



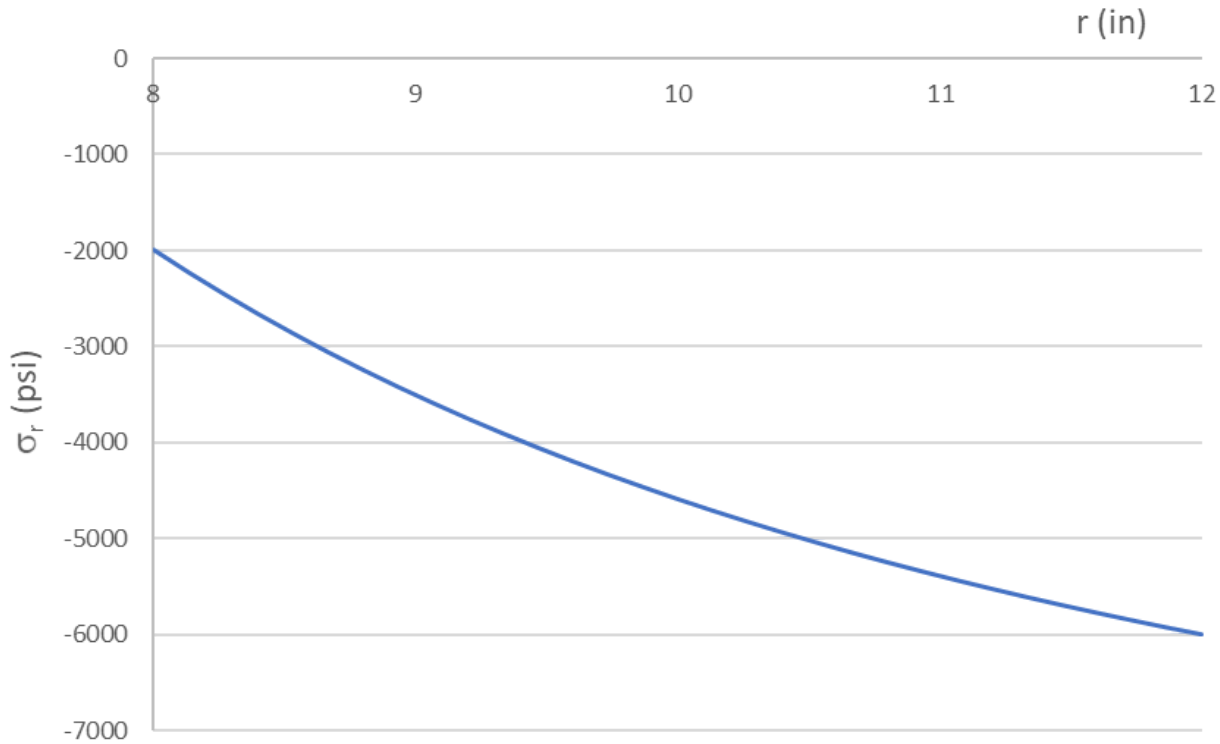
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Continuing Education Course #303  
Pressure Vessels  
Thin and Thick-Walled Stress Analysis

1. A pressure vessel is considered to be thin-walled if the wall thickness is less than or equal to \_\_\_\_\_ of the inner radius.
  - a. 20%
  - b. 18%
  - c. 14%
  - d. 10%
2. A thin-walled pressure vessel has an inside radius of 7 inches and a wall thickness of 0.25 inches. What is the hoop stress if the internal pressure is 450 psi?
  - a. 6,300 psi
  - b. 12,600 psi
  - c. 14,500 psi
  - d. None of the above
3. A cylindrical water tower has an inner diameter of 18 feet and is constructed from 3/8 inch thick plate. The hoop stress is limited to 7 ksi, and the specific weight of water is 62.4 lb/ft<sup>3</sup>. What is the maximum height to which the tank may be filled?
  - a. 28 feet
  - b. 40 feet
  - c. 56 feet
  - d. 75 feet
4. A thin-walled pressure vessel has an inner diameter of 10 inches and is subjected to an internal pressure of 900 psi. What wall thickness is required if the allowable longitudinal stress is 15 ksi?
  - a. 0.30 inches
  - b. 0.25 inches
  - c. 0.20 inches
  - d. 0.15 inches
5. A spherical tank is constructed from 1/4 inch thick steel, and holds an internal pressure of 150 psi. Determine the maximum outer radius of the tank if the stress is limited to 12 ksi.
  - a. 80 inches
  - b. 60.5 inches
  - c. 40.25 inches
  - d. None of the above
6. In a thick-walled pressure vessel subjected to both internal and external pressure, the radial stress at a point located at the inner radius ( $r = a$ ) will have a magnitude equal to which of the following?

- a. the inside pressure in tension
- b. the inside pressure in compression
- c. the outside pressure in tension
- d. the outside pressure in compression

7. A thick-walled pressure vessel has an inside radius of 8 inches and an outside radius of 12 inches. The radial stress distribution is shown. Which of the following statements is true?



- a. The vessel is subjected to an external pressure only
- b. The vessel is subjected to an internal pressure only
- c. The vessel is subjected to both internal and external pressure with the external pressure lower than the inside pressure
- d. The vessel is subjected to both internal and external pressure with the external pressure higher than the inside pressure

8. A thick-walled pressure vessel has an inside radius of 3 inches and a wall thickness of 2.5 inches. The vessel is subjected to an internal pressure of 6,500 psi. What is the tangential stress at a radius of 3.5 inches?

- a. 9,551 psi
- b. 10,978 psi
- c. 12,006 psi
- d. None of the above

9. A thick-walled pressure vessel has an inner diameter of 10 inches and a wall thickness of 1.75 inches. The vessel is subjected to an internal pressure of 12 ksi. Using a modulus of elasticity of  $29 \times 10^6$  psi and Poisson's ratio of 0.25, determine radial displacement at the inner surface in inches.

- a. 0.0198
- b. 0.0023
- c. 0.0134
- d. 0.0076

10. A thick-walled pressure vessel has an inside radius of 3 inches and an outside radius of 7 inches and is subjected to an internal pressure only. The maximum radial stress is 2.5 ksi in compression. What is the maximum tangential stress?
- a. 3,625 psi in tension
  - b. 3,625 psi in compression
  - c. 2,900 psi in tension
  - d. 2,900 psi in compression
11. Which of the following statements is NOT true?
- a. A thick-walled pressure vessel subject to external pressure only will have a maximum radial stress located on the outer surface
  - b. The radial stress for a thick-walled pressure vessel subject to external pressure only will always be compressive
  - c. A thick-walled pressure vessel subject to external pressure only will have a maximum tangential stress located on the outer surface
  - d. All statements are true
12. Which failure theory should be used for a brittle material that has different material behavior in tension and compression?
- a. Maximum stress theory
  - b. Maximum shear theory
  - c. Mohr's failure criterion
  - d. Von Mises yield theory
13. A thick-walled pressure vessel is subjected to an internal pressure of 850 psi. What is the maximum shear stress if the inner radius is 4 inches and the outer radius is 5.25 inches?
- a. 386 psi
  - b. 850 psi
  - c. 2026 psi
  - d. 3200 psi
14. For failure prediction of ductile materials, the maximum shear theory is more conservative than the Von Mises yield theory.
- a. True
  - b. False
15. A thick-walled pressure vessel has an inside radius of 8 inches and an outside radius of 10 inches. The vessel is constructed of a ductile material with a yield stress of 58 ksi. If the vessel is subjected to an internal pressure of 7,200 psi, determine the safety factor based on the maximum shear theory.
- a. 2.27
  - b. 1.77
  - c. 1.45
  - d. None of the above

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