Concerning Pretension of a Ball Screw Shaft

[Purpose of Pretension]
A screw shaft’s positioning accuracy decreases due to thermal expansion caused by an increase in temperature.
(Thermal displacement ≈ 12 μm/°C: per 1m)
One of the measures to prevent this is to apply a pre-tension.
By pulling the screw shaft beforehand, the extension can be absorbed through a change in internal stress.
Normally, apply a pre-tension equivalent to a temperature rise of 2 to 3 °C of the screw shaft.
(Indication of tension amount: approx. 30 μm per screw shaft)

[Precautions in Applying a Pre-tension]
A pretension cannot be applied unless the support section has certain strength (rigidity). Therefore, it is necessary to take much care in designing a support section.
It is also necessary to note that an excessive pretension may increase the torque of the bearing at the support section, increase heat and shortening the service life.

[Indication of Pretensions for Machining Tools]

<table>
<thead>
<tr>
<th>Model</th>
<th>Axis</th>
<th>Indication of Pretension (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lathe</td>
<td>x</td>
<td>-0.02 ~ -0.05</td>
</tr>
<tr>
<td></td>
<td>z</td>
<td>-0.02 ~ -0.03</td>
</tr>
<tr>
<td>Machining Center</td>
<td>x, y</td>
<td>-0.03 ~ -0.04</td>
</tr>
</tbody>
</table>

[Example of Improved Positioning Accuracy with Pretension]
[Structure for Applying a Pretension]

- **Unilateral fixing:**
  Only one side is fixed. Even the shaft is expanded more than the pretension through heat expansion, axes can freely be extended. Therefore, the load on the screw shaft and the support bearing will not exceed the pretension.

- **Bilateral fixing:**
  With bilateral fixing, when the expansion exceeds the pretension, the load on the screw shaft and the bearing increases. In this case, it is necessary to take care not to impose an excessive load.

[Method of Applying a Pretension]

- **Have a difference between the length of the screw shaft (preprocessed to be shorter) and the actual mounting length,** and pull the screw shaft to apply a pretension.

- **Pull the screw shaft to apply a pretension by inserting a shim in the mounting section**