

# Pressure Vessel - Exercises

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## Exercises

Complete the preceding [Pressure Vessel in ANSYS](#) tutorial before attempting the following exercises.

### Exercise 1:

According to thick-walled pressure vessel theory, for what average-radius-to-thickness  $(R_i + R_o)/2t$  will the ratio of hoop stress at the inner radius,  $R_i$ , be 10% larger than the hoop stress at the outer radius,  $R_o$ ? We may decide this represents a reasonable definition for one's "line in the sand", i.e. a ratio below which thick-walled theory should be considered more accurate for validation purposes.

### Exercise 2:

Look up the exact expression for the hoop stress as a function of the average-radius-to-thickness ratio using thick-walled theory. Recommend an element-edge-length-to-thickness ratio (for each  $R/t$  ratio) for which FEA predictions differ from the theory by no more than 5%. Determine the necessary element-edge-to-thickness ratio for meshes using:

- a) linear displacement interpolation and
- b) quadratic displacement interpolation

What do you learn from this exercise?

### Exercise 3:

Using a distortional strain energy criterion valid for ductile materials, at what location will the pressure vessel likely yield according to the ANSYS solution? Consider all stress components when answering.

### Exercise 4:

Consider that the bottom of the vessel and corner have been sufficiently thickened so that the maximum hoop stress appears in the side walls of the pressure vessel.

Using the same distortional strain energy criterion valid for ductile materials, at what location will the pressure vessel likely yield first according to the ANSYS solution? Consider all stress components when answering.

Investigate catastrophic failures in Aluminum 80 SCUBA tanks and comment on your findings relative to these failures.

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