

Thin-Wall Pressure Vessels

Mechanical Engineering

Hoop and axial stress, and why a cylinder splits along its length.

In a thin cylinder the hoop stress is twice the axial stress, which is why they split lengthwise.

hoop = $p r \div t$ · axial = $p r \div 2t$ · sphere = $p r \div 2t$

$p = 2 \text{ MPa}$, $r = 500$, $t = 10$

Axial = 50 MPa.

Hoop = 100 MPa

Thin-wall valid when

Else thick-wall theory.

t below $r \div 10$

Sphere, same p , r , t

Best pressure shape.

Half the cylinder hoop

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× **Substituting the diameter for r**

✓ **r is the radius**

Using the diameter doubles every stress in the answer. Check the magnitude against the material before you trust it.

Assumes a thin wall, internal pressure and no end bending. Pressure vessel codes govern real design.