

9. A cylindrical pressure vessel is subjected to an internal pressure  $p = 450$  psi and the allowable tangential stress of the vessel is  $S_a = 18$  kpsi. The vessel has a wall thickness  $t = 0.2$  in. The factor of safety is  $n_s = 2.0$ . a) What is the maximum inside diameter of the vessel? Then select a preferred diameter. b) If  $p \sim N(450, 50^2)$  psi,  $S_a \sim N(18, 2^2)$  kpsi, and  $p$  and  $S_a$  are independent, determine the probability of failure using the First Order Second Moment Method. Use the theory of thin-walled vessels.

**Answer:** a)  $d_{max} = 7.8$  in,  $d_{preferred} = 7.5$  in; b)  $p_f = 1.294(10^{-5})$