An inverted T-beam is loaded as shown. The cross-section of the beam is as shown. Determine the maximum tensile flexural stress in the beam and the maximum compressive flexural stress in the beam and indicate their respective locations.

**Calculate Reactions**

1. \( \sum M_A = 0 \)
\[
-625 \times 4 + C_y \times 8 = 0
\]
\[C_y = 83.75 \text{ lb} \] as shown

2. \( \sum F_y = 0 \)
\[C_y = 83.75 \text{ lb} \] as shown

3. \( A_y - 625 - 400 + C_y = 0 \)
\[A_y = 187.5 \text{ lb} \] as shown

4. \( \sum F_x = 0 \)
\[A_x = 0 \]
Draw shear and bending moment diagrams

\[ b = 5 \text{ in} \]

\[ 187.5 \text{ lb} \]

\[ 87.5 \text{ lb} \]

\[ 1.4 \text{ in} \]

\[ 4.1 \text{ in} \]

\[ 5 \text{ in} \]

\[ \frac{14}{400} (4) = 750 \]

\[ \frac{14}{400} (5) = 1000 \]

\[ 4.375 \text{ in} \]

\[ -4.375 (4) = -1750 \]

\[ 750 \text{ ft-lb} \]

\[ 1000 \text{ ft-lb} \]

\[ \text{Max Positive Moment} = (750 \text{ ft-lb}) \left( \frac{12}{14} \right) = 7200 \text{ in-lb} \]

\[ \text{Max Negative Moment} = (-1000 \text{ ft-lb}) \left( \frac{12}{400} \right) = -12000 \text{ in-lb} \]
Calculate Cross-Section Properties

\[ 1.5'' \]

\[ 2.5'' \]

Red Axis

\[ \bar{y} = 1'' \]

\[ \bar{y} = \frac{(1.5)(2.5)\left(\frac{2.5}{2} + 1.5\right) + (2.5)(1.5)(\frac{1.5}{2})}{(1.5)(2.5) + (2.5)(1.5)} \]

\[ \bar{y} = \frac{1}{11} \text{ in} \]

\[ I = \frac{1}{12} \left( \frac{1}{2} (2.5)^2 \right) \left( \frac{2.5}{2} + 1.5 - 1 \right) + \frac{1}{12} \left( 2.5 \right)^2 + (2.5)(1.5)(1 - \frac{2}{3}) \]

\[ I = 1.651 + 1.703 + .026 + .703 \]

\[ I = 2.083 \text{ in}^4 \]

Calculate Maximum Stresses \( q + P \)

\[ \n = -\frac{M_y}{I} \]
<table>
<thead>
<tr>
<th>Step</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2)</td>
<td>(-\frac{3,000 \text{ in-lb} \times 2 \text{ in}}{2,083 \text{ in}^4})</td>
</tr>
<tr>
<td>(3)</td>
<td>(-\frac{9,000 \times (-1 \text{ in})}{2,083 \text{ in}^4})</td>
</tr>
<tr>
<td>(4)</td>
<td>(\frac{8,641 \text{ psi}}{}) Compression</td>
</tr>
<tr>
<td>(5)</td>
<td>(\frac{7,432 \text{ psi}}{}) Tension</td>
</tr>
</tbody>
</table>

Calculate Maximum Stress at C

<table>
<thead>
<tr>
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<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(6)</td>
<td>(-\frac{-12,000 \text{ in-lb} \times 2 \text{ in}}{2,083 \text{ in}^4})</td>
</tr>
<tr>
<td>(7)</td>
<td>(\frac{11,522 \text{ psi}}{}) Tension</td>
</tr>
<tr>
<td>(8)</td>
<td>(-\frac{-12,000 \times (-1 \text{ in})}{2,083 \text{ in}^4})</td>
</tr>
<tr>
<td>(9)</td>
<td>(-5,761 \text{ psi}) Compression</td>
</tr>
</tbody>
</table>

The maximum tensile stress occurs at point C on the top of the section.

\(\sigma_{C_{\text{Top}}} = 11,522 \text{ psi}\) Tension

The maximum compressive stress occurs at point B on the top of the section.

\(\sigma_{B_{\text{Top}}} = -5,761 \text{ psi}\) Compression