**Shafts - Precision Standards**

### Accuracy Standards

#### Circularity / Straightness / L Dimension Accuracy

<table>
<thead>
<tr>
<th>O.D. g6/h5 Shafts (Hardened)</th>
<th>O.D. Tolerance for Shafts (Not Hardened)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L / Y Dimension Tolerance</strong></td>
<td><strong>Straightness</strong></td>
</tr>
<tr>
<td>Over</td>
<td>Less than</td>
</tr>
<tr>
<td>8</td>
<td>0.010</td>
</tr>
<tr>
<td>8</td>
<td>0.012</td>
</tr>
<tr>
<td>10</td>
<td>0.014</td>
</tr>
<tr>
<td>12</td>
<td>0.016</td>
</tr>
<tr>
<td>12</td>
<td>0.018</td>
</tr>
<tr>
<td>12</td>
<td>0.020</td>
</tr>
</tbody>
</table>

**Notes on Hardening and Surface Treatment.**

- **Reduced Hardness around Machined Areas**
  - Alterations will be applied after base materials are case hardened.
  - In the example below, annealing caused by machining may result in reduced hardness of the machined area + 0/0.02 mm fore and aft.

  ![image of shafts and machining areas](image-url)

- **Surface Treatment Plating Layers**
  - Machining is applied after the base material is surface treated.
  - For the case below, only D area (D10) is treated with hard-chrome plating or low temperature black chrome plating.
  - Hard chrome plating or low temperature black chrome plating will be removed from stepped, tapped and machined areas.

  ![image of surface treatment layers](image-url)

- **Notes on Hardening and Surface Treatment.**
  - Annealing caused by machining may lower hardness of following parts:
    - All threaded shafts
    - All stepped shafts
    - Tapped holes: If M=10-2, RC threads, two tapped holes on ends, hard chrome plated 440C Stainless Steel products.
    - Retaining ring grooves, keyway, tapers, hexagonal socket holes, wrench flats, set screw grooves
    - Keyways, flats, 50-deg. flats, V-grooves
    - Shaft Ends Configurable Type (O/H shape)
    - Hollow Shafts (lateral hole on one side)

  ![image of inner surface hardness variations](image-url)

- **Cross-drilled Hole Dimension Details.**
  - Cross-drilled hole shape may be oval due to machining. Tolerances due to oval shape may lower hardness in the range of 30mm around the machined area.
  - When combined with fine thread alterations, the effect may be greater than the sum of each alteration.

  ![image of cross-drilled holes](image-url)

- **Shafts: Detailed Wrench Flats Dimensions.**
  - Hexagonal Wrench
  - One End Tapped with a Cross-drilled Hole

  ![image of wrench flats dimensions](image-url)

- **Effective Hardened Layer Depth of Shafts (hardened) with Outer Diameter Tolerance g6/h5**

<table>
<thead>
<tr>
<th>Shaft</th>
<th>Hardness</th>
<th>Surface Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>Over 0.3</td>
<td>Over 0.3</td>
</tr>
<tr>
<td>40</td>
<td>Over 0.3</td>
<td>Over 0.3</td>
</tr>
<tr>
<td>50</td>
<td>Over 0.3</td>
<td>Over 0.3</td>
</tr>
</tbody>
</table>

**About Hollow Shaft Wall Thickness Deviations**

Color diameter tolerance g6/h5 Shafts (Hardened) / Color diameter tolerance h6/h5 Shafts (treated with plating)

- Color diameter tolerance g6/h5 Shafts (Hardened)
- Color diameter tolerance h6/h5 Shafts (treated with plating)

When specifying Shafts with thread undercut or adding thread undercut alterations (PC/QC), PC and QC tolerances are the same data below. When D is specified, undercuts will be D + 0.75 x T.

- For Coarse Threads: When Combined with Fine Thread Alterations

  ![image of thread dimensions](image-url)

- Other plain finished edges are:
  - Threaded and tapped shafts
  - Retaining ring grooves, keyway, tapers, hexagonal socket holes, wrench flats, set screw grooves
  - Keyways, flats, 50-deg. flats, V-grooves
  - Fully Plated Shafts will have the plating on the entire shaft except centering holes and tapped sections.

**Thread Undercut Dimensions (PC / QC) [Reference Values]**

<table>
<thead>
<tr>
<th>Color Diameter Tolerance g6/h5 Shafts (Hardened)</th>
<th>Color Diameter Tolerance h6/h5 Shafts (treated with plating)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

- An hollow shaft interior surfaces are not treated with plating, it may rust.

**Shaft Material / Hardness / Surface Treatment**

- Various Shafts - Precision Standards

  ![image of shaft material and hardness](image-url)

**Straitness Measuring Method**

- Shafts are supported on 10 runs and turned 0.2 degrees to measure straightness. CC or measured radius is defined as the straightness.

- **Shaft Ends are supported on 10 runs and turned 0.2 degrees to measure straightness. CC or measured radius is defined as the straightness.**

- **Straightness**

  ![image of shaft straightness](image-url)

- **Straightness Measuring Method**

  ![image of straightness measuring method](image-url)

- ** Shaft Ends are supported on 10 runs and turned 0.2 degrees to measure straightness. CC or measured radius is defined as the straightness.**

- **Straightness Measuring Method**

  ![image of straightness measuring method](image-url)