TUBESHEET ANALYSIS - A PROPOSED ASME DESIGN PROCEDURE

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ABSTRACT

A simplified design procedure is presented to determine tubesheet thickness in U-tube, Floating Head

and Fixed Tubesheet shell and tube exchangers. The pro-

a fully integral or one-side integral construction, neglects the effect of radial differential thermal expansion, and currently does not include the effect of variations in the ligament efficiency in the perforated

region stress field. Therefore, questionable results

TUBESHEET ANALYSIS - INITIAL REMARKS

We note that x_a represents the ratio of the axial stiffness of the tube bundle to the bending rigidity the following relation holds between edge shear force

$$N_s b = aV_a + p_T \frac{b^2}{2} + \Delta p(b^2-a^2)/2; \; \Delta p = p_S - p_T \qquad (8)$$

The net moment M_R, acting on the ring at radius R* in the direction of the ring rotation ϕ_R, is now constructed. For example, for two-side integral construction, the net moment has the form: (see Fig. 2a)

$$- b \left(M_S - \frac{h}{2} Q_S\right)$$

For any class of construction, the relation between the ring moment M_R and the ring rotation ϕ_R is

$$\phi_R = 12\, R^* M_R/Eh^3 \, \ell n\, (a_1/a) \qquad (9b)$$

Cylindrical shell theory is used to describe the edge displacement and rotation of the shell and head in terms of shell and head edge moments and shears, local

$$\theta(a) = \theta(x_a) = \phi_R \qquad (12)$$

which yields the result

$$M_a = aV_a Q_1 + Q_2 \qquad (13)$$

where

$$K-1 - \Phi Z_V(x_a) \quad \ldots \quad 1-\nu^2 \ldots$$

and

$$Q_2 = \frac{a^2(p_T \gamma_T^{**} + p_T^{TH} \gamma_T^{*} + p_S \gamma_S^{**} - p_S^{TH} \gamma_S^{*}) + Bd_b \gamma_B}{1 + \Phi Z_M(x_a)} \qquad (15)$$

For a fixed tubesheet exchanger or for the stationary tubesheet of a floating head exchanger, Z_V and Z_M are complex expressions involving Ber and Bei Bessel functions evaluated at x_a. Figures 3a,3b illustrate these functions for $\nu^* = 0.4$. For a U-tube exchanger an appropriate limiting process for $x_a \rightarrow 0$ yields the analy-

$\rho(x) = Z(x) + (k\ 1)\ Z(x)$ [illegible]

[illegible]

REMARKS

15. Stoomwezen (Dutch Pressure Vessel Code): "Rules for Pressure Vessels", 1973.