Taper Calculations

Definition

--- A piece of cylindrical work which decreases gradually in diameter so that it becomes a cone in shape is said to be a taper.

--- Taper is usually measured in Taper Per Foot.

— When calculating Tapers, the factors to be considered are;
   — The overall tapered section length and the difference in diameter at the two ends of the tapered section.

1. To find **Total Taper**;
   Subtract the small diameter from the large diameter.

2. To find **Taper Per Inch**;
   Divide the Total Taper by the length of the Taper in inches.

3. To find **Taper Per Foot**;
   Multiply, Taper Per Inch by 12.

Example

1. \[ .625 \text{ (Lg. Dia.)} - .375 \text{ (Sm. Dia.)} \]
   \[ \frac{.250}{.250} = \text{Total Taper} \]

2. \[ .250 \div 4 = .0625 \text{ (Taper Per Inch)} \]

3. \[ .0625 \times 12 = .750 = \text{(Taper Per Foot)} \]
Taper Assignment #1

#1

4.680

3.900

.850

T T =

TPI =

TPF =

#2

2.000

1.650

.875

T T =

TPI =

TPF =

#3

.880

6.00

.145

T T =

TPI =

TPF =

#4

.250

1.990

1.068

T T =

TPI =

TPF =
Tailstock Offset Formula's

Calculating Tailstock Offset When Taper Per Inch Is Known

\[
\text{Offset} = \frac{(L_1 \times \text{Tpi})}{2}
\]

Calculating Tailstock Offset When Taper Per Foot Is Known

\[
\text{Offset} = \frac{(L_1 \times \text{TPF})}{24}
\]

Calculating Tailstock Offset When Specific End Diameters are Known

\[
\text{Offset} = \frac{(L_1 \times (D - d))}{(L_2 \times 2)}
\]

Legend

\[
\begin{align*}
D &= \text{Diameter at large end.} \\
d &= \text{Diameter at small end.} \\
L_1 &= \text{Length of workpiece} \\
L_2 &= \text{Length of taper.} \\
\text{Tpi} &= \text{Taper Per Inch} \\
\text{TPF} &= \text{Taper Per Foot}
\end{align*}
\]
Calculating Offset When Taper Per Inch Is Known

\[ \text{Offset} = \frac{(L_1 \times \text{Tpi})}{2} \]

**Solution**

\[ \text{Offset} = \frac{(L_1 \times \text{Tpi})}{2} \]
\[ \text{Offset} = \frac{(5.00 \times 0.3775)}{2} \]
\[ \text{Offset} = \frac{1.8875}{2} \]
\[ \text{Offset} = 0.944" \]

Calculating Offset When Taper Per Foot Is Known

\[ \text{Offset} = \frac{(L_1 \times \text{TPF})}{24} \]

**Solution**

\[ \text{Offset} = \frac{(L_1 \times \text{TPF})}{24} \]
\[ \text{Offset} = \frac{(4.590 \times 3.296)}{24} \]
\[ \text{Offset} = 15.128 / 24 \]
\[ \text{Offset} = 0.630" \]

Calculating Offset When Specific End Diameters Are Known

\[ \text{Offset} = \frac{(L_1 \times (D-d))}{(L_2 \times 2)} \]

**Solution**

\[ \text{Offset} = \frac{(L_1 \times (D-d))}{(L_2 \times 2)} \]
\[ \text{Offset} = \frac{(6.5 \times (1.125-.312))}{(3 \times 2)} \]
\[ \text{Offset} = \frac{(6.5 \times .813)}{6} \]
\[ \text{Offset} = \frac{5.284}{6} \]
\[ \text{Offset} = 0.881" \]
Taper Assignment #2

Calculating Tailstock Offset

Tailstock Offset =

Tailstock Offset =

Tailstock Offset =

Tailstock Offset =
<table>
<thead>
<tr>
<th>To Find</th>
<th>Given</th>
<th>Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. TPi</td>
<td>TPF</td>
<td>TPF/12</td>
</tr>
<tr>
<td>2. TPF</td>
<td>TPi</td>
<td>TPi x 12</td>
</tr>
<tr>
<td>3. TPi</td>
<td>End Dia's and Length of Taper</td>
<td>(D-d)/Taper Length</td>
</tr>
<tr>
<td>4. Taper Dia. at Small End</td>
<td>TPF, Length of Taper, and Taper Dia. at Large End</td>
<td>Large Dia. - (TPF/12) x Taper Length</td>
</tr>
<tr>
<td>5. Taper Dia. at Large End</td>
<td>TPF, Length of Taper, and Taper Dia. at Small End</td>
<td>(TPF / 12) x Taper Length add result to Small Dia.</td>
</tr>
<tr>
<td>6. Total Taper</td>
<td>TPF, Length of Taper</td>
<td>(TPF / 12) x Taper Length</td>
</tr>
<tr>
<td>7. Total Taper</td>
<td>TPi, &amp; Length of Taper</td>
<td>TPi x Length of Taper</td>
</tr>
<tr>
<td>8. Length of Taper</td>
<td>Both End Dia's &amp; TPF</td>
<td>1. D-d (To get Total Taper)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. TPF/12 (To get TPi)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Total Taper / TPi</td>
</tr>
</tbody>
</table>

**Legend**

D = Diameter at large end.
d = Diameter at small end.
TPi = Taper Per Inch
TPF = Taper Per Foot
Tapered Angles

Objective

Give the student knowledge in converting tapered slopes to angles in degrees

The following three steps must be performed to find the correct

--- Single Angle
--- Included Angle

1. Solve for the 'Taper Per Foot'.
2. Divide the TPF by 24 (TPF/24) to find the Trigonometric Function.
3. Locate the resulting Trigonometric Function in the Trig Functions Handbook.
4. Read the corresponding Tangent Value in Degrees
   This Angle equals the Single Angle, which is the Angular distance from the centerline to the sloped surface on one side only.
5. Multiply the single angle value by 2 to obtain the Included Angle, which is the total angular distance from one sloped surface to the opposite sloped surface.

Example

Included Angle

Single Angle

Tan Trig Function

TPF

.625 / 24 = .0260

.0260 as found in the Trig Functions Tangent column equals 1 deg 30 min

The result must be doubled to obtain the Included Angle.

1 deg 30 min

x 2

2 deg 60 min = 3 deg (Included Angle)