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Design of Pressure Vessels Formulas

Calculators! Examples! Conversions!

List of 52 Design of Pressure Vessels Formulas

Design of Pressure Vessels

Bernie's and Clavarino's Equation

1) Inner Diameter of Pressurized Cylinder from Bernie's Equation

Open Calculator

fx $$d_i = \frac{2 \cdot t_w}{\left(\left(\frac{\sigma_t + ((1-(\nu) \cdot P_i))}{\sigma_t - ((1+\nu) \cdot P_i)} \right)^{0.5} \right) - 1}$$

ex $$755.2067\text{mm} = \frac{2 \cdot 30\text{mm}}{\left(\left(\frac{75\text{N/mm}^2 + ((1-(0.3) \cdot 10.2\text{MPa}))}{75\text{N/mm}^2 - ((1+0.3) \cdot 10.2\text{MPa})} \right)^{0.5} \right) - 1}$$

2) Inner Diameter of Pressurized Cylinder from Clavarino's Equation

Open Calculator

fx $$d_i = \frac{2 \cdot t_w}{\left(\left(\frac{\sigma_t + ((1-(2 \cdot \nu) \cdot P_i))}{\sigma_t - ((1+\nu) \cdot P_i)} \right)^{0.5} \right) - 1}$$

ex $$1066.826\text{mm} = \frac{2 \cdot 30\text{mm}}{\left(\left(\frac{75\text{N/mm}^2 + ((1-(2 \cdot 0.3) \cdot 10.2\text{MPa}))}{75\text{N/mm}^2 - ((1+0.3) \cdot 10.2\text{MPa})} \right)^{0.5} \right) - 1}$$

3) Thickness of Pressurized Cylinder from Bernie's Equation

Open Calculator

fx $$t_w = \left(\frac{d_i}{2} \right) \cdot \left(\left(\left(\frac{\sigma_t + ((1-(\nu) \cdot P_i))}{\sigma_t - ((1+\nu) \cdot P_i)} \right)^{0.5} \right) - 1 \right)$$

ex $$18.47176\text{mm} = \left(\frac{465\text{mm}}{2} \right) \cdot \left(\left(\left(\frac{75\text{N/mm}^2 + ((1-(0.3) \cdot 10.2\text{MPa}))}{75\text{N/mm}^2 - ((1+0.3) \cdot 10.2\text{MPa})} \right)^{0.5} \right) - 1 \right)$$

4) Thickness of Pressurized Cylinder from Clavarino's Equation

Open Calculator

fx $$t_w = \left(\frac{d_i}{2}\right) \cdot \left(\left(\left(\left(\frac{\sigma_t + ((1 - (2 \cdot \nu) \cdot P_i))}{\sigma_t - ((1 + \nu) \cdot P_i)}\right)^{0.5}\right) - 1\right)\right)$$

ex $$13.07617\text{mm} = \left(\frac{465\text{mm}}{2}\right) \cdot \left(\left(\left(\left(\frac{75\text{N/mm}^2 + ((1 - (2 \cdot 0.3) \cdot 10.2\text{MPa}))}{75\text{N/mm}^2 - ((1 + 0.3) \cdot 10.2\text{MPa})}\right)^{0.5}\right) - 1\right)\right)$$

Bolt of Pressurized Cylinder

5) Change in External Load due to Pressure Inside Cylinder given kb and kc

Open Calculator

fx $$\Delta P_i = P_{ext} \cdot \left(\frac{k_b}{k_c + k_b}\right)$$

ex $$5193.662\text{N} = 25000\text{N} \cdot \left(\frac{1180\text{kN/mm}}{4500\text{kN/mm} + 1180\text{kN/mm}}\right)$$

6) Change in External Load on Bolt due to Pressure Inside Cylinder

Open Calculator

fx $$\Delta P_i = P_b - P_l$$

ex $$4500\text{N} = 24500\text{N} - 20000\text{N}$$

7) Decrease in Outer Diameter of Cylinder given Total deformation in Pressure Vessel

Open Calculator

fx $$\delta_c = \delta - \delta_j$$

ex $$0.8\text{mm} = 1.20\text{mm} - 0.4\text{mm}$$

8) External Load on Bolt due to Internal Pressure given kb and kc

Open Calculator

fx $$P_{ext} = \Delta P_i \cdot \left(\frac{k_c + k_b}{k_b}\right)$$

ex $$24308.47\text{N} = 5050\text{N} \cdot \left(\frac{4500\text{kN/mm} + 1180\text{kN/mm}}{1180\text{kN/mm}}\right)$$

9) Initial Preload due to Bolt tightening

Open Calculator

fx $$P_l = P_b - \Delta P_i$$

ex $$19450N = 24500N - 5050N$$

10) Initial Preload due to Bolt tightening given kb and kc

Open Calculator

fx $$P_l = P_{max} \cdot \left(\frac{k_b}{k_c + k_b} \right)$$

ex $$5235.211N = 25200N \cdot \left(\frac{1180kN/mm}{4500kN/mm + 1180kN/mm} \right)$$

11) Internal Diameter of Pressurized Cylinder

Open Calculator

fx $$d_i = 2 \cdot \frac{t_w}{\left(\left(\frac{\sigma_t + P_i}{\sigma_t - P_i} \right)^{\frac{1}{2}} \right) - 1}$$

ex $$409.1269mm = 2 \cdot \frac{30mm}{\left(\left(\frac{75N/mm^2 + 10.2MPa}{75N/mm^2 - 10.2MPa} \right)^{\frac{1}{2}} \right) - 1}$$

12) Maximum Load inside Pressurized Cylinder when Joint is on verge of opening

Open Calculator

fx $$P_{max} = P_l \cdot \left(\frac{k_c + k_b}{k_b} \right)$$

ex $$96271.19N = 20000N \cdot \left(\frac{4500kN/mm + 1180kN/mm}{1180kN/mm} \right)$$

13) Resultant Load on Bolt given Pre load

Open Calculator

fx $$P_b = P_l + \Delta P_i$$

ex $$25050N = 20000N + 5050N$$

14) Thickness of Pressurized Cylinder

Open Calculator

fx $$t_w = \left(\frac{d_i}{2}\right) \cdot \left(\left(\left(\left(\frac{\sigma_t + P_i}{\sigma_t - P_i}\right)^{\frac{1}{2}}\right) - 1\right)\right)$$

ex $$34.097\text{mm} = \left(\frac{465\text{mm}}{2}\right) \cdot \left(\left(\left(\left(\frac{75\text{N/mm}^2 + 10.2\text{MPa}}{75\text{N/mm}^2 - 10.2\text{MPa}}\right)^{\frac{1}{2}}\right) - 1\right)\right)$$

Gasket Joint

15) Approximate Stiffness of Cylinder Cover, Cylinder Flange and Gasket

Open Calculator

fx $$K = (2 \cdot \pi \cdot (d^2)) \cdot \left(\frac{E}{t}\right)$$

ex $$5089.38\text{kN/mm} = \left(2 \cdot \pi \cdot \left((15\text{mm})^2\right)\right) \cdot \left(\frac{90000\text{N/mm}^2}{25\text{mm}}\right)$$

16) Combined Stiffness of Cylinder Cover, Cylinder Flange and Gasket

Open Calculator

fx $$k_c = \frac{1}{\left(\frac{1}{k_1}\right) + \left(\frac{1}{k_2}\right) + \left(\frac{1}{k_g}\right)}$$

ex $$4721.105\text{kN/mm} = \frac{1}{\left(\frac{1}{10050\text{kN/mm}}\right) + \left(\frac{1}{11100\text{kN/mm}}\right) + \left(\frac{1}{45000\text{kN/mm}}\right)}$$

17) Increase in Inner Diameter of Jacket given Total deformation of Pressure Vessel

Open Calculator

fx $$\delta_j = \delta - \delta_c$$

ex $$0.4\text{mm} = 1.20\text{mm} - 0.80\text{mm}$$

18) Nominal Diameter of Gasket Joint

Open Calculator

fx $$d = \sqrt{K \cdot \frac{t}{2 \cdot \pi \cdot E}}$$

ex $$15.00091\text{mm} = \sqrt{5090\text{kN/mm} \cdot \frac{25\text{mm}}{2 \cdot \pi \cdot 90000\text{N/mm}^2}}$$

19) Nominal Diameter of Gasket Joint Bolt given Stiffness, total thickness and Young's Modulus

Open Calculator

fx $$d = \sqrt{k_b \cdot 4 \cdot \frac{l}{\pi \cdot E}}$$

ex $$30.30094\text{mm} = \sqrt{1180\text{kN/mm} \cdot 4 \cdot \frac{55\text{mm}}{\pi \cdot 90000\text{N/mm}^2}}$$

20) Stiffness of Bolt of Gasket Joint given Nominal Diameter, Total Thickness, and Young's Modulus

Open Calculator

fx $$k_b = \left(\pi \cdot \frac{d^2}{4}\right) \cdot \left(\frac{E}{l}\right)$$

ex $$289.1693\text{kN/mm} = \left(\pi \cdot \frac{(15\text{mm})^2}{4}\right) \cdot \left(\frac{90000\text{N/mm}^2}{55\text{mm}}\right)$$

21) Stiffness of Cylinder Cover of Gasket Joint

Open Calculator

fx $$k_1 = \frac{1}{\left(\frac{1}{k_c}\right) - \left(\left(\frac{1}{k_2}\right) + \left(\frac{1}{k_g}\right)\right)}$$

ex $$9098.361\text{kN/mm} = \frac{1}{\left(\frac{1}{4500\text{kN/mm}}\right) - \left(\left(\frac{1}{11100\text{kN/mm}}\right) + \left(\frac{1}{45000\text{kN/mm}}\right)\right)}$$

22) Stiffness of Cylinder Flange of Gasket Joint

Open Calculator

fx $$k_2 = \frac{1}{\left(\frac{1}{k_c}\right) - \left(\left(\frac{1}{k_1}\right) + \left(\frac{1}{k_g}\right)\right)}$$

ex $$9950.495\text{kN/mm} = \frac{1}{\left(\frac{1}{4500\text{kN/mm}}\right) - \left(\left(\frac{1}{10050\text{kN/mm}}\right) + \left(\frac{1}{45000\text{kN/mm}}\right)\right)}$$

23) Stiffness of Gasket of Gasket Joint

Open Calculator

fx $$k_g = \frac{1}{\left(\frac{1}{k_c}\right) - \left(\left(\frac{1}{k_1}\right) + \left(\frac{1}{k_2}\right)\right)}$$

ex $$30646.98\text{kN/mm} = \frac{1}{\left(\frac{1}{4500\text{kN/mm}}\right) - \left(\left(\frac{1}{10050\text{kN/mm}}\right) + \left(\frac{1}{11100\text{kN/mm}}\right)\right)}$$

24) Thickness of Member under Compression for Gasket Joint

Open Calculator

fx $$t = \left(\pi \cdot \frac{d^2}{4}\right) \cdot \left(\frac{E}{K}\right)$$

ex $$3.124619\text{mm} = \left(\pi \cdot \frac{(15\text{mm})^2}{4}\right) \cdot \left(\frac{90000\text{N/mm}^2}{5090\text{kN/mm}}\right)$$

25) Total Deformation of Pressure Vessel given Increase in Inner Diameter of Jacket

Open Calculator

fx $$\delta = \delta_j + \delta_c$$

ex $$1.2\text{mm} = 0.4\text{mm} + 0.80\text{mm}$$

26) Total Thickness of Gasket Joint given Stiffness, Nominal Diameter and Young's Modulus

Open Calculator

fx $$l = \left(\pi \cdot \frac{d^2}{4}\right) \cdot \left(\frac{E}{k_b}\right)$$

ex $$13.47823\text{mm} = \left(\pi \cdot \frac{(15\text{mm})^2}{4}\right) \cdot \left(\frac{90000\text{N/mm}^2}{1180\text{kN/mm}}\right)$$

27) Young's Modulus of Gasket Joint

Open Calculator

fx $$E = 4 \cdot K \cdot \frac{t}{\pi \cdot \left(d^2\right)}$$

ex $$720087.7\text{N/mm²} = 4 \cdot 5090\text{kN/mm} \cdot \frac{25\text{mm}}{\pi \cdot \left((15\text{mm})^2\right)}$$

28) Young's Modulus of Gasket Joint given Stiffness, Total Thickness and Nominal Diameter

Open Calculator

fx $$E = k_b \cdot \frac{l}{\pi \cdot \frac{d^2}{4}}$$

ex $$367258.9\text{N/mm²} = 1180\text{kN/mm} \cdot \frac{55\text{mm}}{\pi \cdot \frac{(15\text{mm})^2}{4}}$$

Thick Cylinder Vessel

29) External Pressure acting on Thick Cylinder given Radial Stress

Open Calculator

fx $$P_o = \frac{\sigma_r}{\left(\frac{d_o^2}{\left(d_o^2\right)-\left(d_i^2\right)}\right) \cdot \left(\left(\frac{d_i^2}{4 \cdot \left(r^2\right)}\right)+1\right)}$$

ex $$11.77034\text{MPa} = \frac{80\text{N/mm²}}{\left(\frac{(550\text{mm})^2}{\left((550\text{mm})^2\right)-\left((465\text{mm})^2\right)}\right) \cdot \left(\left(\frac{(465\text{mm})^2}{4 \cdot \left((240\text{mm})^2\right)}\right)+1\right)}$$

30) External Pressure acting on Thick Cylinder given Tangential Stress

Open Calculator

fx $$P_o = \frac{\sigma_{tang}}{\left(\frac{d_o^2}{\left(d_o^2\right)-\left(d_i^2\right)}\right) \cdot \left(\left(\frac{d_i^2}{4 \cdot \left(r^2\right)}\right)+1\right)}$$

ex $$7.062204\text{MPa} = \frac{48\text{N/mm²}}{\left(\frac{(550\text{mm})^2}{\left((550\text{mm})^2\right)-\left((465\text{mm})^2\right)}\right) \cdot \left(\left(\frac{(465\text{mm})^2}{4 \cdot \left((240\text{mm})^2\right)}\right)+1\right)}$$

31) Internal Pressure in Thick Cylinder given Longitudinal Stress

Open Calculator

fx $$P_i = \sigma_l \cdot \frac{(d_o^2) - (d_i^2)}{d_i^2}$$

ex $$27.13239\text{MPa} = 68\text{N/mm²} \cdot \frac{\left((550\text{mm})^2\right) - \left((465\text{mm})^2\right)}{(465\text{mm})^2}$$

32) Internal Pressure in Thick Cylinder given Radial Stress

Open Calculator

fx $$P_i = \frac{\sigma_r}{\left(\frac{d_i^2}{(d_o^2)-(d_i^2)}\right) \cdot \left(\left(\frac{d_o^2}{4\cdot(r^2)}\right) + 1\right)}$$

ex $$13.80085\text{MPa} = \frac{80\text{N/mm²}}{\left(\frac{(465\text{mm})^2}{\left((550\text{mm})^2\right)-\left((465\text{mm})^2\right)}\right) \cdot \left(\left(\frac{(550\text{mm})^2}{4\cdot\left((240\text{mm})^2\right)}\right) + 1\right)}$$

33) Internal Pressure in Thick Cylinder given Tangential Stress

Open Calculator

fx $$P_i = \frac{\sigma_{tang}}{\left(\frac{d_i^2}{(d_o^2)-(d_i^2)}\right) \cdot \left(\left(\frac{d_o^2}{4\cdot(r^2)}\right) + 1\right)}$$

ex $$8.280509\text{MPa} = \frac{48\text{N/mm²}}{\left(\frac{(465\text{mm})^2}{\left((550\text{mm})^2\right)-\left((465\text{mm})^2\right)}\right) \cdot \left(\left(\frac{(550\text{mm})^2}{4\cdot\left((240\text{mm})^2\right)}\right) + 1\right)}$$

34) Longitudinal Stress in Thick Cylinder subjected to Internal Pressure

Open Calculator

fx $$\sigma_l = \left(P_i \cdot \frac{d_i^2}{(d_o^2) - (d_i^2)}\right)$$

ex $$25.56355\text{N/mm²} = \left(10.2\text{MPa} \cdot \frac{(465\text{mm})^2}{\left((550\text{mm})^2\right) - \left((465\text{mm})^2\right)}\right)$$

35) Radial Stress in Thick Cylinder subjected to External Pressure

Open Calculator

fx $$\sigma_r = \left(P_o \cdot \frac{d_o^2}{(d_o^2) - (d_i^2)}\right) \cdot \left(1 - \left(\frac{d_i^2}{4 \cdot (r^2)}\right)\right)$$

ex $$1.725723\text{N/mm}^2 = \left(8\text{MPa} \cdot \frac{(550\text{mm})^2}{\left((550\text{mm})^2\right) - \left((465\text{mm})^2\right)}\right) \cdot \left(1 - \left(\frac{(465\text{mm})^2}{4 \cdot \left((240\text{mm})^2\right)}\right)\right)$$

36) Radial Stress in Thick Cylinder subjected to Internal Pressure

Open Calculator

fx $$\sigma_r = \left(P_i \cdot \frac{d_i^2}{(d_o^2) - (d_i^2)}\right) \cdot \left(\left(\frac{d_o^2}{4 \cdot (r^2)}\right) - 1\right)$$

ex $$7.999704\text{N/mm}^2 = \left(10.2\text{MPa} \cdot \frac{(465\text{mm})^2}{\left((550\text{mm})^2\right) - \left((465\text{mm})^2\right)}\right) \cdot \left(\left(\frac{(550\text{mm})^2}{4 \cdot \left((240\text{mm})^2\right)}\right) - 1\right)$$

37) Tangential Stress in Thick Cylinder subjected to External Pressure

Open Calculator

fx $$\sigma_{tang} = \left(P_o \cdot \frac{d_o^2}{(d_o^2) - (d_i^2)}\right) \cdot \left(\left(\frac{d_i^2}{4 \cdot (r^2)}\right) + 1\right)$$

ex $$54.37396\text{N/mm}^2 = \left(8\text{MPa} \cdot \frac{(550\text{mm})^2}{\left((550\text{mm})^2\right) - \left((465\text{mm})^2\right)}\right) \cdot \left(\left(\frac{(465\text{mm})^2}{4 \cdot \left((240\text{mm})^2\right)}\right) + 1\right)$$

38) Tangential Stress in Thick Cylinder subjected to Internal Pressure

Open Calculator

fx $$\sigma_{tang} = \left(P_i \cdot \frac{d_i^2}{(d_o^2) - (d_i^2)}\right) \cdot \left(\left(\frac{d_o^2}{4 \cdot (r^2)}\right) + 1\right)$$

ex $$59.1268\text{N/mm}^2 = \left(10.2\text{MPa} \cdot \frac{(465\text{mm})^2}{\left((550\text{mm})^2\right) - \left((465\text{mm})^2\right)}\right) \cdot \left(\left(\frac{(550\text{mm})^2}{4 \cdot \left((240\text{mm})^2\right)}\right) + 1\right)$$

Thin Cylinder Vessel

39) Cylinder Wall Thickness of Thin Cylinder given Longitudinal Stress

Open Calculator

fx $t_w = P_i \cdot \frac{d_i}{4 \cdot \sigma_l}$

ex $17.4375\text{mm} = 10.2\text{MPa} \cdot \frac{465\text{mm}}{4 \cdot 68\text{N/mm}^2}$

40) Cylinder Wall Thickness of Thin Cylinder given Tangential Stress

Open Calculator

fx $t_w = P_i \cdot \frac{d_i}{2 \cdot \sigma_{tang}}$

ex $49.40625\text{mm} = 10.2\text{MPa} \cdot \frac{465\text{mm}}{2 \cdot 48\text{N/mm}^2}$

41) Inner Diameter of Thin Cylinder given Longitudinal Stress

Open Calculator

fx $d_i = 4 \cdot t_w \cdot \frac{\sigma_l}{P_i}$

ex $800\text{mm} = 4 \cdot 30\text{mm} \cdot \frac{68\text{N/mm}^2}{10.2\text{MPa}}$

42) Inner Diameter of Thin Cylinder given Tangential Stress

Open Calculator

fx $d_i = 2 \cdot t_w \cdot \frac{\sigma_{tang}}{P_i}$

ex $282.3529\text{mm} = 2 \cdot 30\text{mm} \cdot \frac{48\text{N/mm}^2}{10.2\text{MPa}}$

43) Inner Diameter of Thin Spherical Shell given Permissible Tensile Stress

Open Calculator

fx $d_i = 4 \cdot t_w \cdot \frac{\sigma_t}{P_i}$

ex $882.3529\text{mm} = 4 \cdot 30\text{mm} \cdot \frac{75\text{N/mm}^2}{10.2\text{MPa}}$

44) Inner Diameter of Thin Spherical Shell given Volume

Open Calculator

fx $$d_i = \left(6 \cdot \frac{V}{\pi}\right)^{\frac{1}{3}}$$

ex $$781.5926\text{mm} = \left(6 \cdot \frac{0.25\text{m}^3}{\pi}\right)^{\frac{1}{3}}$$

45) Internal Pressure in Thin Cylinder given Longitudinal Stress

Open Calculator

fx $$P_i = 4 \cdot t_w \cdot \frac{\sigma_l}{d_i}$$

ex $$17.54839\text{MPa} = 4 \cdot 30\text{mm} \cdot \frac{68\text{N/mm}^2}{465\text{mm}}$$

46) Internal Pressure in Thin Cylinder given Tangential Stress

Open Calculator

fx $$P_i = 2 \cdot t_w \cdot \frac{\sigma_{tang}}{d_i}$$

ex $$6.193548\text{MPa} = 2 \cdot 30\text{mm} \cdot \frac{48\text{N/mm}^2}{465\text{mm}}$$

47) Internal Pressure in Thin Spherical Shell given Permissible Tensile Stress

Open Calculator

fx $$P_i = 4 \cdot t_w \cdot \frac{\sigma_t}{d_i}$$

ex $$19.35484\text{MPa} = 4 \cdot 30\text{mm} \cdot \frac{75\text{N/mm}^2}{465\text{mm}}$$

48) Longitudinal Stress in Thin Cylinder given Internal Pressure

Open Calculator

fx $$\sigma_l = P_i \cdot \frac{d_i}{4 \cdot t_w}$$

ex $$39.525\text{N/mm}^2 = 10.2\text{MPa} \cdot \frac{465\text{mm}}{4 \cdot 30\text{mm}}$$

49) Permissible Tensile Stress in Thin Spherical Shell

Open Calculator

fx $$\sigma_t = P_i \cdot \frac{d_i}{4 \cdot t_w}$$

ex $$39.525\mathrm{N/mm^2} = 10.2\mathrm{MPa} \cdot \frac{465\mathrm{mm}}{4 \cdot 30\mathrm{mm}}$$

50) Tangential Stress in Thin Cylinder given Internal Pressure

Open Calculator

fx $$\sigma_{tang} = P_i \cdot \frac{d_i}{2 \cdot t_w}$$

ex $$79.05\mathrm{N/mm^2} = 10.2\mathrm{MPa} \cdot \frac{465\mathrm{mm}}{2 \cdot 30\mathrm{mm}}$$

51) Thickness of Thin Spherical Shell given Permissible tensile stress

Open Calculator

fx $$t_w = P_i \cdot \frac{d_i}{4 \cdot \sigma_t}$$

ex $$15.81\mathrm{mm} = 10.2\mathrm{MPa} \cdot \frac{465\mathrm{mm}}{4 \cdot 75\mathrm{N/mm^2}}$$

52) Volume of Thin Spherical Shell given Inner Diameter

Open Calculator

fx $$V = \pi \cdot \frac{d_i^3}{6}$$

ex $$0.052645\mathrm{m^3} = \pi \cdot \frac{(465\mathrm{mm})^3}{6}$$

Variables Used

- **d** Nominal Bolt Diameter on Cylinder *(Millimeter)*
- **d_i** Inner Diameter of Pressurized Cylinder *(Millimeter)*
- **d_o** Outer Diameter of Pressurized Cylinder *(Millimeter)*
- **E** Modulus of Elasticity for Gasket Joint *(Newton per Square Millimeter)*
- **K** Approximate Stiffness of Gasketed Joint *(Kilonewton per Millimeter)*
- **k_1** Stiffness of Pressurized Cylinder Cover *(Kilonewton per Millimeter)*
- **k_2** Stiffness of Pressurized Cylinder Flange *(Kilonewton per Millimeter)*
- **k_b** Stiffness of Pressurized Cylinder Bolt *(Kilonewton per Millimeter)*
- **k_c** Combined Stiffness for Gasket Joint *(Kilonewton per Millimeter)*
- **k_g** Stiffness of Gasket *(Kilonewton per Millimeter)*
- **l** Total Thickness of parts held together by Bolt *(Millimeter)*
- **P_b** Resultant Load on Pressurized Cylinder Bolt *(Newton)*
- **P_{ext}** External Load on Pressurized Cylinder Bolt *(Newton)*
- **P_i** Internal Pressure on Cylinder *(Megapascal)*
- **P_l** Initial Preload Due to Bolt Tightening *(Newton)*
- **P_{max}** Maximum Force Inside Pressurized Cylinder *(Newton)*
- **P_o** External Pressure on Cylinder *(Megapascal)*
- **r** Radius of pressurized cylinder *(Millimeter)*
- **t** Thickness of Member under Compression *(Millimeter)*
- **t_w** Thickness of Pressurized Cylinder Wall *(Millimeter)*
- **V** Volume of Thin Spherical Shell *(Cubic Meter)*
- **δ** Total Deformation of Pressure Vessel *(Millimeter)*
- **δ_c** Decrease in Outer Diameter of Cylinder *(Millimeter)*
- **δ_j** Increase in Inner Diameter of Jacket *(Millimeter)*
- **ΔP_i** Increase in Bolt Load of Cylinder *(Newton)*
- **σ_l** Longitudinal Stress in Pressurized Cylinder *(Newton per Square Millimeter)*
- **σ_r** Radial Stress in Pressurized Cylinder *(Newton per Square Millimeter)*
- **σ_t** Permissible Tensile Stress in Pressurized Cylinder *(Newton per Square Millimeter)*
- **σ_{tang}** Tangential Stress in Pressurized Cylinder *(Newton per Square Millimeter)*

- ν Poisson's Ratio of Pressurized Cylinder

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Pressure** in Megapascal (MPa)
  Pressure Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Stiffness Constant** in Kilonewton per Millimeter (kN/mm)
  Stiffness Constant Unit Conversion
- Measurement: **Stress** in Newton per Square Millimeter (N/mm^2)
  Stress Unit Conversion

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