Unbalanced Flange Moment at Diameter $B_1$

$$M_{u1} = 1.206 E_1 \theta_{b1} \frac{A}{B_1}$$

(27)

Balanced Flange Moment at Diameter $B_1$

$$M_{b1} = M_{S1} - M_{u1}$$

(29)

Slope of Flange at Diameter $B_1$ Times $E$

$$E_1 \theta_{b1} = \frac{5.46}{\pi t_1^3} \left(5M_{b1} + J_{pMP} + E_1 \theta_{b1} / \pi t_1^3 \right)$$

(31)

Contact Force Between Flanges at $h_C$

$$H_C = \left( M_P + M_{b1} \right) / h_C$$

(33)

Bolt Load at Operating Conditions

$$W_{m1} = H + H_G + H_C$$

(34)

Operating Bolt Stress

$$\sigma_b = W_{m1} / A_b$$

(35)

Design Prestress in Bolts

$$S_i = \sigma_b - 1.159h_C^2 \left( \frac{M_P + M_{b1}}{2(1 - x) \pi C t_1^3} \right) t_1 B_1$$

(36)

Radial Stress in Flange I at Bolt Circle

$$S_{RI} = \frac{6(M_P + M_{S1})}{\pi t_1^2 (\pi C - nD)}$$

(37)

Radial Stress in Flange I at Inside Diameter

$$S_{RI} = - \left( \frac{2F_Y}{h_0 + F_Y} + 6 \right) \frac{M_{S1} \pi B_1^2}{\pi B_1 t_1^2}$$

(38a)

$$S_{RI} = - \left( \frac{2F_Y t_1}{h_0 + F_Y t_1} + 6 \right) \frac{M_{S1} \pi B_1^2}{\pi B_1 t_1^2}$$

(38b)

$$S_{RI} = 0$$

(38c)

Tangential Stress in Flange I at Inside Diameter

$$S_{TI} = \frac{t_1 E_1 \theta_{b1}}{B_1} + \left( \frac{2F_Y Z}{h_0 + F_Y} - 1.8 \right) \frac{M_{S1} \pi B_1^2}{\pi B_1 t_1^2}$$

(39a)

Longitudinal Hub Stress in Flange I

$$S_{HI} = \frac{h_0 E_1 \theta_{b1} l}{0.91 \left( g_1 / g_0 \right) B_1 V}$$

(40a)

Radial Stress in Flange II at Bolt Circle

$$S_{RII} = \frac{6(M_P + M_{S1})}{\pi t_1^2 (\pi C - nD)}$$

(41)

Radial Stress in Flange II at Diameter $B_1$

$$S_{R2} = \frac{M_{b1} l}{\pi t_1^2 (\pi C - nD)}$$

(42)

Tangential Stress in Flange II at Diameter $B_1$

$$S_{TI} = \frac{t_1 E_1 \theta_{b1}}{B_1} - 1.8 \frac{M_{S1} \pi B_1^2}{\pi B_1 t_1^2}$$

(43)

Radial and Tangential Stress at Center of Flange II

$$S_{R1} = S_{TI} = \frac{3.094PB_1^2}{\pi t_1^2} - \frac{6M_{SII}}{\pi B_1 t_1^2}$$

(44)

(b) The thickness of Flange II of a Group 3 assembly determined by the above rules shall be used in lieu of the thickness that is determined by the minimum thickness equations for flat heads and covers of the applicable Division. However, any centrally located opening in Flange II shall be reinforced to meet the rules of Mandatory Appendix XIX.

L-3250 ALLOWABLE FLANGE DESIGN STRESSES

The stresses calculated by the above equations, whether tensile or compressive (−), shall not exceed the following values for all groups of assemblies:

(a) operating bolt stress $\sigma_b$ not greater than $S_b$ for the design value of $S_i$

(b) longitudinal hub stress $S_H$ not greater than $S_f$ for Category 1 and 2 cast iron flanges except as otherwise limited by (1) and (2) below and not greater than 1.5 $S_f$ for materials other than cast iron

(1) longitudinal hub stress $S_H$ not greater than the smaller of 1.5 $S_f$ or 1.5 $S_n$ for Category 1 flanges where the pipe or shell constitutes the hub