Thin cylinder

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A cylindrical vessel whose thickness of the wall is less than 1/15 to 1/20 of its internal diameter is known as a thin cylinder.

Thin cylinder assumption

1)The thickness of wall is less than 1/15 to 1/20 of its internal diameter.

2)The stress distribution over the thickness of the wall is assumed uniform.

Thin cylinder stress

1)Circumferential stress (also called as hoop stress) and

2)Longitudinal stress.

Circumferential stress and longitudinal stress

The stress acting along the circumference of the cylinder is calledcircumferential stress (or hoop stress) whereas the stress acting along the length of the cylinder is known as longitudinal stress.

Stress formula for thin cylinder

1)Circumferential stress, $\sigma_c = \frac{pd}{2t}$

2)Longitudinal stress $\sigma_l = \frac{pd}{4t}$

where, P = Internal pressure in N/mm^2

d = Internal diameter of shell in mm

t = Thickness of wall in mm

Shear stress formula

Maximum shear stress, $\tau_{max} = \frac{pd}{8t}$

Internal pressure of thin cylinder

1)Change in diameter, $\delta_d = \frac{pd^2}{2tE}\left(1-\frac{1}{2m}\right)$

2)Change in length, $\delta_l = \frac{pd\ell}{2tE}\left(\frac{1}{2}-\frac{1}{m}\right)$

Hoop stress in a thin cylinder

1.The resisting section of the cylinder to be increased.

2.The walls of the cylinder to be winded by strong steel wire under tension to put the cylinder wall under an initial compressive stress.