Title: Revise Corner Radius r1 in Table 5-9 for 36” x 48” FTCO (API 650 11th Edition)

Purpose: Revise the corner radius (r1) in Column-4 of Table 5-9 for the 36” x 48” Flush Type Clean-Outs from 18” to 24” so that it can be used for all material groups and remove restrictions listed in Foot Note “c”.

Source: B. Mistry’s e-mail

Impact: Minor Cost Savings to end users

Rationale: 36”x48” FTCO are very common and they are used on all size of tanks. Presently, we require corner radius r1=18” for Gr. I to IIIA and r1=24” for Gr. IV to VI. There is no reason to have these differences in corner radius if we make corner radius r1=24” for all 36”x48” FTCO. The clear opening area with r1=18” radius is 1589 sq. in. and one with r1=24” radius is 1481 sq. in. Area reduction is only about 7% if corner radius of 24” is used instead of 18” for all 36”x48” FTCO.

The proposed change would save fabrication cost when multiple size tanks are involved on the same project. Gasket inventory can be reduced as well.

Proposed Changes: (See Following Sheets)

The proposed changes are shown on the following sheets as marked up for Tables 5-9a and 5-9b and Section 5.7.7.2

Negatives from Doug Miller, Larry Hiner, Steve Adolphsen and Ron Bailey have been resolved by not increasing the f3 dimension and fixing section 5.7.7.2.
### Table 5-9a—(SI) Dimensions for Flush-Type Cleanout Fittings (mm)

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
<th>Column 6</th>
<th>Column 7</th>
<th>Column 8</th>
<th>Column 9</th>
<th>Column 10</th>
<th>Column 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height of Opening $h$</td>
<td>Width of Opening $b$</td>
<td>Arc Width of Shell Reinforcing Plate $W$</td>
<td>Upper Corner Radius of Shell Reinforcing Plate $R_1$</td>
<td>Upper Corner Radius of Shell Reinforcing Plate $R_2$</td>
<td>Edge Distance of Bolts $e$</td>
<td>Flange Width $f_3$ (Except at Bottom)</td>
<td>Bottom Flange Width $f_4$</td>
<td>Special Bolt Spacing $g$</td>
<td>Number of Bolts</td>
<td>Diameter of Bolts $d$</td>
</tr>
<tr>
<td>203</td>
<td>406</td>
<td>1170</td>
<td>100</td>
<td>360</td>
<td>32</td>
<td>102</td>
<td>89</td>
<td>83</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>610</td>
<td>610</td>
<td>1830</td>
<td>200</td>
<td>740</td>
<td>38</td>
<td>102</td>
<td>95</td>
<td>89</td>
<td>36</td>
<td>20</td>
</tr>
<tr>
<td>919</td>
<td>1219</td>
<td>2700</td>
<td>300</td>
<td>1040</td>
<td>38</td>
<td>114</td>
<td>121</td>
<td>108</td>
<td>46</td>
<td>24</td>
</tr>
<tr>
<td>1270</td>
<td>1219</td>
<td>3200</td>
<td>400</td>
<td>1310</td>
<td>38</td>
<td>114</td>
<td>127</td>
<td>114</td>
<td>52</td>
<td>24</td>
</tr>
</tbody>
</table>

$a$For neck thicknesses greater than 40 mm, increase $f_3$ as necessary to provide a 1.5 mm clearance between the required neck-to-flange weld and the head of the bolt.

$b$Refers to spacing at the lower corners of the cleanout-fitting flange.

$c$Only for Groups IV, IV-A, V, and VI, 600 mm.

For Groups I, II, III, or IIIA shell materials (see 5.7.7.2).

Note: See Figure 5-12.

### Table 5-9b—(USC) Dimensions for Flush-Type Cleanout Fittings (in.)

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
<th>Column 6</th>
<th>Column 7</th>
<th>Column 8</th>
<th>Column 9</th>
<th>Column 10</th>
<th>Column 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height of Opening $h$</td>
<td>Width of Opening $b$</td>
<td>Arc Width of Shell Reinforcing Plate $W$</td>
<td>Upper Corner Radius of Shell Reinforcing Plate $R_1$</td>
<td>Upper Corner Radius of Shell Reinforcing Plate $R_2$</td>
<td>Edge Distance of Bolts $e$</td>
<td>Flange Width $f_3$ (Except at Bottom)</td>
<td>Bottom Flange Width $f_4$</td>
<td>Special Bolt Spacing $g$</td>
<td>Number of Bolts</td>
<td>Diameter of Bolts $d$</td>
</tr>
<tr>
<td>8</td>
<td>16</td>
<td>46</td>
<td>4</td>
<td>14</td>
<td>1$\frac{1}{4}$</td>
<td>4</td>
<td>3$\frac{1}{2}$</td>
<td>3$\frac{1}{2}$</td>
<td>22</td>
<td>3$\frac{1}{4}$</td>
</tr>
<tr>
<td>24</td>
<td>24</td>
<td>72</td>
<td>12</td>
<td>29</td>
<td>1$\frac{1}{2}$</td>
<td>4</td>
<td>3$\frac{3}{4}$</td>
<td>3$\frac{1}{2}$</td>
<td>36</td>
<td>3$\frac{1}{4}$</td>
</tr>
<tr>
<td>36</td>
<td>48</td>
<td>106</td>
<td>18$\frac{1}{2}$</td>
<td>41</td>
<td>1$\frac{1}{2}$</td>
<td>4$\frac{1}{2}$</td>
<td>4$\frac{1}{4}$</td>
<td>4$\frac{1}{4}$</td>
<td>46</td>
<td>1</td>
</tr>
<tr>
<td>48</td>
<td>48</td>
<td>125</td>
<td>24</td>
<td>51$\frac{1}{2}$</td>
<td>1$\frac{1}{2}$</td>
<td>4$\frac{1}{2}$</td>
<td>5</td>
<td>4$\frac{1}{2}$</td>
<td>52</td>
<td>1</td>
</tr>
</tbody>
</table>

$a$For neck thicknesses greater than 1$\frac{1}{16}$ in., increase $f_3$ as necessary to provide a 1$\frac{1}{16}$ in. clearance between the required neck-to-flange weld and the head of the bolt.

$b$Refers to spacing at the lower corners of the cleanout-fitting flange.

$c$Only for Groups I, II, III, or IIIA shell materials (see 5.7.7.2).

Note: See Figure 5-12.

Yield and tensile strengths. When the material strength is greater than or equal to the 70% and 80% minimum values, the area in the neck available for reinforcement shall be reduced by the ratio of the allowable stress in the neck, using the governing stress factors, to the allowable stress in the attached shell plate. No credit may be taken for the additional strength of any reinforcing material that has a higher allowable stress than that of the shell plate. Neck material that has a yield or tensile strength less than the 70% or 80% minimum values may be used, provided that no neck area is considered as effective reinforcement.

#### 5.7.2.4

The following portions of the neck of a fitting may be considered part of the area of reinforcement, except where prohibited by 5.7.2.3, Item e:

- a. The portion extending outward from the outside surface of the tank shell plate to a distance equal to four times the neck-wall thickness or, if the neck-wall thickness is reduced within this distance, to the point of transition.
- b. The portion lying within the shell-plate thickness.
- c. The portion extending inward from the inside surface of the tank shell plate to the distance specified in Item a.

#### 5.7.2.5

The aggregate strength of the weld attaching a fitting to the shell plate, an intervening reinforcing plate, or both shall be at least equal to the proportion of the forces passing through the entire reinforcement that is calculated to pass through the fitting.

#### 5.7.2.6

The aggregate strength of the welds attaching any intervening reinforcing plate to the shell plate shall be at least equal to the proportion of the forces passing through the entire reinforcement that is calculated to pass through the reinforcing plate.
Current Wording:

5.7.7.2 The opening shall be rectangular, but the upper corners of the opening shall have a radius equal to one-half the greatest height of the clear opening. When the shell material is Group I, II, III, or IIIA, the width or height of the clear opening shall not exceed 1200 mm (48 in.); when the shell material is Group IV, IVA, V, or VI, the height shall not exceed 900 mm (36 in.).

Proposed Wording:

5.7.7.2 The opening shall be rectangular, but the upper corners of the opening shall have a radius equal to one-half the greatest height of the clear opening (r1) as shown in tables 5-9a and 5-9b. When the shell material is Group I, II, III, or IIIA, the width or height of the clear opening shall not exceed 1200 mm (48 in.); when the shell material is Group IV, IVA, V, or VI, the height shall not exceed 900 mm (36 in.).
Current Wording:

5.7.7.2 The opening shall be rectangular, but the upper corners of the opening shall have a radius equal to one-half the greatest height of the clear opening. When the shell material is Group I, II, III, or IIIA, the width or height of the clear opening shall not exceed 1200 mm (48 in.); when the shell material is Group IV, IVA, V, or VI, the height shall not exceed 900 mm (36 in.).

Proposed Wording:

5.7.7.2 The opening shall be rectangular, but the upper corners of the opening shall have a radius equal to one-half the greatest height of the clear opening \((r_1)\) as shown in tables 5-9a and 5-9b. When the shell material is Group I, II, III, or IIIA, the width or height of the clear opening shall not exceed 1200 mm (48 in.); when the shell material is Group IV, IVA, V, or VI, the height shall not exceed 900 mm (36 in.).