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Evaluation of External Loads on Welding Neck Flanges Covered by Section VIII, Division 1, UG-44 (a)(2), (a)(9), and (a)(10); 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

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, 4.1.1.6) 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.

4.16.11

Nonmandatory

Inquiry: May additional rules for evaluating external loads (forces and moments) on flanged joints with weld neck flanges be used to satisfy the rules of Section VIII, Division 1 or Section VIII, Division 2?

(c) The combination of flange design pressure with external moment and external axial force shall be consistent with the following equation, and shall be consistent with the vessel design pressure (corrected for static pressure acting on the flange)

$$P_D + \frac{16M_E + 4F_E G}{\pi G^3} \leq (1 + F_M)P_R$$

(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 = external tensile axial force

F_M = moment factor in accordance with Table 1

G = gasket reaction diameter (see Section VIII, Division 1, Mandatory Appendix 2, 2-3 and Section VIII, Division 2, 4.16.12)

M_E = external moment

P_D = flange design pressure at design temperature

P_R = flange pressure rating at design temperature

vessel design pressure (corrected for static pressure acting on the flange) at the design temperature

The Committee's function is to establish rules of safety, relating only to pressure integrity, governing the construction of boilers, pressure vessels, transport tanks and nuclear components, and inservice inspection for pressure integrity of nuclear components and transport tanks, and to interpret these rules when questions arise regarding their intent. This Code does not address other safety issues relating to the construction of boilers, pressure vessels, transport tanks and nuclear components, and the inservice inspection of nuclear components and transport tanks. The user of the Code should refer to other pertinent codes, standards, laws, regulations or other relevant documents.

Table 1
Moment Factor, F_M

ASME Standard [Note (1)]	Size Range, NPS	Flange Pressure Class					
		150	300	600	900	1500	2500
B16.5	≤ 12	1.2	0.5	0.5	0.5	0.5	0.5
	> 12 and ≤ 24	1.2	0.5	0.5	0.3	0.3	...
B16.47, Series A	All	0.6	0.1	0.1	0.1	...	...
B16.47, Series B	< 48	[Note (2)]	[Note (2)]	0.13	0.13	...	...
	≥ 48	0.1	[Note (3)]	...	...	...	...

Note to Editors -
General Notes
(a) and (b) stay
with the
replacement
Table 1.

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:

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

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

Table 1 - Code Case 2901 Moment Factor, F_M

Flange Standard and Pressure Class

Size						
NPS (DN)	B16.5, cl.150	B16.5, cl.300	B16.5, cl.600	B16.5, cl.900	B16.5, cl.1500	B16.5, cl.2500
½ (15)	23.0	11.5	5.7	7.1	4.2	2.5
¾ (20)	15.3	9.1	4.4	4.3	2.5	1.5
1 (25)	13.9	7.8	3.7	3.9	2.3	1.4
1½ (40)	5.5	5.1	2.4	2.7	1.5	1.0
2 (50)	5.6	4.3	2.1	2.7	1.6	1.0
2½ (65)	4.0	3.8	1.8	2.4	0.73	0.98
3 (80)	2.5	3.0	1.4	1.4	1.0	0.75
4 (100)	3.3	1.8	1.3	1.3	0.84	0.66
5 (125)	3.4	1.1	1.1	1.1	0.75	0.64
6 (150)	2.3	1.2	1.2	1.0	0.66	0.59
8 (175)	1.2	0.94	0.85	0.8	0.54	0.57
10 (250)	1.9	1.2	1.0	0.59	0.47	0.64
12 (300)	1.2	1.1	0.84	0.61	0.53	0.5
14 (350)	1.4	1.2	0.9	0.54	0.6	-
16 (400)	1.4	1.1	0.79	0.41	0.52	-
18 (450)	1.4	0.98	0.66	0.46	0.44	-
20 (500)	1.5	0.72	0.65	0.32	0.42	-
24 (600)	1.3	0.78	0.51	0.37	0.38	-
	B16.47A, cl.150	B16.47A, cl.300	B16.47A, cl.600	B16.47A, cl.900	B16.47A_1500	B16.47A_2500
26 (650)	0.90	0.50	0.33	0.34	-	-
28 (700)	0.85	0.42	0.28	0.38	-	-
30 (750)	0.74	0.43	0.22	0.26	-	-
32 (800)	1.1	0.44	0.21	0.29	-	-
34 (850)	1.1	0.49	0.25	0.32	-	-
36 (900)	0.90	0.50	0.22	0.23	-	-
38 (950)	0.76	0.25	0.20	0.21	-	-
40 (1000)	0.79	0.29	0.22	0.16	-	-
42 (1050)	0.72	0.22	0.20	0.20	-	-
44 (1100)	0.66	0.24	0.23	0.13	-	-
46 (1150)	0.62	0.21	0.17	0.15	-	-
48 (1200)	0.64	0.23	0.15	0.10	-	-
50 (1250)	0.92	0.25	0.14	-	-	-
52 (1300)	0.82	0.20	0.18	-	-	-
54 (1350)	0.72	0.22	0.13	-	-	-
56 (1400)	0.75	0.17	0.20	-	-	-
58 (1450)	0.66	0.18	0.14	-	-	-
60 (1500)	0.68	0.16	0.11	-	-	-
	B16.47B, cl.150	B16.47B, cl.300	B16.47B, cl.600	B16.47B, cl.900	B16.47B_1500	B16.47B_2500
26 (650)	0.47	0.55	0.16	0.14	-	-
28 (700)	0.44	0.53	0.20	0.18	-	-
30 (750)	0.35	0.57	0.15	0.22	-	-
32 (800)	0.37	0.55	0.16	0.13	-	-
34 (850)	0.36	0.46	0.14	0.16	-	-
36 (900)	0.36	0.43	0.18	0.15	-	-
38 (950)	0.42	0.29	-	-	-	-
40 (1000)	0.41	0.25	-	-	-	-
42 (1050)	0.41	0.22	-	-	-	-
44 (1100)	0.39	0.20	-	-	-	-
46 (1150)	0.29	0.16	-	-	-	-
48 (1200)	0.30	0.27	-	-	-	-
50 (1250)	0.30	0.11	-	-	-	-
52 (1300)	0.28	0.11	-	-	-	-
54 (1350)	0.21	0.25	-	-	-	-
56 (1400)	0.23	0.12	-	-	-	-
58 (1450)	0.12	0.09	-	-	-	-
60 (1500)	0.13	0.03	-	-	-	-