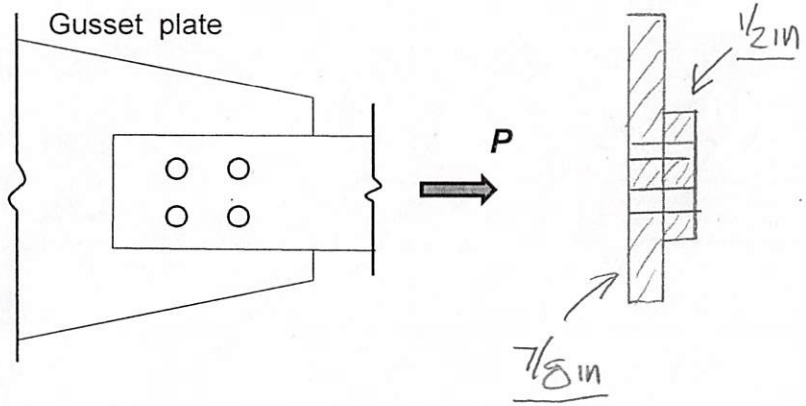
**Classroom Problem 3.2-1:** A tension member consists of a **PL4 x ½** of **A36** steel bolted to an ⅞-in. thick gusset plate by four ⅝-in. diameter bolts. What is the design strength for ***LRFD***?




$$d_{HOLE} = d_b + \tfrac{1}{8}\,in = \tfrac{5}{8}\,in + \tfrac{1}{8}\,in = \tfrac{3}{4}\,in$$

$$A_g = wt = 4\,in(\tfrac{1}{2}\,in) = 2.0\,in^2$$

$$A_n = A_g - t\sum d_{HOLES}$$

$$= 2.0\,in^2 + \tfrac{1}{2}\,in(2\,HOLES)\tfrac{3}{4}\,in = 1.25\,in^2$$

A36 STEEL $F_y = 36\,ksi$

$F_u = 58\,ksi$

YIELDING $P_n = F_y A_g = 36\,ksi(2.0\,in^2) = 72\,k$ $\quad \phi_t P_n = 0.90(72^k) = 64.8^k$

RUPTURE $P_n = F_u A_n = 58\,ksi(1.25\,in^2) = 72.5^k$ $\quad \phi_t P_n = 0.75(72.5^k) = 54.38^k$

$A_e = A_n$

DESIGN STRENGTH $\phi_t P_n = 54.38^k$