

# Pressure Vessels p404

Tuesday, 31 May 2011  
8:23 PM

**BOLTED JOINTS (Revision)**

**AXIAL OR SPHERE STRESS**  
 $f = \frac{PD}{4t}$   
 P = pressure  
 D = diameter  
 t = thickness

**HOOP STRESS (CYL)**  
 $f = \frac{PD}{2t}$   
 HOOP = 2x AXIAL

**ASSUMPTIONS**  
 → t is small (thin-walled pressure vessel)  
 → D or ID

**32.5**

p = 900 kPa = 0.9 MPa  
 Plate  $f_a = 80 \text{ MPa}$  allowable not rated  
 Weld  $f = 0.9 \times 80 = 72 \text{ MPa}$

$$f = \frac{PD}{2t} \rightarrow t = \frac{PD}{2f}$$

$$= \frac{0.9 \times 800}{2 \times 72}$$

$$= 5 \text{ mm}$$

**Q11: This fire extinguisher is tested at 2.5 MPa. Assume a safety factor of 2.1 over yield strength 750 MPa and weld efficiency of 73%. Find thickness.**

MPa!!!!!!!!!!!!



Hoop Stress =  $\frac{PD}{2t}$  (Cylinders)

Axial Stress =  $\frac{PD}{4t}$  (Spheres)

$f = \frac{pD}{2t}$

Allowable stress =  $\frac{750}{2.1} = 357.1429$

Welds:  $357.1429 \times 0.73 = 260.7143 \text{ MPa}$

$t = \frac{PD}{2f} = \frac{2.5 \times 178}{(2 \times 260.7143)} = 0.8534 \text{ mm}$

**Q13: With a diameter of 21 mm and a wall thickness of 1.9 mm, what pressure would burst this annealed copper pipe?**



Hoop Stress =  $\frac{PD}{2t}$  (Cylinders)

$f = \frac{PD}{2t}$

D = 21mm, t = 1.9, P = ?

Stress? Annealed Copper, Tensile, Ultimate (Get-

Info) => 250MPa

[http://www.learneasy.info/MDME/iTester/get-info/materials\\_general.html](http://www.learneasy.info/MDME/iTester/get-info/materials_general.html)

$$f = pD/2t$$

$$p = 2 * f * t / D$$

$$= 2 * 250 * 1.9 / 21 = 45.2381 \text{ MPa}$$

Q14: Determine the thickness of steel plate with allowable stress of 50 MPa. Diameter is 1110 mm and pressure is 560 kPa.

f

t

D

P

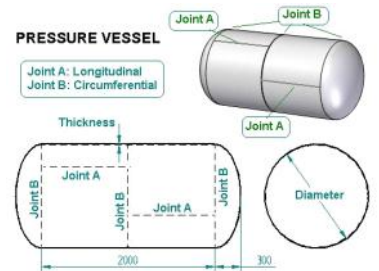
Hoop Stress =  $PD/2t$  (Cylinders)

$$f = pD/2t$$

$$t = pD/(2f)$$

$$= 0.56 * 1110 / (2 * 50)$$

$$= 6.216 \text{ mm}$$



Q15: This steam boiler has a diameter of 1220 mm and plate thickness of 13 mm. If the UTS is 490 MPa and safety factor 4.7, find the safe steam pressure. P ?

D

t

P ?

$$f = 490 / 4.7 = 104.2553 \text{ MPa}$$

$$P = 2ft/D$$

$$= 2 * 104.2553 * 13 / 1220 = 2.2218 \text{ MPa}$$