

CHL 712

- Q1. A Self-supporting tall vertical cylindrical vessel with double-welded butt joints, stress relieved, is working in a locality which falls under seismic zone 3 and where the map wind pressure is 28 psf. Basic weld-joint-efficiency factor is 0.8. Height factor is 1.3. Neglect the dead weight of top head. Seismic coefficient in zone 3 is 0.2 for rigid and 0.08 for flexible structures. It is not a class I construction.

The shell has an o.d. = 5.75 ft. and length (TL to TL) = 140 ft; skirt height = 8 ft.; insulation thickness = 2.5 in.; design internal pressure = 42 psig; design temp. = 300°F; material of construction is plain carbon steel with a UTS = 56,000 psi; corrosion allowance = 0.15 inch. It has an overhead insulated vapour line weighing 98.5 lb/ft inclusive of insulation and made of 10.75 inch o.d. steel pipe. It is provided with one caged ladder (17 inches in diameter and weighing 25 lb per foot) for maintenance purposes.

- a) It is proposed to have plate thickness of 3/8, 7/8 and 5/4 inches respectively for the top 64 ft., middle 48 ft. and bottom 28 ft. of the shell height. Check whether the vessel is safe at the lower end of the middle section, that is, calculate the maximum value of combined tensile and compressive stresses in the axial direction under wind/seismic loading at that location and compare them with their respective allowable stresses. Density of steel and insulation is 490 and 40 lb per cubic feet respectively. E of steel = 29×10^6 psi.
- b) Is the vessel safe in the circumferential direction?