
PROBLEM 7-15N QUESTION

Drain Tank Pressurization Problem

A drain tank is used to temporarily store water discharged from the pressurizer through the PORV (Figure 1). The drain tank has a burst disk on it which ruptures if the pressure inside the drain tank becomes too large. For this problem, assume that the PORV at the top of the pressurizer is stuck open, and saturated water at 15.4 MPa leaves the pressurizer at a constant flowrate of 3kg/sec and enters a perfectly insulated drain tank of total volume 12 m³. In addition, assume that the initial conditions (before the water due to the stuck open PORV has entered the drain tank) in the drain tank are:

No air present

Initial vapor volume = 10 m³

Initial pressure = 3 MPa

Initial liquid volume = 2 m³

Also assume that the liquid and the water vapor are in thermal equilibrium at all times in the drain tank, and that the burst disk on the drain tank ruptures at 10 MPa.

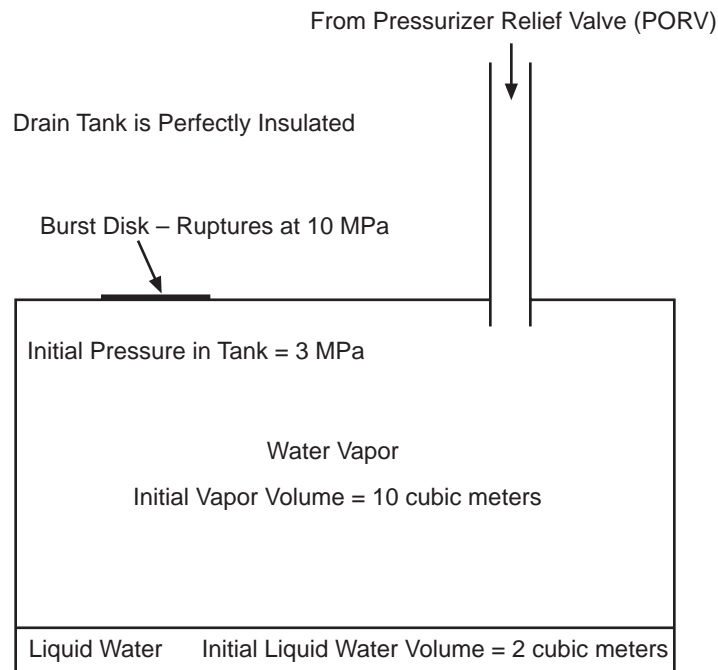


Figure 1

QUESTIONS

- A . Define the control mass or control volume you will use and the equation set you will develop.
- B . Solve for the elapsed time to burst disk rupture.
- C . Now assume 11.93 kg of air are present in the drain tank along with the liquid water and water vapor, $(P_{1w})_{\text{initial}} = 3 \text{ MPa}$ and that the change in volume of the liquid water from the initial state to the final state is large. What is the new time to rupture?