS2041 P 30
30	O-ring	JIS2041 P 40
31	O-ring	JIS2041 G 135
32	O-ring	NOK S 30
33	O-ring	NOK S 135
34	O-ring	NOK S 150

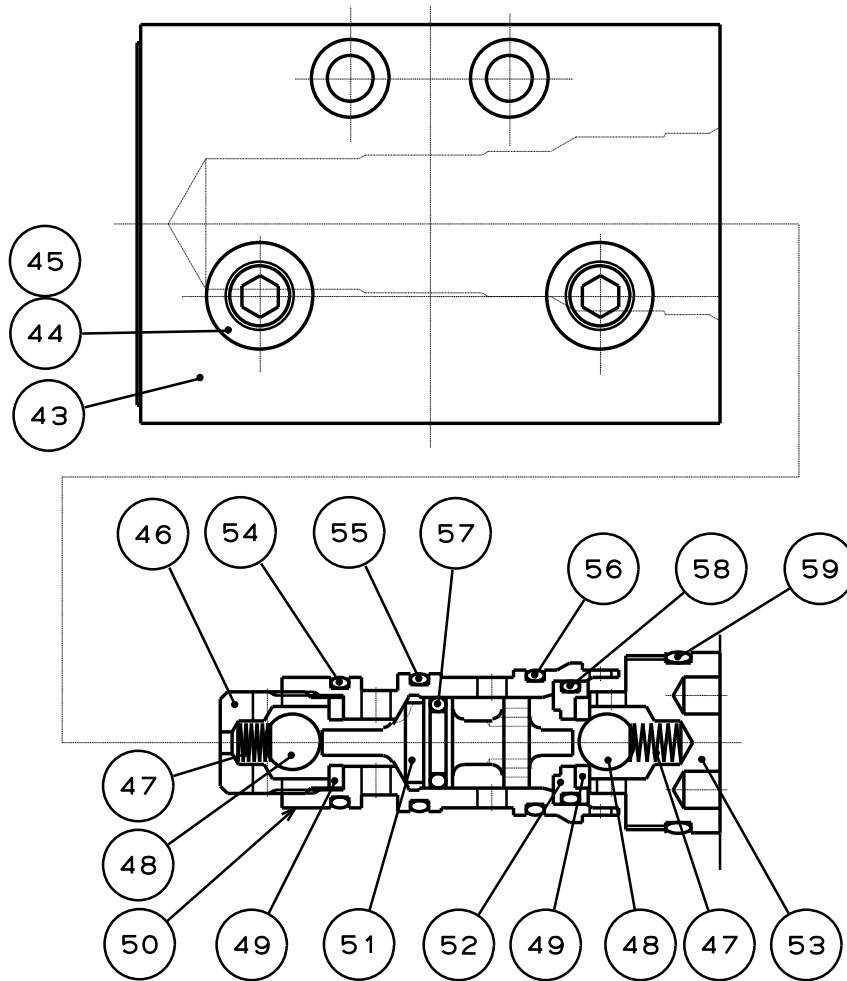


Fig.1-4 Lock valve unit

Table 1-3

No.	Part name	Quantity	No.	Part name	Quantity
43	Block	1	53	Plug	1
44	Seal washer	2	54	O-ring JASO 1015	1
45	Cap screw	2	55	O-ring JASO 1016	1
46	Cap	1	56	O-ring JASO 1017	1
47	Spring	2	57	O-ring JIS B2401 P9	1
48	Ball $\phi 8$	2	58	O-ring JASO 1014	1
49	Valve seat	2	59	O-ring JASO 1021	1
50	Housing	1	60	Hex. key 5	1
51	Pilot spool	1	61	Cap screw M6 \times 50	2
52	Ring	1	62	Air pressure gauge	1

2. Important Safety Precautions

Important safety precautions are summarized below. Please read this section before first starting to use this product.



DANGER

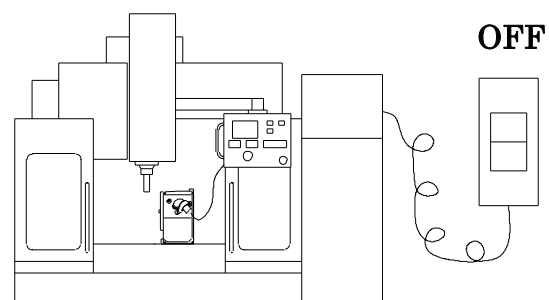
Failure to follow the safety precautions below will result in serious injury or death.



Turn off main power supply before attaching, inspecting or replacing work gripper, and before adding oil.

For All Users

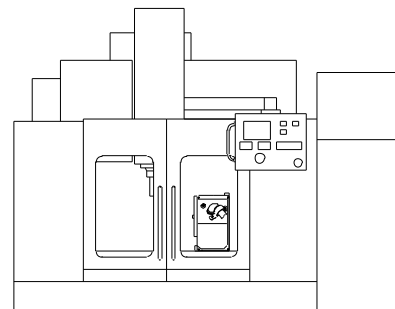
- The machine tool may start rotation suddenly, and a part of the body or clothing may be caught.



Close door before machining.

For All Users

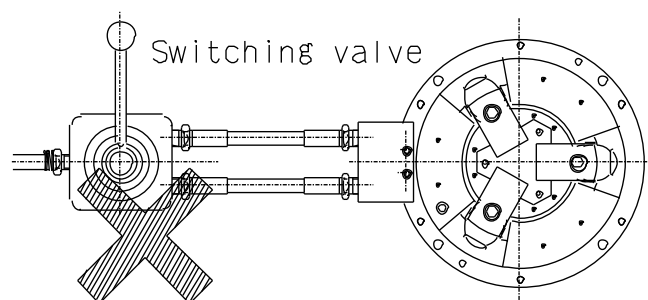
- If the door is not closed, you may touch the tools or the work gripper, or the work may fly out, which is very dangerous. (In general, the safety interlock function which allows machining only when the door is the manual mode or the test mode)



During machining, do not operate switching valve.

For All Users

- This is dangerous as the work will fly out.





Important Safety Precautions



DANGER

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



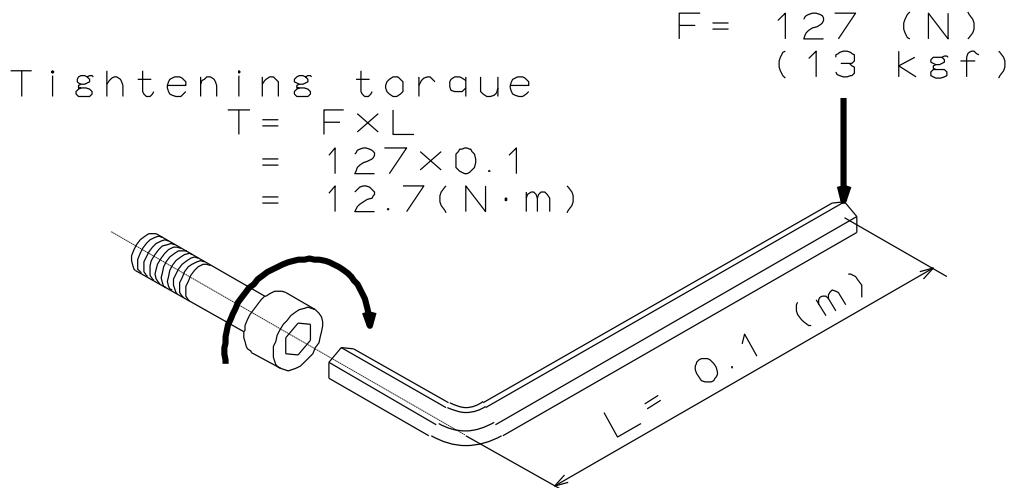
Always tighten the bolts at the specified torque. If the torque is insufficient or excessive, the bolt will break, which is dangerous as the work gripper or work will fly out. Use the bolts attached to the work gripper, and do not use bolts other than these.

For All Users

- If the torque is insufficient or excessive, the bolt will break, which is dangerous as the work gripper or work will fly out.
- You cannot control the torque by a hex key. You must use a torque wrench for torque control.

Specified torque for socket head cap screw

Bolt size	Tightening torque	
M5	7.5	N·m
M6	13	N·m
M8	33	N·m
M10	73	N·m



- Tightening torque is moment of force when you tighten a bolt. Tightening torque = $F \times L$.



Important Safety Precautions



WARNING

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



Use a lock valve (safety valve, check valve) incorporated in case of sudden pneumatic pressure drop due to blackout, malfunction, etc. Further, use a solenoid valve with a circuit that retains the gripping position when no current is carried.

(Refer to page 31)

For Machine Tool Manufacturers

- If the pneumatic pressure suddenly drops due to blackout or malfunction, etc., this is dangerous as work will fly out.
- Lock valve retains the pneumatic pressure inside the cylinder temporarily, when the pneumatic pressure suddenly drops due to blackout or malfunction, etc. We prepare for the lock valve unit for exclusive use of the work gripper optionally.



When the protrusion of the work is long, support it with the steady rest or center.

For All Users

- If the protrusion is long, the tip of the work can turn and the work fly out.



Do not use the work gripper on the lathe.

For All Users

- Gripping force is short by centrifugal force, or the work gripper may break and the work gripper or work could fly out.



Important Safety Precautions



WARNING

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

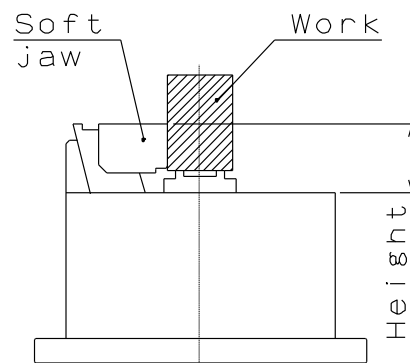


Use neither jaw that is taller jaw than standard jaw. The air pressure must not exceed the maximum air pressure, and the oil pressure must not exceed the maximum oil pressure.

(Refer to pages 15-17)

For All Users

- The work gripper will break and the work gripper and work will break and fly out.



Determine the gripping force required for processing by the machine tool manufacturer or user, and check that the required gripping force is provided before processing.

(Refer to pages 15-16)

For All Users

- Adjust the pneumatic pressure to obtain the required gripping force. If the gripping force is insufficient, this is dangerous as the work will fly out. Adjust the steering wheel of the reducing valve, and set it to prescribed pressure. Afterwards, tighten the lock nut, and prevent the setting pressure from carelessly changing.



Always fill lubricator with oil up to proper level. Periodically drain water in the filter. (Refer to each instruction manual for the details.)

For All Users

- Rust may occur in the cylinder, the work scatters due to the defective operation and the decrease of the gripping force, and it is dangerous.



Important Safety Precautions



WARNING

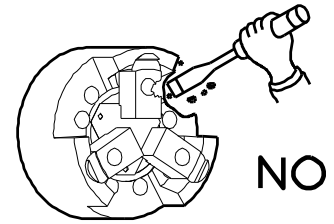
Failure to follow the safety precautions below could result in serious injury or death.



Do not modify the work gripper in a way not permitted by the manufacturer.

For All Users

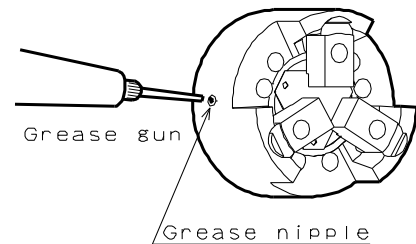
- It may not only break the work gripper but the work gripper and the work may fly out, which is dangerous.
- If you attach a locator or jig on the work gripper body surface, only process work in an acceptable range (Refer to pages 30-31).



Periodically supply adequate grease (Refer to page 32). Turn off power before adding grease.

For All Users

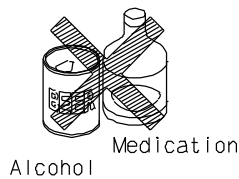
- Insufficient grease supply lowers the gripping force, causes operation failure due to lower hydraulic pressure, lowers the gripping precision, and causes abnormal wearing and seizing, etc.
- This is dangerous as the work could fly out from a drop in the gripping force.



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

For All Users

- Dangerous since these lead to operation mistakes and misjudgment.



Do not operate the machine wearing gloves, a necktie, and other loose clothing or jewelry.

For All Users

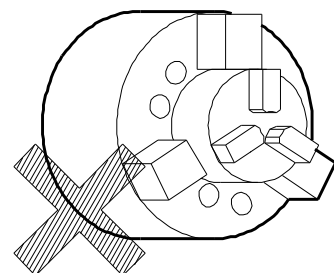
- Dangerous since it will be caught.



Do not grip a chuck with a chuck.

For All Users

- Because it is easy to confuse the specifications of each work gripper and the protrusion become long and is apt to exceed the specifications, it is apt to exceed the specifications of the base chuck. The work gripper may break and the work gripper or work could fly out.



3. Specifications

3-1. Specifications

Table 3-1

Type		PLS06
Plunger stroke	mm	11.1
Jaw stroke (in diameter)	mm	7.7
Gripping force (Air pressure : 0.6MPa)	kN	19
Gripping force (Oil pressure : 1.3MPa)	kN	53
Gripping range (outside diameter gripping)	mm	φ13 ~ φ120
Gripping range (inside diameter gripping)	mm	φ70 ~ φ160
Mass (standard soft jaw included)	kg	24
Nominal air pressure	MPa	0.2 ~ 0.7
Max air pressure	MPa	0.7
Nominal oil pressure	MPa	0.2 ~ 1.3
Max oil pressure	MPa	1.3
Air consumption (Plunger stroke 5mm, 0.6MPa)	NI	0.54
Storing temperature / Operating temperature		-20 ~ +50 °C / -10 ~ +40 °C

※When storing this product, the product should be subjected to the antirust treatment and stored in a place free from wetting, condensation, or freeze.

※We recommend using pneumatic pressure when operating at 0.2 to 0.7 MPa. Using hydraulic pressure at 0.2 to 0.7 MPa will result in slower operation time.

3-2. Relationship between pressure and gripping force

1. Gripping force

The work gripper has a mechanism to convert air or oil pressure from the built-in cylinder to gripping force. The gripping force specified in the specification is the value that the air pressure is 0.6 MPa, or the oil pressure is 1.3MPa.

However, the gripping force is different depending on the state of grease lubrication, grease in use, height of the jaw, etc.

The gripping force specified in the specification is the value under the following conditions:

- The Kitagawa standard soft jaw is used as the jaw.
- The attaching bolts of the soft jaw are tightened at the specified torque. (Refer to page 11)
- The numerical values are obtained with the Kitagawa gripping force meter . The gripping position of the gripping force meter is at a position 1/2 of the height of the soft jaw top surface (height from the chuck surface to the top surface of the jaw).
- CHUCK GREASE PRO is used. (Refer to page 33).

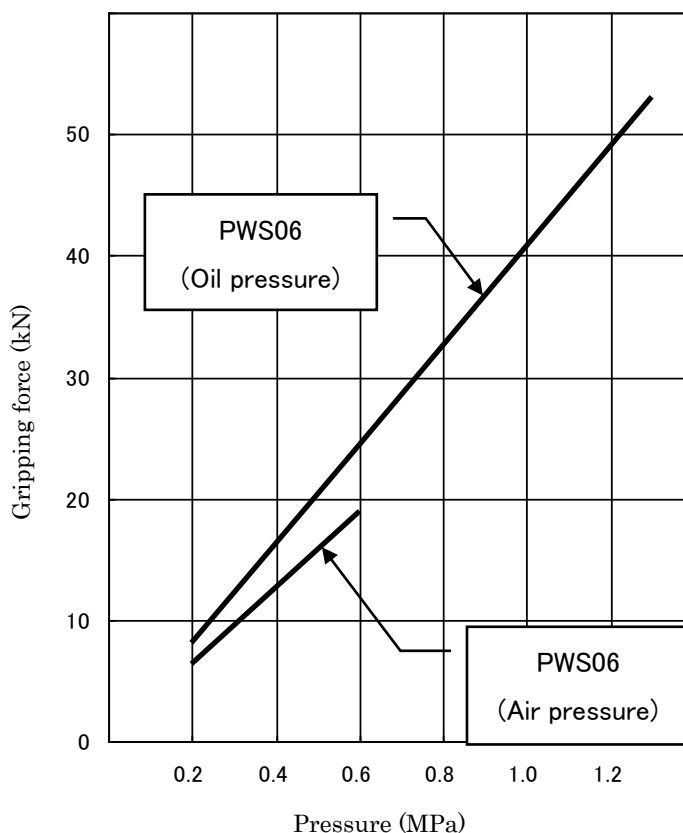


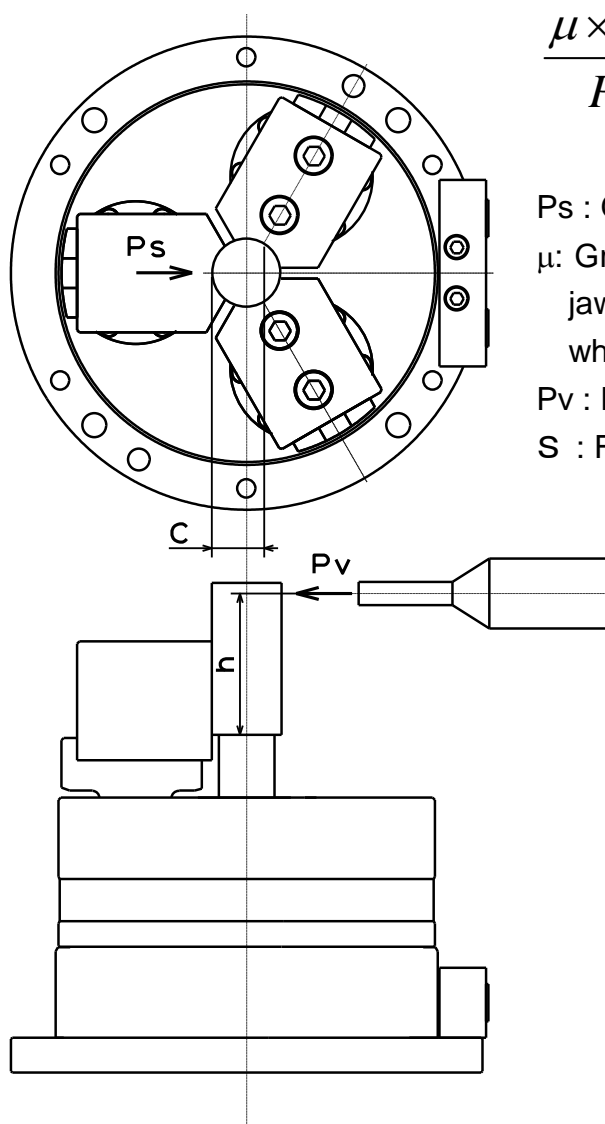
Fig.3-1

! WARNING

- Use neither jaw that is taller jaw than standard jaw. The moment hanging to the work gripper becomes large when you use taller jaw and this is dangerous as the work gripper and work will fly out.

Cutting condition

As a review method of cutting condition, the following shows a calculation example in the case where the moment load is put on the workpiece by a drilling. The final cutting condition, however, must be determined by a test cutting.



$$\frac{\mu \times P_s \times C}{P_v \times h} = S > 2.5$$

P_s : Gripping force per a jaw

μ : Gripping surface friction coefficient between jaw and workpiece. In general, 0.1 is used when both are smooth surfaces.

P_v : Drilling thrust

S : Factor of safety

Fig.3-2

4. Forming Soft Jaw

Prepare the jaw that has the shape, dimensions, accuracy, plane roughness and quenching suitable for processing the workpiece. We recommend following the following method for manufacturing the jaws.

- Forming standard soft jaw on the machine and using a raw material as is. Although it is inferior in durability on gripping face, you can manufacture product immediately.
- Forming standard soft jaw roughly and quenching their gripping face, then finishing on the machine. This is suitable for a mass production, because it excels in durability of the gripping face.
- We recommend you request KITAGAWA for manufacturing, if you manufacture a special shape jaw from scratch without using soft jaw.

4-1. Change of inner/outer diameter gripping

The input force to the plunger cannot be used at the pushing side when the workpiece is gripped with the PWS series. It is necessary to use the input force at the pulling side regardless of outer diameter gripping and inner diameter gripping. Since the master jaws are faced reversely at the outer diameter gripping and inner diameter gripping, it is necessary to change the master jaws. (See Fig. 4-1).

In the single master jaw, the direction to grip the workpiece is constant regardless of outer diameter gripping and inner diameter gripping.

WARNING

- When the workpiece is gripped with the input force to the plunger set to the push side, there is a danger because the inside of the chuck is damaged, the gripping force is low and the workpiece will scatter.

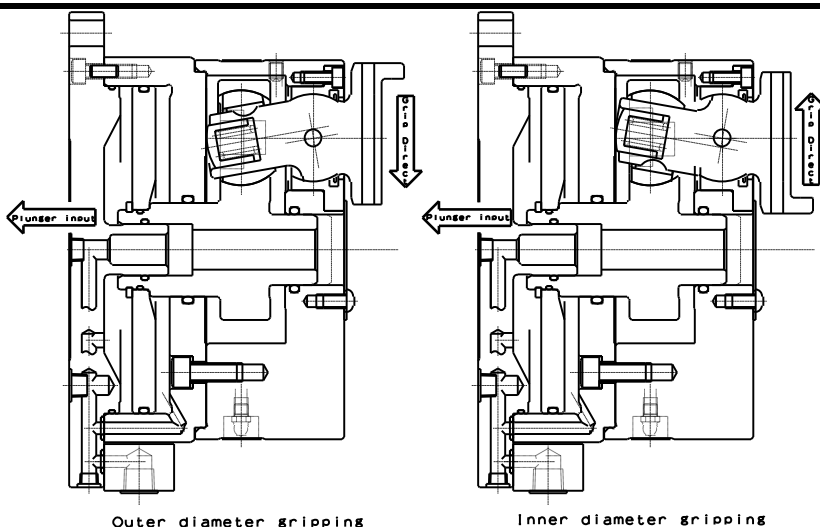


Fig.4-1

○Change steps of inner/outer diameter gripping

- ① Remove the jaw and T-nut.
- ② Remove the locator and other jigs from the chuck surface.
- ③ Remove the mounting bolts of spherical bushing surface. (See Fig.4-2)

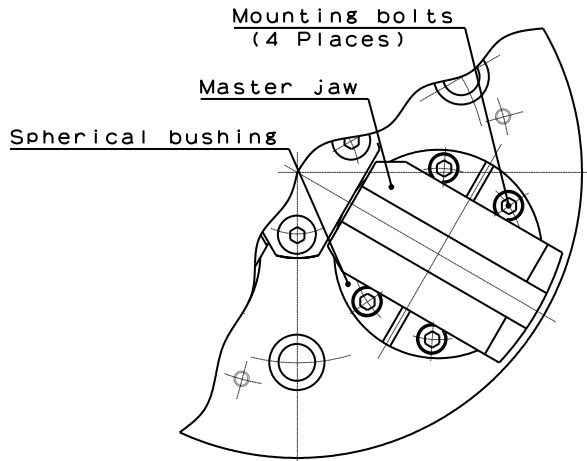


Fig.4-2

- ④ Pull up the spherical bushing together with the master jaw to the extent that the side of spherical bushing appears a little.
- ⑤ Remove to set the spherical bushing in the spherical bushing assembling jig. (See 6-1) (Check to see that no woodruff key falls.) If spherical bushing separated into two parts, apply the new sealing compound “Three bond company Seal compound 1212” to the separated surface after remove the old sealing compound, moisture, oil stain, and others. Then, set the spherical bushing in the spherical bushing-assembling jig.
- ⑥ Turn the bearing to 180 degree horizontally to aim the flute of bearing. (See Fig.4-3)

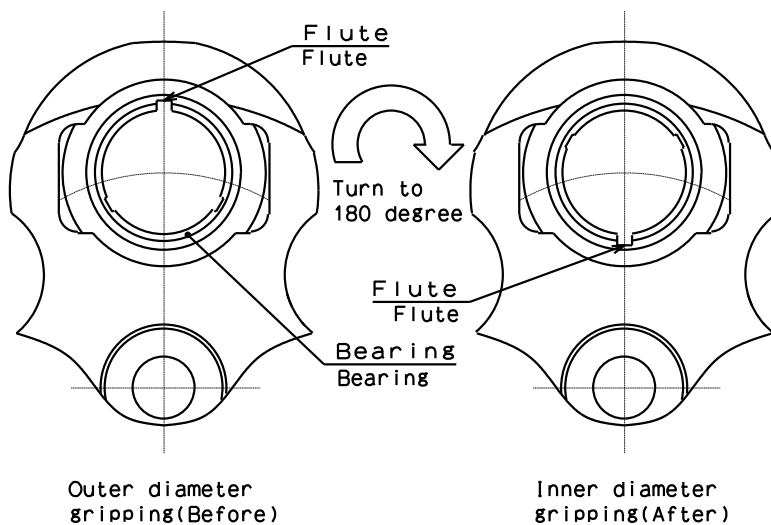


Fig.4-3

⑦After remove the old sealing compound, moisture, oil stain, and others, apply the new sealing compound “Three bond company : Seal compound 1212” to the body and the fitting surface of spherical bushing. (See Fig.4-4)

⑧Fix the spherical bushing set in the jig. With the key flute, set the spherical bushing in the body-engaged hole and insert it, striking the front of jig. When the back of jig comes in contact with the front body, put together the bolt holes of spherical bushing before temporarily tightening the bolts. At this time, remove the jig from the spherical bushing, and tighten the bolts. (If the grease is in short supply, remove the hex. socket head less set screw from tap hole at the chuck periphery and lubricate the grease into the grease nipple with grease gun until the grease overflows from the tap hole.)

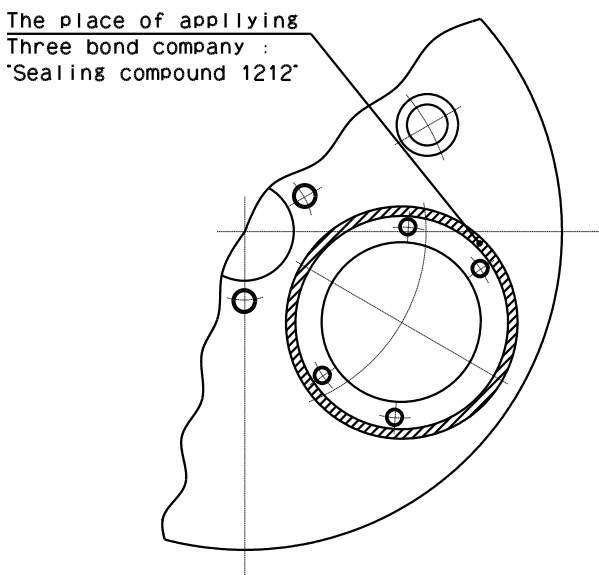


Fig.4-4

CAUTION

- **Cover the surface of the spherical bushing-assembling jig with an packaging tape or others. Because of the chuck not to be damaged. And should use the chuck after sealing compound dry. (It is after 24-hour or more progress at normal temperature.)**

4-2. Attachment of jaw



- Use the bolts attached to the work gripper, and do not use other bolts. However, if you must use other bolts not provided by Kitagawa, use bolts that have at least a strength classification of 12.9 (10.9 for M22 or more) and be sure they are long enough.
- Do not rotate the work gripper so that the jaw attaching bolt is loosened causing the jaw to fly out.
- Always tighten the bolts at the specified torque. If the torque is insufficient or excessive, the bolt will break, which is dangerous as the work gripper or work will fly out.

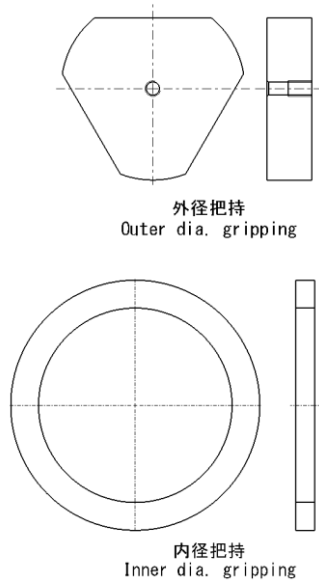
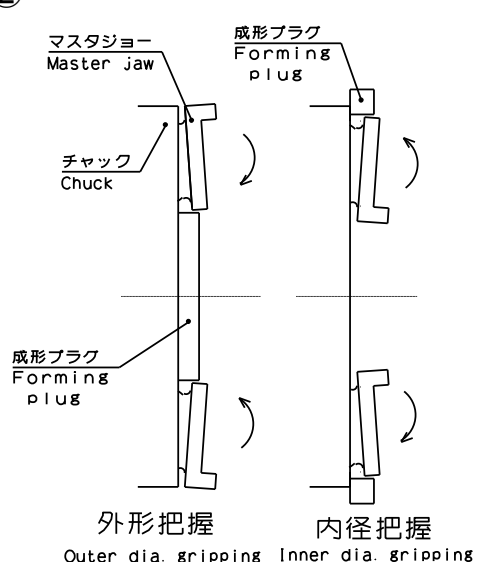
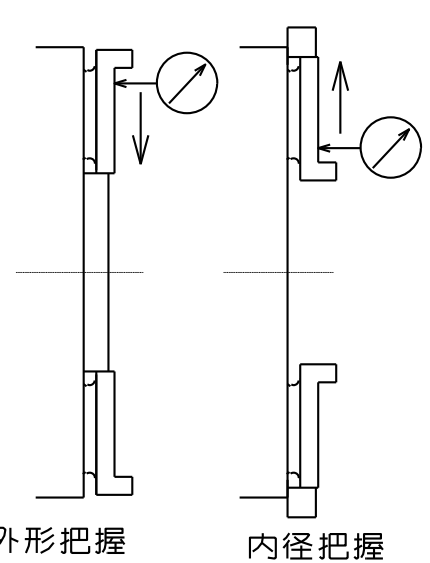
Table 3-2

Bolt size	Tightening torque	
M5	7.5	N·m
M6	13	N·m
M8	33	N·m
M10	73	N·m

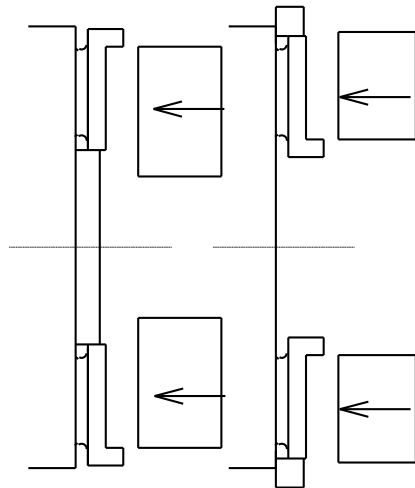
4-3. Forming soft jaw

The jaw gripping face for the workpiece is finally finished with the jaw mounted to the chuck for actual processing (on the machine). At this time, processing on the machine is carried out in a state where a suitable forming plug is used and is gripped. Thus, the jaw gripping face for the workpiece must be finished with the forming plug gripped at the stroke center. The forming plug is gripped with its end face contacting the chuck surface or locator datum end face.

Set the cylinder setting pressure when the forming plug is gripped the same as the set pressure when the workpiece is machined or has slightly high pressure.

<p>①</p>  <p>外径把持 Outer dia. gripping</p> <p>内径把持 Inner dia. gripping</p>	<p>1. Prepare the forming plug.</p> <ul style="list-style-type: none"> Prepare the forming plug. Refer to Figures 4-5 and 4-6 for the dimensions of the forming plug. It is recommended to tap the forming plug center and to be guided with a bolt.
<p>②</p>  <p>マスタジョー Master jaw</p> <p>成形プラグ Forming plug</p> <p>チャック Chuck</p> <p>成形プラグ Forming plug</p> <p>外形把握 Outer dia. gripping</p> <p>内径把握 Inner dia. gripping</p>	<p>2. Gripping the forming plug</p> <ul style="list-style-type: none"> Set the master jaw to the open (closed) position. Place the forming plug on the surface of the body. Operate the switching valve to grip the forming plug with the master jaw. At this time, press the forming plug against the body surface to prevent it from tilting. Repeat chucking several times to stabilize the forming plug. Do not perform inching operation on the switching valve.
<p>③</p>  <p>外形把握 Outer dia. gripping</p> <p>内径把握 Inner dia. gripping</p>	<p>3. Measuring the level of the Master Jaw</p> <ul style="list-style-type: none"> Ensure that each master jaw is level. <ul style="list-style-type: none"> For external diameter gripping, measure from the outside to the inside using a dial gauge. For internal diameter gripping, measure from the inside to the outside using a dial gauge. Tolerance: ± 0.1 (for a measurement distance of 50mm). If the measurements are outside the tolerance range, reprocess using the forming plug.

④



外形把握

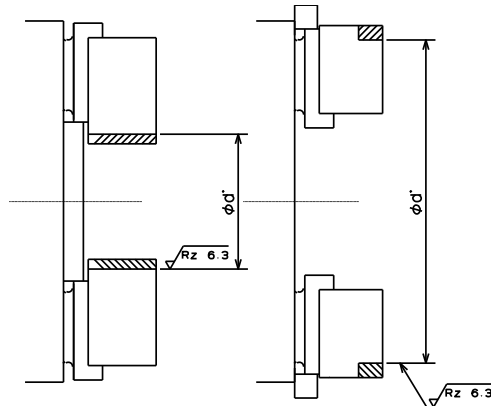
内径把握

Outer dia. gripping Inner dia. gripping

4. Installing the Soft Jaw

- Prepare the soft jaw and align the jaw number with the master jaw number before installation.

⑤



外形把握

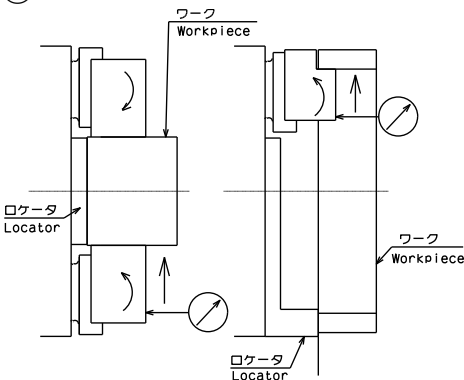
内径把握

Outer dia. gripping Inner dia. gripping

5. Forming

- Form the workpiece gripping part ($\phi d'$) while gripping the forming plug. (As much as possible, provide a level surface for measurement on the top of the soft jaw, similar to the level measurement of the master jaw in step 3.)
- When quenching the gripping face, quench it after forming at a dimension considering the finish allowance, and finish the gripping part again with the forming plug grasped.
- Machine the $\phi d'$ part so that it has the same diameter (H7,h7) as the workpiece gripping part.
- During the forming process, set the hydraulic pressure to the same pressure or slightly higher as when machining the workpiece.
- After forming the jaws, clearances and forming mistakes can be checked by fitting a workpiece or master work into the gripping section while the forming plug is still gripped.

⑥



外径把握

内径把握

Outer dia. gripping Inner dia. gripping

6. Trial cutting

- After forming, remove the forming plug and ensure that the top surface of the soft jaws is level while only gripping the workpiece.
- After forming jaws, attach required parts such as locator, etc., and check the jaw stroke.
- Perform trial cutting to check machining accuracy, non-slippage, etc.

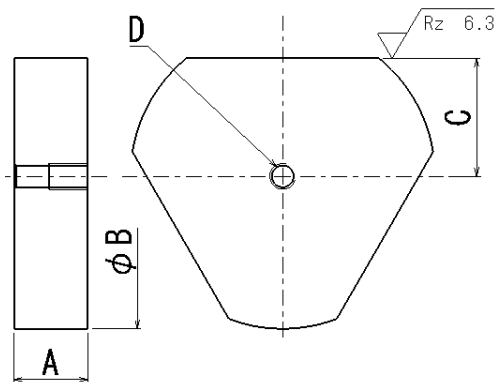
! DANGER

- Ensure that the jaw is level by using a dial gauge while gripping the master work.
 - If the soft jaw is not level during forming, or if the soft jaw is used while worn without regular inspections, it may grip near the stroke end of the chuck. This can cause variation in the tolerance of the workpiece gripping section, resulting in the workpiece not being securely gripped and potentially flying out, which is dangerous.
 - Regular use near the stroke end of the chuck can exert excessive force on the master jaw, causing damage to the chuck and the workpiece to fly out, which is dangerous.

! WARNING

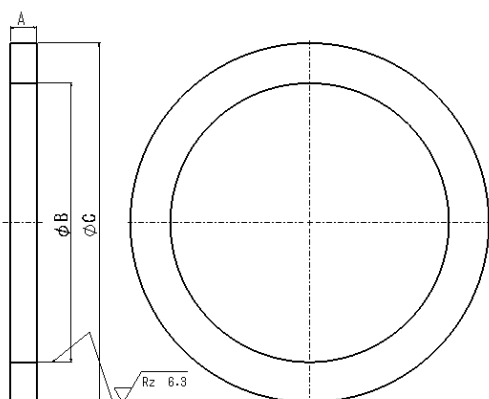
- Grip the plug for forming when you form the soft jaw. If you do not, the jaw will rotate due to the cutting force that may break the jaw mounting bolt and cause the jaw to fly out, which is dangerous.

Fig.4-5 Forming plug (for outer dia. gripping)



Model	PWS06
A (mm)	17
B (mm)	70
C (mm)	27.1
D	M6

Fig.4-6 Forming plug (for inner dia. gripping)



Model	PWS06
A (mm)	17
B (mm)	178.7
C (mm)	230

CAUTION

- The C dimension in Fig. 4-5 and 4-6 is a theoretical value. For external diameter gripping, make the C dimension larger, and for internal diameter gripping, make it smaller. Adjust the dimension so that the master jaw becomes level while gripping.

NOTICE

- The gripping force, retracting motion and accuracy become stable when the gripping center height becomes as low as possible.
- When the jaw is not finished on the machine or it is finished on another machine, the contact for the workpiece becomes worse, thus resulting in an unstable retracting motion or reducing the gripping accuracy.
- When finishing the jaw without touching the plug for forming to the chuck surface or locator datum end face, the gripping accuracy may be impaired.
- When the gripping position of the plug for forming is near the gripping face of workpiece as much as possible, the gripping accuracy becomes stable.
- When the jaw finished on the machine is removed from the work gripper once, the gripping accuracy becomes low as compare with when it is attached as is.
- Do not mistake the numbers marked on jaw.
- If the rigidity of the plug for forming is insufficient, the gripping accuracy becomes low or stroke position becomes out of order.

4—4 Jaw with grip pieces

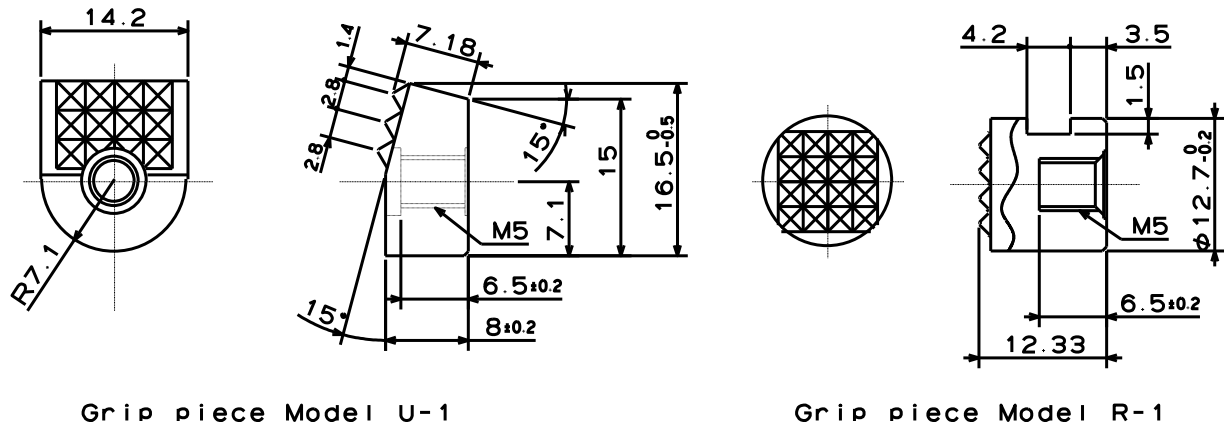
When using the grip pieces, the gripping face increases frictional force. As a result, it becomes hard to slip the workpiece in machining. However, the workpiece will be damaged.

WARNING

- **When the jaws with grip pieces are used, a retracting force becomes large and a great load will be applied to the jaws, T-nut and mounting bolts. Therefore, take extreme care so that jaws are not used at a gripping force exceeding the maximum static gripping force.**

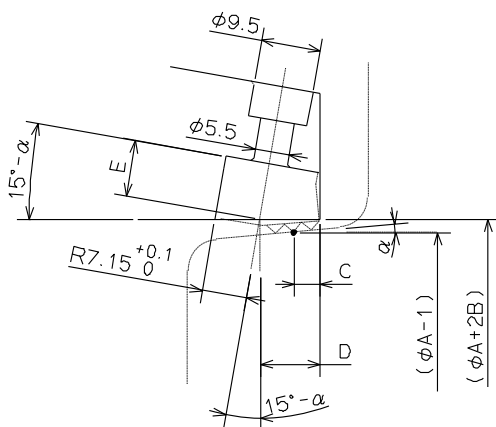
The grip piece model u-1 is especially effective when short-gripping area of work is chucked because the gripping area is arranged near the front edge of jaw. The grip piece model r-1 is easy to mount the different work s of intricate shape. The following explains forming steps for jaw, which uses the grip piece model u-1.

Fig.4-7



- 1) First, deciding the gripping area of workpiece. It is necessary to select the position on which there is high stiffness, the standard edge face near gripping area and all processes are concluded with reverse revolution as few as possible.
- 2) After deciding the gripping area of workpiece, decide the jaw shape so that the area except the grip piece does not interfere with the workpiece. The face for mounting the grip piece is a cylindrical face that in inner dia. $(A+2B)$, thus adding the two-time values of B to the gripping diameter A . When the gripping force tapered, the outer diameter at distance C from the front edge of jaw is decided as the gripping diameter A , thus positioning the medium of grip piece crest.

Fig.4-8

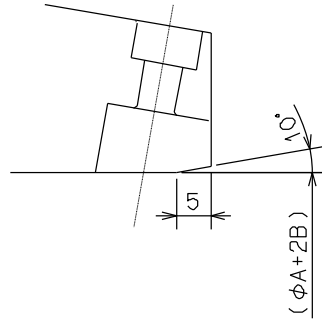


α	A	B	C	D	E
0	The value is varied by workpiece. (Note)	2.50	4.5	9.52	7.29
2		2.65	4.4	9.46	6.96
4		2.80	4.3	9.40	6.63
6		2.95	4.2	9.34	6.30
8		3.10	4.1	9.28	5.97
10		3.25	4.0	9.22	5.64

(Note)The serration penetration should be about 1mm on diameter.

- 3) The cylindrical part $\phi (A+2B)$ of grip piece mounting face is formed with forming jig gripped. (Refer to 4-3 Forming of soft jaw)
- 4) If the slope of workpiece is less than 5, it may be usual cylindrical face, while if it is more than 5, provide the taper at the front side of jaw as shown in figure (Fig.4-8) to prevent the work from interference.

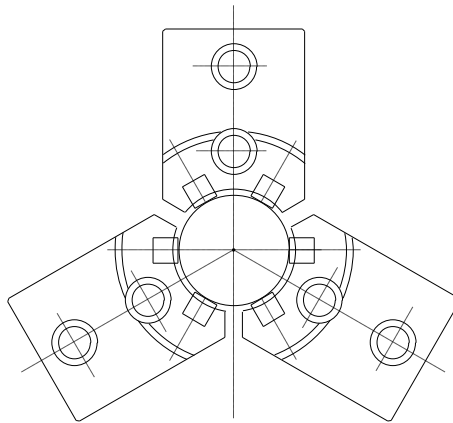
Fig.4-9



5) Next, provide the grip piece mounting seat of depth E sloped only ($15^\circ - \alpha^\circ$) at position D from jaw front edge. When adjusting the height of grip piece with a washer, and the washer thickness to the depth E.

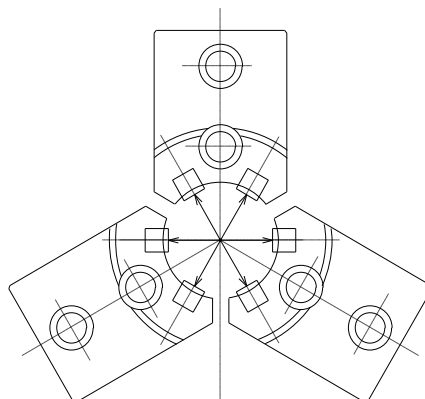
6) Number of grip piece used is 6-piece per chuck. If the workpiece is liable to be distorted, it is necessary to arrange to 6 equal parts as near as possible.

Fig.4-10



7) With the forming jig chucked, read respective differences of grip piece with a dial gauge and adjust the grip piece so that they uniform to lowest grip piece height. In this case, it is possible to adjust the grip piece height by regulating the washer thickness.

Fig.4-11



5. Usage

This product is a device to fix a workpiece when it is processed by the rotary table or the machining center. A built-in cylinder closes the jaw and fixes a workpiece so that it does not move during processing. The chuck opens the jaw after having processed it and remove a workpiece.

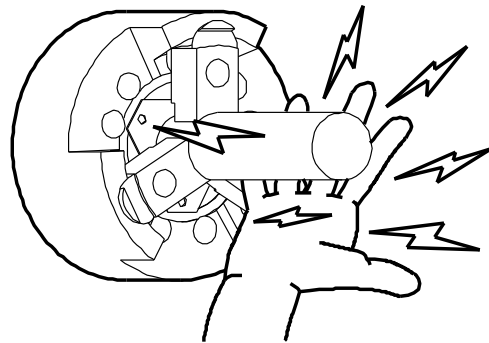
NOTICE

- When replacing the top jaw, carefully clean the serration part with the master jaw, and the engagement part of the T nut. Failure to do this may cause a precision failure.
- Set the air pressure according to the shape of the work and the cutting conditions. Pipe shape work, etc., may be distorted if they are tightened at a high gripping force.

5-1. Precautions during gripping work with work gripper

DANGER

- When gripping a work with the chuck, do not get fingers or hands become caught. This could cause crushed or cut fingers and hands.



5-2. Precautions during gripping work in irregular shape

WARNING

- If the protrusion of the work is long, support it with a center or the steady rest. If the protrusion is long the tip of the work turns, and this is dangerous as the work will fly out.

5-3. Precautions related to usage of jaw



- If a soft jaw other than one made by Kitagawa Corporation is used, the engagement will be inferior, and the master jaw will be deformed, the gripping precision will worsen, and the work will fly out due to gripping failure, which is dangerous.
- Do not use the soft jaw by welding to join for extension. The jaw will break due to insufficient strength and the serration part will become distorted due to welding. As a result, the engagement will worsen, the serration crests will break, and this is dangerous as the work will fly out.

5-4. Precautions related to processing



<1> Interference, contact, impact

- Before starting work, check that the top jaw, locator, work, etc., and the tool and the tool post, etc., do not interfere at low rotation and then start processing.
- Do not allow anything to impact the work gripper, jaw, and the work. The work gripper will break and this is dangerous as the work gripper and work will fly out.
- If the tool and the tool post contact the work gripper or the work due to malfunction or program mistake, etc., and impact is given, immediately stop the machining, and check that there are no abnormalities in the top jaw, master jaw, T nut and bolts of each part, etc.

<2> Coolant

- Unless coolant with a rust preventive effect is used, rust will occur inside the work gripper and gripping force drop may result. The work will fly out due to the gripping force drop and this is dangerous.

5-5. Attachment of locator and jig

The locator is required for the PWS work gripper. The PWS work gripper grips the workpiece in the radial direction and presses the workpiece to the locator simultaneously. Prepare the locator that has the dimensions, accuracy, materials and quenching suitable for processing the workpiece.

DANGER

- **Grip the workpiece after having pushed it to the locator. You can't grip the workpiece stably when you use without locator, this is dangerous as the work will fly out. (The black thin cover for the center of the chuck is not a locator. This is temporary protection for the hole.)**
- Since the runout of the locator datum end face remarkably influences the finishing accuracy of the workpiece, the datum end face requires that it has sufficient hardness and accuracy. To improve the accuracy of the datum end face, we recommend that the locator is finished with it attached to the chuck after quenching.
- In the case of attaching the locator and the jig on the chuck body surface, tap or drill a hole in the additional process range specified in Fig. 8
- Air can be supplied to the seating position by removing the orifice plug【39】from the block【8】. Air can also be supplied through the work gripper back side by first removing hole plug D【7】from the flange【3】air supply port for seating position. Also, remove the orifice plug【39】 from the block【8】 and replace it with the hole plug D【7】 that has been rewound with sealing tape to be used as a stopper.

WARNING

- **The work gripper can be modified only in the manufacturer permissible range. This will not only break the work gripper but the work gripper and work may fly out, which is dangerous.**
- **Provide a countermeasure against flying out (dwell pin, etc.) due to centrifugal force to the locator or the jig, and attach with bolts which have sufficient strength. The locator or the jig may fly out, and this is dangerous.**

Shaded part additional process possible range

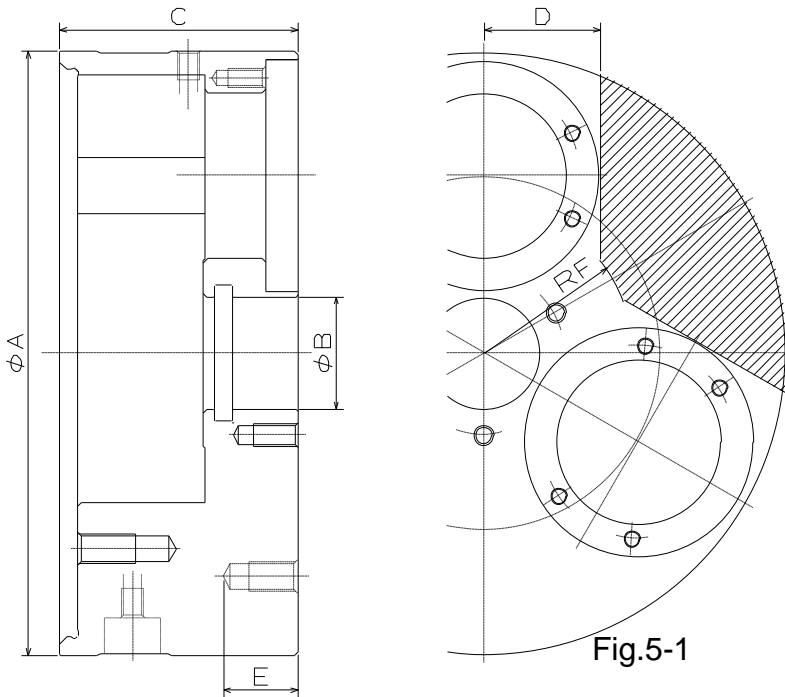


Fig.5-1

Table 5-1

Type	A	B	C	D	E	F
PLS04	162	30.17	64	31	20	40

5-6. Precautions related to usage of lock valve unit

Lock valve unit

Lock valve retains the pneumatic pressure inside the cylinder temporarily, when the pneumatic pressure suddenly drops due to blackout or malfunction, etc. We prepare for the lock valve unit for exclusive use of the work gripper optionally.

The air pressure in the work gripper is sealed up by using the lock valve unit. Therefore, it is possible to machining a workpiece without piping.

! WARNING

- If the air supply is stopped and the workpiece is held for a long time using the lock valve unit, before start of the work, measure the pressure retention time to make sure that the internal pressure does not drop. Reduction in gripping force due to the internal pressure drop causes the workpiece to fly out.
- Use the lock valve unit only by air. The lock valve unit is damaged when the oil pressure is put, this is dangerous as the work will fly.

6. Maintenance and Inspection

6-1. Periodic Inspection

- Add grease at least once a month.
- Fully stroke the jaw before starting work or upon supplying grease, and check the specified stroke.
- Before or after operation, grip the master work and use a dial gauge on the flat surface of the soft jaw (the surface parallel to the top of the master jaw) formed during forming to ensure it is within the tolerance range. (Refer to P22, Section 4-3: Forming the Soft Jaw, and Section ③: Measuring the level of the Master Jaw.)
If the values are outside the tolerance range, rework the soft jaws according to P21~23.
- Always clean the chuck body or the sliding surface using an air gun, etc., at the end of work.
- Periodically drain water in the filter.
- Always fill lubricator with oil up to proper level.
- When the lock valve unit is used, confirm whether there will not be the decrease in inner pressure because of the air leakage in at least once a week. (Refer to Page 31)
- Check that the bolts of each part are not loosened at least once every 3 months.
- Disassemble and clean at least once every 6 months or every 100,000 strokes (once every 2 months or more for cutting cast metal).

6-2. Grease lubrication

1. Position to lubricate

- Lubricate using a grease gun from the grease nipple on the body periphery part.
- Read the following lubricating procedures with reference to pages 7-8.
 1. Turn off the main power of the machine before starting work.
 2. Place the plunger on the platform, positioning it forward and upward.
 3. Remove the set screw [26] on the body periphery part.
 4. Move the jaws several times without workpiece to exhaust old grease. At this time, if the coolant or cutting chips are in the chuck, disassemble and clean it. It is necessary to doubt the damage of the seal.
 5. Lubricate using a grease gun from the grease nipple [37] on the body periphery part until grease is exhausted from the hole.
 6. Keep in item 2 above, clamp and unclamp a couple of times without work piece to discharge extra grease.
 7. Install the set screw [26] certainly.
 8. Clamp and unclamp a couple of times without work piece again, and check that the No.1 master jaw fully stroke
- It is convenient to use grease supply port (Rc1/8) on the body periphery part if you arrange and use a lot of work grippers.

2. Grease to use

- Use the designated grease specified in Table 6-1. If grease other than the designated grease is used, sufficient effect may not be obtained.

Table 6-1

Genuine product	CHUCK GREASE PRO	Kitagawa genuine product (Kitagawa distributor of each country)
Conventional product	Kitagawa chuck grease	Conventional product
	Molykote EP Grease	TORAY Dow Corning (only inside Japan)
	Chuck EEZ grease	Kitagawa-Northtech Inc. (North American region)
	MOLYKOTE TP-42	Dow Corning (Europe, Asian region)
	Klüberpaste ME31-52	Klüber lubrication (worldwide)

3. Frequency of lubrication

- Add grease at least once a month.
- In the case of high rotation or in the case of using a large amount of water soluble coolant, increase the frequency of lubrication according to the usage conditions.



- To keep the chuck running in the best condition for a long time, adequate grease lubrication is necessary. Insufficient grease lubrication causes a drop in the gripping force, operation failure at low hydraulic pressure, drop in gripping precision, abnormal wearing, seizing, etc. The work will fly out due to a drop in the gripping force and this is dangerous.**

4. Safety information about grease and anti-rust oil

Applicable range

- Designated grease
- Antirust agent applied to the product at the delivery.

First aid measures

After inhalation: Remove victim to fresh air. If symptoms persist, call a physician.

After contact with skin: Wash off with mild cleaners and plenty of water. If symptoms persist, call a physician.

After contact with eyes: Rinse with plenty of water. If symptoms persist, call a physician.

After ingestion: If large amounts are swallowed, do not induce vomiting. Obtain medical attention.

- Please refer to each MSDS about the grease and the anti-rust oil which you prepared.

6-3. Disassembling

Disassembling procedures

Read the following disassembling procedures with reference to pages 7-9.

- ① Turn off the main power of the machine before starting work.
- ② If the lock valve unit is used, loosen slowly two cap screws [45] while bleeding the air gradually from the inside, and after making sure that the air is expelled completely, remove the screws.
- ③ Remove the jaw [12] and T-nut [14].
- ④ Remove the locator from the chuck surface.
- ⑤ Loosen the socket head cap screw [21] and remove the flange [3].
- ⑥ Remove the Retaining ring [38] and remove the piston [4].
- ⑦ Loosen the socket head cap screw [23] and remove the cylinder [2].
- ⑧ Remove the mounting bolts [20] of spherical surface bushing [10] and turn the master jaw [9] in the right and left direction before removing the spherical surface bushing together with the master jaw (check to see that no woodruff key [19] falls).
- ⑨ Remove the plunger [5] by inserting a wooden bar out of the center hole of body [1]. (The slide area with body is not only shaft. Thus, one portion among Three-Projected portions is engaged with the body. As a result, this portion is slid with the body)
- ⑩ The bearing [13] is spherically engaged on the plunger [5]. With the bearing turned up against the plunger spherical surface, align bearing width position to a notch of spherical surface inner diameter and turn the bearing in order to search a removing position. If the bearing is facing the wrong direction it will not come out. Therefore, change the bearing to the correct direction.

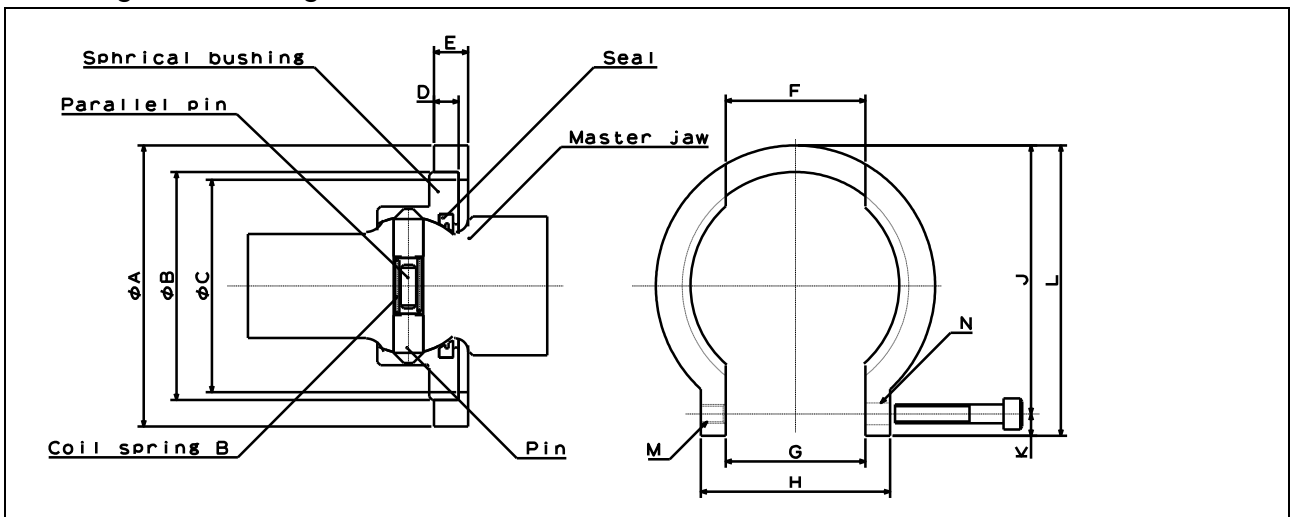


Fig.6-1 Spherical bushing assembling jig

Table 6-2

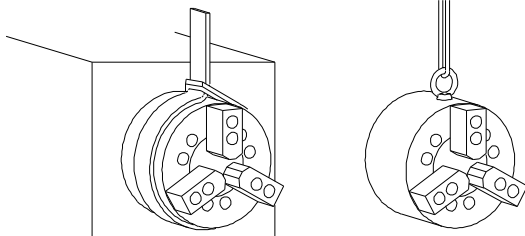
Model	A	B	C	D	E	F	G	H	J	K	L	M	N
PWS06	75	62	59	7.5	10	39	39	55	72	6	78	M5	5.5

Assembling procedures

- Assemble again in the reverse procedures of disassembling. Refer to pages 7-9.
 - Assemble again while sufficiently coating the recommended grease.
 - Lubricate grease after assembling. (Refer to pages 32-33)
 - Because the attaching jig for the spherical bushing which looks Fig.6-1 and sealing compound 1212 (Threebond co.,ltd) are need for work, prepare beforehand.
- ① Remove the old sealing compound, moisture, oil stain and others. Then apply the new sealing compound 1212 (Three bond co.,ltd.) to the separate surface of spherical bushing.
 - ② Incorporate a parallel pin [35], coil spring B [17] and pin [16] into the master jaw [9] before sealing [18] the spherical bushings [10] and set the spherical bushings with the master jaw placed between both bushings. At this time, check the seal is thoroughly inserted into seal flute. Also, with the lower spherical bushing gripped by vise, tighten the vise until the half-separated rings of spherical bushing are corresponded each other completely. Also, repeat the tightening and loosening of vise two or three times, thereby eliminating the deviation of bushing.
 - ③ With the spherical bushing [10] chucked with the vise, and set the attaching jig before tightening the bolts, As a result, the spherical bushing remains set on the master jaw[3] even if it is removed from the vise.
 - ④ Set the plunger[5] in which the bearing[13]is incorporated to the body[1]. Pay attention to arrangement.
 - ⑤ Remove the old sealing compound, moisture, oil stain and others. Then apply the new sealing compound 1212 (Three bond co.,ltd.) to the body [1] and the fitting surface of spherical bushing. (Refer to Page 20, Fig.4-4)
 - ⑥ The spherical bushing [10] and the master jaw [9] install to the body [1]. In this time, align the key flute position in advance. With the key of master jaw aligned to the bearing key flute, set the spherical bushing in the body-engaged hole and insert it, striking the front jig. When the back of jig comes in contact with the body surface, put together the bolt holes of spherical bushing before temporarily tightening the bolts. At this time, remove the jig from the spherical bushing and tighten the bolts at the specified torque.
 - ⑦ After this, make it up from the disassembling and a reverse procedure
 - ⑧ Supply grease.
 - ⑨ Refer to page 40 about the installation procedure. (8. Attachment).

! CAUTION

- Use an eyebolt when attaching and detaching the chuck to and from the machine, as there is a danger of injury or damage if the work gripper drops.



Size	Eyebolt
6"	M10

! WARNING

- Be sure to remove the eyebolt after use. If the machining starts without removing the eyebolt, it will interfere with a tool, causing the bolt or tool to fly out.
- Disassemble and clean the work gripper at least once every 6 months or every 100,000 strokes (once every 2 months or more for cutting cast metal). If cutting powder or other substances stagnate inside the work gripper, it will lead to insufficient stroke and a drop in the gripping force, and this is dangerous as the work will fly out. Check each part carefully and replace any part that is worn or cracked.
- Before disassembling the work gripper, remove the cap screw to bleed the air. Loosen slowly the cap screw while bleeding the air gradually from the inside, and after making sure that the air is expelled completely, remove the cap screw. With internal pressure applied, disassembling the work gripper causes the parts to fly out.
- After inspection, apply sufficient grease in the designated areas and reassemble.
- After assembling, measure the gripping force according to the method on page 16, and check that the specified gripping force is obtained.
- If you stop the machine for a long period of time, remove the work from the machine. If you don't, the work can drop due to a drop in the air pressure or the cylinder can stop or malfunction.
- If you stop the machine or store the work gripper for a long period of time, add grease to prevent rust.

6-4. Inspection of lock valve unit

When the lock valve unit is used, confirm whether there will not be the decrease in inner pressure because of the air leakage in at least once a week. Read the following procedures with reference to pages 7-9.

1. Loosen slowly two cap screws [43] while bleeding the air gradually from the inside, and after making sure that the air is expelled completely, remove the cap screws.
2. Install the pressure gauge [60] and set it to 0.5 – 0.6 MPa, and stop the air supply.
3. If the pressure drop per hour exceeds 0.05MPa, the lock valve unit must be repaired or replaced.

WARNING

- Loosen slowly the cap screw while bleeding the air gradually from the inside, and after making sure that the air is expelled completely, remove the cap screw. With internal pressure applied, disassembling the work gripper causes the parts to fly out.
- If the air supply is stopped and the workpiece is held for a long time using the lock valve unit, before start of the work, measure the pressure retention time to make sure that the internal pressure does not drop. Reduction in gripping force due to the internal pressure drop causes the workpiece to fly out.

7. Malfunction and Countermeasures

7-1. In the case of malfunction

Check the points specified in the table below and take the appropriate countermeasure.

Table 7-1

Defective	Cause	Countermeasure
The work gripper does not operate.	The work gripper inside will break.	Disassemble and replace the broken part.
	The sliding surface is seized.	Disassemble, correct the seized part with oilstone, etc., or replace the part.
	The cylinder is not operating.	Check the piping and the electric system, and if there is no abnormality, disassemble and clean the cylinder.
	Malfunction of lock valve unit.	Repair or replace the lock valve unit.
Insufficient stroke of the jaw.	A large amount of cutting powder is inside. Rust might occur.	Disassemble and clean.
The Work slips.	The stroke of the jaw is insufficient.	Adjust so that the jaw is near the center of the stroke when gripping the work.
	The gripping force is insufficient.	Check that the correct hydraulic pressure is obtained.
	The forming diameter of the top jaw is not consistent with the work diameter.	Form again based on the correct forming method.
	The cutting force is too large.	Calculate the cutting force and check that it is suitable for the specification of the work gripper.
	Insufficient grease lubrication	Supply grease from the grease nipple, and open and close the jaw several times without gripping a work.
Precision failure.	The outer periphery of the work gripper is running out.	Check the end surface run-out and the outer periphery, and retighten the attaching bolts.
	Dust is attached on the attaching part of the master jaw and the top jaw.	Remove the top jaw, and clean the attaching part thoroughly.
	The attaching bolt of the top jaw is not tightened sufficiently.	Tighten the top jaw attaching bolt at the specified torque. (Refer to page 18)
	The forming method of the soft jaw is inappropriate.	Is the plug for forming parallel to the work gripper end surface? Is the plug for forming not deformed due to the gripping force?
	The height of the top jaw is too high, the top jaw is deformed, the top jaw attaching bolt is elongated.	Lower the height of the top jaw. (Replace it with the standard size) or check the gripping contact surface and make it uniform.
	The gripping force is too large leading to the work being deformed.	Lower the gripping force in the range possible to process to prevent deformation.

**WARNING**

- If the work gripper failed due to a seizure or breakage, remove the work gripper from the machine, following the disassembly steps in page 28. When the work gripper cannot be removed due to a blockage of workpiece, do not disassemble forcibly but please contact us or our agent.
- If these countermeasures do not correct the problem or improve the situation. Immediately stop using the machine. Continuous use of a broken product or a defective product may cause a serious accident by the chuck or the work flying out.
- Only experienced and trained personnel should do repairs and fix malfunctions. Repair of a malfunction by a person who has never received instruction from an experienced person, the distributor or our company may cause a serious accident.

7-2. Where to contact in the case of malfunction

In the case of malfunction, contact the distributor where you purchased the product or our branch office listed on the back cover.

For Machine Tool Manufactures

Following pages are described for machine tool manufacturers (personnel who attach a chuck to a machine). Please read following instruction carefully when you attach or detach a chuck to machine, and please sufficiently understand and follow the instructions for safe operation.

8. Attachment

8-1. Air piping

8-1-1. Outline drawing of attachment

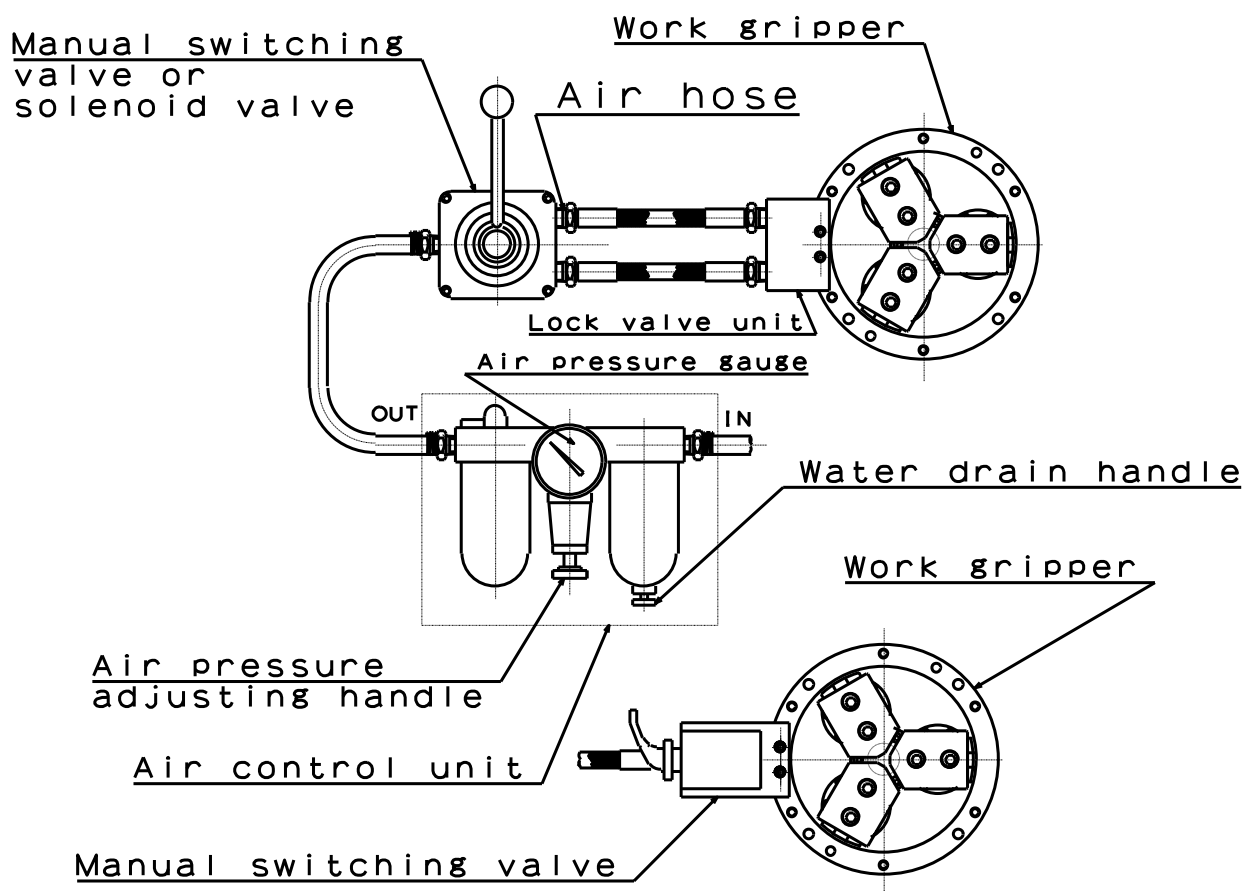


Fig.8-1

8-1-2. Piping

- Connect the pipe to the air supply port at the block or work gripper bottom. Blind the port on the side not used. (See Fig.8-5)
- To prevent the pressure drop and flow rate drop, use the pipe of Rc1/8 or larger size. Also, use the minimum number of elbows.
- Air control unit should be located near the work gripper as much as possible.
- Braided air hose should be used between the switching valve and the work gripper.

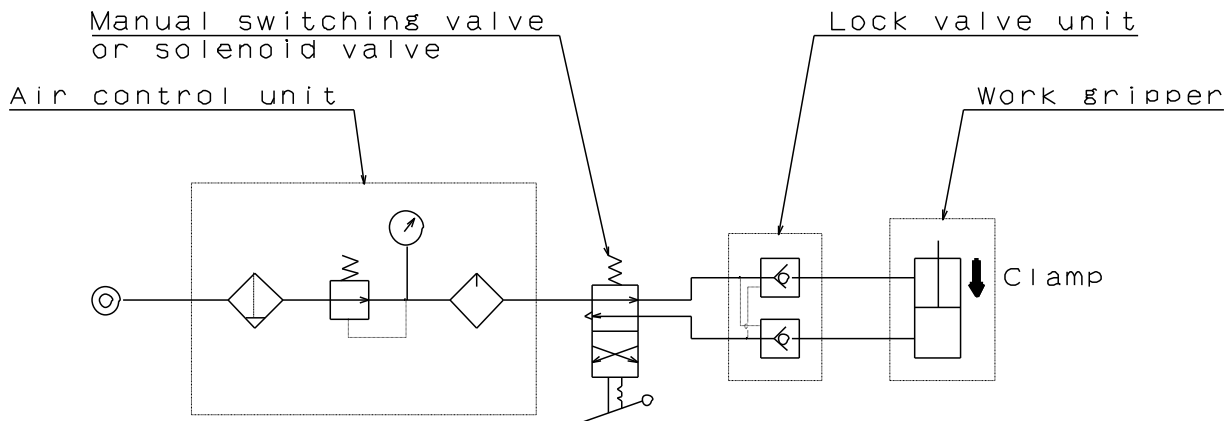


Fig.8-2

! WARNING

- Use a solenoid valve with a circuit that retains the gripping position when no current is carried. If the pneumatic pressure suddenly drops due to blackout or malfunction, etc., this is dangerous as work will fly out.
- During the piping, remove dust completely in the piping. Presence of dust in the piping causes air leakage and then the workpiece to fly out.

8-2. Attachment of lock valve unit

Use a lock valve (safety valve, check valve) incorporated in case of sudden pneumatic pressure drop due to blackout, malfunction, etc. We prepare for the lock valve unit for exclusive use of the work gripper optionally.

Attaching procedures of lock valve unit

Read the following attaching procedures with reference to pages 7-9.

1. Loosen the cap screw [15] and Remove the block [9].
2. Confirm the O-ring [27] exists, and install the lock valve unit with the cap screw [61].

8-3. Oil piping

8-3-1. Outline drawing of attachment

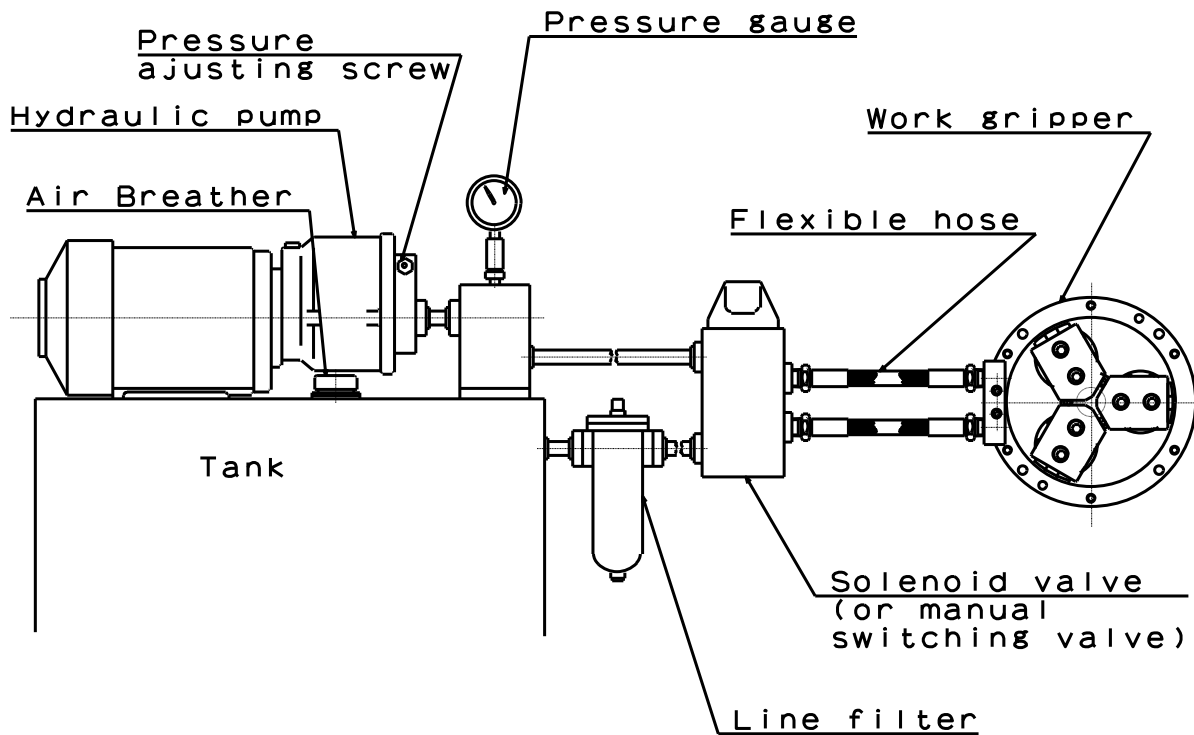


Fig.8-3

8-3-2. Piping

- Attach the manual switching valve at a position where it is easy to operate for the attaching equipment.
- Install the hydraulic unit at a position where the needle of the pressure gauge is easily read.

! DANGER

- When other actuators are operated by the same hydraulic pressure source as the work gripper, be sure that a pressure drop of the work gripper does not occur during use. A hydraulic pressure drop leads to a drop in the gripping force which could allow the work to fly out.

! WARNING

- Install after removing the dust inside the pipe completely.
- During the piping, remove dust completely in the piping. Add a filter of 20 μ m or less in the pressure supply line. Presence of dust in the piping causes leakage and then the workpiece to fly out.
- Braided air hose should be used between the switching valve and the work gripper. Use a pipe inside diameter as large as possible and keep the piping length as short as possible.

NOTICE

- Especially, when a large sized hydraulic unit is used, excessive surge pressure is generated and the gripping force becomes large, therefore, it may result in breakage of the chuck or the lowering of endurance. Restrain the surge pressure by adopting a throttle valve, etc.

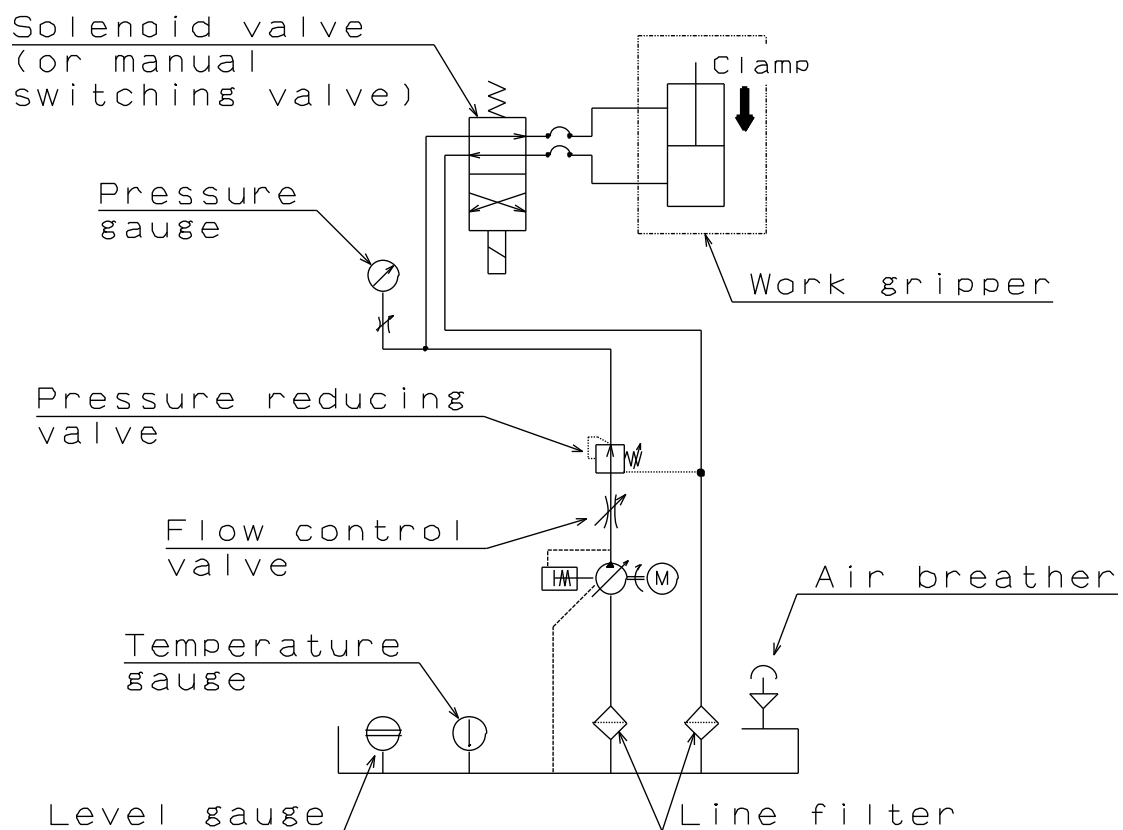


Fig.8-4

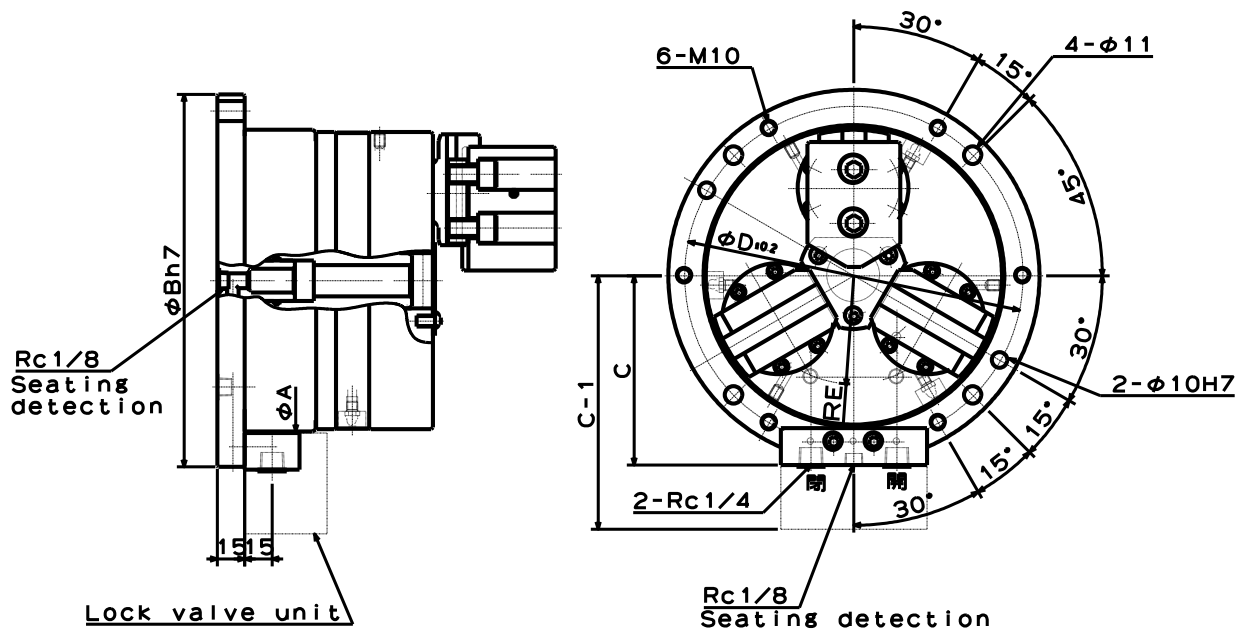


Fig.8-5

Table 8-1

Dimension	PWS06
φA	164.5
φB	203
C	103
C-1	138
φD	185
RE	60

* C-1 show when lock valve unit is installed

9. Trial Operation

Thoroughly read the “Important Safety Precautions” on and after page 10 in this manual before trial operation.

Air pressure

1. Supply grease, following the “6-2. Grease lubrication” on and after page 32 in this manual.
2. Supply turbine oil of additive-free of Class 1 (Viscosity ISO: VG32 or the equivalent) up to the upper extreme end of the indication table of the lubricator of the air control unit.
3. Turn the air pressure adjusting handle and set it to the 0.20-0.25 MPa. Then, make inching of the switching valve, in order to check that the switching valve can operate normally.
4. Turn the needle on the upper part of the lubricator to adjust the drop the site dome. The proper number of drops is 2 or 3 drops per a clamp.
5. Increase the air pressure up to 0.5 MPa, and check to see if air dose not leak and if there is nothing abnormal.

Oil pressure

1. Supply grease, following the “6-2. Grease lubrication” on and after page 32 in this manual.
2. Turn the oil pressure adjusting handle and set it to the 0.4-0.5 MPa. Then, make inching of the switching valve, in order to check that the switching valve can operate normally.
3. Increase the oil pressure up to 1.3 MPa, and check to see if air dose not leak and if there is nothing abnormal.

10. Other information

10-1. About standards and orders

This product is based on the following standards or orders.

- Machinery directive:2006/42/EC Annex I
- EN ISO 12100:2010
- EN1550:1997+A1:2008

10-2. Information about markings of product

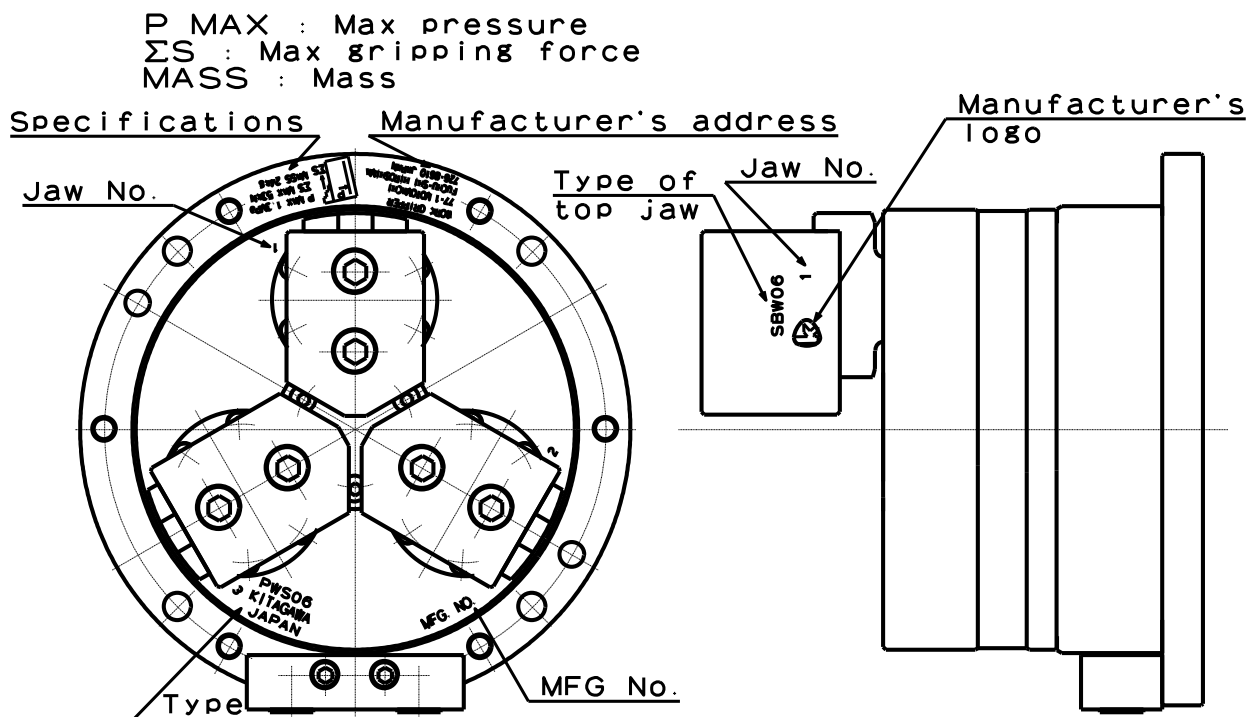


Fig.10-1

10-3. About disposal

Ultimate disposal of this product should be handled according to all national laws and regulations.

DECLARATION OF INCORPORATION

of partly completed machinery

Copy of original

We hereby declare that the following our product conform with the essential health and safety requirements of the EC Machinery Directive so that the product is to be incorporated into end-machinery. The product must not be put into service until end-machinery has been declared in conformity with the provisions of the EC Machinery Directive 2006/42/EC Annex II part 1.A.

We also declare that the specific technical documentation for this partly completed machinery was drawn up according to the EC Machinery Directive 2006/42/EC Annex VII part B.

Product	: Work gripper
Model	: PWS series (Models PWS06)
Serial number	: See original declaration
Manufacturer	: Kitagawa Corporation 77-1, Motomachi, Fuchu-shi, Hiroshima 726-8610, Japan
Authorized compiler in the community	: Peter Soetebier / Prokurist Kitagawa Europe GmbH Borsigstr.3 D-40880 Ratingen, GERMANY

The essential health and safety requirements in accordance with the EC Machinery Directive 2006/42/EC Annex I were applied and fulfilled:
1.1.2, 1.1.3, 1.1.5, 1.1.6, 1.3.1, 1.3.2, 1.3.4, 1.5.4, 1.5.8, 1.5.9, 1.5.13, 1.6.1, 1.7.1, 1.7.2, 1.7.3, 1.7.4, 1.7.4.1, 1.7.4.2

The following harmonized standards were applied:
EN ISO 12100:2010, EN 1550:1997+A1: 2008

Signature : See original declaration

Place / Date : See original declaration

Name / Title :	Yuki Kawakita /	Manager, Technical section 1 Technical department Kitagawa Global hand Company
----------------	-----------------	--

Being the responsible person appointed and employed the manufacturer.

UK DECLARATION OF INCORPORATION

of partly completed machinery

Copy of original

We hereby declare that the following our product conform with the essential health and safety requirements of the Supply of Machinery (Safety) Regulations 2008 so that the product is to be incorporated into end-machinery. The product must not be put into service until end-machinery has been declared in conformity with the provisions of the Supply of Machinery (Safety) Regulations 2008 Annex II part 1.A.

We also declare that the specific technical documentation for this partly completed machinery was drawn up according to the Supply of Machinery (Safety) Regulations 2008 Annex VII part B.

Product : Work gripper

Model : PWS series
(Models PWS06)

Serial number : See original declaration

Manufacturer : Kitagawa Corporation
77-1, Motomachi, Fuchu-shi,
Hiroshima 726-8610, Japan

Authorized complier
in the community : Mark Jones / Financial Director
UNIT 1 THE HEADLANS, DOWNTON,
SALISBURY, WILTSHIRE, SP5 3JJ, UNITED
KINGDOM

The essential health and safety requirements in accordance with the Supply of Machinery (Safety) Regulations 2008 Annex I were applied and fulfilled:
1.1.2, 1.1.3, 1.1.5, 1.1.6, 1.3.1, 1.3.2, 1.3.4, 1.5.4, 1.5.8, 1.5.9, 1.5.13, 1.6.1, 1.7.1, 1.7.2, 1.7.3, 1.7.4, 1.7.4.1, 1.7.4.2

The following harmonized standards were applied:
EN ISO 12100:2010, EN 1550:1997+A1: 2008

Signature : See original declaration

Place / Date : See original declaration

Name / Title : Yuki Kawakita / Manager, Technical section 1
Technical department
Kitagawa Global hand Company

Being the responsible person appointed and employed the manufacturer.

Kitagawa Corporation Kitagawa Global hand Company
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