

INSTRUCTION MANUAL

DL200 type

Dual Lock Chuck



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 power chuck (DL200 type) for a lathe.

Before starting to use this power chuck, 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 lathes or rotary tables. This product is equipped with the jaws to clamp the workpiece and they operate by means of a rotary 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 Iron Works 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 Iron Works. Additionally, if parts other than genuine parts manufactured by Kitagawa Iron Works are used, this guarantee will be completely invalid.

The chuck and cylinder from Kitagawa Iron Works should be used together. If you must use a part not made by Kitagawa, check with us or our distributor to be sure it is safe to do so. We will not be responsible for injury, death, damage or loss caused by use of a chuck or cylinder made by another company unless this use has been approved by Kitagawa or its distributor.

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1. Structural Drawing and Parts List

1-1. Type display

Type display as shown below

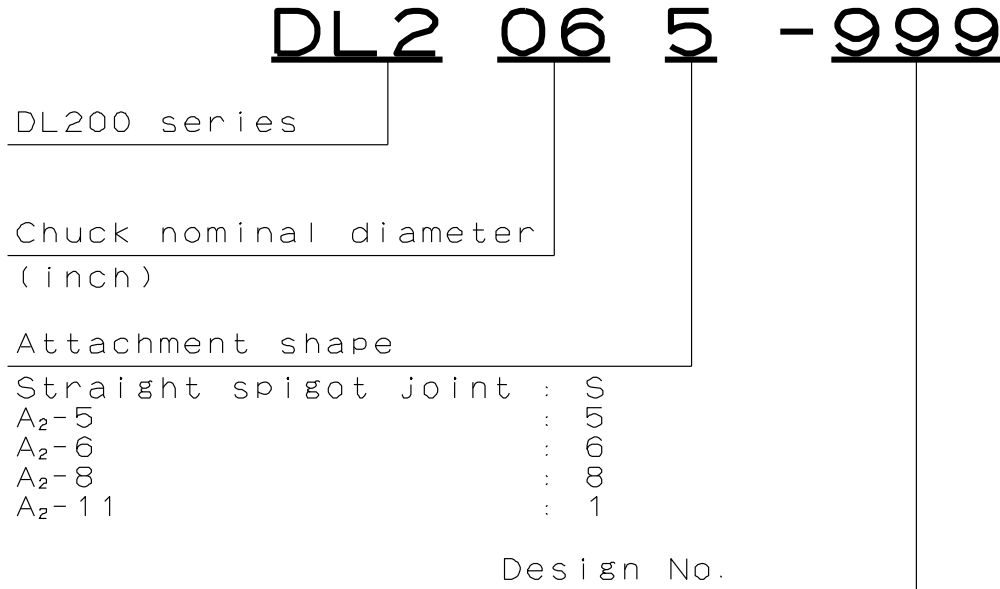


Fig.1

1-2. Structural drawing

Table 1

Type	A	B	C	D	E	F	G _{max}	G _{min}	H	J	K	L	M
DL206	169	105	140	104.8	3-M10	20	34	22.5	30	42	17	M26×1.5	-
DL208	210	110	170	133.4	3-M12	20	37.5	26	31	45	17	M28×1.5	75
DL210	254	132	220	171.4	3-M16	20	38.5	24.5	39.5	50	17	M30×1.5	-
DL212	304	132	220	171.4	3-M16	50	33.5	19.5	44.5	75	17	M30×1.5	-

Type	N	P	Q	R	S _{max}	S _{min}	T _{max}	T _{min}	U	V	W	X	Y	Z
DL206	55	-	7	20	14.25	8.25	23.7	20.8	72	41.5	31	10.3	12	32
DL208	60	2	5	25	25.25	16.25	28.9	25.3	95	45	35	7.8	14	32
DL210	65	-	5	30	26.25	12.75	32.8	28.3	101.5	59	45	14.7	18	35
DL212	-	-	-	30	26.25	12.75	57.8	53.3	129	64	50	14.7	18	50

Type	A1	A2	A3	A4	A5	A6	A7	A8 _{max}	A8 _{min}	A9 _{max}	A9 _{min}
DL206	4	3×7-M6	12	10.5	15	116	6-M6	23.7	20.8	21.25	15.25
DL208	5.5	3×4-M8	16	11.5	16	150	6-M6	26.2	22.6	20.25	11.25
DL210	5.5	3×4-M8	16	14	24	190	6-M8	29.7	25.2	35.25	21.75
DL212	14	3×4-M8	16	14	24	190	6-M8	54.7	50.2	35.25	21.75

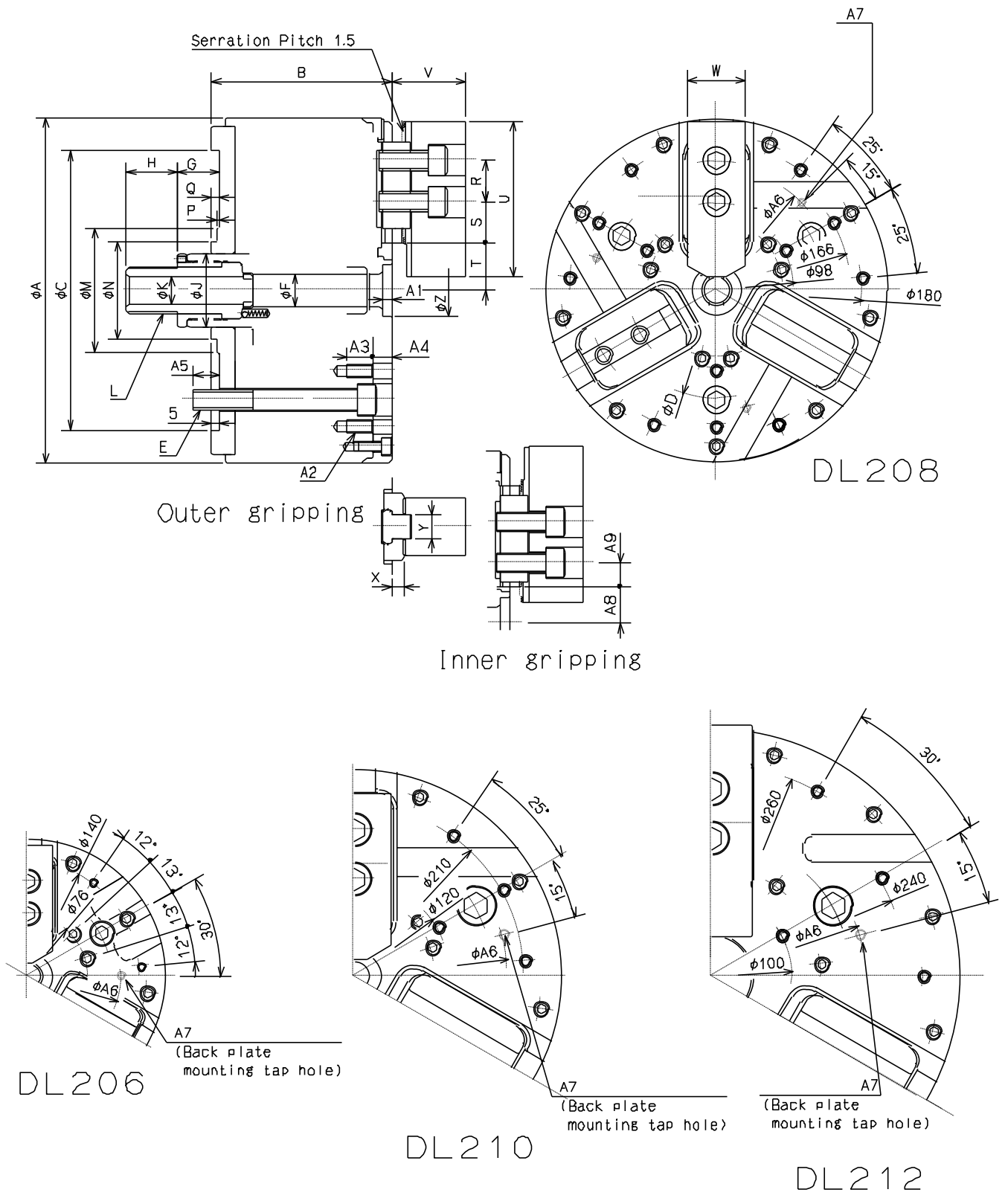


Fig.2

1-3. Scope of product

This instruction manual is for the chuck part.

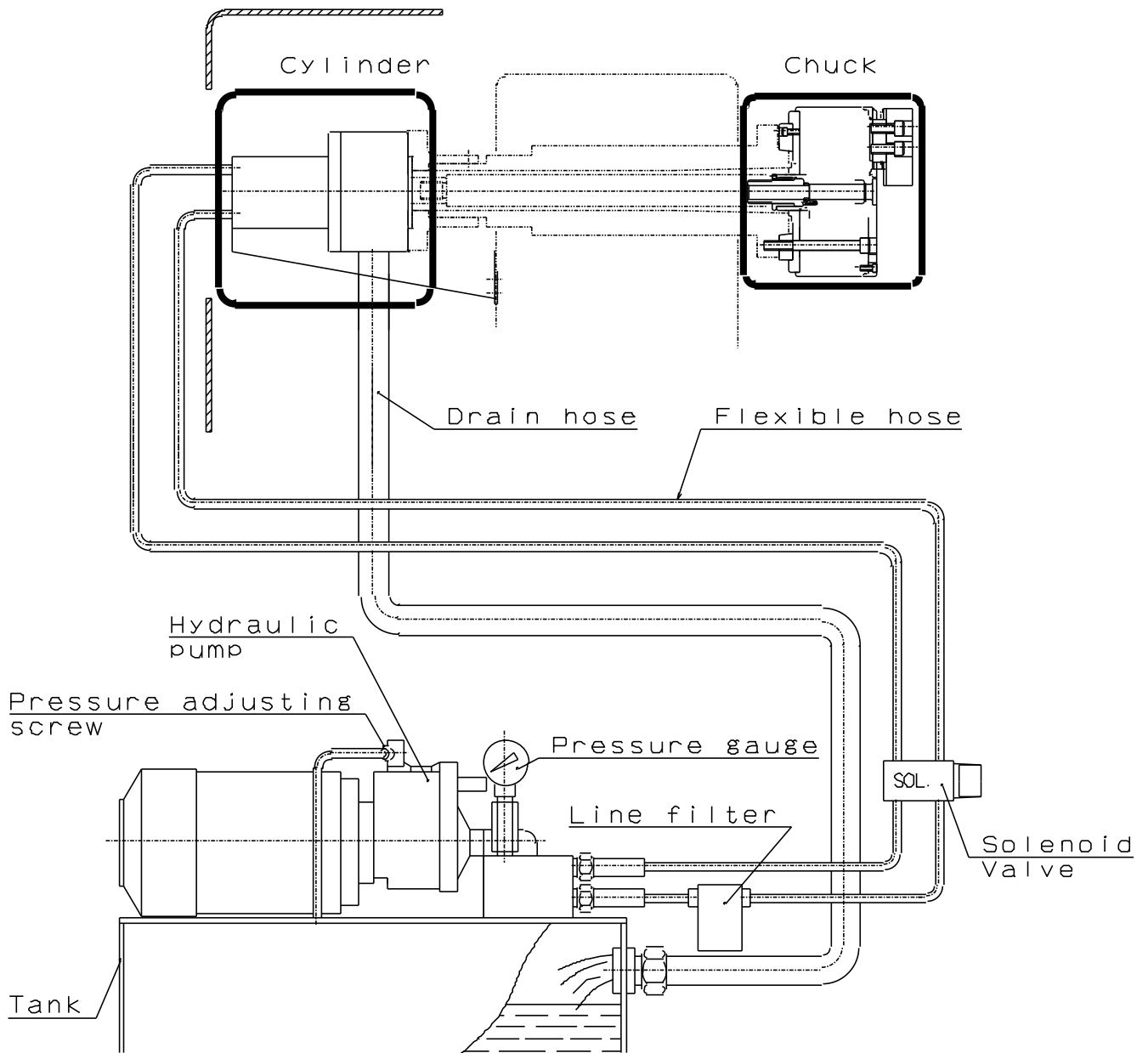


Fig.3

! WARNING

- To prevent the work from flying, safe design, maintenance and erroneous action prevention of the hydraulic system to maintain the gripping force of the chuck is extremely important. Thoroughly read the “Important Safety Precautions” on and after page 11 in this manual.
- As for the cylinder, follow the instruction manual for the cylinder.

1-4. Parts list

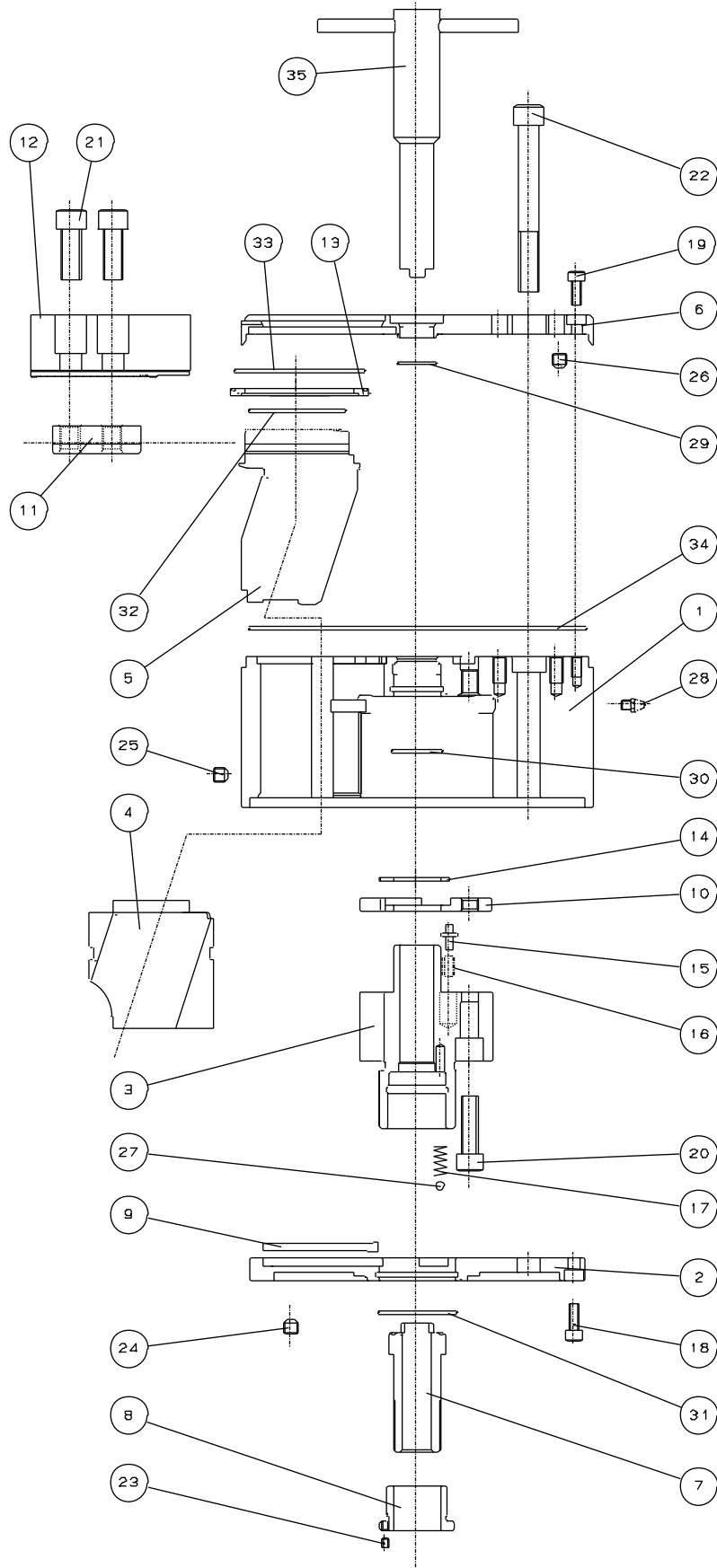


Fig.4

Table 2

■ Parts list

No.	Name	Q'ty	No.	Name	Q'ty
1	Body	1	19	Cover mounting bolt	15
2	Rear body	1	20	Plate mounting bolt	3
3	Plunger	1	21	Jaw mounting bolt	6
4	Bush	3	22	Chuck mounting bolt	3
5	Master jaw	3	23	Set screw	6
6	Cover	1	24	Set screw	3
7	Draw screw	1	25	Set screw	1
8	Nut	1	26	Set screw	1
9	Flat spring	3	27	Steel ball	3
10	Plate	1	28	Grease nipple	1
11	T-nut	3	29	O-ring	1
12	Soft jaw	3	30	O-ring	1
13	Seal	3	31	O-ring	1
14	Pusher	1	32	O-ring	3
15	Pin	4	33	O-ring	3
16	Spring	4	34	O-ring	1
17	Spring	3	35	Mounting hundle	1
18	Rear body mounting bolt	6			

■ Consumables

No.	Name	DL206	DL208	DL210	DL212	Q'ty
29	O-ring	S 22	S 22	S 22.4	S 60	1
30	O-ring	JASO 1028	JASO 2028	JASO 2028	G 65	1
31	O-ring	P 42	JASO 2045	P 50	JASO 3075	1
32	O-ring	JASO 2047	JASO 2056	G 75	G 75	3
33	O-ring	S 56	S 71	AS568-043	AS568-043	3
34	O-ring	S 160	S 200	S 240	S 290	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.



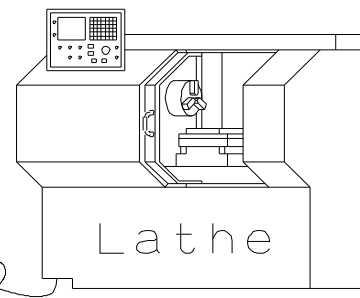
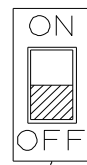
Turn off main power supply before attaching, inspecting or replacing chuck, and before adding oil.

For All Users

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

Main power supply

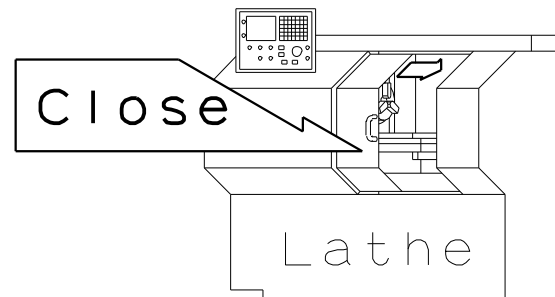
OFF



Close door before rotating spindle.

For All Users

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



During spindle rotation, do not turn off hydraulic pump power supply and do not operate switching valve.

For All Users

- Cutting off hydraulic pressure causes a drop in the gripping force which could result in the work being released and flying out.
- Operating the manual switching valve or solenoid valve will lead to a drop of hydraulic pressure.

Manual switching valve

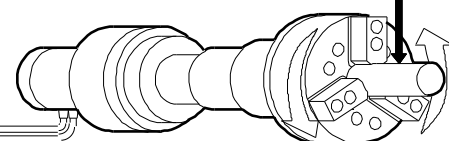
Jaw closed

Jaw open



Solenoid valve

Work





Important Safety Precautions



DANGER

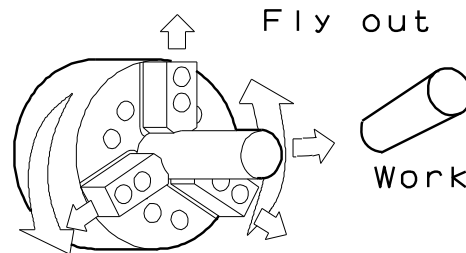
Failure to follow the safety precautions below will result in serious injury or death.



Do not allow the rotation speed of the chuck to exceed the maximum allowable speed limit. (Refer to pages 21-31)

For All Users

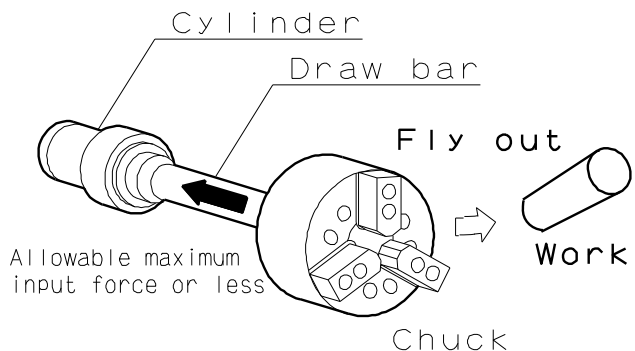
- If the rotation speed of the chuck exceeds the rotation speed limit, this is very dangerous as the chuck and work will fly out.



The input force of the chuck (piston thrust, pulling force of the draw bar) must not exceed the allowable maximum input force. (Refer to pages 21-31)

For All Users

- Input must match the specification of the chuck.
- Adjust the hydraulic pressure to the cylinder so that the input force, which determines the gripping force of the chuck, does not exceed.
- Excessive input force can lead to breakage of the chuck, which is very dangerous, as the chuck and work can be damaged and fly out.





Important Safety Precautions



DANGER

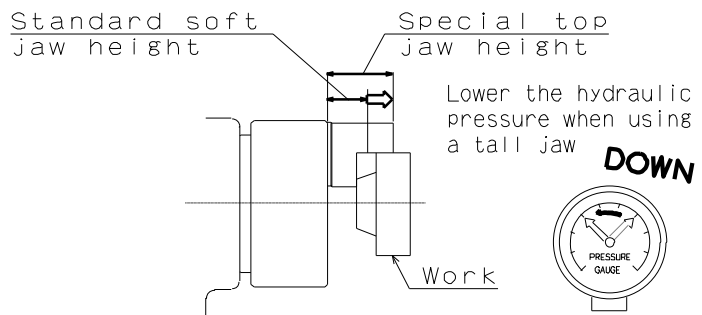
Failure to follow the safety precautions below will result in serious injury or death.



Keep the height of the jaw within the range specified in the gripping force limit table (Refer to pages 26-27). If you must use a jaw taller than a standard soft jaw, use less than the input (piston thrust force, draw bar drawing force) specified in the gripping force limit table.

For All Users

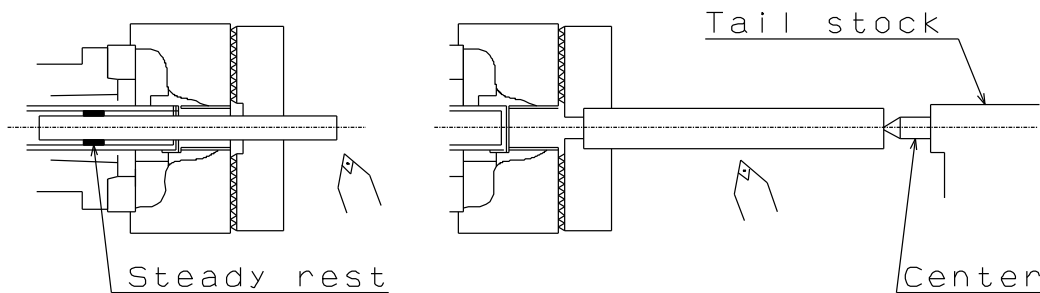
- Do not use a jaw of a height out of the range of the gripping force limit table or a jaw with mass moment out of the range of the gripping force limit table. The chuck will break and the chuck and work will break and fly out.



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.

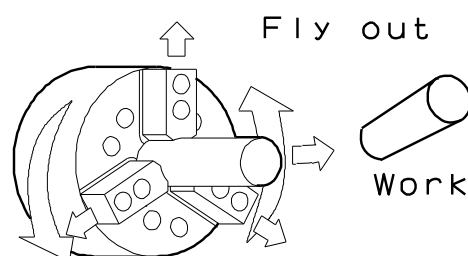


Determine the gripping force required for processing by the machine tool manufacturer or user, and check that the required gripping force is provided before processing.

(Refer to pages 21-30 and cylinder manual)

For All Users

- Adjust the hydraulic pressure to the cylinder to obtain the required gripping force. If the gripping force is insufficient, this is dangerous as the work will fly out.





Important Safety Precautions



DANGER

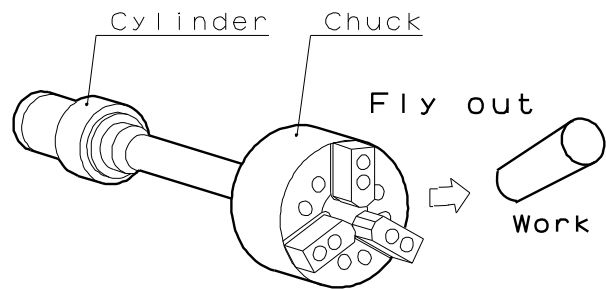
Failure to follow the safety precautions below will result in serious injury or death.



Use of a chuck and cylinder that cannot be used together safely may cause the cylinder to break at high pressure resulting in the chuck and work flying out.

For All Users

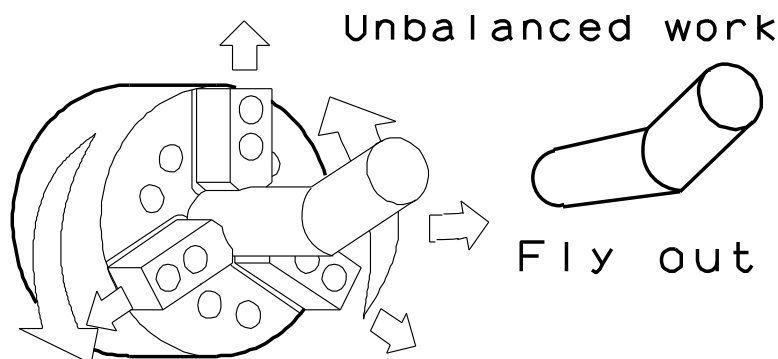
- Check that the chuck and the cylinder are in the “safe combination” when using at high pressure with our company or the distributor. Especially when the cylinder of our company and a high pressure chuck of other company are combined, confirmation is necessary.
- If one of the abnormal events shown below occurs during operation, immediately stop the machine and consult with our company or the distributor.
 - The work slips.
 - Loss of accuracy.
 - The work begins to chatter.
 - The machine's vibration significantly increases.
 - The gripping force does not rise even if hydraulic pressure is raised.



In the case of processing a significant unbalanced work, lower the rotation speed.

For All Users

- Unbalanced work generates dangerous centrifugal forces and the work could 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 chuck or work will fly out. Use the bolts attached to the chuck, and do not use bolts other than these.

For All Users

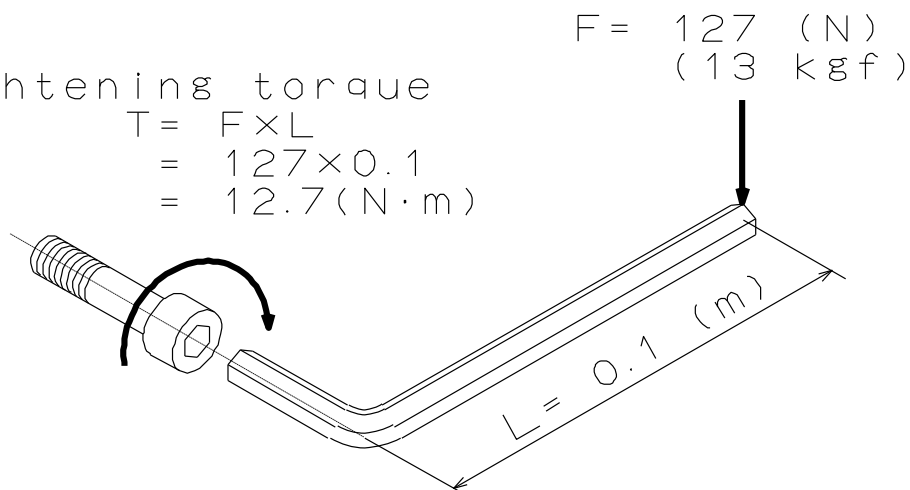
- If the torque is insufficient or excessive, the bolt will break, which is dangerous as the chuck or work will fly out.
- Fix the lathe spindle or the chuck when you tighten bolts. Your hand could slip and get injury when you work without fixing the spindle.
- You cannot control the torque by a hex 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
M12	107	N·m
M14	171	N·m
M16	250	N·m
M20	402	N·m

Tightening torque

$$\begin{aligned}
 T &= F \times L \\
 &= 127 \times 0.1 \\
 &= 12.7 \text{ (N} \cdot \text{m)}
 \end{aligned}$$



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



Important Safety Precautions



DANGER

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



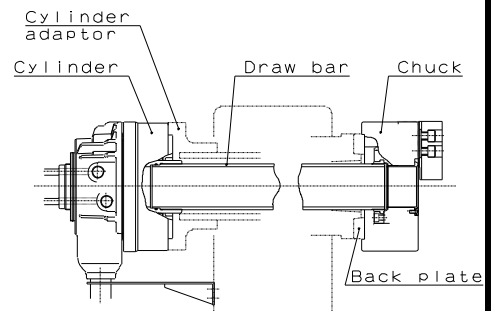
Provide sufficient strength for the draw bar (Refer to pages 67-68).

Provide sufficient screw depth for the draw bar.

Firmly tighten the draw bar.

For Machine Tool Manufacturers

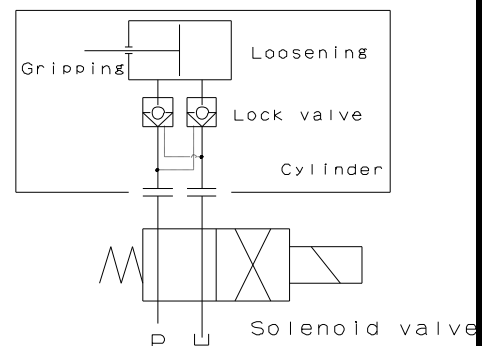
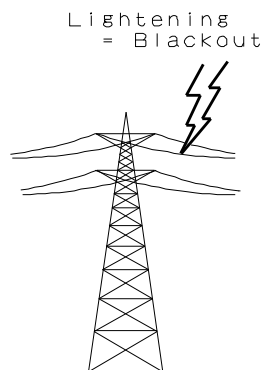
- If the draw bar break, the gripping force is instantly lost and this is dangerous as work will fly out.
- If the screw depth of the draw bar is insufficient, the screw will break and the gripping force will be lost instantly, and this is dangerous as work will fly out.
- If the engagement of the screw of the draw bar is loose, vibration may occur resulting in breakage of the screw. If the screw breaks, the gripping force will be lost instantly, which is dangerous as the work will fly out.
- If the draw bar is unbalanced, vibration occurs, the screw is broken and the gripping force will be lost instantly, which is dangerous as the work will fly out.



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

For Machine Tool Manufacturers

- If the hydraulic pressure suddenly drops due to blackout or malfunction of the hydraulic pump, etc., this is dangerous as work will fly out.
- Lock valve retains the hydraulic pressure inside the cylinder temporarily, when the hydraulic pressure suddenly drops due to blackout or malfunction of the hydraulic pump, etc.



The gripping position must be retained.



Important Safety Precautions



WARNING

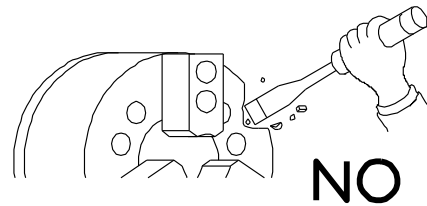
Failure to follow the safety precautions below could result in serious injury or death.



Do not modify the chuck in a way not permitted by the manufacturer.

For All Users

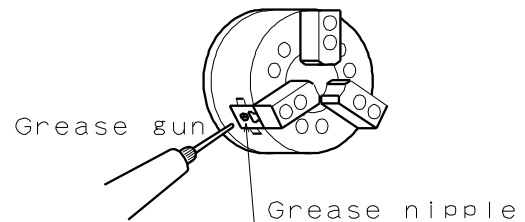
- It may not only break the chuck but the chuck and the work may fly out, which is dangerous.
- If you attach a locator or jig on the chuck body surface, only process work in an acceptable range (Refer to page 48).



Periodically supply adequate grease (Refer to page 56). Turn off power before adding grease.

For All Users

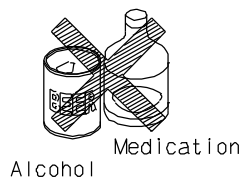
- Insufficient grease supply lowers the gripping force, causes operation failure due to lower hydraulic pressure, lowers the gripping precision, and causes abnormal wearing and seizing, etc.
- This is dangerous as the work could fly out from a drop in the gripping force.



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

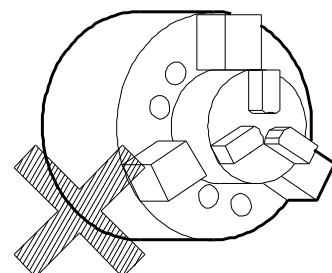
- Dangerous since it will be caught.



Do not grip a chuck with a chuck.

For All Users

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





Important Safety Precautions



WARNING

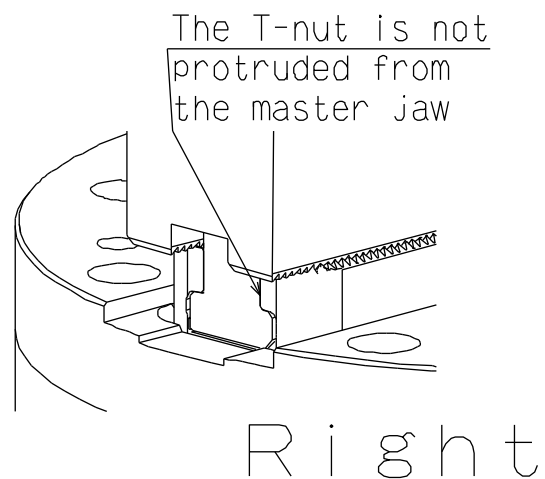
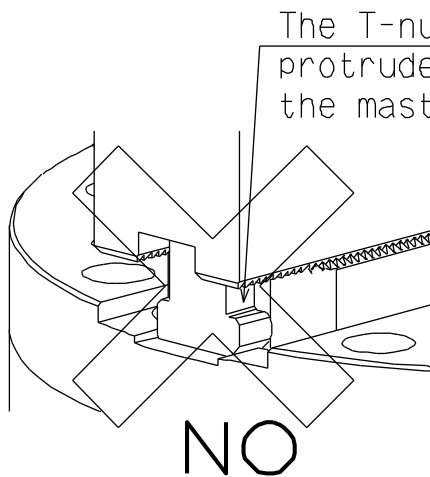
Failure to follow the safety precautions below could result in serious injury or death.



If the T-nut is protruded from the master jaw, the T-nut and master jaw are damaged. Also, the jaw or work-piece will scatter, thus resulting in danger.

For All Users

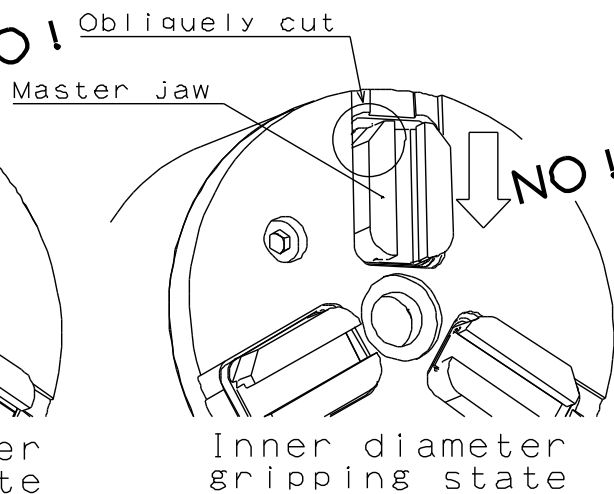
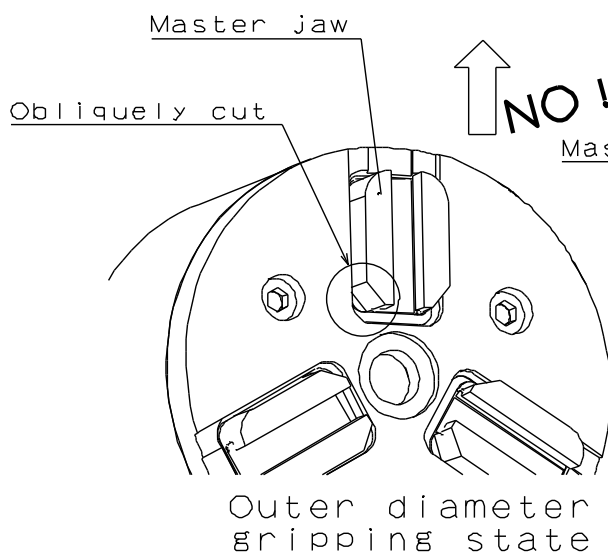
- Danger of scattering of chuck or workpiece.



Grip work in the place where it is obliquely cut by master jaw.

For All Users

- Danger of scattering of chuck or workpiece because of chuck damage.



3. Specifications

3-1. Specifications

Table 3

Outer gripping

Type		DL206	DL 208	DL 210	DL 212
Plunger stroke	mm	11.5	11.5	14	14
Jaw stroke (in diameter)	mm	5.8	7.2	9.0	9.0
Allowable maximum input force	kN (kgf)	19 (1937)	35 (3569)	50 (5099)	50 (5099)
Maximum static gripping force	kN (kgf)	54 (5506)	84 (8566)	110 (11217)	110 (11217)
Minimum input force	kN (kgf)	5 (510)	6.2 (632)	10 (1020)	10 (1020)
Allowable maximum rotation speed	min ⁻¹	6000	5000	4000	3000
Gripping range (outside diameter gripping)	mm	φ 25~140	φ 30~210	φ 40~234	φ 90~304
Mass (standard soft jaw included)	kg	18	30	52	74
Moment of inertia	kg·m ²	0.08	0.135	0.41	0.88
Matching cylinder		Y1020R	Y1225R	Y1530R	Y1530R
Maximum oil pressure	MPa (kgf/cm ²)	2.7 (27.5)	3.2 (32.6)	3.4 (34.7)	3.4 (34.7)
Minimum oil pressure	MPa (kgf/cm ²)	0.9 (9.2)	0.8 (8.2)	0.9 (9.2)	0.9 (9.2)
Standard soft jaw		SB06D1	SB08B1	SB10D1	SB12A1
Option jaw		SB06B1	—	SB12A1	—
Gripping range (Option jaw)		φ 25~158	—	φ 40~254	—

Inner gripping

Type		DL206	DL 208	DL 210	DL 212
Allowable maximum input force	kN	12.6	23	33	33
	(kgf)	(1285)	(2379)	(3365)	(3365)
Maximum static gripping force	kN	36	56	73.3	73.3
	(kgf)	(3671)	(5710)	(7478)	(7478)
Maximum oil pressure	MPa	1.7	2.1	2.3	2.3
	(kgf/cm ²)	(17.3)	(21.4)	(23.5)	(23.5)

Reference: 1kN = 101.97kgf 1MPa = 10.197kgf/cm²

Type	DL206	DL 208	DL 210	DL 212
Balance quality (standard soft jaw not included)	G6.3			
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.

 **WARNING**

- If workpiece of a diameter is smaller the standard specification, a great load will be applied to the mounting bolt, also damage the workpiece and jaws scatter. Refer to standard specification.

3-2. Relationship between gripping force and rotation speed

1. Maximum static gripping force

The static gripping force is the gripping force when the chuck is at a stop.

The power chuck has a mechanism to convert input force (piston thrust force, draw bar drawing force) from the cylinder to gripping force. Therefore, the gripping force when the allowable maximum input force becomes the maximum static gripping force.

However, the gripping force is different depending on the state of grease lubrication, grease in use, height of the jaw, etc. The maximum static 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 15)
- The numerical values are obtained with the Kitagawa gripping force meter . The gripping position of the gripping force meter is at h_0 .
- CHUCK GREASE PRO is used. (Refer to page 56).
- A variable displacement pump with the discharge volume of 20 liters/min or more is used as the hydraulic source. The pressure is set by the pressure control equipment of the pump itself, or the pressure reduction valve equipped separately.

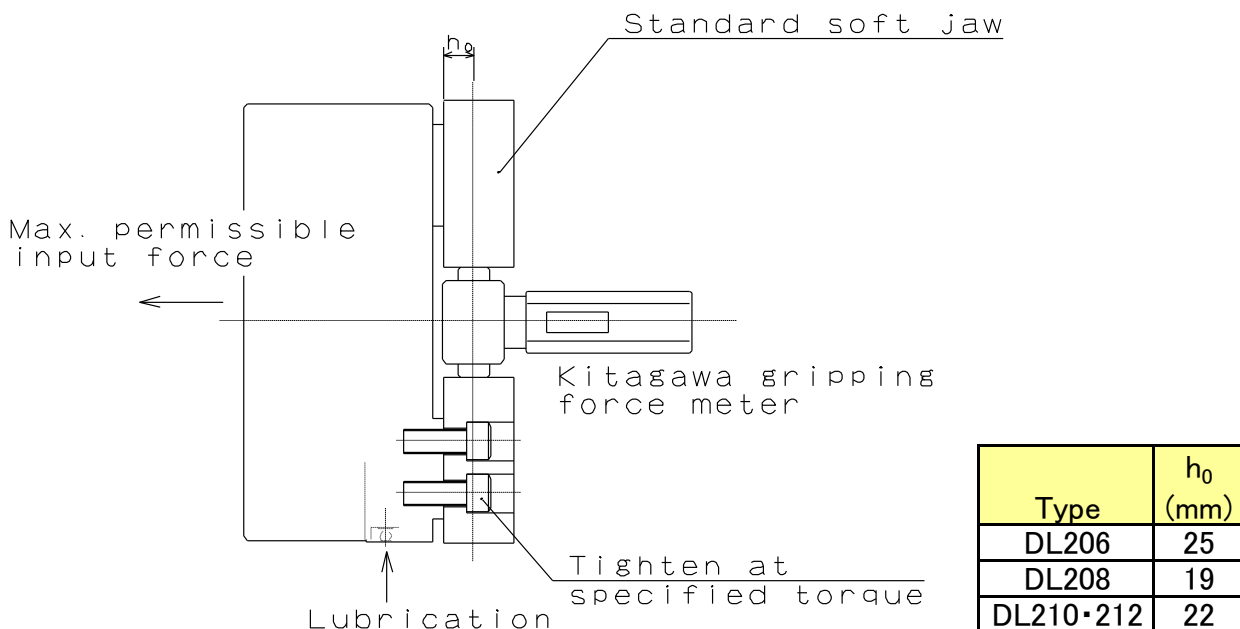


Fig.5

2. Allowable maximum rotation speed

In the case of outside diameter gripping, when the chuck is rotated, the gripping force lowers due to the centrifugal force of the top jaw. Therefore, the rotation speed when the dynamic gripping force (gripping force during rotation) becomes approximately 1/3 of the maximum static gripping force is set as the allowable maximum rotation speed. The centrifugal force is different depending on the mass of the top jaw and the barycentric position as well as the rotation speed. The allowable maximum rotation speed specified in the specification is the value under the following conditions:

- The Kitagawa standard soft jaw is used.
- Grip the gripping force meter in the center of the jaw stroke, and at this point, the soft jaw is attached at the position where the periphery side end of the T-nut and the master jaw periphery are almost lined up.
- The numerical values are obtained by the Kitagawa gripping force meter. The gripping position of the gripping force meter is at h_0 .



To avoid serious accidents caused by the chuck or work flying 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. The gripping force of the chuck must not exceed the maximum static gripping force.**
- **Determine the rotation speed required for processing by the machine tool manufacturer or user based on the gripping force required for the processing. The rotation speed at this point must not exceed the allowable maximum rotation speed.**

NOTICE

- When determining the cutting conditions, refer to pages 22-31.
- Pay attention since the gripping force is different depending on the state of the oil supply, grease in use, height of the jaw, performance of the pump and the pressure reducing valve, piping state, etc.

3. Relationship between gripping force and rotation speed

As the rotation speed becomes higher, the centrifugal force of the jaw increases and the gripping force lowers. The curves displayed in Fig. 6 shows relationships between the rotation speed and the centrifugal force when using the standard soft jaw. The centrifugal force differs significantly depending on the size and shape of the top jaw and the attaching

position, therefore, when the rotation speed is high, actual measurement using a Kitagawa gripping force meter is required.

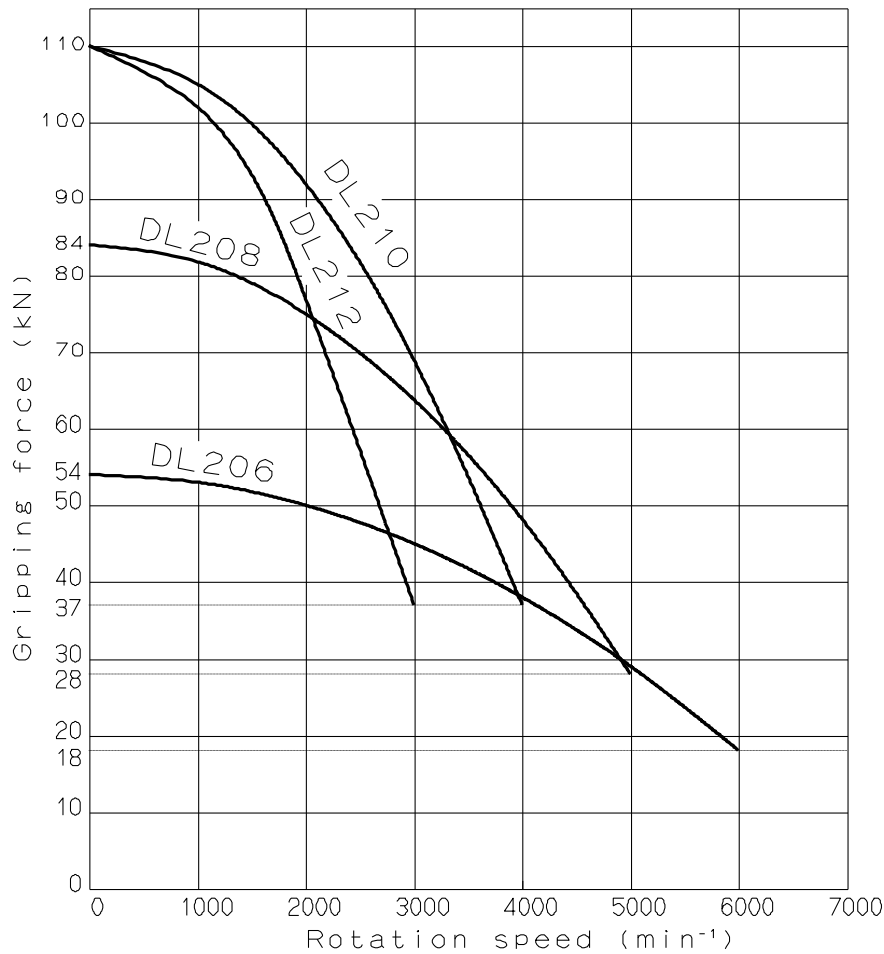


Fig.6



- In the case of processing a considerably unbalanced work, lower the rotation speed. The work will fly out and this is dangerous.
- Vibration is generated if there is unbalance due to the work and the jig, etc. Vibration decreases process precision and shortens the working life of the chuck, even possibly breaking it. Correct the unbalance by using a balance weight, etc., or lower the rotation speed for use.
- In the case of heavy cutting at high rotation speed, vibration is easily generated in the same manner as the unbalance of the chuck, therefore, set the cutting conditions appropriate for the dynamic gripping force and machine rigidity.

3-3. Relationship between gripping part center height, static gripping force and input force / Relationship between top jaw mass moment and gripping force loss

If the gripping part center height of the used top jaw (dimension H in Fig. 7) is higher than the gripping part center height of the standard soft jaw, a large load is applied to the master jaw, T nut, jaw attaching bolts, etc. To prevent these parts from being broken, it is necessary to use the machine by using a lower input force than the allowable maximum input force. Additionally, if the top jaw is larger and heavier, the centrifugal force generated at the top jaw will increase. It is necessary to examine the dynamic gripping force considering the centrifugal force and to use the machine at a rotation speed that can withstand the cutting force.

The following explains the procedures of the specification review.

1. Calculation of gripping center height H

The gripping center is based on the dynamic center of the gripping force which acts on the workpiece from the jaws, and H means the height from the master jaw top face to the gripping center of jaw. When the gripping face contacts the workpiece equally, a gripping center is considered at the dimension center of the gripping face. Depending on the state of workpiece surface or a jaw gripping face, the gripping force may not be applied to the workpiece uniformly. When checking a contact state is difficult, determine the gripping center to top section with safety always taking precedence.

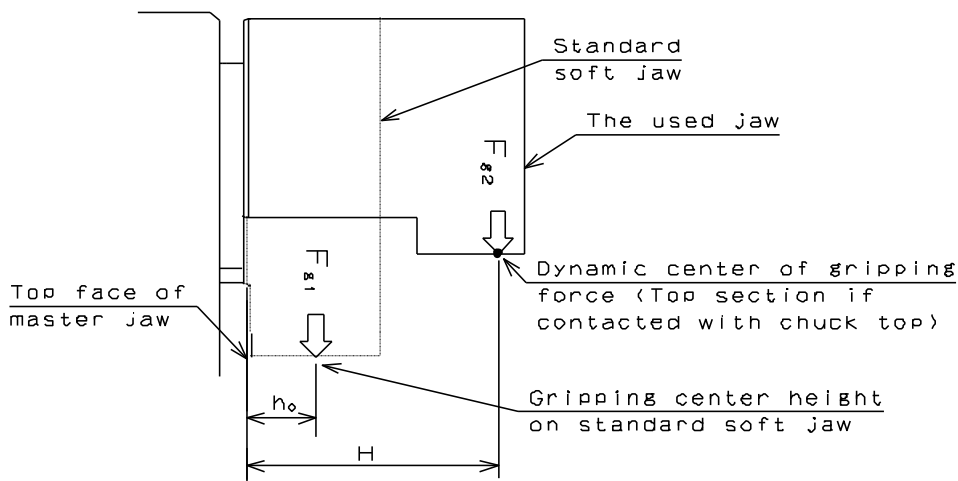


Fig.7

h_0 : Gripping center height of standard soft jaw (mm)

H : Gripping center height of jaw (mm)

F_{g1} : Static gripping force of standard soft jaw (kN)

F_{g2} : Static gripping force of jaw (kN)



- Keep the height of the top jaw within the range of the gripping force limit table. (Refer to Fig.8-10)
- If a top jaw is taller than the standard soft jaw, use it at the input force (piston thrust force, draw bar drawing force) specified in the gripping force limit table. If it is used without lowering the input, the chuck will break and this is dangerous as the chuck and work will fly out.

2. Calculation of maximum static gripping force $F_{g2(max)}$

Calculation method of maximum static gripping force on Outer diameter gripping

● $H \leq h_0$

$$F_{g2(max)} = \frac{F_{g1(max)} \times (h_0 + C)}{H + C}$$

● $h_0 < H \leq H_{max}$

$$F_{g2(max)} = \frac{F_{g1(max)} \times h_0}{H}$$

● $H_{max} < H$

Do not use the jaw for which the gripping center height H becomes higher than limit height H_{max} . Use a jaw so that the gripping center height H is low.

$F_{g1(max)}$: Maximum static gripping force (kN)
in standard spec.

H_{max} : Maximum limit height (mm)

C : Constant decided by chuck shape

Type	$F_{g1(max)}$ (kN)	H_{max} (mm)	C
DL206	54	66	80
DL208	84	70	100
DL210·212	110	80	150

Calculation method for maximum static gripping force on Inner dia. gripping

● $H \leq h_1$

$$F_{g2(max)} = \frac{2}{3} \times \frac{F_{g1(max)} \times (h_0 + C)}{H + C}$$

● $h_1 < H \leq H_{max}$

$$F_{g2(max)} = \frac{F_{g1(max)} \times h_0}{H}$$

● $H_{max} < H$

Do not use the jaw for which the gripping center height H becomes higher than limit height H_{max} . Use a jaw so that the gripping center height H is low.

h_1 : Boundary of the gripping middle height to calculate the maximum static gripping force on inner diameter gripping.

Type	h_1 (mm)
DL206	44.4
DL208	31.5
DL210·212	36.5

3. Determination of static gripping force F_{g2}

Determine the static gripping force F_{g2} by considering the required conditions such as the distortion of the workpiece and strength of the jaw. However, the gripping force F_{g2} should be $F_{g2(max)}$ or less.

4. Calculation of input Q

$$Q = \frac{Q_{max}}{F_{g1(max)}} \times \frac{F_{g2} \times (H + C)}{h_0 + C}$$

Q : Input so that gripping force is F_{g2} (kN)

Q_{max} : Max. permissible input of standard spec. (kN)

Type	Q_{max} (kN)
DL206	19
DL208	35
DL210-212	50

Fig.8-10 shows the graph of the relationship between the gripping center height, the static gripping force and input force of conventional steps 1-4.

Using these items as a reference, the static gripping force F_{g2} and input Q according to the gripping center height H can also be roughly obtained.

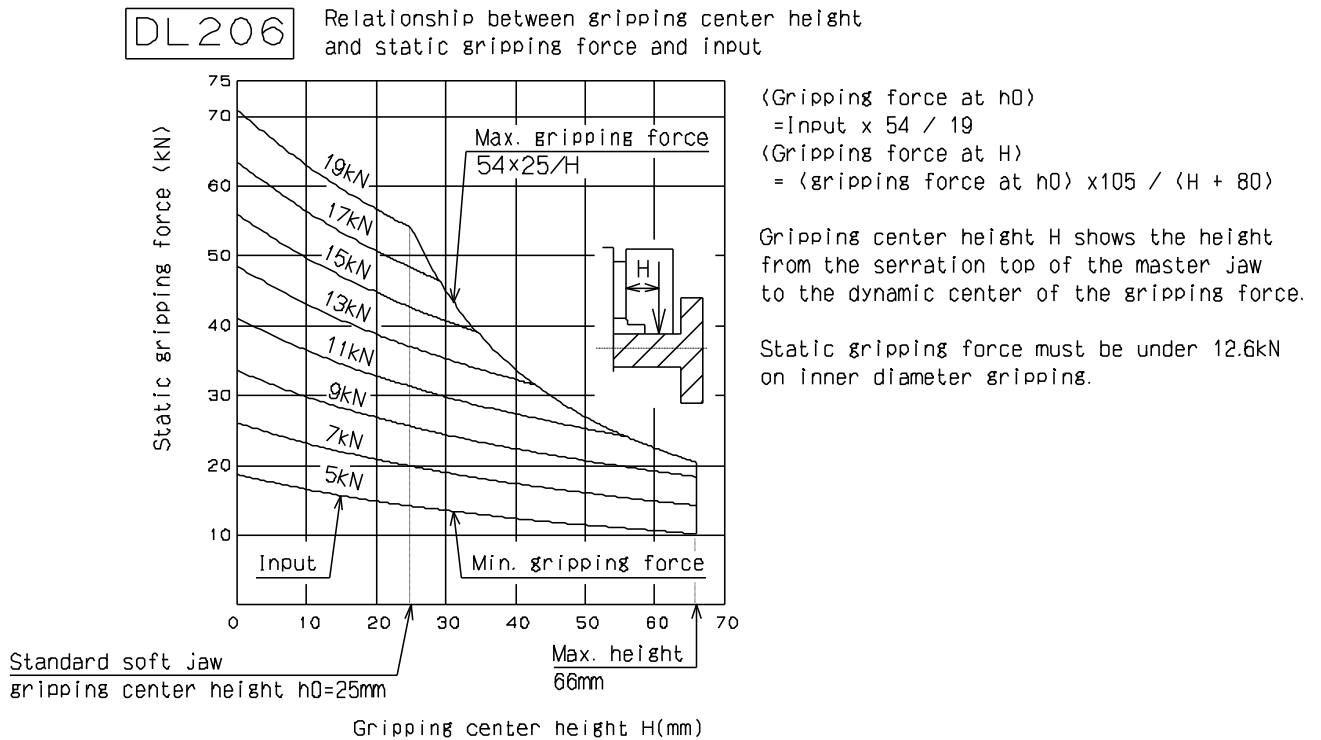
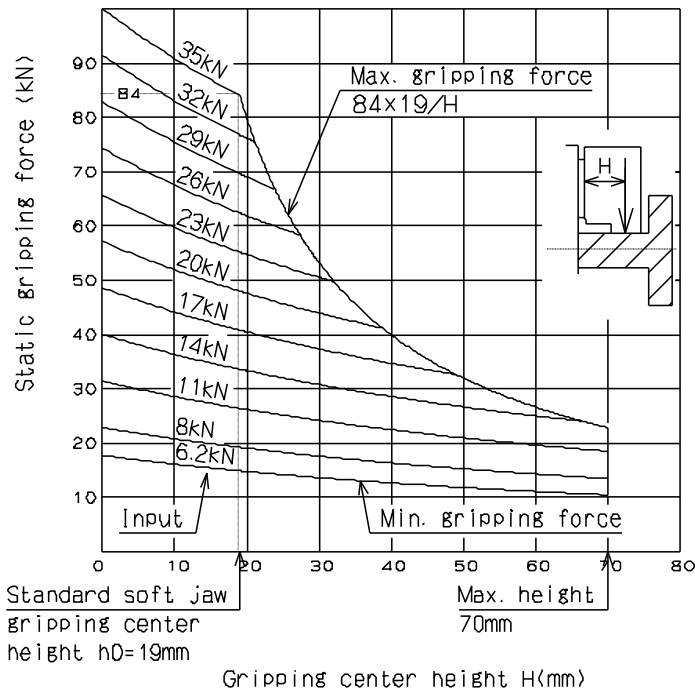


Fig.8

DL208

Relationship between gripping center height and static gripping force and input



(Gripping force at h0)
 = Input x 84 / 35
 (Gripping force at H)
 = (gripping force at h0) x 119 / (H + 100)

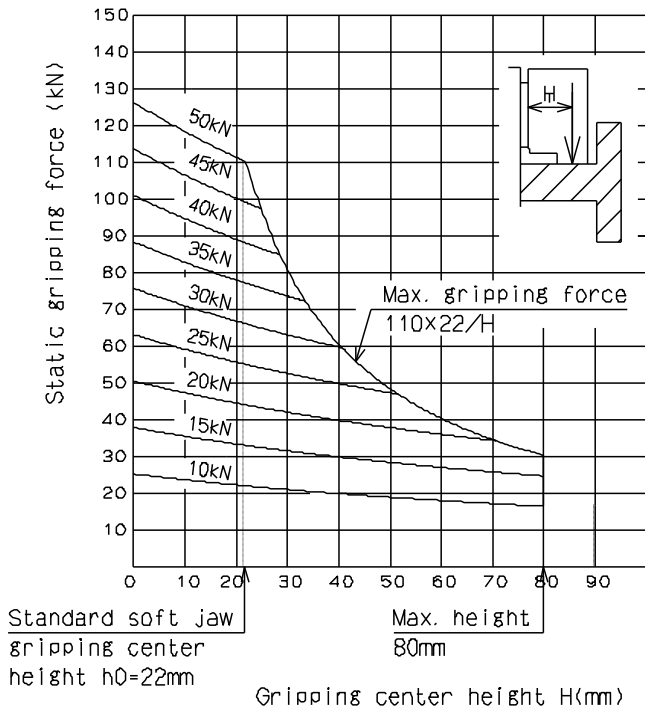
Gripping center height H shows the height from the serration top of the master jaw to the dynamic center of the gripping force.

Static gripping force must be under 23kN on inner diameter gripping.

Fig.9

DL210 · 212

Relationship between gripping center height and static gripping force and input



(Gripping force at h0)
 = Input x 110 / 50
 (Gripping force at H)
 = (gripping force at h0) x 172 / (H + 150)

Gripping center height H shows the height from the serration top of the master jaw to the dynamic center of the gripping force.

Static gripping force must be under 33.3kN on inner diameter gripping.

Fig.10

5. Calculation of set hydraulic pressure

$$P = \frac{Q}{Q_{\text{cyl(max)}}} \times (P_{\text{max}} - \text{loss}) + \text{loss}$$

P : Cyl. Set hydraulic pressure (MPa)

P_{max} : Max. permissible hydraulic pressure of
cyl. (MPa)

$Q_{\text{cyl(max)}}$: Max. cyl. thrust (kN)

loss : Pressure loss (MPa)

Type	Pmax (MPa)	Qcyl(max) (kN)	loss (MPa)
Y1020R	4	29	0.25
Y1225R	4	42	0.25
Y1530R	4	60	0.25

Values of P_{max} , $Q_{\text{cyl(max)}}$ and loss in Table are for the standard cylinder. When using other cylinders, refer to the attached instruction manual.

6. Calculation of increment $\Delta(m \times r)$ of jaw mass moment

The increment $\Delta(m \times r)$ of mass moment for the used jaw against the standard soft jaw is calculated. (Fig.11)

It can also be found even if the mass moment $m_0 \times r_0$ of the standard soft jaw is subtracted from the whole mass moment $m \times r$. (Fig.12)

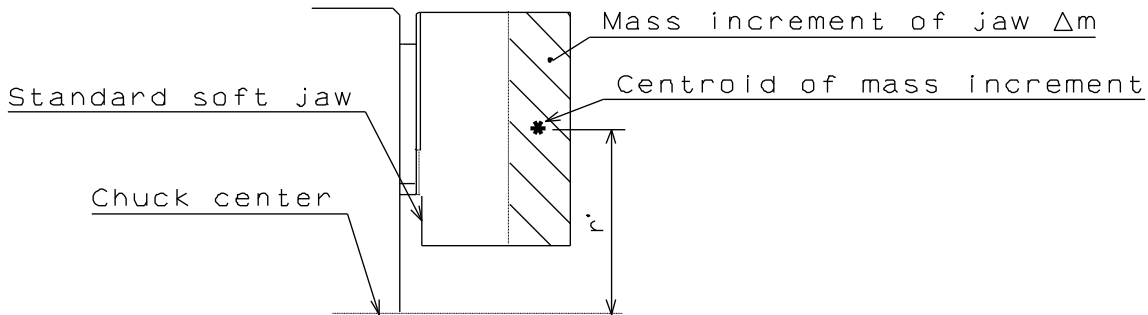


Fig.11

$$\Delta(m \times r) = \Delta m \times r'$$

$\Delta(m \times r)$: Mass increment (kg·m) of a jaw

Δm : Mass increment (kg) of a jaw

r' : Centroid pos (m) of mass increment

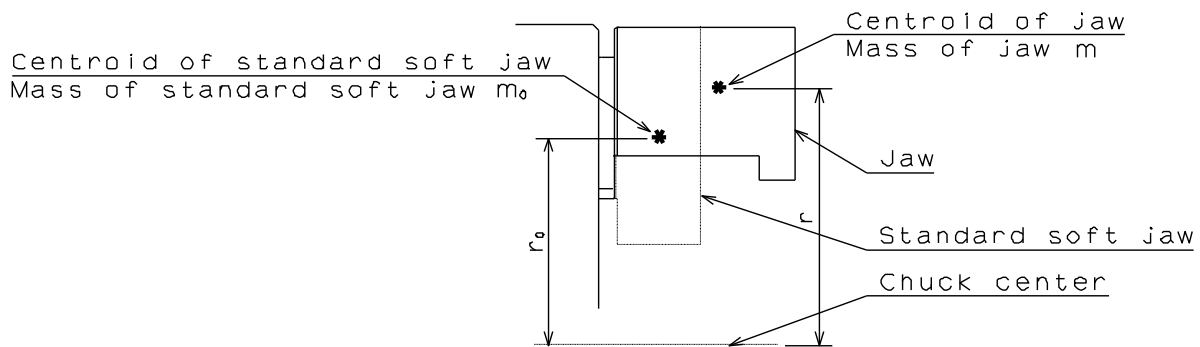


Fig.12

m : Mass of a jaw (kg)

r : Distance (m) from chuck center to jaw centroid

m_0 : Mass (kg) of a standard soft jaw

r_0 : Distance (m) from chuck center to standard soft jaw centroid

Type	m_0 (kg)	r_0 (m)
DL206	0.4	0.045
DL208	0.9	0.057
DL210	1.3	0.058
DL212	2.2	0.085

7. Calculation of centrifugal force F

$$\Delta F = \Delta(m \times r) \times \left(\frac{N \times 2\pi}{60} \right)^2 \times \frac{1}{1000}$$

$$F = F_{\max} \times \frac{N^2}{N_{\max}^2} + \Delta F \times \mu \times 3$$

Type	F _{max} (kN)	N _{max} (min ⁻¹)
DL206	36	6000
DL208	56	5000
DL210	73	4000
DL212	73	3000

F : Centrifugal force (kN) applied to jaw

ΔF : Centrifugal force (kN) applied to mass increment of a jaw

F_{max} : Maximum (kN) of centrifugal force in standard specification

N : Rotating speed determined from cutting conditions etc. (min⁻¹)

N_{max} : Max. permissible rotating speed in standard specification (min⁻¹)

μ : Rate which influences gripping force of centrifugal force
(Safety is taken into consideration)

Outer diameter gripping μ=1

Inner diameter gripping μ=0.5

8. Calculation of dynamic gripping force F_{g2n}

In case of outer diameter gripping

$$F_{g2n} = F_{g2} - F$$

$$F_{g2n} \geq F_{g2} \times 1/3 \quad (\text{condition})$$

In case of inner diameter gripping

$$F_{g2n} = F_{g2} + F$$

$$F_{g2(\max)} \geq F_{g2n} \quad F_{g2} \geq F \quad (\text{condition})$$

If the condition is not accepted, return to procedure 7 after reducing the rotating speed N. Or return to procedure 3 after counting backward the value of F_{g2}.

9. Verification of dynamic gripping force F_{g2n}

Verify terms and conditions such as the slip and distortion of a workpiece, the strength of the jaw based on F_{g2n}. If there is any problem, reconsider the jaw shape and cutting conditions by returning to procedures 1 – 8.

The specifications of procedures 1 – 9 are only reference values. Since specifications may have a large error in comparison to the actual cutting conditions because the procedures include hypothetical condition values, determine final specifications after trial cutting.

DANGER

- If the chuck is used at a gripping force exceeding the maximum permissible gripping force, the chuck will be damaged and the workpiece will scatter.
- When it is difficult to calculate the dynamic gripping force, rotate the chuck at as low a rotating speed as possible. If the dynamic gripping force becomes small or large excessively, the workpiece slips or the inside of the chuck is damaged. Thus, there is a danger that the workpiece will scatter.
- If the chuck is used according to procedures of 1 - 9 without performing a trial cutting or a high rotating speed and a large cutting force are applied, the workpiece will slip or the inside of the chuck will be damaged. Thus, there is a danger that the workpiece will scatter.

NOTICE

- When the cylinder is operated at a minimum input force, the gripping motion becomes unstable and accuracy may become worse.

4. Forming Soft Jaw

4-1. Attachment of soft jaw

The attaching position of the soft jaw can be adjusted by loosening the socket head cap screw, attaching the soft jaw and by changing each serration engagement position.

Use the most appropriate soft jaw considering the shape, dimension, material, and surface roughness of the work and the cutting conditions, etc.

Directions of T-nits vary by chuck sizes. Please refer to Fig.14 (Fig.15 in case of DL208).



- Use the T nut so that it does not come out from the master jaw. (Refer to Fig.9)
- If the T nut comes out from the master jaw, the master jaw and T nut will break causing the work to fly out and a possible precision failure.

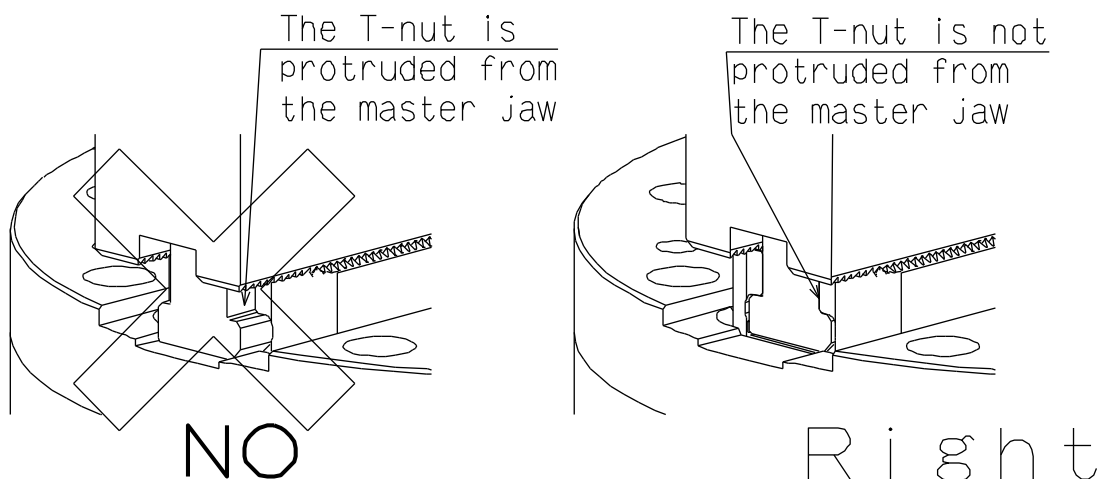


Fig.13

- Always tighten the bolts at the specified torque. If the torque is insufficient or excessive, the bolt will break, which is dangerous as the chuck or work will fly out.

Table 4

Bolt size	Tightening torque	
M5	7.5	N·m
M6	13	N·m
M8	33	N·m
M10	73	N·m
M12	107	N·m
M14	171	N·m
M16	250	N·m
M20	402	N·m

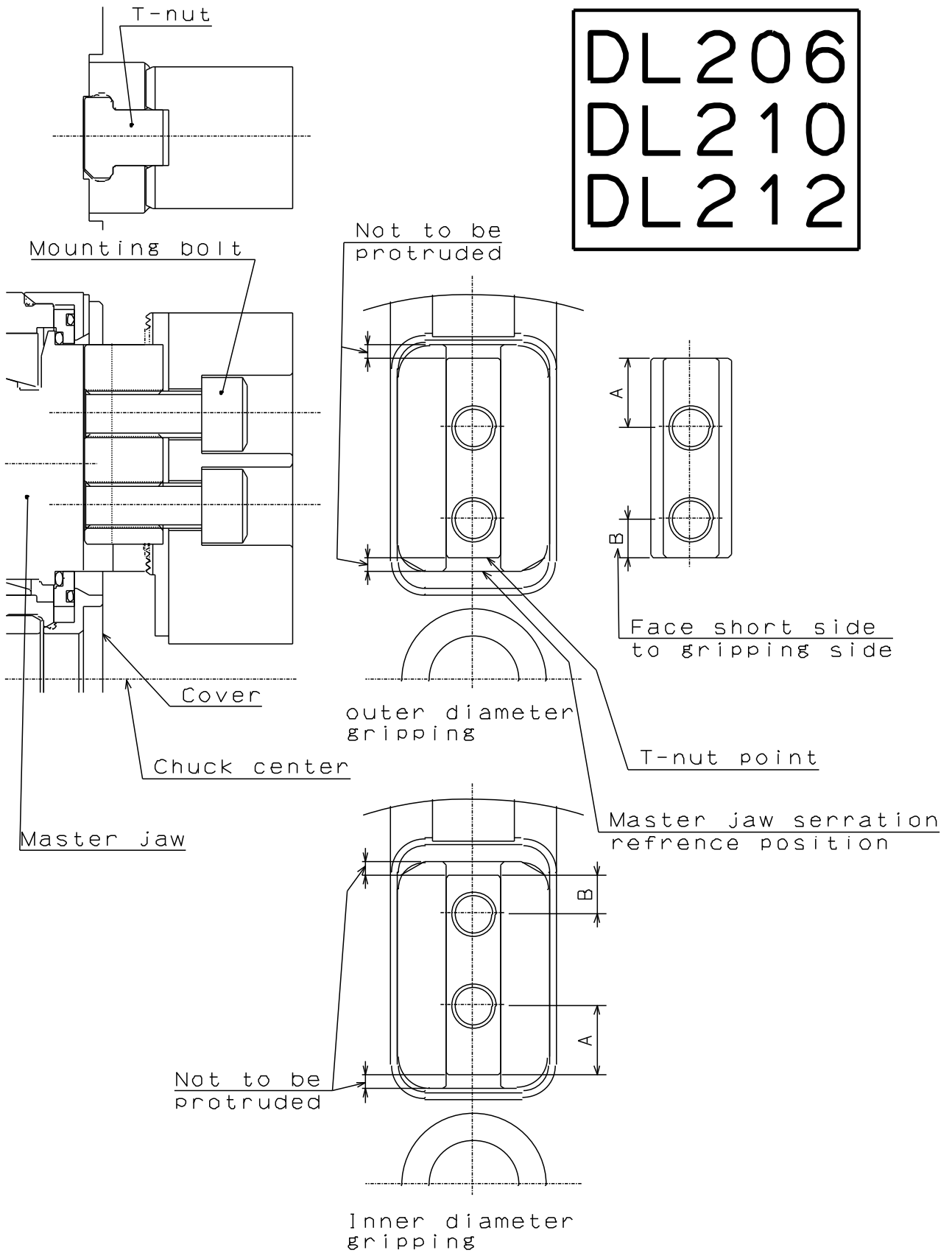


Fig.14

DL208

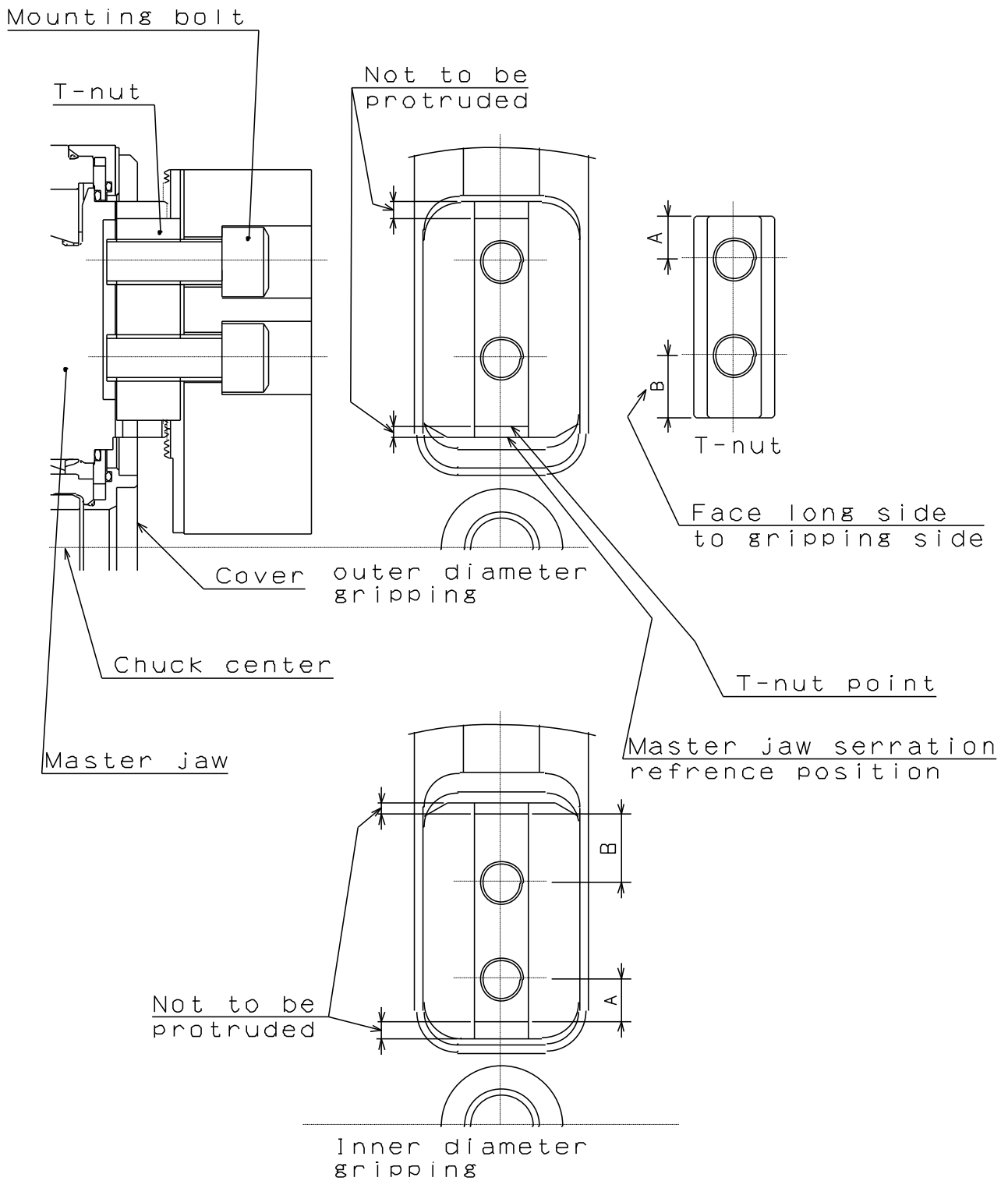
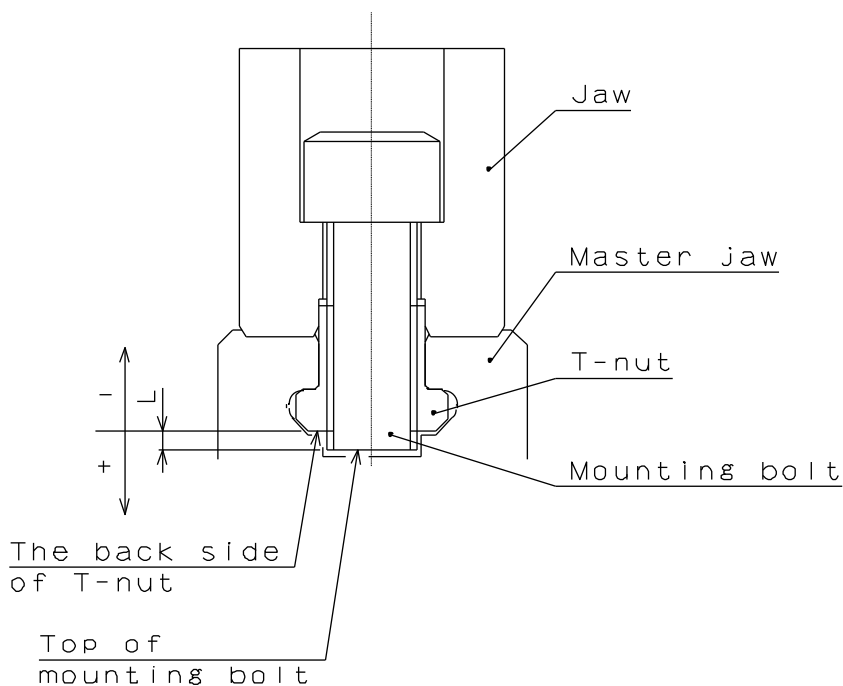


Fig.15

! DANGER

- Use the T nut and the attaching bolts attached to the chuck and do not use bolts other than these. If commercially available bolts are used for an unavoidable reason, use bolts at the strength classification 12.9 (strength classification 10.9 for M22 or more) or more, and pay sufficient attention to the length. (Refer to Fig.16)



Type	L (mm)
DL206	-0.5~0
DL208	0~+2.5
DL210·212	-0.5~0

Fig.16

L : The position of the top of adjusting bolt based on T-nut's back side

The + value of L means that the top of bolts is at the outside of the back side of T-nut and - value means that one is at the inside of it.

- Do not rotate the chuck so that the T nut is loosened causing the jaw to fly out.
- Please use only standard T-nuts and do not modify them. T-nuts will get broken and jaws or work piece will fly out to cause damage or injury if non-standard T-nuts or modified T-nuts are used.
- If a workpiece is gripped, a great force will be applied to the jaws and components. If each strength of these components is not sufficient, the chuck will be damaged and the workpiece or jaws will scatter, thus creating danger.
- If jaws are enlarged remarkably, the gripping force is lost by centrifugal force. As a result, the workpiece will scatter, thus creating danger.

! DANGER

- Check that the reference mark on the side of the No. 1 master jaw is within the range of the entire stroke as shown in Fig. 17. Full stroke the jaw at least once a day to check it before work or when supplying grease, etc. If it goes out of the range of appropriate stroke due to loosening of the draw screw, etc., the work may not be gripped, and this is dangerous as the work will fly out.
- When gripping the work, use it by keeping the position of the master jaw within the appropriate stroke range. Gripping in the center of the stroke is the most stable for the mechanism, and the best precision can be obtained.
 - When gripping near the stroke end, the work may not be gripped sometimes according to the deviation, etc., of the gripping part allowance of the work, and this is dangerous as the work will fly out.
 - When gripping near the stroke end, the chuck may break and the chuck or work could fly out.

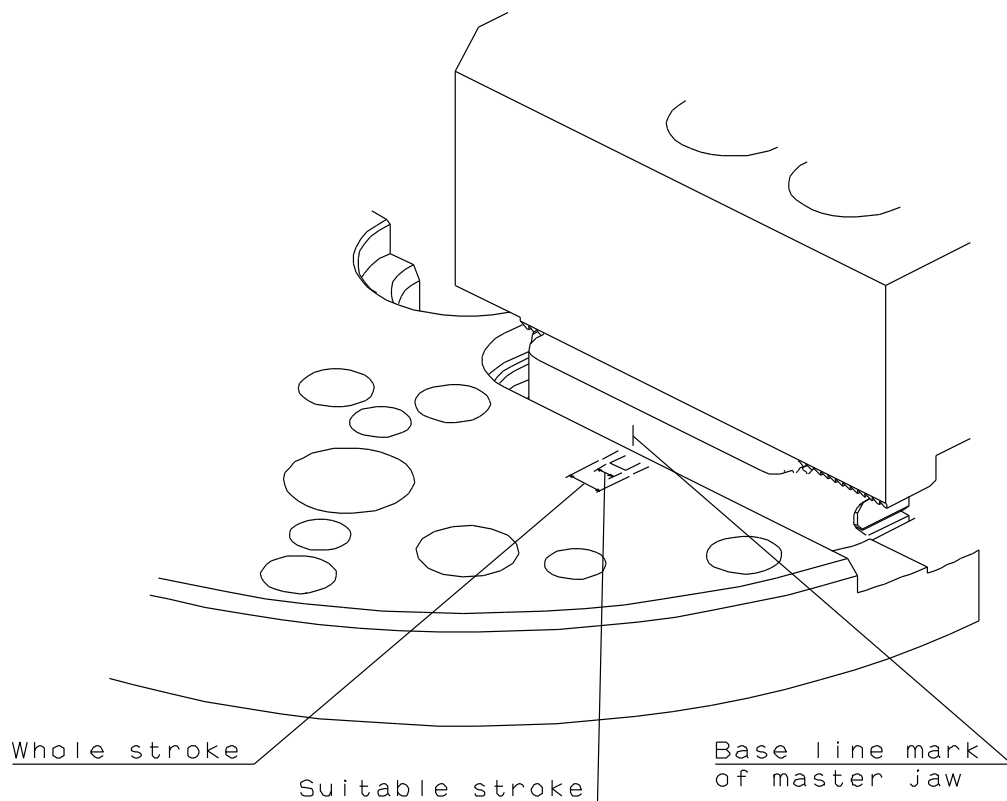


Fig.17

NOTICE

- When the gripping center height becomes as low as possible, the gripping force, retract motion and accuracy are stable and this will result in stable production.
- The high jaw and wide jaw increase mass. A jaw where the mass is large increases the gripping force loss because of centrifugal force by chuck rotation, and cutting conditions become disadvantageous.
- The position of the master jaw to grip the workpiece is best when using it at the stroke center. At this time, the workpiece is stabilized at the maximum in view of the mechanism, and high precision is obtained.

4-2. Forming 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.

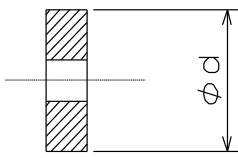
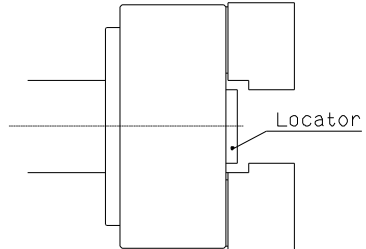
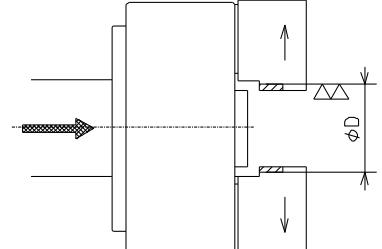
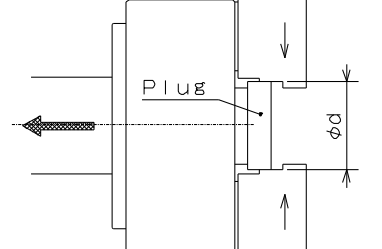
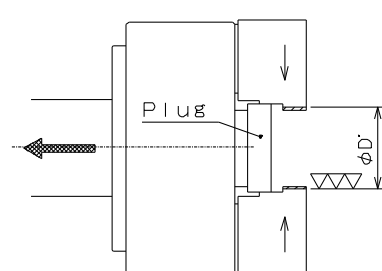
The forming plug is gripped with its end face contacting the chuck surface or locator datum end face.

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.

NOTICE

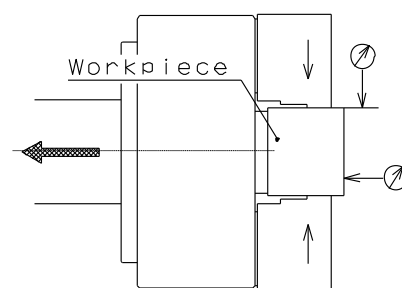
- When the jaw is not finished on the machine, or it is finished on another machine, the contact for the workpiece becomes worse, thus resulting in an unstable retracting motion or reducing the gripping accuracy.
- When finishing the jaw without touching the forming plug end face to the chuck surface or locator datum end face, the gripping accuracy may be impaired.
- When the gripping position of the forming plug is near the gripping face of the workpiece as much as possible, the gripping accuracy becomes stable.
- When the jaw finished on the machine is removed from the chuck once, the gripping accuracy becomes low as compared with when it is attached as is.
- When mounting the jaw, match the jaw No. to the master jaw No.
- If the plug rigidity is insufficient, the gripping accuracy becomes low or stroke position is out of order.
- Make the stroke from the grasped position to unclamp position into the following value at one side. It becomes a cause no longer releasing with workpiece grasped.
DL206: 0.7mm 、 DL208: 0.8mm 、 DL210: 1mm 、 DL212: 1mm

4-3. Forming soft jaw with outside diameter gripping

<p>1. Preparation of the plug for forming</p> <ul style="list-style-type: none"> Prepare the plug for forming. The surface roughness of the plug outside diameter is to be approximately 25s, and make a shape with sufficient thickness which does not distort. It is convenient to prepare various outside diameter dimensions for dimensions of forming parts. It is convenient to process tapping in the center part of the plug and to guide with a bolt, etc. 	
<p>2. Mounting of locator</p> <ul style="list-style-type: none"> When using for the datum end face of the forming plug or it is hard to mount after the jaw is mounted, mount the locator. Prepare the soft jaw and mount it with the jaw No. matched to master jaw No. Additionally process the soft jaw in advance so as not to interfere with the locator even if it is clamped under a no load. 	
<p>3. Process of the plug gripping part for forming</p> <ul style="list-style-type: none"> Operate the switch valve and maximize the opening of the jaw. Then, process the ϕD part (part to grip the plug for forming). Set the dimension ϕD so that gripping near the center of the jaw maximum stroke (diameter) is possible. $\phi D = \phi d + (\text{jaw maximum stroke}/2)$ 	
<p>4. Gripping of the plug for forming</p> <ul style="list-style-type: none"> By operating the switch valve, grip the plug for forming in the ϕD part. At this time, grip by pressing the plug on the chuck front surface in order for the plug not to be tilted. Repeat chucking several times to stabilize the plug. 	
<p>5. Forming</p> <ul style="list-style-type: none"> Process the gripping part (dimension $\phi D'$) of the work in the state that the plug is kept gripped. The $\phi D'$ part is to be approximately the same diameter (H7) as the diameter of the gripping part of the work, and process to be surface roughness at 6s or less. Set the hydraulic pressure during forming the same as during processing of the work, or slightly higher. When the plug distorts, lower the hydraulic pressure or change the plug into a shape which does not easily distort. 	

6. Trial cutting

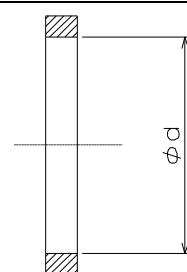
- Remove the plug for forming and grip the work to check the jaw stroke.
- Implement trial cutting to check the process precision and that there is no slip, etc.
- Contacting on the gripping surface is to be 2 points contact of the side A and the side B when gripping.



4-4. Forming soft jaw with inside diameter gripping

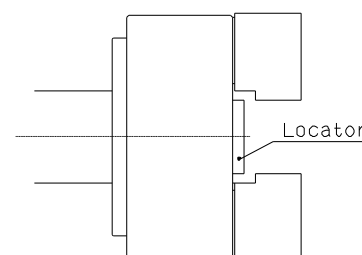
1. Preparation of the ring for forming

- Prepare the ring for forming. The surface roughness of the ring inside diameter is to be approximately 25s, and make a shape with a sufficient thickness which does not distort.
- It is convenient to prepare various inside diameter dimensions for dimensions of forming parts.



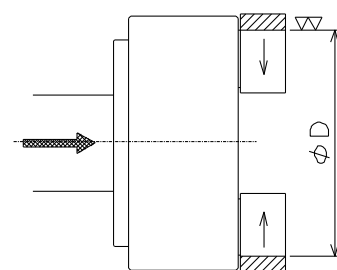
2. Mounting of locator

- When using for the datum end face of the forming plug or it is hard to mount after the jaw is mounted, mount the locator.
- Prepare the soft jaw and mount it with the jaw No. matched to master jaw No.
- Additionally process the soft jaw in advance so as not to interfere with the locator even if it is clamped under a no load.



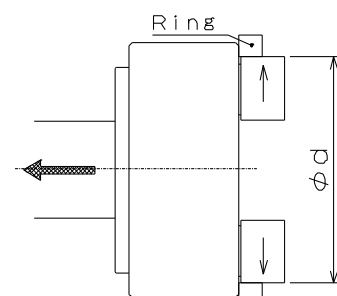
3. Process of the ring gripping part for forming

- Operate the switch valve and minimize the jaw to close.
- Then, process the ϕD part (part to grip the ring for forming). Set the dimension ϕD so that gripping near the center of the jaw maximum stroke (diameter) is possible.
- $\phi D = \phi d - (\text{jaw maximum stroke}/2)$



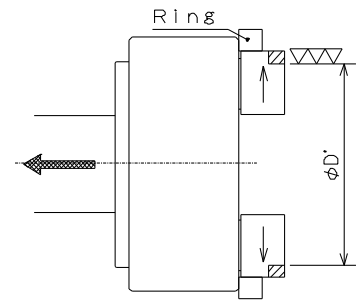
4. Gripping of the ring for forming

- By operating the switch valve, grip the ring for forming in the ϕD part. At this time, grip by pressing the ring on the jaw in order for the ring not to be tilted. Repeat chucking several times to stabilize the ring.



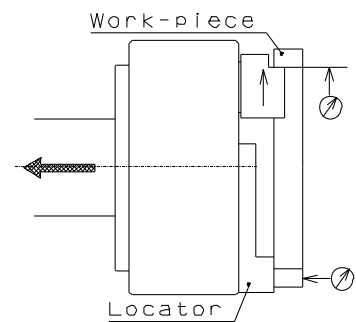
5. Forming

- Process the gripping part (dimension $\phi D'$) of the work in the state that the ring is kept gripped. The $\phi D'$ part is to be approximately the same diameter (H7) as the diameter of the gripping part of the work, and process to be surface roughness at 6s or less.
- Set the hydraulic pressure when forming the same as when processing of the work, or slightly higher. Additionally, in the case of inside diameter gripping, it is necessary to use the input at 1/2 of the allowable maximum input or less.
- When the ring distorts, lower the hydraulic pressure or change the ring into a shape which does not easily distort.



6. Trial cutting

- Remove the ring for forming and grip the work to check the jaw stroke.
- Implement trial cutting to check the process precision and that there is no slip, etc.
- Contacting on the gripping surface is to be 2 points contact of the side A and the side B when gripping.



4-5. Jaw with grooves/jaw with grip pieces

The jaws with grooves or grip pieces cannot be used. The gripping face increases frictional force. As a result, it becomes large and a great load will be applied to the jaws, T-nut and mounting bolts.

If there is no choice but to use the jaw with grooves or grip pieces, contact Kitagawa.

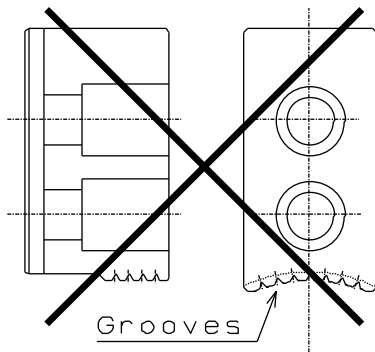


Fig.18

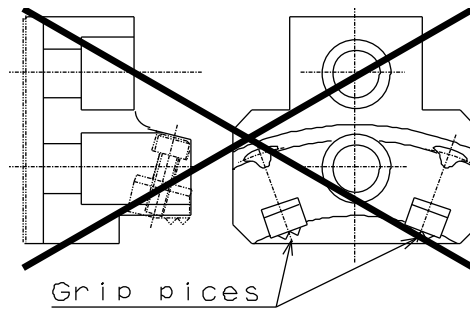


Fig.19

WARNING

- When the jaws with grooves or grip pieces are used, a retracting force becomes large. As a result, the jaws, T-nut and mounting bolt will be damaged and the workpiece or jaws will scatter, thus creating danger.

5. Usage

This product is a device to fix a work-piece when it is processed by the lathe machine or the rotary table.

The rotary cylinder closes the jaw and fixes a work-piece so that it does not move during processing. The chuck opens the jaw after having processed it and remove a work-piece.

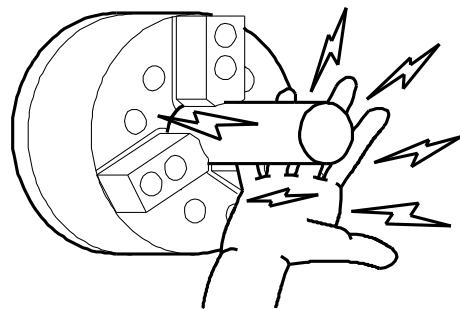
NOTICE

- 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 hydraulic 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.
- Never strike a workpiece, which is kept on the chuck, by a hammer or the like. Avoid striking, since it will impair the chuck accuracy and function and shorten its life.
- Do not perform the inching operation of switching valve. Grease is lubricated for the DL chuck when the plunger stroke is moved. The grease on the slide way is eliminated by inching operation, thus resulting in an incorrect accuracy and an unstable retracting motion. When opening and closing the switching valve continuously, check the operation finish one by one.

5-1. Precautions during gripping work with chuck

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



- If a work in an irregular shape is gripped the master jaw may be broken. Consult our company or the distributor if there is any concern.
- Cast metal, pitched shape or taper shape cannot be gripped.
- 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 Iron Works 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 a top jaw with a different serration pitch from the master jaw. The engagement of the crests of the serration will become insufficient, therefore, the serration crests will break when gripping the work, and this is dangerous as the jaw and work will fly out.
- 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> Unbalance

- In the case of processing largely unbalanced work, lower the rotation speed. The work will fly out and this is dangerous.
- Vibrations are generated if there is unbalance owing to the work or the jig, etc. Vibration not only will impart a negative influence on the process precision but also the endurance of the chuck being remarkably shortened, and the chuck may break. Correct the unbalance using balance weights, etc., or lower the rotation speed for use.
- Heavy cutting at high rotation speed easily generates vibration in the same manner as chuck unbalance, therefore, set cutting conditions appropriate for the dynamic gripping force and machine rigidity.

<2> 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 chuck, jaw, and the work. The chuck will break and this is dangerous as the chuck and work will fly out.
- If the tool and the tool post contact the chuck or the work due to malfunction or tape mistake, etc., and impact is given, immediately stop the rotation, and check that there are no abnormalities in the top jaw, master jaw, T nut and bolts of each part, etc.

<3> Coolant

- Unless coolant with a rust preventive effect is used, rust will occur inside the chuck 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 DL chuck. The DL chuck grips the workpiece in the chuck radial direction and simultaneously, presses the workpiece to the locator. Prepare a locator that has the shape, dimensions, accuracy, material and quenching suitable for production of the workpiece. 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.21.

1. Manufacturing of locator

- To mount the locator to the chuck, use the tap hole on the body surface or the faucet hole on the central part. Concerning these detailed dimensions, refer to pages 5-6 External view.
- Since the run out of the locator datum end face remarkably influences the finishing accuracy of the workpiece, sufficient hardness and accuracy are required for a datum end face. To improve the accuracy on the datum end face, it is recommended that the locator is finished with it mounted to the chuck after quenching. Fig.20 show the examples of a locator.

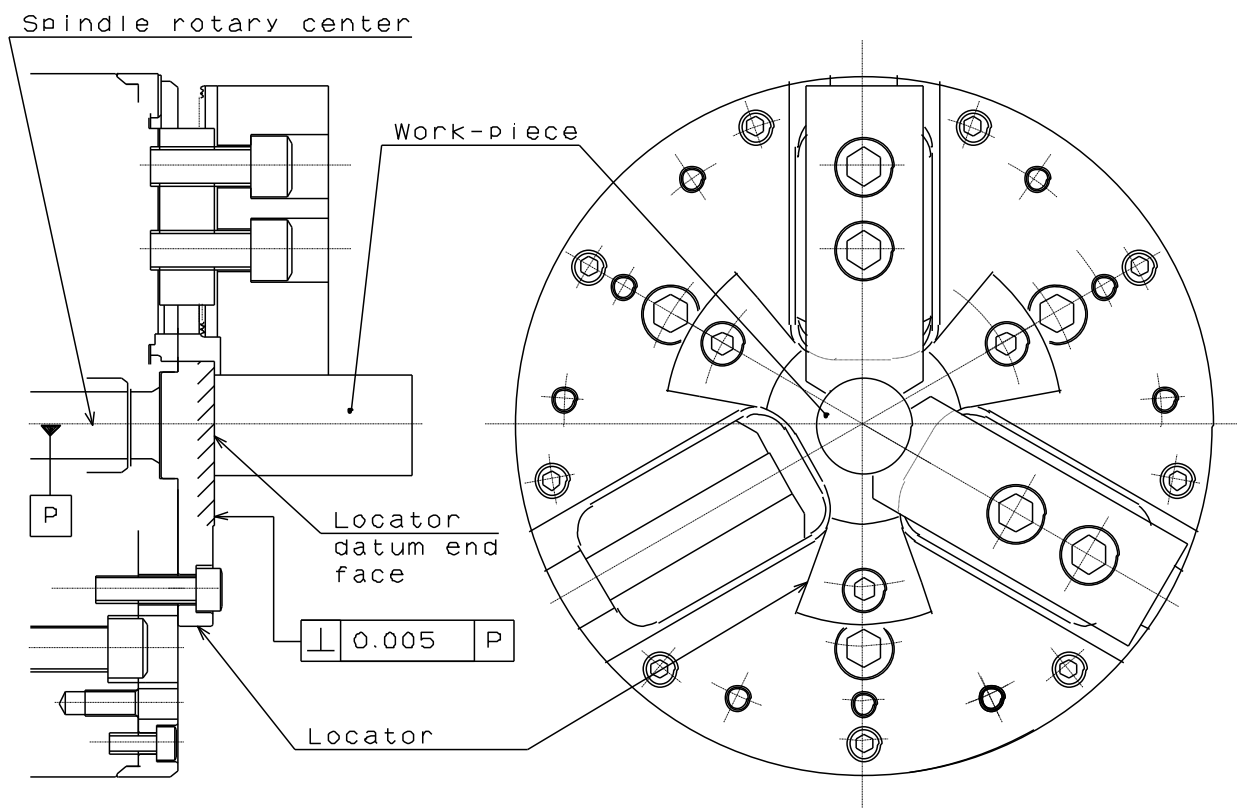


Fig.20-1

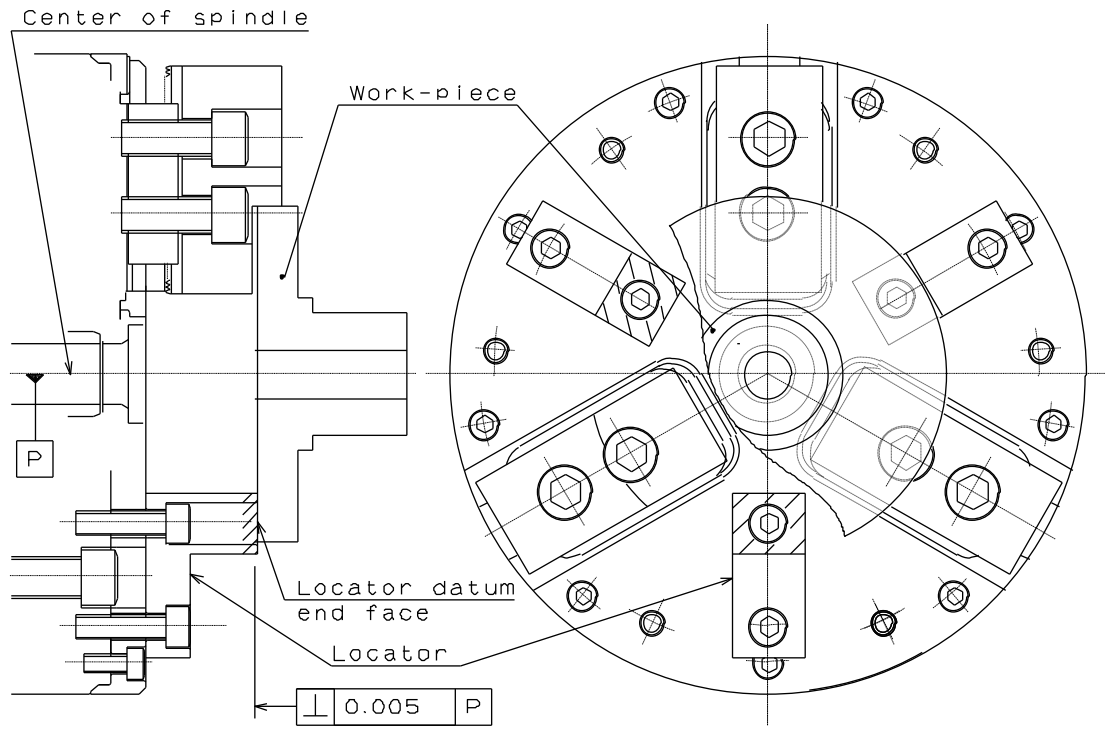


Fig.20-2

2. Seating spec. locator and air feed tube

Fig. 20-3 shows an example of a locator in the seating spec. The air feed tube is mounted to the spindle back to supply air or coolant for seating to the locator.

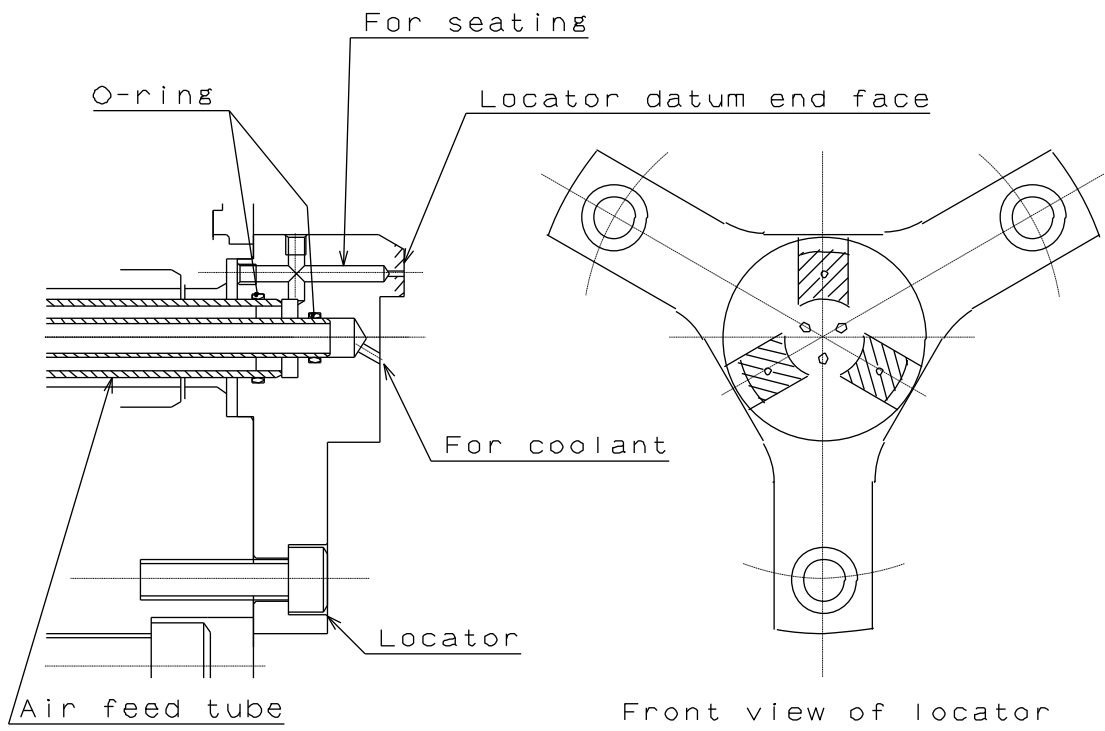


Fig.20-3

3.Additional machining for cover

- When the rotary direction of the locator is positioned by boring pin holes additionally on the chuck surface, the cover can be additionally machined. The cover used is made of refining material (HS30 – 35). Pay attention to tools and cutting conditions in the case of additional machining.

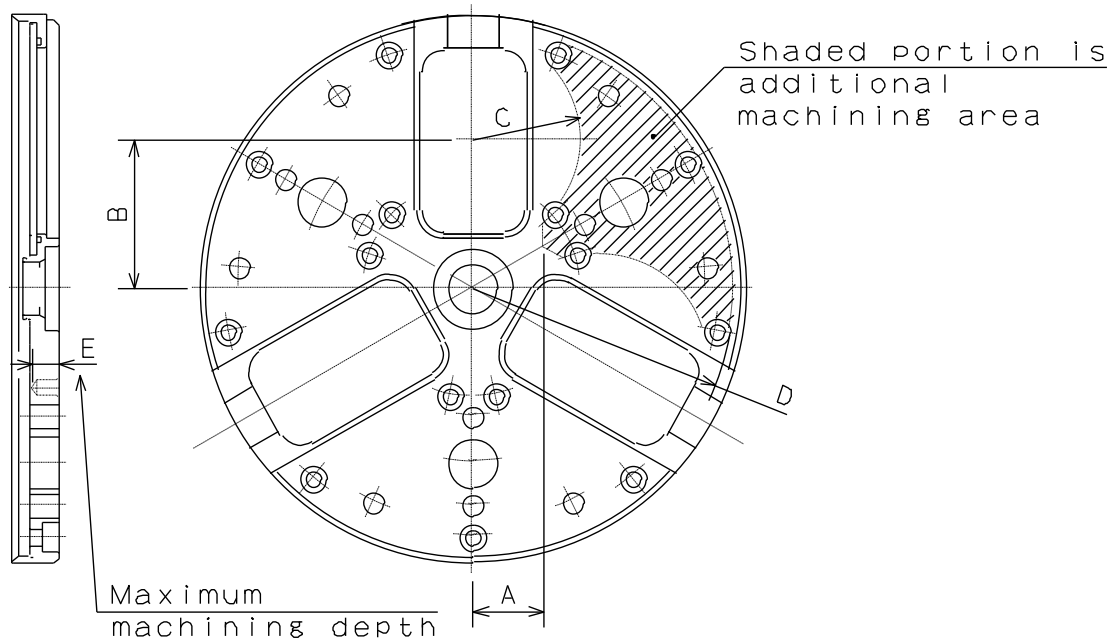


Fig.21

Table 5

Type	A	B	C	D	E
DL206	24	47	R32	R79	9
DL208	27	56.5	R42	R100	10
DL210	33	68	R49	R120	12
DL212	33	93	R49	R145	12



- The chuck can be modified only in the manufacturer permissible range. This will not only break the chuck but the chuck 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.

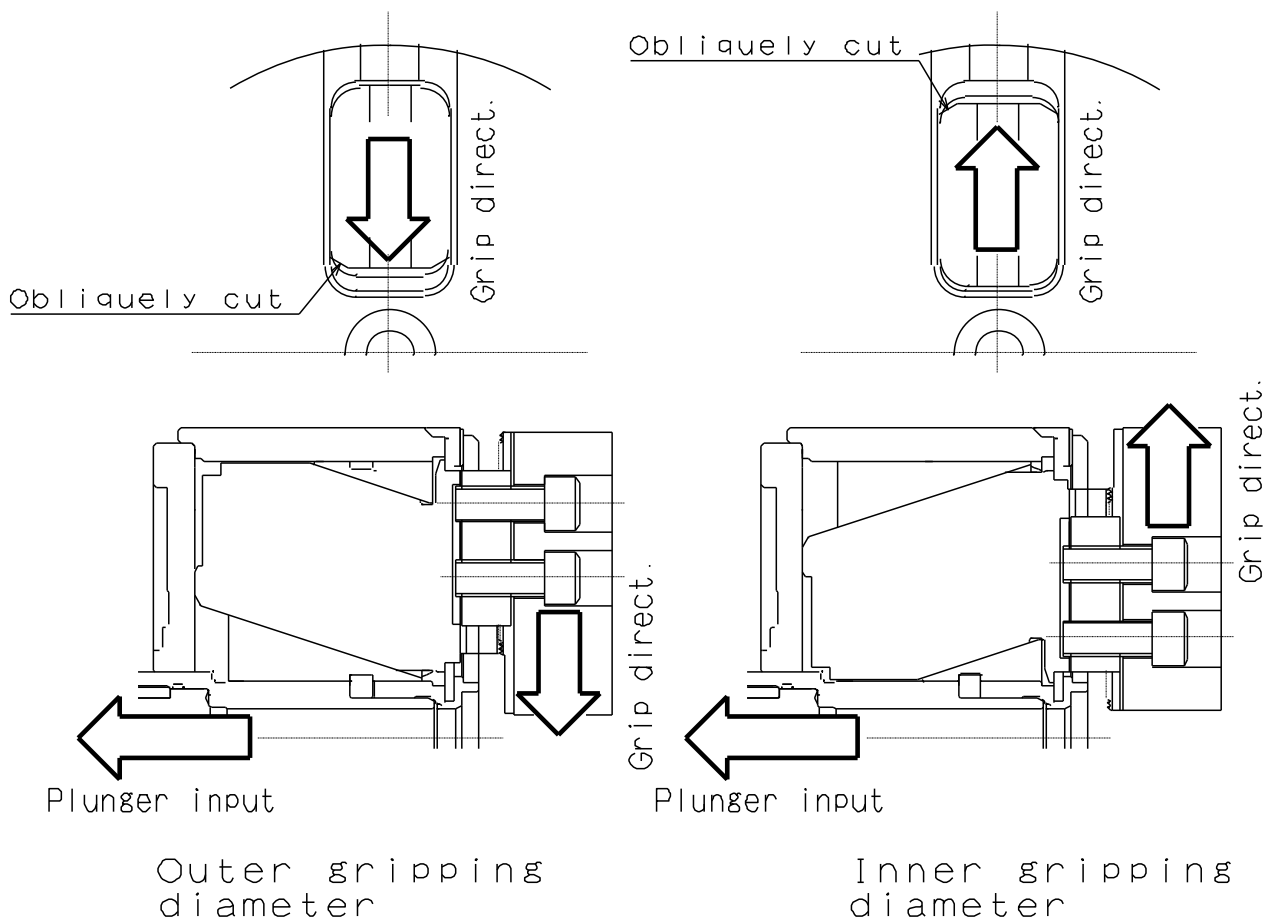
NOTICE

- Pay attention so that a drill tip does not penetrate the cover.
- Additional machining is to be pin holes. Never cut the cover remarkably.
- Take care so that the cover is not deformed by additional machining.

5-6. Change of inner/outer diameter gripping

1. Change steps 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 DL chuck. 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 with the chuck mounted to the spindle (See Fig.22).
- In the single master jaw, the direction to grip the workpiece is constant regardless of outer diameter gripping and inner diameter gripping. The side where the serration starting point of the master jaw is cut obliquely is the gripping direction, and the R-side is the non-gripping direction. When this cut position is in the inside of the chuck, the chuck is in the outer diameter gripping state, and when the cut position is in the outside of the chuck, the chuck is the inner diameter gripping state.



Fig,22

! DANGER

- 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.
- Chips or coolant enters or infiltrates if cleaning is inadequate. At this time, there is a danger because the gripping force is low and the workpiece will scatter. Therefore, it is necessary to disassemble and clean the chuck.

2. Change steps of inner/outer diameter gripping

1. Unclamp the jaws (Plunger: advanced) and turn off the main power of the machine before starting work.
2. Remove the jaws and locator.
3. Clean the chuck surface and periphery so that chips or coolant will not enter into the inside of the chuck.
4. Remove cover mounting bolts to remove the cover.(Fig.23)
5. Draw out the master jaw from the width across flat of the body slightly and hook it on the protruding portion of the bush. Push the master jaw into the width across flat of the body again at the place where the master jaw is rotated 180°. Perform this procedure for all master jaws. (See Fig. 24) If it is hard to draw out the master jaw, attach the other jaw temporarily and hold it since the master jaw is drawn out easily. Since grease is fully filled inside of the chuck, a strong force may be required for drawing out the master jaw.
6. Wipe off chips and grease adhered on the cover, seal and body surface (mating face with cover).
7. Face the marked No. on the cover surface and the master jaw No. before setting the cover. Take care so that the O-ring in the cover rear will not protrude from the groove. When setting the cover with the O-ring protruded, the O-ring will be damaged. If the O-ring is damaged, replace it with a new one.
8. When it seems that the grease inside of the body has been decreased, replenish the grease.

NOTICE

- If chips or grease enter into the gap between the cover and the body surface, the cover surface may be distorted. As a result, machining accuracy may become worse.
- When drawing out the master jaw accidentally, insert it immediately. At this time, match the master jaw No., body No. and bush No. If both Nos. are different, gripping accuracy may be reduced. (Fig.24)

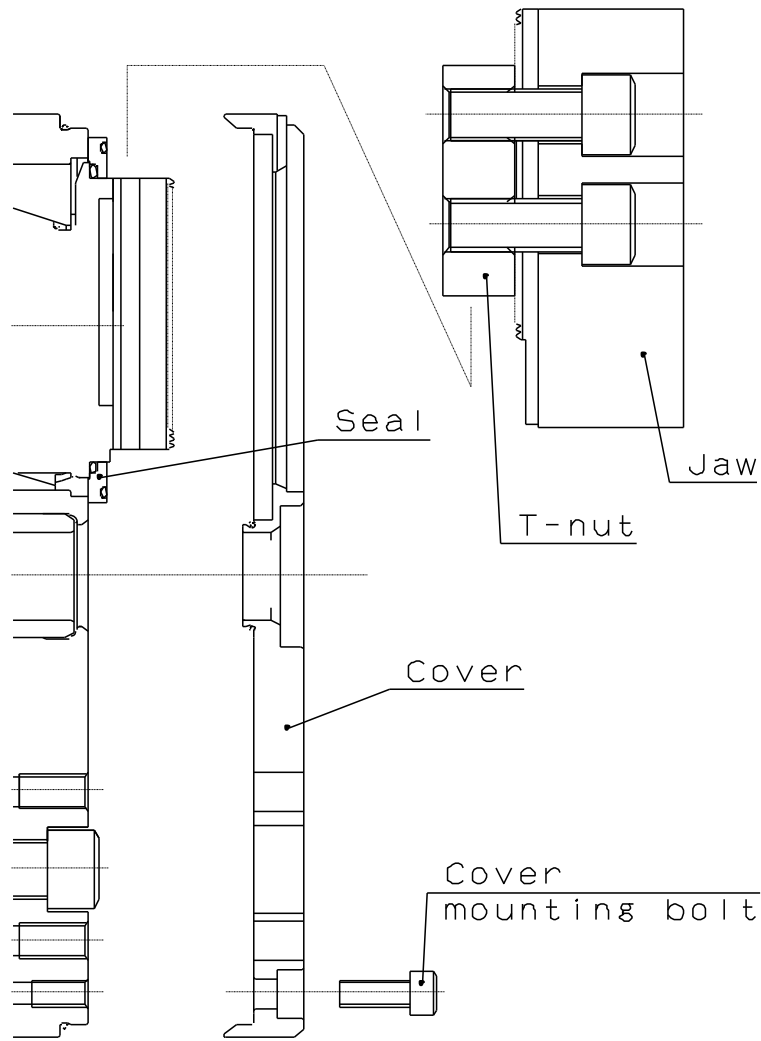


Fig.23

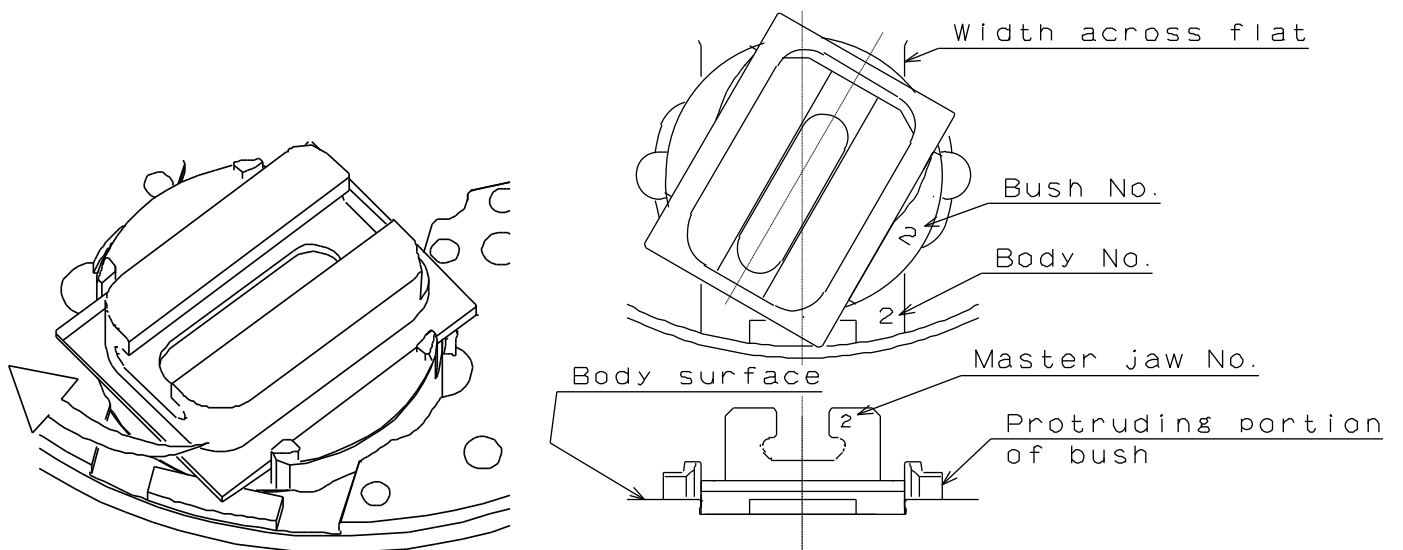


Fig.24

5-7. Dust-proof measures

Although the DL chuck has a dust-proof function, neither a cutting chip nor coolant can be shut out 100%.

When the chuck is used where significant chips or coolant exists, or where it is hard to discharge the chips at the vertical lathe or stationery cylinder, take measures for forming the locator that mounts the scraper or consider a chip discharge. (Fig.25)

If chips or coolant enters or infiltrates inside of the chuck, it is necessary to disassemble and clean the chuck, to replace the O-ring and to supply grease.

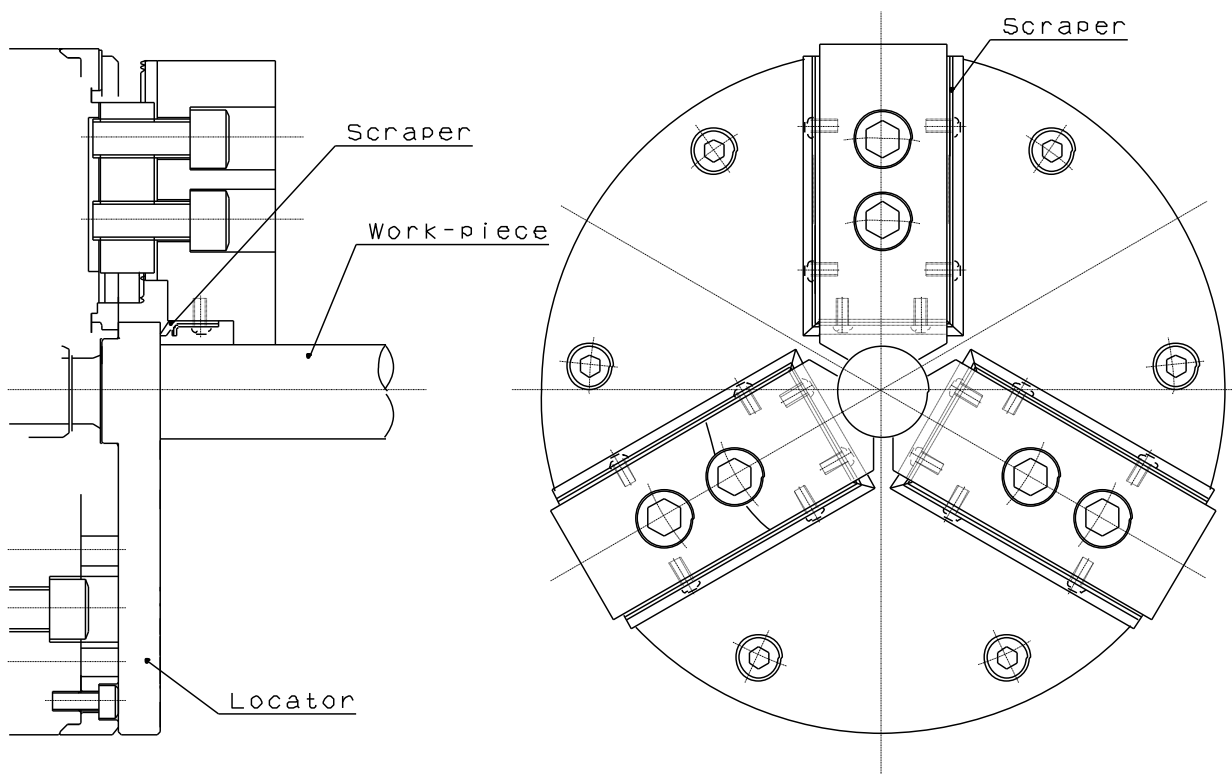


Fig.25

WARNING

- If chips enter inside of the chuck without taking dust-proof measures, the gripping force is low and the workpiece will scatter, thus creating danger.

5-8. Adjustment of retracting amount

- The DL chuck presses the workpiece to the locator end by a retracting force. Although the retracting motion itself is a minimal amount, the retracting may become unstable by conditions such as the state of the workpiece's gripping part and locator state, jaw rigidity, jaw's gripping face state, gripping diameter and locator position. Also, the workpiece is distorted by retracting remarkably. Such a problem may be solved by adjusting the retracting amount after changing the flat spring direction or replacing the flat spring that make up the internal parts.
- There are flat springs as follows:
 1. Type having seats where the length is different for both front and back sides.
 2. Type having seat on only back side
 3. Type not having a seat on both front and back sides.
- In the standard shipping state, flat spring of 1 is inserted with a long seat faced to the spindle side. When KITAGAWA manufactures and ships the jaws or locators for a specific workpiece production, various types such as the direction being opposite to 1, or 2 or 3 type is included are provided for optimal setting. (Three flat springs are not limited as the same.)
- In case of type 1, the retracting amount can be changed to large or small by turning inside the flat spring out. When mounting the flat spring of a short width seat to the spindle side, the retracting amount becomes large. When mounting a long width seat, it becomes small. (Retracting amount is small in a standard shipping state) When the workpiece floats at a small retracting amount, change the retracting amount to a large position.
- When adjusting and replacing the flat spring, remove the chuck from the lathe to remove the rear body. Although the flat spring is fitted in the square socket of the rear body, knead minus screw drivers from the holes of both sides lightly when it is difficult to remove.

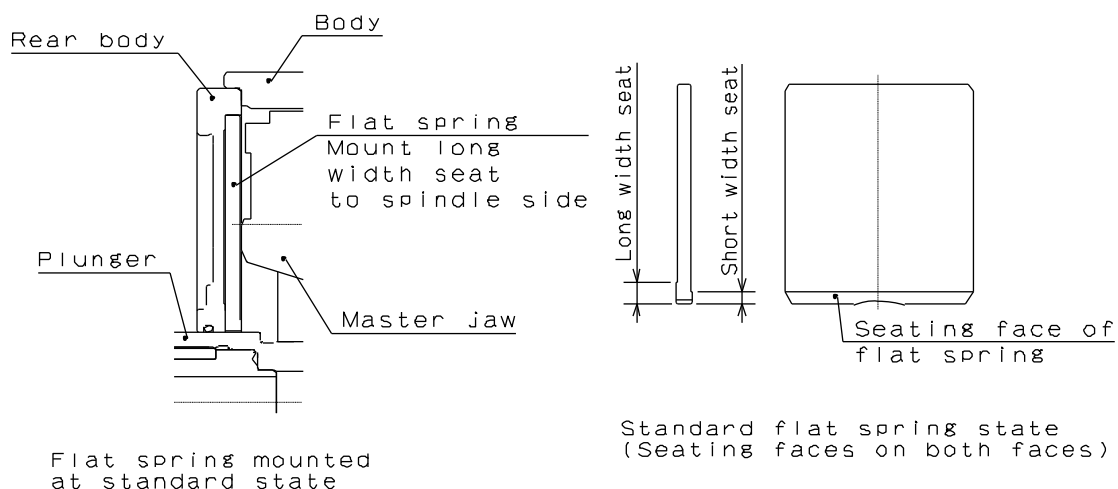


Fig.26

NOTICE

- Take care so that the rear body is not damaged.
- When excessively retracted or a problem is not solved even if it is adjusted, contact KITAGAWA.

6. Maintenance and Inspection

6-1. Periodic Inspection

- Fully stroke the jaw before starting work or upon supplying grease, and check that the jaw is inside the appropriate stroke area. (Refer to page 37)
- Always clean the chuck body or the sliding surface using an air gun, etc., at the end of work.
- 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.

2. Lubricating procedures

1. Remove the set screw on the body periphery part.
2. Rotate the chuck so that the hole with the set screw may become it downward.
3. Move the jaws several times without work-piece 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.
4. Lubricate using a grease gun from the grease nipple on the body periphery part until grease is exhausted from the hole.
5. Keep in item 2 above, clamp and unclamp a couple of times without work-piece to discharge extra grease.
6. Install the set screw certainly.
7. Clamp and unclamp a couple of times without work-piece again, and check that the reference mark on the side of the No.1 master jaw fully stroke.

3. Grease to use

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

Table 6

Genuine product	CHUCK GREASE PRO	Kitagawa genuine product (Kitagawa distributor of each country)
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4. Frequency of lubrication

- Add grease once every two months.
- 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.**

5. 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

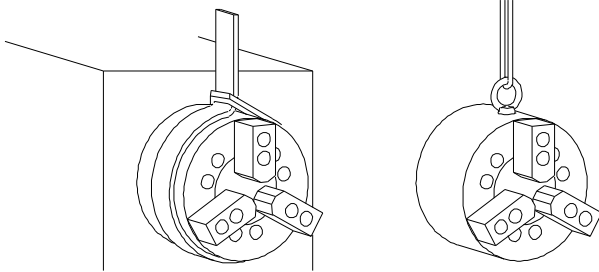
Disassembling procedures

Read the following disassembling procedures with reference to pages 9-10.

1. Turn off the main power of the machine before starting work.
2. Loosen the jaw attaching bolt [21] and remove the soft jaw [12] and the T nut [11].
3. Turn the draw screw [7] with the handle [35] while loosening the chuck attaching bolt [19], and remove the chuck from the spindle.
4. Loosen the cover attaching bolt [19] and remove the cover [6].
5. Remove the seal [13] and the master jaw [5].
6. Loosen the rear body attaching bolt [18] and remove the rear body [2].
7. Remove the flat spring [9]. At this time, write down the direction of the flat spring. Knead the flat spring with slotted head screw drivers etc., lightly from both sides when it is difficult to remove it. (Take care that the rear body is not damaged.)
8. Pull out the bush [4] together with the plunger [3] from the body. Usually it is unnecessary to remove the plate [10], the pin, [15] and the spring [16] from the plunger.
9. Although it is usually unnecessary to disassemble the draw screw [7], if it must be removed, remove the hexagon socket set screw [23] before removing the nut [8].
10. Clean the chuck carefully with cleaning oil after disassembling, and dry it. Remove chips, seizure and galling of the slide way and coat the chuck with the specified grease.
11. Assemble again while sufficiently coating the recommended grease in the reverse procedures of disassembling. At this time, pay sufficient attention so as not to make a mistake in the numbers of the body [1], master jaw [5], plunger [3] and bush [4].
12. Refer to page 70 about the installation procedure. (8-3. Attachment of chuck).

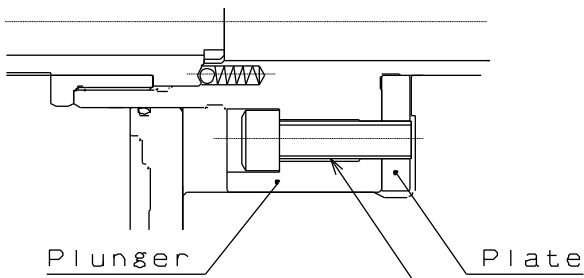
CAUTION

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



Chuck size (inch)	Eyebolt
6 , 8 , 10	M10
12	M12

- When removing the plate [10] from the plunger [3], tighten the mounting bolts of the plunger and plate at the tightening torque specified in the table of Fig.27 when being reassembled. If the tightening torque is too large or too small, the gripping force is insufficient or the bolts are damaged. As a result, the workpiece will scatter thus resulting in danger.



Type	Size	Torque
DL206	M8	33 N•m
DL208	M10	
DL210-212	M12	107 N•m

hex. socket head cap screw
Tighten at specified torque

Fig.27



WARNING

- Remove the eyebolt or the belt without fail after using. If the chuck is rotated with the eyebolt, etc., attached, they may fly out and this is dangerous.
- Disassemble and clean the chuck 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 chuck, 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.
- After inspection, apply sufficient grease in the designated areas and reassemble.
- After assembling, measure the gripping force according to the method on page 21, 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 hydraulic pressure or the cylinder can stop or malfunction.
- If you stop the machine or store the chuck for a long period of time, add grease to prevent rust.

NOTICE

- Return to the same condition before disassembling, taking care of the No. of each part and the direction of the flat spring [9].
- Mount the seal [13] to the master jaw [5] in the correct direction. Although the seal cannot be mounted in the opposite direction, when mounted forcibly, the seal is damaged.
- Tighten the mounting bolts with a specified tightening torque.
- Replace the O-ring with a new one if deteriorated.

2. Replacement of O-ring

- If the DL chuck is used, the O-ring is worn. Moreover, if chips are caught in the slide way, the O-ring may be damaged. An O-ring like this must be replaced.
- In particular, the O-ring [33] of the socket part located on the upper surface of the seal [13] is worn intensely because it is exposed to the harsh environment of chips and coolant.
- The worn degree of the O-ring on each part can be visually checked when the plunger stroke is repeated under a no load. At this time, a large amount of grease leaks and an air breath sound is heard.



- **When the O-ring is left in a worn condition, the chips or coolant enters or infiltrates inside of the chuck. At this time, there is a danger because the gripping force lowers and the workpiece will scatter.**

3. Bush mounting jig

It is required that the bush [4] should be linked with the plunger [3] by pressing the pusher [14]. The pressing force is rather large against the spring [16] force. The bush mounting jig of Fig.28 is needed.

4. About use of the bush mounting jig

1. Attach the pusher [14] to the plunger [3], and attach the jig as shown in Fig.29.
2. Tighten the nut on the plate side. It enters the state that the jig 2 pushed the pusher.
3. Attach the bush [4] to the plunger
4. Loosen a nut, and detach the jig from the plunger.

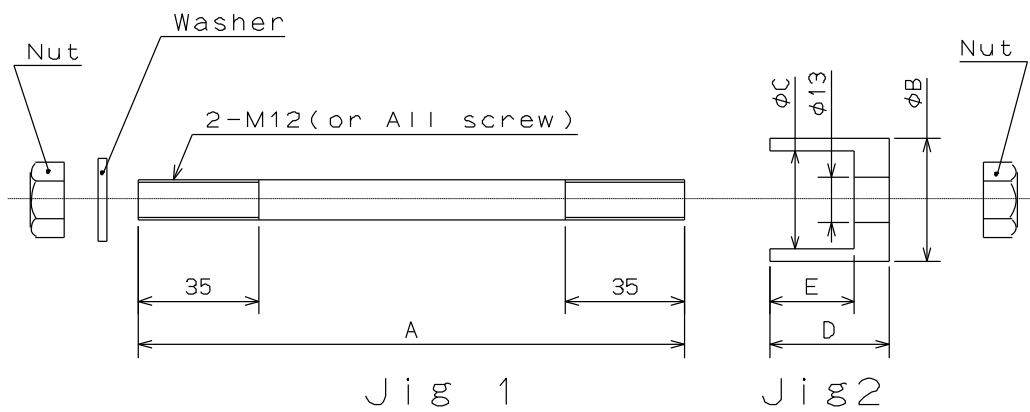


Fig.28

Table 6

Type	A (mm)	ϕ B (mm)	ϕ C (mm)	D (mm)	E (mm)
DL206	190	36	29	36	26
DL208	190	36	29	36	26
DL210	220	36	29	36	26
DL212	220	80	66	36	26

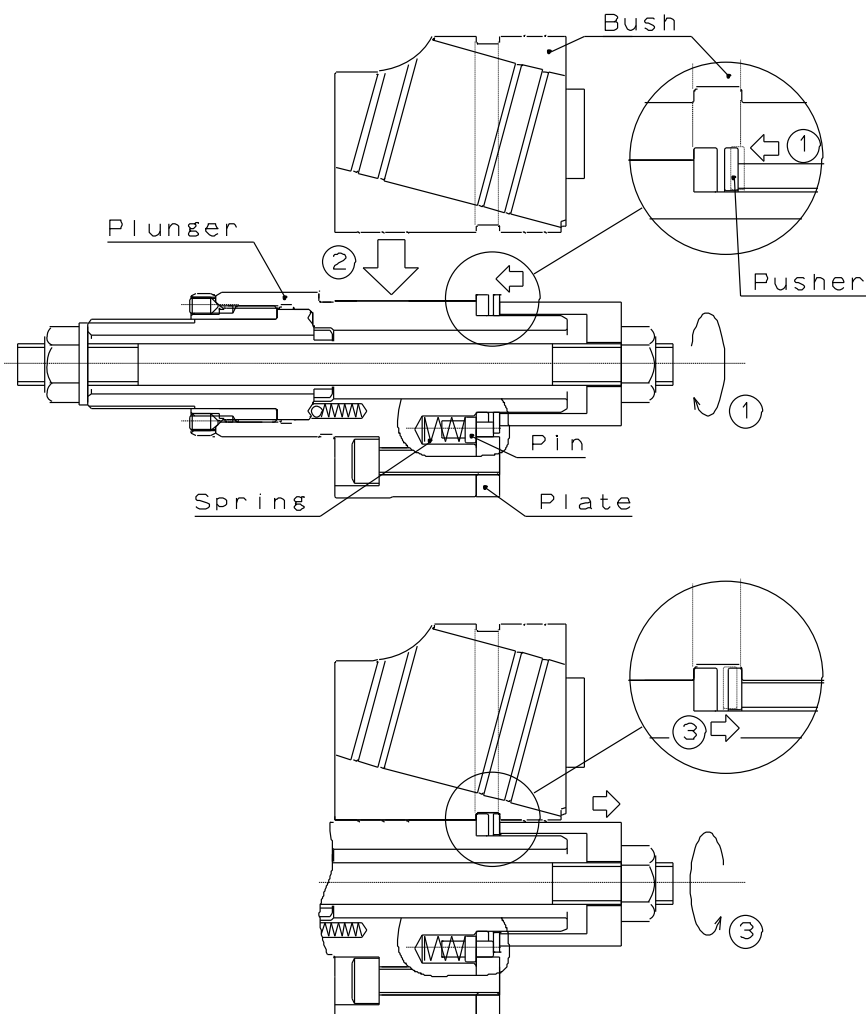


Fig.29

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

Defective	Cause	Countermeasure
The chuck does not operate.	The chuck 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.
Insufficient stroke of the jaw.	A large amount of cutting powder is inside.	Disassemble and clean.
	The draw bar loosened.	Remove the Draw bar and retighten it again.
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 chuck.
	Insufficient grease lubrication	Supply grease from the grease nipple, and open and close the jaw several times without gripping a work.
	The rotation speed is too high. Swinging occurs due to incorrect alignment of cores of work feeder, steady rest, tail stock, etc.	Lower the rotation speed to a speed at which the required gripping force can be obtained. Align the cores sufficiently to eliminate such swinging.
Precision failure.	The outer periphery of the chuck is running out.	Check the end surface run-out and the outer periphery, and retighten the chuck attaching bolts.
	Dust is attached on the serration part of the master jaw and the top jaw.	Remove the top jaw, and clean the serration part thoroughly.
	Chips are caught in the gap between the cover and body.	Remove the top jaw, and clean the body surface.
	The attaching bolt of the top jaw is not tightened sufficiently.	Tighten the top jaw attaching bolt at the specified torque. (Refer to page 15)
	The forming method of the soft jaw is inappropriate.	Is the plug for forming parallel to the chuck end surface? Is the plug for forming not deformed due to the gripping force?

Defective	Cause	Countermeasure
Precision failure.	Workpiece is deformed by excessive gripping force.	Reduce gripping force in a range where processing is possible.
	Because gripping center height is too high, jaw is deformed or mounting bolt is extended.	Lower the jaw height.
	Jaws and locator formed by chuck except for chuck being used are used.	Form the jaws and locator using the chuck being used.
Workpiece floats.	Retracting force of chuck is weak.	Adjust inside parts so as to be retracted easily.
Chuck does not unclamp workpiece.	Workpiece is gripped near stroke end. or There are few strokes to a unclamp position.	Clamp the workpiece at stroke center. Or the amount of jaw strokes from a grasp position to a unclamp position takes more than regulation. Refer to notice of 4-2 Forming jaw.
	Oil pressure is too low.	Raise the oil pressure more than Min. oil pressure.
	Gripping center height is too high.	Lower the jaw height.
	The amount of grease is not enough or it changes in quality.	Replenish grease.
Large amount of grease ejects out of master jaw periphery.	O-ring located on cover back face is deteriorated or damaged.	Replace the O-ring and replenish grease if required.



- If the chuck failed due to a seizure or breakage, remove the chuck from the machine, following the disassembly steps in page 58. When the jaws and covers 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. Outline drawing of attachment

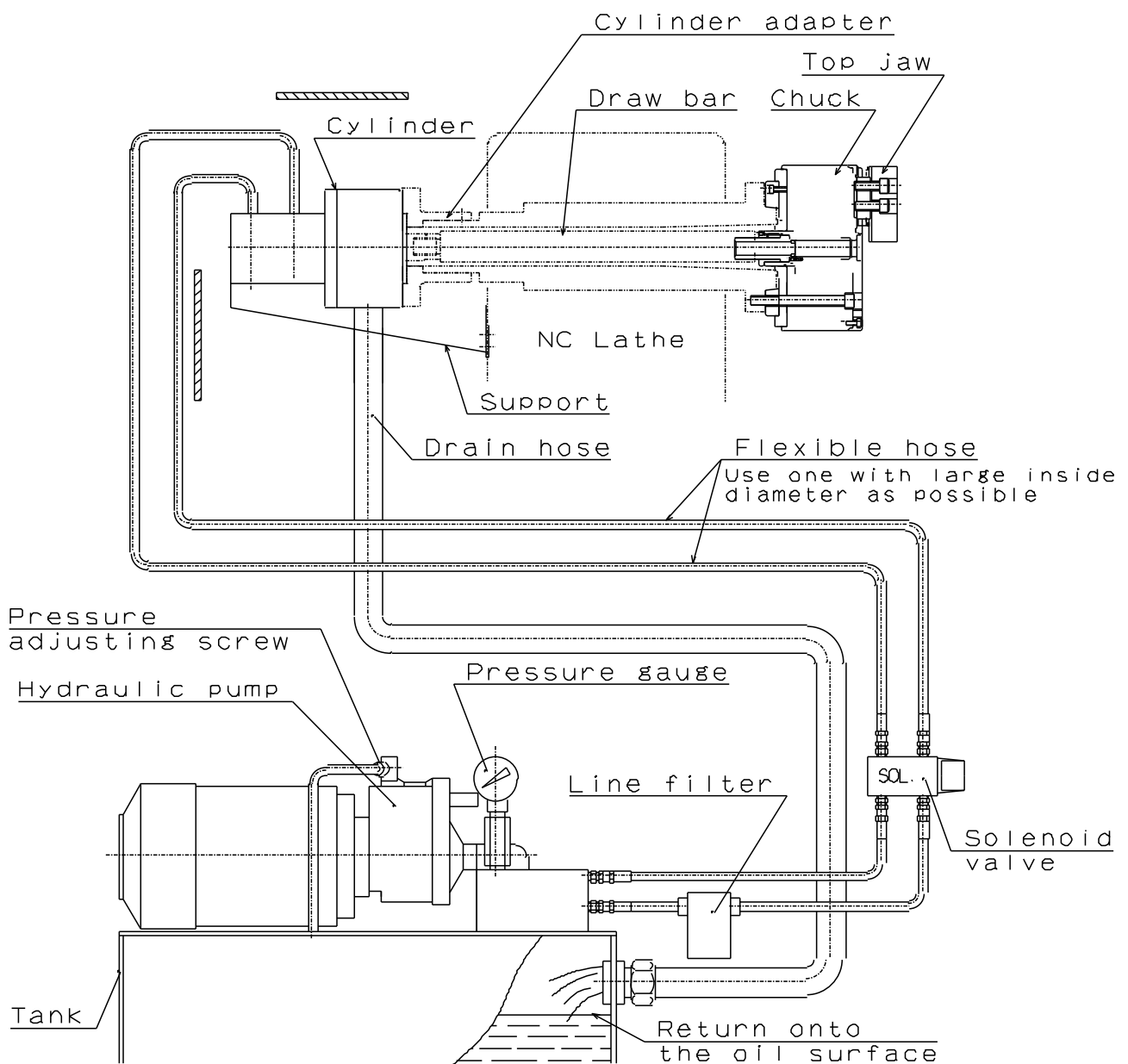


Fig.30

- 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 drain hose is not kinked and the needle of the pressure gauge is easily read.

DANGER

- **When other actuators are operated by the same hydraulic pressure source as the cylinder for chuck, be sure that a pressure drop of the cylinder 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.**
- **As to the drain hose**
 - **Provide a stream slope, without air pocket. This will ensure no back pressure.**
 - **The end of the hose is physically above the oil level. (Refer to Fig.30)**
- **If the hydraulic oil stagnates inside the cylinder, oil leakage occurs, which may cause a fire.**

WARNING

- **Install after removing the dust inside the pipe completely.**
- **Add a filter to the pressure supply line. If foreign matters gets inside the cylinder, this is dangerous since the rotation valve of the cylinder will seize, the hose will tear off, and the cylinder will rotate. This is also dangerous as the work will fly out.**
- **Always use a flexible hose for the hydraulic piping to the cylinder, and the bending force or tensile force of the pipe must not be applied to the cylinder. 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.

8-2. Manufacturing and mounting of draw bar

1. Production of draw bar

Determine the length of the draw bar as shown below.

This part should be worked so that spanner or the like can be set here. (Width across flat)

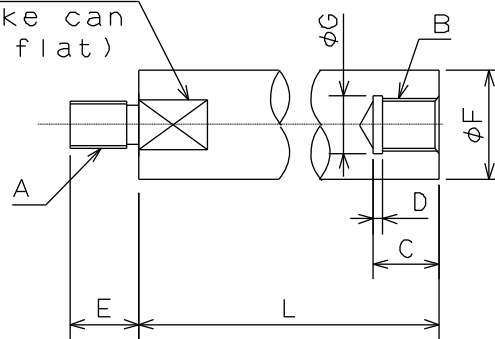


Fig.31

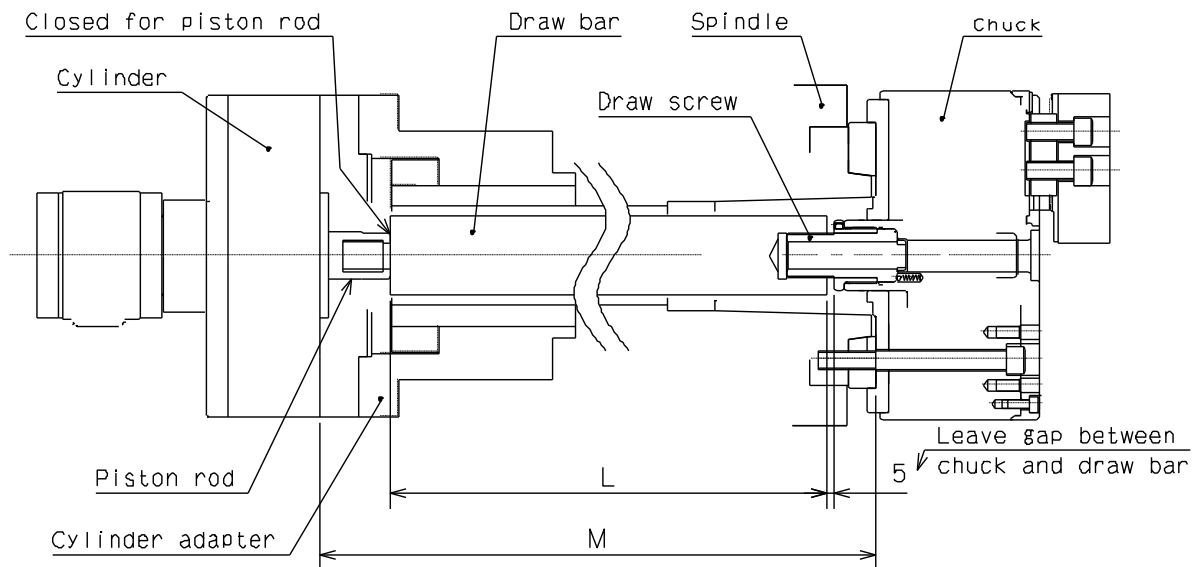


Fig.32

Table 8

Type	Cylinder	A	B	C	D	E	F	G	L
DL206	Y1020R	M20	M26 × 1.5	35	5	30	40	27	M-72.5
DL208	Y1225R	M24	M28 × 1.5	33	5	35	50	29	M-82
DL210-212	Y1530R	M30	M30 × 1.5	40	5	40	50	31	M-86

The dimension L in Table 8 is determined from the distance A between the cylinder adapter and the back plate.

(Example) In the combination of DL208, Y1225R, and when M=600mm, the Draw bar length L is to be $L = M - 82 = 600 - 82 = 518\text{mm}$.

At the time of the screw process of the dimension a, the precision is to be JIS 6H and 6h, 6g matching the screw of the piston of the cylinder. Pay attention so that the thread parts on

both ends and the inner periphery do not swing or become unbalanced.



- **Provide sufficient strength for the Draw bar.** If the Draw bar is broken due to insufficiency of the strength, the gripping force will be lost instantly, which is dangerous as the work will fly out.
 - Keep the dimension e and the dimension B in Fig. 31 for the Draw bar and a material with the tensile strength 380MPa (38kgf/mm²) or more must be used.
 - The personnel who designed Draw bar must judge whether the strength of the Draw bar is sufficient for the usage conditions.
 - The dimensions and materials specified in this manual do not guarantee that the Draw bar will not break under every usage condition.
- **If the screw-in depth of the Draw bar to the draw nut is insufficient,** the screw will break and the gripping force will be lost instantly, which is dangerous as the work will fly out.
- **If the engagement of the screw of the Draw bar is loose,** vibration may occur resulting in breakage of the screw. If the screw breaks, the gripping force will be lost instantly, which is dangerous as the work will fly out.
- **If the Draw bar is unbalanced, vibration occurs,** the screw is broken and the gripping force will be lost instantly, which is dangerous as the work will fly out.

2. Usage of air feed tube

When the air feed tube is passed into the spindle center on the seating detection specification, it is necessary to use a hollow type cylinder and a draw pipe. (Fig.33)

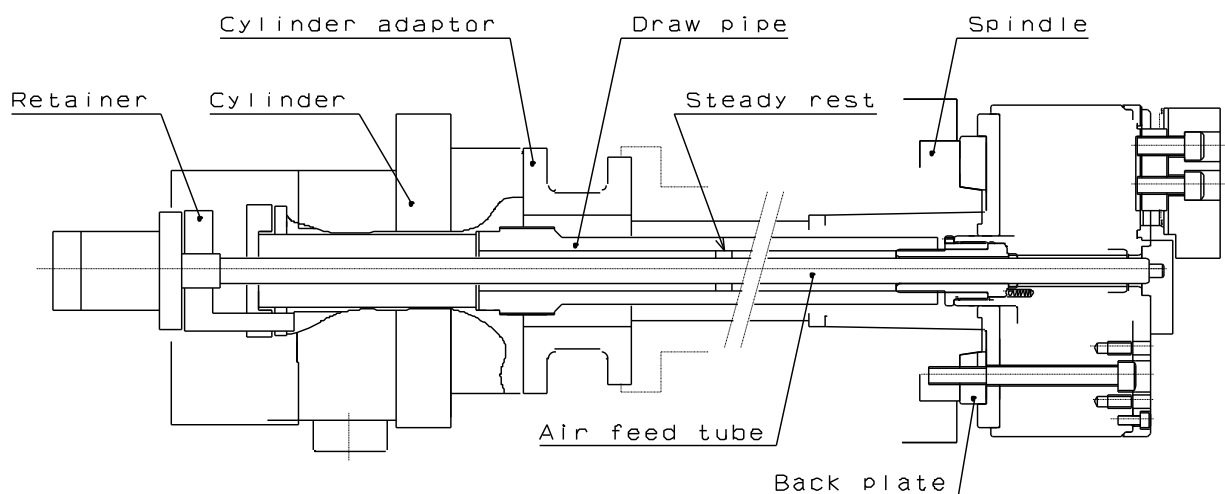


Fig.33

3. Production of back plate

NOTICE

- Process the engagement diameter of the back plate after measuring the actual spindle.
- Run-out of the back plate directly affects the process precision. The end surface run-out of the back plate, spigot joint diameter run-out must be 0.005 mm or less.
- The precision of the processing of the chuck attachment end surface of the back plate and the spigot joint diameter can be raised by processing them after mounting to the installed machine.

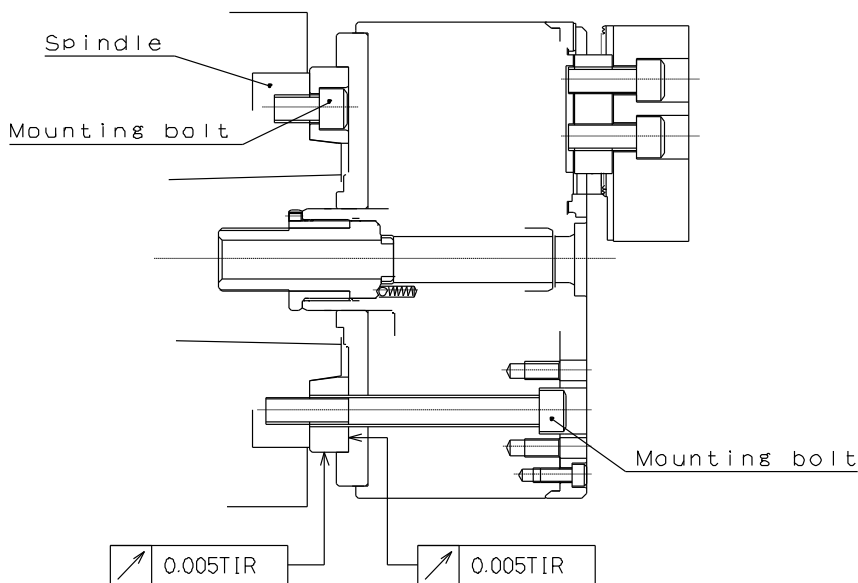


Fig.34

! DANGER

- Always tighten the bolts at the specified torque. If the torque is insufficient or excessive, the bolt will break, which is dangerous as the chuck or work will fly out.
- Use the bolts attached to the chuck, 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.

Table 9

Bolt size	Tightening torque	
M5	7.5	N·m
M6	13	N·m
M8	33	N·m
M10	73	N·m
M12	107	N·m
M14	171	N·m
M16	250	N·m
M20	402	N·m

8-3. Attachment of chuck

1. Attaching the draw bar to the cylinder

- Apply adhesive onto the screw part of the draw bar, and screw it into the piston rod of cylinder. At this time, refer to the instruction manual for the cylinder for tightening torque.

NOTICE

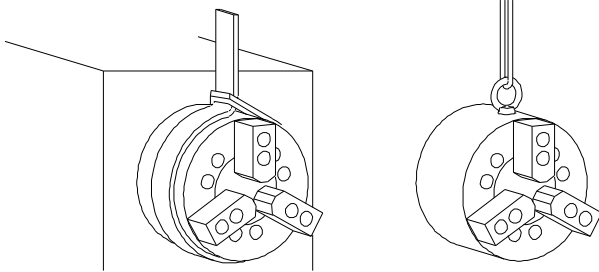
- When attaching the Draw bar to the cylinder, the stopper pin of the piston may break if tightened at the stroke middle position of the piston. In the case of a Y type cylinder, screw it in so that the piston rod is fully in. Follow the explanation of the instruction manual for the cylinder for other items about the cylinder.

2. Attach the cylinder to the spindle (or the cylinder adapter)

- Check the run-out of the cylinder, and if it is normal, attach the hydraulic pipe.
- Move 2 to 3 times at low pressure (0.4 MPa-0.5 MPa, 4 - 5 kgf/cm²) and set the piston at the forward end and turn off the power supply.

CAUTION

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



Chuck size (inch)	Eyebolt
6 , 8 , 10	M10
12	M12

WARNING

- Remove the eyebolt or the belt without fail after using. If the chuck is rotated with the eyebolt, etc., attached, they may fly out and this is dangerous.

3. Connect the chuck to the Draw bar

- Connect the chuck with the plunger retracted (plunger protruded at the minimum from the chuck back) to the chuck side. (Shipping state)
- When the chuck center hole is closed by the jaw or locator, remove it. Hoist the chuck with the crane to align the center of the chuck axle to the lathe spindle center.
- Insert the joint handle into the chuck center hole and connect the chuck to the draw bar, rotating the draw screw. Thread the draw screw until the chuck mounting face matches the spindle mounting face (backplate face) of the lathe.
- When connecting the draw screw and the draw bar, do not forcibly screw them in if they cannot be screwed smoothly, but check the inclination of the core of the screw, etc.

DANGER

- If the screw-in depth of the Draw bar to the draw nut is insufficient, the screw will break and the gripping force will be lost instantly, which will the work to fly out.
- If the engagement of the screw of the Draw bar is loose, vibration may occur resulting in breakage of the screw, loss of gripping force and the work flying out.

4. Attach the chuck matching to the attaching surface of the spindle (or the back plate).

- Turn the handle for connection to make a state that the chuck closely contacts the spindle attaching surface of the lathe.
- In the case of adjusting the centering of the chuck, lightly hit the body side face with a plastic hammer.
- Tighten the chuck attaching bolts evenly. At this time, tighten the bolts at the specified torque.



- **Always tighten the bolts at the specified torque. If the torque is insufficient or excessive, the bolt will break, which is dangerous as the chuck or work will fly out.**
- **Use the bolts attached to the chuck, 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.**

Table 10

Bolt size	Tightening torque	
M5	7.5	N·m
M6	13	N·m
M8	33	N·m
M10	73	N·m
M12	107	N·m
M14	171	N·m
M16	250	N·m
M20	402	N·m

NOTICE

- When the draw nut cannot be screwed correctly to the spindle face, or can be screwed correctly to the face in only a few turns but cannot be screwed further, the draw bar length may be inappropriate and needs checking.
- If the draw screw is not smoothly connected to the draw bar, check the slant of the thread center. If connected by force, the plunger will seize, thus resulting in poor gripping accuracy.

5. Adjust the position of the wedge plunger

- Full stroke the jaw and check that the reference mark of the master jaw is completely within the entire stroke area (Refer to Fig.35).
- To prevent the plunger from contact with the body with the jaw opened, rotate the joint handle counterclockwise. Also, rotate the joint handle 0 – 60° clockwise so that the draw screw will be fitted to the notch for rotation stop.

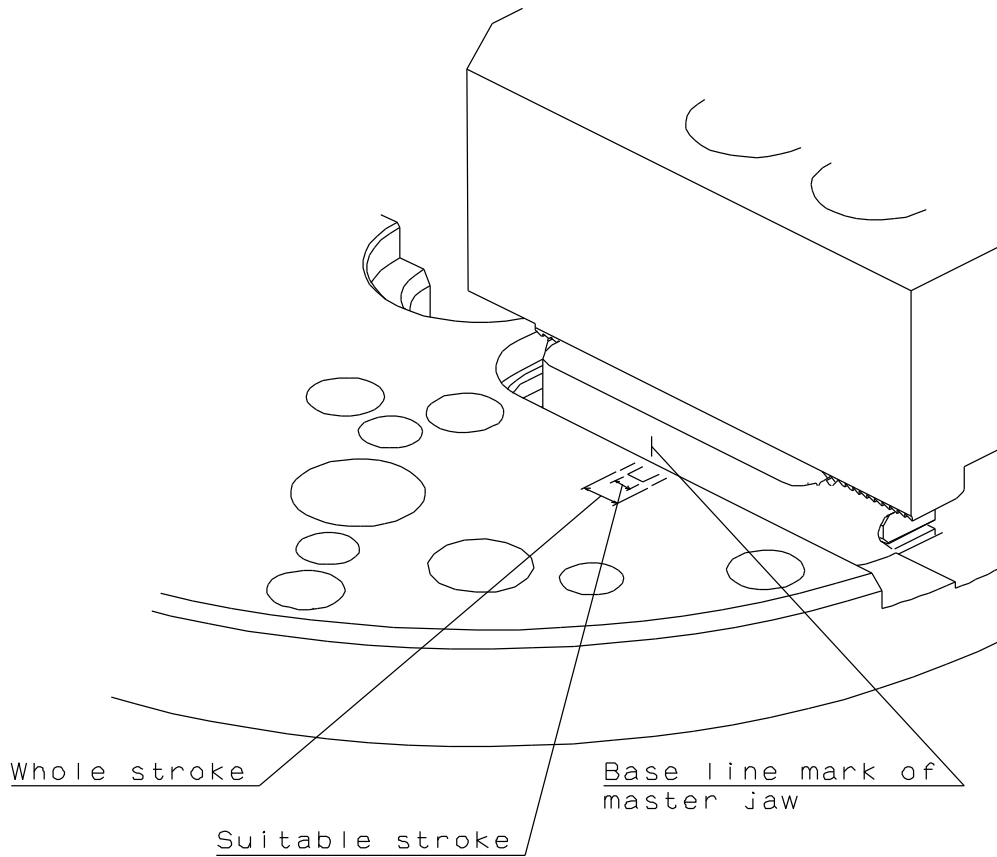


Fig.35

9. Other information

9-1. 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

9-2. Information about markings of product

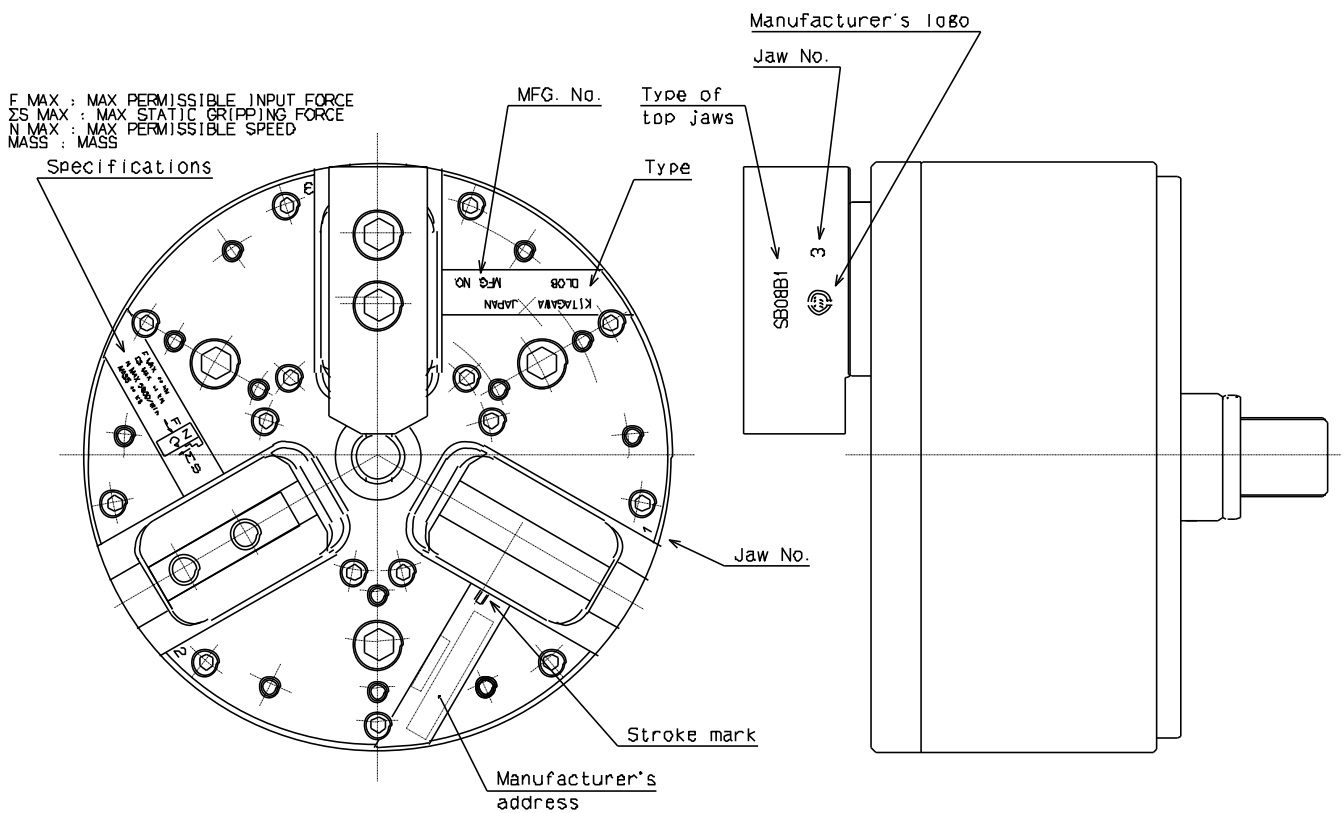


Fig.36

9-3. About disposal

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

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