1. Basis of the product report:
   - 2018 and 2015 International Building Code (IBC): Sections 104.11 Alternative materials and 2303.1.10 Structural composite lumber
   - 2012 IBC: Sections 104.11 Alternative materials and 2303.1.9 Structural composite lumber
   - 2018 and 2015 International Residential Code (IRC): Sections R104.11 Alternative materials, and R502.1.5, R602.1.5, and R802.1.4 Structural composite lumber
   - 2012 IRC: Section R104.11 Alternative materials, and 2012 IRC Sections R502.1.7, R602.1.4, and R802.1.6 Structural composite lumber
   - ASTM D5456-14b, D5456-13, and D5456-09 recognized by the 2018 IBC and IRC, 2015 IBC and IRC, and 2012 IBC and IRC, respectively

2. Product description:
   Forex LVL is made with aspen veneers in accordance with the in-plant manufacturing standard approved by APA. Forex 2580Fb - 1.55E LVL is available in thicknesses from 1-1/4 inches to 1-3/4 inches, widths of 3-1/2 inches to 24 inches, and lengths up to 60 feet. Forex 2700Fb - 1.8E, 3000Fb - 1.9E and 3100Fb - 2.0E LVL’s are available in thicknesses from 1-1/2 inches to 5-1/4 inches, widths of 3-1/2 inches to 24 inches, and lengths up to 60 feet.

3. Design properties:
   Table 1 lists the Allowable Stress Design properties for Forex LVL. Table 2 lists the equivalent specific gravities for fastener design of Forex LVL. Table 3 lists the allowable nail spacing for Forex LVL. The allowable spans for Forex LVL shall be in accordance with the recommendations provided by the manufacturer.

4. Product installation:
   Forex LVL shall be installed in accordance with the recommendations provided by the manufacturer. Permissible details and allowable hole sizes shall be in accordance with the recommendations provided by the manufacturer.

5. Fire-rated assemblies:
   The provisions of 2018 and 2015 IBC Section 722 Calculated fire resistance, and 2012 IBC Section 722.6.3 Design of fire-resistant exposed wood members shall be applicable to Forex LVL. Fire-rated assemblies shall be constructed in accordance with the recommendations provided by APA Design/Construction Guide: Fire-Rated Systems, Form W305 (www.apawood.org/resource-library), and the manufacturer.

6. Limitations:
   a) Forex LVL shall be designed in accordance with the code using the design properties specified in this report.
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lbf = 4.448 N, 1 psi = 6.9 kPa.

(a) The tabulated values are design values for normal duration of load. All values, except for E and $F_{c||}$, are permitted to be adjusted for other load durations as permitted by the code. The design stresses are limited to conditions in which the average moisture content is less than 16 percent at maximum.

(b) Joist = load parallel to glueline, plank = load perpendicular to glueline.

(c) Tabulated bending stress ($F_b$) may be increased by 4 percent when the member qualifies as a repetitive member as defined in the NDS.

(d) The tabulated values are based on a reference depth of 12 inches. For other depths, when loaded edgewise, the allowable bending stress ($F_b$) shall be modified by $(12/d)^{0.25}$ for Forex 2580Fb - 1.55E, and $(12/d)^{0.16}$ for Forex 2700Fb - 1.8E, 3000Fb - 1.9E, and 3100Fb - 2.0E LVL, as shown in the following table, where $d$ = member depth in inches. For depths less than 3-1/2 inches, the factor for the 3-1/2-inch depth shall be used.

(e) Apparent modulus of elasticity. The deflection for a simply-supported beam under uniform load shall be calculated using the following equation:

\[
\delta = \frac{270wL^4}{E_{apparent}bh^3}
\]

Where: $\delta$ = Estimated deflection, inches  
$w$ = uniform load, plf  
$L$ = span, feet  
$E_{apparent}$ = tabulated apparent modulus of elasticity, psi  
$b$ = beam width, inches  
$h$ = beam depth, inches
True (shear-free) modulus of elasticity. When calculating deflection, both bending and shear deformations must be included. The deflection for a simply-supported beam under uniform load shall be calculated using the following equation:

\[
\delta = \frac{270 \cdot w \cdot L^4}{E_{true} \cdot b \cdot h^3} + \frac{28.8 \cdot w^2 \cdot L^2}{E_{true} \cdot b 
\]

Where:
- \(\delta\) = Estimated deflection, inches
- \(w\) = uniform load, plf
- \(L\) = span, feet
- \(b\) = beam width, inches
- \(h\) = beam depth, inches

The tabulated values are based on a reference length of 20 feet. For lengths greater than 20 feet, the allowable tensile stress shall be modified by \((20/L)^{0.146}\), where \(L\) = member length in feet.

### Table 2. Fastener Design for Forex LVL

<table>
<thead>
<tr>
<th>GRADE</th>
<th>EQUIVALENT SPECIFIC GRAVITY (S.G.)</th>
<th>NAILS</th>
<th>BOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Withdrawal Load</td>
<td>Lateral Load</td>
<td>Lateral Load</td>
</tr>
<tr>
<td></td>
<td>Installed in Edge</td>
<td>Installed in Face</td>
<td>Installed in Edge</td>
</tr>
<tr>
<td>2580Fb - 1.55E apparent 1.6E true</td>
<td>Hemlock/ fir North (0.46)</td>
<td>Red pine (0.44)</td>
<td>Spruce/pine/fir (0.42)</td>
</tr>
<tr>
<td>2700Fb - 1.8E apparent 1.9E true</td>
<td>Western white pine (0.40)</td>
<td>Western white pine (0.40)</td>
<td>Spruce/pine/fir (0.42)</td>
</tr>
<tr>
<td>3000Fb - 2.0E apparent 2.0E true</td>
<td>Western white pine (0.40)</td>
<td>Western white pine (0.40)</td>
<td>Spruce/pine/fir (0.42)</td>
</tr>
<tr>
<td>3100Fb - 2.0E apparent 2.1E true</td>
<td>Western white pine (0.40)</td>
<td>Western white pine (0.40)</td>
<td>Spruce/pine/fir (0.42)</td>
</tr>
</tbody>
</table>

### Table 3. Minimum Allowable Nail Spacings for Forex LVL

<table>
<thead>
<tr>
<th>Connector Size</th>
<th>Nails Installed in the Narrow Face (d,e,f)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On-Center Spacing (inches)</td>
</tr>
<tr>
<td>8d box (0.113&quot; x 2-1/2&quot;) and common (0.131&quot; x 2-1/2&quot;)</td>
<td>3</td>
</tr>
<tr>
<td>10d box (0.128&quot; x 3&quot;) and common (0.148&quot; x 3&quot;)</td>
<td>3</td>
</tr>
<tr>
<td>16d sinker (0.148&quot; x 3-1/4&quot;) and 12d common (0.148&quot; x 3-1/4&quot;)</td>
<td>3</td>
</tr>
<tr>
<td>16d common (0.162&quot; x 3-1/2&quot;)</td>
<td>6</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm.

(a) The minimum on-center spacing permitted for nails installed in the wide face of Forex LVL is the same as that permitted by the applicable code for solid-sawn lumber.

(b) Fastener sizes and closest on-center spacing not specifically described above are beyond the scope of this report.

(c) Edge distance shall be sufficient to prevent splitting.

(d) Unless otherwise specified, nails installed parallel to the gluelines on the narrow face of material shall be at least 1-1/4 inches thick and 3-1/2 inches wide.

(e) Multiple rows of nails are allowed in the narrow face of members with a minimum thickness of 1-3/4 inches. A minimum spacing of 1/2 inch is required between rows.

(f) Multiple rows must be offset 1/2 inch or more from each other and staggered around the centerline.

(g) The minimum on-center spacing is permitted to be reduced to 4 inches when nailing through wall plate and sheathing (maximum 1-3/8-inch penetration).
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