

63. A tapered bar is subjected to a tensional force $F \sim N(8000, 800^2)$ lbf shown in the figure. The length is $l \sim N(8, 0.08^2)$ in and the modulus of elasticity is $E = 18$ Mpsi. The bar has a diameter of $d_1 = 2$ in at one end and a diameter of $d_2 = 3$ in at the other end. If the allowable axial elongation is $\delta_a = 10^{-3}$ in and F and l are independent, determine the probability of failure using the First Order Second Moment Method. Note that the elongation of tapered portion is $\delta = \frac{4}{\pi} \frac{Pl}{d_1 d_2 E}$.

Answer: $p_f = 6.03(10^{-4})$

