

Important Design of Pressure Vessel Subjected to Internal Pressure Formulas PDF



Formulas Examples with Units

List of 17

Important Design of Pressure Vessel Subjected to Internal Pressure Formulas

1) Bolt Circle Diameter Formula ↻

Formula

$$B = G_o + (2 \cdot d_b) + 12$$

Example with Units

$$4.112 \text{ m} = 1.1 \text{ m} + (2 \cdot 1.5 \text{ m}) + 12$$

Evaluate Formula ↻

2) Circumferential Stress (Hoop Stress) in Cylindrical Shell Formula ↻

Formula

$$\sigma_c = \frac{P_{\text{Internal}} \cdot D}{2} \cdot t_c$$

Example with Units

$$1625.7 \text{ Pa} = \frac{270.95 \text{ Pa} \cdot 5 \text{ m}}{2} \cdot 2.4 \text{ m}$$

Evaluate Formula ↻

3) Coefficient Value for Thickness of Flange Formula ↻

Formula

$$k = \left(\frac{1}{(0.3) + \frac{1.5 \cdot W_m \cdot h_G}{H_{\text{gasket}} \cdot G}} \right)$$

Example with Units

$$0.4561 = \left(\frac{1}{(0.3) + \frac{1.5 \cdot 1000 \text{ N} \cdot 1.82 \text{ m}}{3136 \text{ N} \cdot 0.46 \text{ m}}} \right)$$

Evaluate Formula ↻

4) Diameter of Gasket at Load Reaction Formula ↻

Formula

$$G = G_o - 2 \cdot b$$

Example with Units

$$0.46 \text{ m} = 1.1 \text{ m} - 2 \cdot 0.32 \text{ m}$$

Evaluate Formula ↻

5) Effective Thickness of Conical Head Formula ↻

Formula

$$t_e = t_{ch} \cdot (\cos(A))$$

Example with Units

$$1.576 \text{ m} = 3 \text{ m} \cdot (\cos(45 \text{ rad}))$$

Evaluate Formula ↻

6) Gasket Factor Formula ↻

Formula

$$m = \frac{W - A_2 \cdot P_{\text{test}}}{A_1 \cdot P_{\text{test}}}$$

Example with Units

$$2.381 = \frac{97 \text{ N} - 13 \text{ m}^2 \cdot 0.39 \text{ Pa}}{99 \text{ m}^2 \cdot 0.39 \text{ Pa}}$$

Evaluate Formula ↻



7) Hoop Strain Formula

Formula

$$E = \frac{l_2 - l_0}{l_0}$$

Example with Units

$$0.4286 = \frac{10_m - 7_m}{7_m}$$

Evaluate Formula 

8) Hydrostatic End Force using Design Pressure Formula

Formula

$$H = \left(\frac{\pi}{4} \right) \cdot \left(h_G^2 \right) \cdot P_i$$

Example with Units

$$2.5E+7_N = \left(\frac{3.1416}{4} \right) \cdot \left(1.82_m^2 \right) \cdot 9.8_{MPa}$$

Evaluate Formula 

9) Internal Pressure of Cylindrical Vessel given Hoop Stress Formula

Formula

$$P_{HoopStress} = \frac{2 \cdot \sigma_c \cdot t_c}{D}$$

Example with Units

$$1560.672_{Pa} = \frac{2 \cdot 1625.7_{Pa} \cdot 2.4_m}{5_m}$$

Evaluate Formula 

10) Internal Pressure of Vessel given Longitudinal Stress Formula

Formula

$$P_{LS} = \frac{4 \cdot \sigma_l \cdot t_c}{D}$$

Example with Units

$$51776.64_{Pa} = \frac{4 \cdot 26967_{Pa} \cdot 2.4_m}{5_m}$$

Evaluate Formula 

11) Longitudinal Stress (Axial Stress) in Cylindrical Shell Formula

Formula

$$\sigma_{CylindricalShell} = \frac{P_{LS} \cdot D}{4} \cdot t_c$$

Example with Units

$$155329.92_{Pa} = \frac{51776.64_{Pa} \cdot 5_m}{4} \cdot 2.4_m$$

Evaluate Formula 

12) Maximum Bolt Spacing Formula

Formula

$$b_{s(max)} = 2 \cdot d_b + \left(6 \cdot \frac{t_f}{m} + 0.5 \right)$$

Example with Units

$$303.5_m = 2 \cdot 1.5_m + \left(6 \cdot \frac{100_m}{2} + 0.5 \right)$$

Evaluate Formula 

13) Minimum Bolt Spacing Formula

Formula

$$b_{s(min)} = 2.5 \cdot d_b$$

Example with Units

$$3.75_m = 2.5 \cdot 1.5_m$$

Evaluate Formula 

14) Outside Diameter of Flange using Bolt Diameter Formula

Formula

$$D_{f0} = B + 2 \cdot d_b + 12$$

Example with Units

$$7.112_m = 4.1_m + 2 \cdot 1.5_m + 12$$

Evaluate Formula 



15) Radial Distance from Gasket Load Reaction to Bolt Circle Formula

Formula

$$h_G = \frac{B - G}{2}$$

Example with Units

$$1.82 \text{ m} = \frac{4.1 \text{ m} - 0.46 \text{ m}}{2}$$

Evaluate Formula 

16) Wall Thickness of Cylindrical Shell Given Hoop Stress Formula

Formula

$$t_{\text{hoopstress}} = \frac{2 \cdot P_{\text{HoopStress}} \cdot D}{\sigma_c}$$

Example with Units

$$9.6 \text{ m} = \frac{2 \cdot 1560.672 \text{ Pa} \cdot 5 \text{ m}}{1625.7 \text{ Pa}}$$

Evaluate Formula 

17) Wall Thickness of Pressure Vessel given Longitudinal Stress Formula

Formula

$$t_{\text{longitudinalstress}} = \frac{P_{\text{Internal}} \cdot D}{4 \cdot \sigma_l}$$

Example with Units

$$0.0126 \text{ Pa} = \frac{270.95 \text{ Pa} \cdot 5 \text{ m}}{4 \cdot 26967 \text{ Pa}}$$

Evaluate Formula 



Variables used in list of Design of Pressure Vessel Subjected to Internal Pressure Formulas above

- **A** Apex Angle (Radian)
- **A₁** Gasket Area (Square Meter)
- **A₂** Inside Area of Gasket (Square Meter)
- **b** Effective Gasket Seating Width (Meter)
- **B** Bolt Circle Diameter (Meter)
- **b_{s(max)}** Maximum Bolt Spacing (Meter)
- **b_{s(min)}** Minimum Bolt Spacing (Meter)
- **D** Mean Diameter of Shell (Meter)
- **d_b** Nominal Bolt Diameter (Meter)
- **D_{fo}** Outside Flange Diameter (Meter)
- **E** Hoop Strain
- **G** Diameter of Gasket at Load Reaction (Meter)
- **G_o** Outside Diameter of Gasket (Meter)
- **H** Hydrostatic End Force (Newton)
- **h_G** Radial Distance (Meter)
- **H_{gasket}** Hydrostatic End Force in Gasket Seal (Newton)
- **k** Coefficient Value for Thickness of Flange
- **l₀** Initial Length (Meter)
- **l₂** Final Length (Meter)
- **m** Gasket Factor
- **P_{HoopStress}** Internal Pressure given Hoop Stress (Pascal)
- **P_i** Internal Pressure (Megapascal)
- **P_{Internal}** Internal Pressure for Vessel (Pascal)
- **P_{LS}** Internal Pressure given Longitudinal Stress (Pascal)
- **P_{test}** Test Pressure (Pascal)
- **t_c** Thickness of Cylindrical Shell (Meter)
- **t_{ch}** Thickness of Conical Head (Meter)
- **t_e** Effective Thickness (Meter)
- **t_f** Thickness of Flange (Meter)

Constants, Functions, Measurements used in list of Design of Pressure Vessel Subjected to Internal Pressure Formulas above

- **constant(s):** pi, 3.14159265358979323846264338327950288
Archimedes' constant
- **Functions:** cos, cos(Angle)
Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- **Measurement: Length** in Meter (m)
Length Unit Conversion 
- **Measurement: Area** in Square Meter (m²)
Area Unit Conversion 
- **Measurement: Pressure** in Pascal (Pa), Megapascal (MPa)
Pressure Unit Conversion 
- **Measurement: Force** in Newton (N)
Force Unit Conversion 
- **Measurement: Angle** in Radian (rad)
Angle Unit Conversion 
- **Measurement: Stress** in Pascal (Pa)
Stress Unit Conversion 



- **$t_{\text{choopstress}}$** Thickness of Shell for Hoop Stress (Meter)
- **$t_{\text{longitudinalstress}}$** Thickness of Shell for Longitudinal Stress (Pascal)
- **W** Total Fastener Force (Newton)
- **W_m** Maximum Bolt Loads (Newton)
- **σ_c** Circumferential Stress (Pascal)
- **$\sigma_{\text{CylindricalShell}}$** Longitudinal Stress for Cylindrical Shell (Pascal)
- **σ_l** Longitudinal Stress (Pascal)



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