B4.5.5.5  **Aluminum-Minimum Properties**

![Graph showing minimum bending modulus of rupture curves for 2014-T6 aluminum alloy forgings.](image)

- $F_{tu} = 62,000$ psi
- $F_{ty} = 52,000$ psi
- $E = 10.5 \times 10^6$ psi
- Elongation = 10%

**Figure B4.5.5.5-2** Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 2014-T6 Aluminum Alloy Forgings, (Transverse) Thickness ≤ 4 In.
B4.5.5.5 **Aluminum-Minimum Properties**

![Graph showing the minimum properties of aluminum with the following data points:

- Minimum Tensile Strength ($F_{tu}$) = 64,000 psi
- Minimum Yield Strength ($F_{ty}$) = 42,000 psi
- Modulus of Elasticity ($E$) = $10.5 \times 10^6$ psi
- Elongation = 12%]

**Equation:**

$$k = \frac{2Qc}{I}$$

**Fig. B4.5.5.5-3** Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 2024-T3 Alloy Sheet & Plate - Heat Treated. Thickness $\leq 0.250$ In.
B4.5.5.5  Aluminum-Minimum Properties

Fig. B4.5.5.4-4 Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 2024-T3 & T4 Aluminum Alloy Sheet & Plate - Heat Treated. Thickness \( \leq 0.50 \) In.
Fig. B4.5.5.5-5 Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 2024-T3 Aluminum Alloy Clad Sheet & Plate - Heat Treated. Thickness 0.010 to 0.062 In.
Fig. B4.5.5-6  Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 2024-T4 Aluminum Alloy Clad Sheet & Plate - Heat Treated. Thickness 0.25 to 0.50 In.
**Aluminum-Minimum Properties**

- $F_{tu} = 60,000$ psi
- $F_{ty} = 47,000$ psi
- $E = 9.5 \times 10^6$ psi
- Elongation = 8%

**Fig. B4.5.5.5-7** Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 2024-T6 Aluminum Alloy Clad Sheet - Heat Treated & Aged. Thickness < 0.064 In.
B4.5.5.5  Aluminum-Minimum Properties

\[ \sigma_{tu} = 62,000 \text{ psi} \]
\[ \sigma_{ty} = 54,000 \text{ psi} \]
\[ E = 9.5 \times 10^6 \text{ psi} \]
\[ \text{Elongation} = 5\% \]

Fig. B4.5.5.5-8 Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 2024-T81 Aluminum Alloy Clad Sheet - Heat Treated, Cold Worked & Aged Thickness < 0.064 In.
B4.5.5.5  Aluminum-Minimum Properties

\[ F_{tu} = 42,000 \text{ psi} \]
\[ F_{ty} = 35,000 \text{ psi} \]
\[ E = 9.9 \times 10^6 \text{ psi} \]

Elongation = 14%

Fig. B4.5.5.5-9  Minimum Bending Modulus of Rupture Curves for
Symmetrical Sections 6061-T6 Aluminum Alloy
Sheet - Heat Treated & Aged.  Thickness \( \geq 0.020 \text{ In.} \)
Fig. B4.5.5-10 Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 7075-T6 Aluminum Alloy Bare Sheet & Plate. Thickness ≤ .039 In.
B4.5.5.5 Aluminum-Minimum Properties

\[ F_{tu} = 70,000 \text{ psi} \]
\[ F_{ty} = 60,000 \text{ psi} \]
\[ E = 9.5 \times 10^6 \text{ psi} \]
\[ \text{Elongation} = 7\% \]

**Fig. B4.5.5.5-11** Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 7075-T6 Aluminum Alloy Clad Sheet & Plate. Thickness \( \leq .039 \) In.
B4.5.5.5 Aluminum-Minimum Properties

\[ F_{tu} = 75,000 \text{ psi} \]
\[ F_{ty} = 65,000 \text{ psi} \]
\[ E = 10.3 \times 10^6 \text{ psi} \]
\[ \text{Elongation} = 7\% \]

\[ k = \frac{2Qc}{I} \]

Fig. B4.5.5.5-12 Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 7075-T6 Aluminum Alloy Extrusions. Thickness \( \leq 0.25 \) in.
B4.5.5.5  Aluminum-Minimum Properties

\[ k = \frac{2Qc}{I} \]

- \( F_{tu} = 75,000 \text{ psi} \)
- \( F_{ty} = 65,000 \text{ psi} \)
- \( E = 10.3 \times 10^6 \text{ psi} \)
- Elongation = 7%

**Fig. B4.5.5.5-13** Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 7075-T6 Aluminum Alloy Die Forgings. Thickness ≤ 3 in.
B4.5.5.5  Aluminum-Minimum Properties

\[ F_{tu} = 72,000 \text{ psi} \]
\[ F_{ty} = 60,000 \text{ psi} \]
\[ E = 10.3 \times 10^6 \text{ psi} \]
\[ Elongation = 4\% \]

Fig. B4.5.5.5-14  Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 7075-T6 Aluminum Alloy Hand Forgings Area \( \leq 16 \text{ in.}^2 \)
Fig. B4.5.5-15 Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 7079-T6 Aluminum Alloy Die Forgings (Transverse). Thickness ≤ 6.0 In.
B4.5.5.5 Aluminum-Minimum Properties

\[ F_{tu} = 74,000 \text{ psi} \]
\[ F_{ty} = 64,000 \text{ psi} \]
\[ E = 10,3 \times 10^6 \text{ psi} \]
\[ \text{Elongation} = 7\% \]

**Fig. B4.5.5.5-16** Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 7079-T6 Aluminum Alloy Die Forgings (Longitudinal) Thickness \( \leq 6.0 \text{ in.} \)
B4.5.5.5 Aluminum-Minimum Properties

\[ F_{tu} = 67,000 \text{ psi} \]
\[ F_{ty} = 56,000 \text{ psi} \]
\[ E = 10.3 \times 10^6 \text{ psi} \]
\[ \text{Elongation} = 4\% \]

\[ k = \frac{2Qc}{I} \]

Fig. B4.5.5-17 Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 7079-T6 Aluminum Alloy Hand Forgings (Short Transverse) Thickness \( \leq 6.0 \text{ In.} \)
B4.5.5.5 Aluminum-Minimum Properties

\[ F_{tu} = 69,000 \text{ psi} \]
\[ F_{ty} = 58,000 \text{ psi} \]
\[ E = 10.3 \times 10^6 \text{ psi} \]
\[ \text{Elongation} = 6\% \]

Fig. B4.5.5.5-18 Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 7079-T6 Aluminum Alloy Hand Forgings-(Long Transverse) Thickness \( \leq 6 \) in.
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B4.5.5.5  Aluminum - Minimum Properties

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Room Temperature

Ultimate

Yield

\( F_b \) (ksi)

\( F_{tu} = 71,000 \) psi
\( F_{ty} = 62,000 \) psi
\( E = 10.3 \times 10^6 \) psi
Elongation = 9%

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\[ k = \frac{2Qc}{I} \]

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Fig. B4.5.5.5-19  Minimum Bending Modulus of Rupture Curves for Symmetrical Sections 7079-T6 Aluminum Alloy Hand Forgings - (Longitudinal). Thickness \( \leq 6 \) In.
**B4.5.6.5 Aluminum-Minimum Properties**

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**Fig. B4.5.6.5-1** Minimum Plastic Bending Curves 2014-T6
Aluminum Alloy Extrusions. Thickness ≤ .499 in.
Graph to be furnished when available
Fig. B4.5.6.5-3  Minimum Plastic Bending Curves 2014-T6
Aluminum Alloy Die Forgings. Thickness ≤ 4 in.
B4.5.6.5  Aluminum-Minimum Properties

Fig. B4.5.6.5-4  Minimum Plastic Bending Curves 2014-T6
Aluminum Alloy Die Forgings.  Thickness ≤ 4 in.
Fig. B4.5.6.5-5  Minimum Plastic Bending Curves 2024-T3
Aluminum Alloy Sheet & Plate - Heat Treated.
Thickness ≤ 0.250 Inches
Fig. B4.5.6.5-6  Minimum Plastic Bending Curves 2024-T3
Aluminum Alloy Sheet and Plate - Heat Treated.
Thickness ≤ 0.250 Inches
Graph to be furnished when available
B4.5.6.5 Aluminum-Minimum Properties

![Graph showing stress-strain curve with various k values.](image)

**Fig. B4.5.6.5-8** Minimum Plastic Bending Curves for 2024-T3 & T4 Aluminum Alloy-Heat Treated-Sheet & Plate. Thickness ≤ 0.50 Inches

- $F_{tu} = 64,800$ psi
- $F_{ty} = 40,000$ psi
- $E = 10.5 \times 10^6$ psi
- Elongation = 12%
**B4.5.6.5**  Aluminum-Minimum Properties

<table>
<thead>
<tr>
<th>$k$</th>
<th>$F_{tu}$</th>
<th>$F_{ty}$</th>
<th>$E$</th>
<th>Elongation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>59,000 psi</td>
<td>39,000 psi</td>
<td>$9.5 \times 10^6$ psi</td>
<td>12%</td>
</tr>
</tbody>
</table>

**Fig. B4.5.6.5-9** Minimum Plastic Bending Curves 2024-T3
Aluminum Alloy Clad Sheet & Plate - Heat Treated.
Thickness 0.010 to 0.062 in.
Fig. B4.5.6.5-10 Minimum Plastic Bending Curves 2024-T3
Aluminum Alloy Clad Sheet and Plate-Heat Treated.
Thickness 0.010 to 0.062 in.

- $F_{tu} = 59,000$ psi
- $F_{ty} = 39,000$ psi
- $E = 9.5 \times 10^6$ psi
- Elongation = 12%

Stress-Strain Curve

$k = 2.0$
$k = 1.7$
$k = 1.5$
$k = 1.25$
$k = 1.0$
**B4.5.6.5 Aluminum-Minimum Properties**

- $F_{tu} = 62,000$ psi
- $F_{ty} = 40,000$ psi
- $E = 10.0 \times 10^6$ psi
- Elongation = 11%

**Fig. B4.5.6.5-11** Minimum Plastic Bending Curve 2024-T4
Aluminum Alloy Clad Sheet & Plate - Heat Treated Thickness 0.25 to 0.50 in.
B4.5.6.5  Aluminum-Minimum Properties

![Diagram of Stress-Strain Curve with annotations]

**Fig. B4.5.6.5-12 Minimum Plastic Bending Curves 2024-T4 Aluminum Alloy Clad Sheet and Plate - Heat Treated Thickness 0.25 to 0.50 in.**

- $F_{tu} = 62,000$ psi
- $F_{ty} = 40,000$ psi
- $E = 10.0 \times 10^6$ psi
- Elongation = 11%
B4.5.6.5 Aluminum-Minimum Properties

Fig. B4.5.6.5-13 Minimum Plastic Bonding Curves 2024-T6 Aluminum Alloy Clad Sheet - Heat Treated & Aged. Thickness < 0.064 Inches
Fig. B4.5.6.5-14 Minimum Plastic Bending Curves 2024-T6
Aluminum Alloy Clad Sheet-Heat Treated and Aged Thickness < 0.064 in.
Graph to be furnished when available
Fig. B4.5.6.5-16 Minimum Plastic Bending Curves 2024-T81
Aluminum Alloy Clad Sheet-Heat Treat, Cold Worked and Aged Thickness < 0.064 in.
Aluminum-Minimum Properties

Fig. B4.5.6.5-17 Minimum Plastic Bending Curves 6061-T6 Aluminum Alloy Sheet Heat Treated & Aged. Thickness ≥ 0.020 in.
Fig. B4.5.6.5-18 Minimum Plastic Bending Curves 6061-T6
Aluminum Alloy Sheet - Heat Treated & Aged
Thickness ≥ 0.020 in.
Fig. B4.5.6.5-19 Minimum Plastic Bending Curves 7075-T6
Aluminum Alloy Bare Sheet and Plate. Thickness ≤ .039 in.
B4.5.6.5 Aluminum-Minimum Properties

Fig. B4.5.6.5-20 Minimum Plastic Bending Curves 7075-T6
Aluminum Alloy Bare Sheet & Plate Thickness ≤ .039 in.
B4.5.6.5 Aluminum-Minimum Properties

Fig. B4.5.6.5-21 Minimum Plastic Bending Curves 7075-T6
Aluminum Alloy Clad Sheet & Plate. Thickness ≤ 0.039 in.
Fig. B4.5.6.5-22 Minimum Plastic Bending Curves 7075-T6 Aluminum Alloy Clad Sheet & Plate Thickness ≤ 0.39 in.
B4.5.6.5  Aluminum-Minimum Properties

![Graph](image)

\[ F_{tu} = 75,000 \text{ psi} \]
\[ F_{ty} = 65,000 \text{ psi} \]
\[ E = 10.3 \times 10^6 \text{ psi} \]
\[ \text{Elongation} = 7\% \]

**Stress - Strain Curve**

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**Fig. B4.5.6.5-23** Minimum Plastic Bending Curves 7075-T6
Aluminum Alloy Extrusions. Thickness \( \leq 0.25 \text{ in.} \)
Fig. B4.5.6.5-24 Minimum Plastic Bending Curves 7075-T6 Aluminum Alloy Extrusions. Thickness ≤ 0.25 in.
Graph to be furnished when available
B4.5.6.5  Aluminum-Minimum Properties

![Stress-Strain Curve]

- $F_{tu} = 75,000$ psi
- $F_{ty} = 65,000$ psi
- $E = 10.3 \times 10^6$ psi
- Elongation = 7%

Fig. B4.5.6.5-26  Minimum Plastic Bending Curves 7075-T6 Aluminum Alloy Die Forgings. Thickness ≤ 2 in.
Graph to be furnished when available
Fig. B4.5.6.5-28 Minimum Plastic Bending Curves 7075-T6
Aluminum Alloy Hand Forgings Area ≤ 16 in.²
Fig. B4.5.6.5-29 Minimum Plastic Bending Curves 7079-T6
Aluminum Alloy Die Forgings. (Transverse)
Thickness ≤ 6.0 in.
Graph to be furnished when available
**B4.5.6.5 Aluminum-Minimum Properties**

![Diagram](image-url)

- $F_{tu} = 74,000$ psi
- $F_{ty} = 64,000$ psi
- $E' = 10.3 \times 10^6$ psi
- Elongation = 7%

**Stress-Strain Curve**
- $f_0$ Curve
- $k = 2.0$
- $k = 1.7$
- $k = 1.5$
- $k = 1.25$
- $k = 1.0$

**Fig. B4.5.6.5-31 Minimum Plastic Bending Curves 7079-T6**

Aluminum Alloy Die Forgings (Longitudinal)

Thickness $\leq 6.0$ in.
**B4.5.6.5 Aluminum-Minimum Properties**

### Stress-Strain Curve

- **Room Temperature**
- **Fb** (ksi) vs. **ε** (inches/inch)

- **Ftu** = 74,000 psi
- **Fty** = 64,000 psi
- **E** = 10.3 x 10^6 psi
- **Elongation** = 7%

**Fig. B4.5.6.5-32** Minimum Plastic Bending Curves 7079-T6
Aluminum Alloy Die Forgings (Longitudinal)
Thickness ≤ 6.0 in.
Graph to be furnished when available
Fig. B4.5.6.5-34 Minimum Plastic Bending Curves 7079-T6
Aluminum Alloy Hand Forgings (Short Transverse) Thickness ≤ 6.0 in.

$F_{tu} = 67,000$ psi,

$F_{ty} = 56,000$ psi

$E = 10.3 \times 10^6$ psi

Elongation = 4%
Fig. B4.5.6.5-35 Minimum Plastic Bending Curves 7079-T6
Aluminum Alloy Hand Forgings (Long Transverse)
Thickness ≤ 6 in.
B4.5.6.5  Aluminum-Minimum Properties

![Graph showing stress-strain curve for aluminum with various k values.](image)

- Room temperature
- Stress-Strain Curve
- f₀ Curve

**Values:**
- $F_{tu} = 69,000$ psi
- $F_{ty} = 58,000$ psi
- $E = 10.3 \times 10^6$ psi
- Elongation = 6%

**Fig. B4.5.6.5-36** Minimum Plastic Bending Curves 7079-T6
Aluminum Alloy Hand Forgings (Long Transverse)
Thickness ≤ 6 in.
Graph to be furnished when available
**B4.5.6.5 Aluminum-Minimum Properties**

![Graph showing stress-strain curves for aluminum.](image)

**Fig. B4.5.6.5-38 Minimum Plastic Bending Curves 7079-T6 Aluminum Alloy Hand Forgings (Longitudinal) Thickness ≤ 6.0 in.**

- \( F_{tu} = 71,000 \) psi
- \( F_{ty} = 62,000 \) psi
- \( E = 10.3 \times 10^6 \) psi
- Elongation = 9%
Graph to be furnished when available