### TABLE 10.2 Formulas for torsional properties and stresses in thin-walled open cross sections

**NOTATION:** Point 0 indicates the shear center.  
\( e = \) distance from a reference to the shear center;  
\( K = \) torsional stiffness constant (length to the fourth power);  
\( C_w = \) warping constant (length to the sixth power);  
\( t = \) shear stress due to torsional rigidity of the cross section (force per unit area);  
\( t = \) shear stress due to warping rigidity of the cross section (force per unit area);  
\( \sigma_{r} = \) bending stress due to warping rigidity of the cross section (force per unit area);  
\( E = \) modulus of elasticity of the material (force per unit area);  
\( G = \) modulus of rigidity (shear modulus) of the material (force per unit area)

The appropriate values of \( \sigma' \), \( \theta' \), and \( \theta'' \) are found in Table 10.3 for the loading and boundary restraints desired.

<table>
<thead>
<tr>
<th>Cross section, reference no.</th>
<th>Constants</th>
<th>Selected maximum values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Channel</td>
<td></td>
<td>(( \sigma_{r} ))_max = ( \frac{hb}{h+3b} ) ( \frac{E}{K} ) through the thickness at corners A and D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(( \tau_{2} ))_max = ( \frac{h^2}{4(h+6b)} ) ( \frac{E}{b} ) through the thickness at a distance ( \frac{h+3b}{h+6b} ) from corners A and D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(( \tau_{1} ))_max = ( tG ) at the surface everywhere</td>
</tr>
<tr>
<td>2. C-section</td>
<td></td>
<td>(( \sigma_{r} ))_max = ( \frac{h}{12(h+6b)} ) ( \frac{E}{b} ) through the thickness at corners A and F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(( \tau_{2} ))_max = ( \frac{h}{2(b+e)(b+e)} ) ( \frac{E}{b} ) through the thickness on the top and bottom flanges at a distance ( e ) from corners C and D</td>
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<tr>
<td></td>
<td></td>
<td>(( \tau_{1} ))_max = ( tG ) at the surface everywhere</td>
</tr>
<tr>
<td>3. Hat section</td>
<td></td>
<td>(( \sigma_{r} ))_max = ( \frac{h}{12(b+e)} ) ( \frac{E}{b} ) through the thickness at corners A and F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(( \sigma_{r} ))_max = ( \frac{h}{2(b+e)} ) ( \frac{E}{b} ) through the thickness at corners B and E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(( \tau_{2} ))_max = ( \frac{h^2}{8(b+e)} + \frac{b}{2(b+e)} - \frac{h}{2(b+e)} ) ( \frac{E}{b} ) through the thickness at a distance ( \frac{h(b-e)}{2(b+e)} ) from corner B toward corner A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(( \tau_{2} ))_max = ( \frac{h}{2(b+e)} ) ( \frac{E}{b} ) through the thickness at a distance ( e ) from corner C toward corner B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(( \tau_{1} ))_max = ( tG ) at the surface everywhere</td>
</tr>
</tbody>
</table>