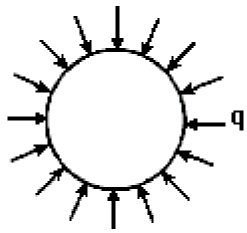
Table 35 Formulas for elastic stability of plates and shells

Case 19a Thin Tube Under Uniform Lateral External Pressure; Very Long Tube with Free Ends

Thin tube under uniform lateral external pressure



Notation file Provides a description of Table 35 and the notation used.

Enter dimensions and properties

Plate dimensions:

radius: $r := 6.75 \cdot in$

axial length: $L := 100000 \cdot in$

wall thickness: $t := 0.375 \cdot in$

Modulus of elasticity: $E := 29 \cdot 10^{6} \cdot \frac{lbf}{in^{2}}$

Poisson's ratio: $\nu := 0.290$

Calculation procedure

For this procedure, the ratio (r/t) must be greater than 10:

$$\frac{r}{t} = 18$$

The critical pressure is found by the following equation. If the condition doesn't hold, the critical pressure must be found experimentally:

$$q_{critical} := \frac{1}{4} \cdot \frac{E}{1 - \nu^2} \cdot \frac{t^3}{r^3} \cdot \left(L > 4.90 \cdot r \cdot \sqrt{\frac{r}{t}} \right)$$

$$q_{critical} = 1.357 \times 10^3 \frac{lbf}{in^2}$$

$$CriticalDepth := \frac{q_{critical}}{\left(\frac{1atm}{33.ft} \right)} = 3048\,ft$$

References

Ref. 19. Saunders, H. E., and D. F. Windenberg: Strength of Thin Cylindrical Shells Under External Pressure, *Trans. ASME,* vol. 53, no. 15, p. 207, 1931.