Welcome!

Chucks 101
Agenda

- Types of Chucks
- Spindle Data Sheet
- Grip Force
- Maintenance
Types of Chucks

- Thru-hole style
- Closed center
- Wedge
- Lever
Through Hole

- Bar feed
- Chucker work
- Accurate
- Durable
- High speed

- High grip force
- Wide range of application
- Most common
- Body is high grade alloy steal
- All-wear surfaces are hardened and ground
Closed Center Style

- Accurate
- Durable
- High speed
- High grip force

- Wide range of application
- Body is high grade alloy steal
- All-wear surfaces are hardened and ground
Interaction between angle on master jaw to angle on wedge plunger. "wedge" surfaces interacting to give motion and mechanical advantage.
Lever Style

1. Lever Pin
2. Lever
3. Stopper
4. Master Jaw
5. Top Jaw

Cover

Diagram of a lever-style setup with labels for each component.
KITAGAWA

Data Required To Machine Draw Tube Adapter

Machine:  
MAKE:  
MODEL:  

Chuck:  
MAKE:  
MODEL:  

Actuator:  
MAKE:  
MODEL:  

C - SPINDLE TYPE AND SIZE

D - DRAW TUBE THREAD DATA
1 - DIAMETER OF THREAD

2 - PITCH
3 - INTERNAL OR EXTERNAL

4 - LENGTH OF THREAD

A-MAX. (TUBE EXTENDED)

B-MIN. (TUBE RETRACTED)

E - DRAW TUBE I.D.
F - DRAW TUBE O.D.
G - SPINDLE I.D.
### Specifications

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Thru-Hole mm</th>
<th>Gripping range mm</th>
<th>Jaw Stroke (diameter) mm</th>
<th>Plunger Stroke mm</th>
<th>Max. Draw Bar Pull Force kN (Kgf)</th>
<th>Max. Gripping Force kN (Kgf)</th>
<th>Max. Speed m/min (r.p.m)</th>
<th>Net Weight with Soft top jaws kg</th>
<th>Moment of inertia kg·m²</th>
<th>Matching Cylinder</th>
<th>Max. pressure MPa (kgf/cm²)</th>
<th>Matching Hard top jaw</th>
<th>Matching Soft top jaw</th>
</tr>
</thead>
<tbody>
<tr>
<td>B204</td>
<td>26</td>
<td>110 – 7</td>
<td>5.4</td>
<td>10</td>
<td>14 (1428)</td>
<td>28.5 (2906)</td>
<td>8000</td>
<td>4</td>
<td>0.007</td>
<td>F0933H</td>
<td>2.80 (28.6)</td>
<td>HB04N1</td>
<td>SB04N1</td>
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<tr>
<td>B205</td>
<td>33</td>
<td>135 – 12</td>
<td>5.4</td>
<td>10</td>
<td>17.5 (1784)</td>
<td>36 (3671)</td>
<td>7000</td>
<td>6.7</td>
<td>0.018</td>
<td>F0933H</td>
<td>3.43 (35.0)</td>
<td>HB04N1</td>
<td>SB05N1</td>
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<tr>
<td>B206</td>
<td>45</td>
<td>169 – 16</td>
<td>5.5</td>
<td>12</td>
<td>22 (2243)</td>
<td>57 (5812)</td>
<td>6000</td>
<td>11.9</td>
<td>0.058</td>
<td>S1246</td>
<td>2.8 (28.6)</td>
<td>HB06B1</td>
<td>SB06L1A</td>
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<tr>
<td>B208</td>
<td>52</td>
<td>210 – 13</td>
<td>7.4</td>
<td>16</td>
<td>34.8 (3549)</td>
<td>86 (8769)</td>
<td>5000</td>
<td>22.3</td>
<td>0.170</td>
<td>S1552</td>
<td>2.65 (27 )</td>
<td>HB08A1</td>
<td>SB08B1</td>
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<tr>
<td>B210</td>
<td>75</td>
<td>254 – 31</td>
<td>8.8</td>
<td>19</td>
<td>43 (4385)</td>
<td>111 (11319)</td>
<td>4200</td>
<td>34.5</td>
<td>0.315</td>
<td>S1875</td>
<td>2.7 (27.5)</td>
<td>HB10A1</td>
<td>SB10B1</td>
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<tr>
<td>B212</td>
<td>91</td>
<td>304 – 34</td>
<td>10.6</td>
<td>23</td>
<td>55 (5608)</td>
<td>144 (14866)</td>
<td>3300</td>
<td>55.3</td>
<td>0.738</td>
<td>S2091</td>
<td>2.7 (27.5)</td>
<td>HB12N1</td>
<td>SB12N1</td>
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<tr>
<td>B215</td>
<td>100</td>
<td>381 – 50</td>
<td>10.6</td>
<td>23</td>
<td>98 (9963)</td>
<td>249 (25391)</td>
<td>2800</td>
<td>116</td>
<td>2.20</td>
<td>F2511H</td>
<td>33 (33.7)</td>
<td>HB15N1</td>
<td>SB15N1</td>
</tr>
</tbody>
</table>

1) **MECHANICAL ADVANTAGE = MAX GRIP FORCE/MAX DRAWBAR PULL FORCE:**

\[
\frac{5812 \text{ (Kgf)}}{2243 \text{ (Kgf)}} = 2.59 \text{ (Kgf)}
\]

**MECHANICAL ADVANTAGE**

2) **CYLINDER STROKE MUST EQUAL OR EXCEED CHUCK PLUNGER STROKE**

3) **JAW STROKE IS ON DIAMETER. TO GET STROKE PER JAW DIVIDE BY 2:**

\[
\frac{5.5 \text{ mm}}{2} = 2.75 \text{ mm STROKE PER JAW}
\]

You can find this information for all our chucks at [www.kitagawa.com](http://www.kitagawa.com)
What Affects Grip Force?

- **Speed (RPM) Of Chuck:**
  As speed increases grip force decreases.

- **Jaw Height:**
  As the gripping center height increases the grip force decreases.

- **Jaw Mass:**
  As the mass of the top jaw increases the grip force decreases.

- **Chuck Condition:**
  If the chuck has damage or excessive wear grip force can be impacted.

- **Lubrication:**
  Proper chuck lubrication can increase grip force up to 50%.

*Grip force and maximum rpm ratings are based on using Kitagawa soft jaws*
Grip Force Loss

With increased speed, the gripping force decreases. The graph shows that as speed increases, the total gripping force in kilograms (kgf) decreases. The graph indicates that with increased speed, the gripping force decreases to a lower value, as seen by the trend lines moving downward as speed increases.
Grip Force Loss

Jaw Height vs. Grip Force

WITH INCREASED HEIGHT

G : Mass center of top jaw
m : Mass of top jaw (One jaw)
r : Distance up to chuck center
H : Gripping force center height

DECREASED FORCE
Greasing the chuck not only lubricates, but also helps remove contamination from the chuck. Proper lubrication can prevent the loss of up to 50% grip force.

To maintain the chuck for a long period of time, it is necessary to lubricate the chuck on a regular basis. Inadequate lubrication causes malfunction at low hydraulic pressure, reduces gripping force, affects gripping accuracy and causes wear and seizure. Consequently, securely lubricate the chuck.

<table>
<thead>
<tr>
<th>Section to be Lubricated</th>
<th>Grease Used</th>
<th>Lubrication Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply grease from the grease nipple at the periphery end of each master jaw with a grease gun.</td>
<td>Kitagawa Chuck-EEZ® or Chuck Grease Pro®</td>
<td>Once per day. However, when the machine is operated at high speed rotation, or a large amount of water soluble cutting oil is used, more lubrication is needed according to service conditions.</td>
</tr>
</tbody>
</table>

Greasing the chuck not only lubricates, but also helps remove contamination from the chuck. Proper lubrication can prevent the loss of up to 50% grip force.
How Chuck-EEZ® Works

SEPARATING THE SURFACES BY

Hydrodynamic Lubrication  Boundary Lubrication

LOADS

EXTREME LOADS

LIQUID LUBRICANT FILM  SOLID LUBRICANT FILM

Fig. 1 Diagram illustrating the separation of surfaces by thin liquid and solid film.

EXTREME LOADS

LIQUID LUBRICANT

Fig. 4 Hydrodynamic lubrication failure due to inadequate speed and loads.

SOLID LUBRICANT

Fig. 5 A boundary lubricant prevents metal to metal contact under conditions of high loads and slow speeds.

All metal surfaces, regardless of how smooth they appear to the naked eye, are not really smooth at all. Observing them under a high powered microscope, they project a cross section of saw-toothed irregularities, as illustrated in figure 2. These metal surface asperities complicate the laws of hydrodynamics in that they can poke through an oil film and cause lubrication failure.

Fig. 2 Highly polished metal surface asperities
With CHUCK-EEZ Grease you have more grip force at 5000 RPM than lithium grease has at 0 RPM.
**Periodic Disassemble**

Disassemble chuck periodically to clean & inspect

**BENEFITS:**
- Increase chuck life
- Decrease unplanned downtime
- Safety
- Maintain chuck performance & accuracy
- **Jaw Lift**: Sliding jaw chucks will impart a slight lift when they clamp.

- **Forming Soft Jaws**: Form soft jaws under clamp load.

- **T-Nut Position**: There is a maximum front and back position.

- **Potential Problems With Aftermarket Jaws**: If the serrations are not made correctly it can cause wear issues and grip force problems.
The sliding jaw style power chucks open and close when the master jaws slides along the wedge plunger's fitted slots. OD clamping is illustrated in the above figure. The master jaws move until the top jaws touch the work piece. However, there is a gap between the master jaw tabs and the wedge plunger's slots. In order for the master jaws to make contact with the wedge plunger, the jaws will tilt when the work piece is gripped. The inner top and outer bottom of the master jaws tab will contact the dovetail grooves (slot) in the wedge plunger.

The **amount of lift up is increased by the following conditions:**

- High gripping force
- Taller jaws (high gripping center height)
- Small gripping diameter
Forming Soft Jaws – Sliding Jaw Chucks

Step 1

- Prepare the plug for forming. Forming outer dia. of plug is limited to finishing. Ensure the plug is strong with a suitable wall thickness.
Note: It is necessary to prepare different size plugs in advance.
Note: It is recommended to tap the center hole of plug and insert the bolt.

Step 2

- Open the master jaw fully by operating the valve.
- Next, set $\Phi$ D dimension to grip around the middle of the maximum jaw stroke.

Plug dia.: $\Phi$ d $\Phi$ D = $\Phi$ d + Max. jaw stroke / 2

Step 3

- Grip the plug in $\Phi$ D part with the valve.
Check that the plug is full against the chuck face.
Note: Repeat chucking several times to ensure the plug is correct.

Step 4

- Form the part $\Phi$ d’ for gripping the workpiece with the plug still gripped. Machine the part $\Phi$ d’ to the same diameter (H7) as the workpiece and surface roughness less than 6S.
- Set the gripping pressure for the jaws to be approximately the same as when the workpiece is gripped.
Note: If the plug is distorted, reduce the pressure or alternatively use a stronger plug with additional wall thickness.

Step 5

- After forming jaws, grip the workpiece to check the jaw stroke.
- Perform trial cutting to inspect machining accuracy, etc.
- For checking jaw seating face (A) release component and rotate workpiece 90°, grip again and check end face (B).
Even if you re-mount the top jaws that were made on the chuck at the same position, the gripping accuracy will most likely be worse than before the removal occurred. If you need the accuracy to remain the same as before, you will need to re-cut these jaws on the chuck.

The above figure shows the worst case scenario: Top jaws were finished touching the right-hand side of t-nuts (left side of the figure). Then, they were detached and re-installed touching the left-hand side of the t-nuts. Since there is a gap between the t-nut and the top jaws, the position of the top jaws is not completely the same. This is the cause for the deterioration of accuracy.
T-Nut Positioning

Not to be protruded

飞出さないように注意

IN MASTER JAW OPEN

CAUTION

注意

Tナットがマスタジョー基準位置より飛出すと
Tナットとカバーが衝突しカバーを破損

If T-nut protrudes from the reference position of master jaw, T-nut interferes with cover, thereby causing a cover damage.

Correct

Incorrect
Learn more about CHUCKS!
Read about safe operations, troubleshooting, mounting steps, maintenance and inspection procedures at: http://kitagawa.com/knowledge-base/typical-chucks/

More Questions?
Call us at 800.222.4138