Case 2901
Evaluation of External Loads on Welding Neck Flanges
Covered by Section VIII, Division 1, UG-44(b), (i), and (j); or Section VIII, Division 2, 4.1.11.1(a) and (g), and 4.1.11.3
Section VIII, Division 1; Section VIII, Division 2

Inquiry: Under what requirements may external loads (forces and bending moments) be evaluated for welding neck flanges chosen in accordance with Section VIII, Division 1, UG-44(b), (i), and (j); or Section VIII, Division 2, 4.1.11.1(a) and (g), and 4.1.11.3?

Reply: It is the opinion of the Committee that external loads (forces and bending moments) may be evaluated for welding neck flanges chosen in accordance with Section VIII, Division 1, UG-44(b), (i), and (j); or Section VIII, Division 2, 4.1.11.1(a) and (g), and 4.1.11.3, provided the following requirements are met:

(a) The actual assembly bolt load (see Section VIII, Division 1, Mandatory Appendix S and Section VIII, Division 2, 4.11.16) shall comply with ASME PCC-1, Appendix O.

(b) The bolt material is SA-193, B8, Class 2 or has a higher allowable stress at the specified bolt size.

(c) The combination of flange design pressure with external moment and external axial tensile force shall satisfy the following equation, and the units of the variables shall be consistent with the pressure rating.

\[16M_E + 4F_E G \leq \pi G R [P_D - P_R] + F_M P_R\]

(d) This Case number shall be recorded on the Manufacturer’s Data Report (Section VIII, Division 1, UG-120) or Manufacturer’s Design Report (Section VIII, Division 2, 2.3.3).

(e) Nomenclature

\[F_E = \text{external tensile axial force}\]
\[M_E = \text{external moment}\]
\[F_M = \text{moment factor in accordance with Table 1}\]
\[G = \text{gasket reaction diameter (see Section VIII, Division 1, Mandatory Appendix 2, 2-3 and Section VIII, Division 2, 4.16.12)}\]
\[P_D = \text{flange design pressure at design temperature}\]
\[P_R = \text{flange pressure rating at design temperature}\]
### Table 1
Moment Factor, $F_M$

<table>
<thead>
<tr>
<th>ASME Standard</th>
<th>Size Range, NPS</th>
<th>Flange Pressure Class</th>
<th>150</th>
<th>300</th>
<th>600</th>
<th>900</th>
<th>1500</th>
<th>2500</th>
</tr>
</thead>
<tbody>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B16.5</td>
<td>≤ 12</td>
<td></td>
<td>1.2</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>&gt; 12 and ≤ 24</td>
<td></td>
<td>1.2</td>
<td>0.5</td>
<td>0.5</td>
<td>0.3</td>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>B16.47, Series A</td>
<td>All</td>
<td></td>
<td>0.6</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>B16.47, Series B ≤ 48</td>
<td>[Note (2)]</td>
<td></td>
<td>0.13</td>
<td>0.13</td>
<td></td>
<td></td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>≥ 48</td>
<td></td>
<td>0.1</td>
<td>[Note (3)]</td>
<td></td>
<td></td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

**GENERAL NOTES:**
(a) The combinations of size ranges and flange pressure classes for which this table gives no moment factor value are outside the scope of this Case.
(b) The designer should consider reducing the allowable factor if the loading is primarily sustained in nature, and the bolted flange joint operates at a temperature where gasket creep/relaxation will be significant [typically above 450°F (232°C) metal temperature].

**NOTES:**
(1) The acceptable edition of the ASME Standard shall be as shown in Table U-3 for Section VIII, Division 1 construction and Table 1.1 for Section VIII, Division 2 construction.
(2) The following value for $F_M$ applies:

$$F_M = 0.1 + \left(\frac{48 - \text{NPS}}{56}\right)$$

(3) $F_M = 0.1$ except NPS 60, Class 300, in which case $F_M = 0.03$. 

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**ASME BPVC.CC.BPV.S4-2017**

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**BPV – SUPP. 4**

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**2 (2901)**