Title: Figure F-2, 16t<sub>b</sub> Maximum Width

Date: May 17, 2006 Revision: 3
May 1, 2006 Revision: 2
Nov. 14, 2005 Revision: 1
May 17, 2004 Revision: 0

Contact: Steve Adolphsen
CBI Services, Inc.
425-258-2350 ext 130
sadolphsen@cbi.com

Purpose: More clearly depict, in API 650 Figure F-2, the limit of “16tb max” for horizontal members that are wider than 16 tb.

Source: 650-I-35/03

Impact: Business impact is low. This agenda item is needed to prevent the misinterpretation of existing rules.

Rationale: The original inquiry dealt with Addendum 2, Figure F-2, detail g (10th Ed. Addm #3) only. This issue is common to other bar details. Agenda item scope was extended to rim angles. Details a-j, excluding detail f, have been altered to make it clear that members can be wider, but no credit is allowed in the compression area calculation.

Completion of this agenda item was placed on “working” status pending the outcome of Agenda Item 620-267.

Proposal: Modify Figure F-2 per attached figure, dated 11/14/05.

Revisions May 1, 2006:
After Agenda item 620-267 was passed to publication, this agenda item was presented and passed to SCLB. The following table outlines comments received, from the balloting prior to this Spring 2006 meeting, and their resolution:

<table>
<thead>
<tr>
<th>Balloter</th>
<th>Their comment</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nelson Acosta</td>
<td>Technical Negative: As proposed, I feel the added Note 3 is too confusing as it references details a through e and g. To be technically correct based on the details shown in those referenced views, I believe the added Note 3 should be revised to read differently to delete the words “for rim angles “ and add “or 16tb” before applies (as the note actually references views which have either dimension).</td>
<td>Nelson withdrew his negative under the condition that Note 3 be deleted and that details b-e and g all be modified as shown for detail a.</td>
</tr>
<tr>
<td>Bob Hendrix</td>
<td>Technical Affirmative: The term rim angles is also used with floating roofs. Why not just delete &quot;for rim angles&quot;? Doesn't it also apply to detail f?</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. the term 'rim angle' is appropriate for Figure F-2 and for Note 3. Note 3 this intended to apply only to the details using the term 'ta' AND, in those, only the ones with outstanding legs. The term &quot;ta&quot; is defined as footnote in Figure F-2 as applying to &quot;angle legs&quot;. Figure F-2 only has two &quot;pre-approved&quot; shapes to meet API configurations, angles and bars. Other shapes can be used, I suppose, with owner approval. The limit of 16t for bars is covered by revision of details g thru k in my proposed figure.</td>
<td></td>
</tr>
<tr>
<td>John Lieb</td>
<td>Technical Affirmative: The &quot;a&quot; in 16ta&quot; should be shown as a subscript to &quot;a&quot;.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Note 3 has been deleted, therefore moot.</td>
<td></td>
</tr>
<tr>
<td>Tom Lorentz</td>
<td>Technical Affirmative: There is no detail j. Details are consecutive from a through l, then jump to k.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The comment was reviewed and found non persuasive for two reasons.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. The detail headings were part of agenda item 650-545 handled by Mark Baker, went thru committee reviewed and was passed to publication as written. This suggested change is not within the scope of the agenda item.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. I agree with the use of 'k' for the last detail over the use of 'j'. It is common practice is structural shop drawing detailing to omit letters that can be confused with each other. Letters 'i' and 'j' fall into that category.</td>
<td></td>
</tr>
</tbody>
</table>

**Revision 3 changes dated 5/17/06:**

Additional 4 comments received after close of balloting were discussed and resolved as follows:

1. b/t should be measured from roof-to-angle contact point, not from heel. This was determined to be unconservative because the exact location of the contact point varies.
2. limit of 16t should be $95/(F_y)^{1/2}$. This was accepted.
3. Aluminum and duplex steels were not addressed. This was agreed upon. This concern was met by using $95/(F_y)^{1/2}$.
4. Vertical leg of detail f should be limited, same as other unstiffened elements. This was accepted.

Figure F-2 has been revised per attached to meet these new requirements. There are 2 versions, one marked up copy and one "clean" copy. In addition to the above changes, detail g has been altered from how it now appears in Addendum 3, specifically, dimensions for "A", for "B", and the neutral axis have been deleted. These dimensions are needed for frangible roof details a thru e only (see footnote 2)
Figure F-2 Permissible Details of Compression Rings

Notes:
1. All dimensions and thicknesses are in min (in.)
2. Dimension B in details b, d, and e is 0 ≤ B ≤ A.
3. The unstiffened length of the angle or bar, Le, shall be limited to 250/(Fy)^{1/2}, mm (3000/(Fy)^{1/2}, in.) multiplied times t_e for details g or times t_s for details h thru k, where Fy is the minimum specified yield strength, MPa (lbf/in^2).

\[ W_b = \text{maximum width of participating roof,} \]
\[ = 0.3(R_e)^{0.5} \text{ or } 300 \text{ mm (12 in.)}, \text{ whichever is less,} \]
\[ R_e = \text{inside radius of tank shell,} \]
\[ R_s = \text{length of the normal to the roof, measured} \]
\[ \text{from the vertical centerline of the tank,} \]
\[ = R_e/(\sin \theta). \]

Notes:
- \( t_a \) = thickness of angle leg.
- \( t_b \) = thickness of bar.
- \( t_c \) = thickness of shell plate.
- \( t_d \) = thickness of roof plate.
- \( t_e \) = thickness of thickened plate in shell.
- \( W_e \) = maximum width of participating shell.
\[ = 0.6(R_e)^{0.5} \text{ where } t = t_c \text{ or } t_e \text{ as applicable,} \]
Figure F-2 -- Permissible Details of Compression Rings