

$$D^2 + \frac{d^2}{2} = \frac{\pi}{2} \left[ (5\frac{1}{4})^2 + \frac{(4)^2}{2} \right]$$

$$D^2 + \frac{d^2}{2} = \frac{\pi}{2} \sqrt{(5\frac{1}{4})^2 + (4)^2}$$

$$\frac{(223.3)}{(3.3)}$$

$$n^2$$

$$4)$$

THE VARIOUS FORCES ON WELD,  
PROPERTIES OF WELD FOUND  
Table 4).

$$\frac{(6300)(8)}{(67.6)} = 746 \text{ lbs/in.}$$

$$\frac{9(2)}{9)$$

$$9)$$

$$9/\text{in.}$$

$$\text{in.}$$

Determine ACTUAL RESULTANT  
ALLOWABLE FORCE ON THE

$$\begin{aligned} & \text{1 inch of fillet weld} \\ & \text{at hub} \\ & 250 \rightarrow f_t = 1880 \end{aligned}$$

$$f_t^2 + f_v^2$$

$$+ (1880)^2 + (250)^2$$

$$\text{in. (actual resultant force)}$$

fatigue loading, assume service life

of  $N = 2,000,000$  cycles and use Table 8 formula. In this case, assume a complete reversal of load; hence  $K = \min/\max = -1$  and:

$$f = \frac{5100}{1 - \frac{K}{2}}$$

$$= \frac{5100}{1 + \frac{1}{2}}$$

$$= 3400 \text{ lbs/in. (allowable force)}$$

**Step 4:** NOW REQUIRED LEG SIZE OF FILLET WELD AROUND HUB CAN BE FOUND.

$$\omega = \frac{\text{actual force}}{\text{allowable force}}$$

$$= \frac{(2040)}{(3400)}$$

$$= .600'' \text{ or use } \frac{5}{8}'' \Delta$$

#### Problem 7

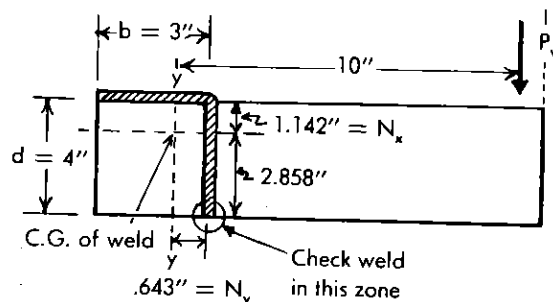
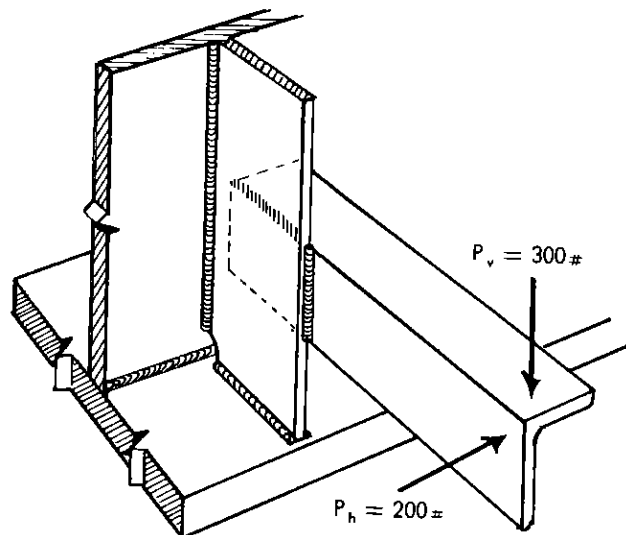


FIGURE 25

## 7.4-18 / Joint Design and Production

A 3" × 4" angle for support of a pipe extends out from the transverse intermediate stiffeners on a plate girder, Figure 25. This must be field welded. It will be difficult to weld in the overhead position along the bottom edge of the angle as well as to make the vertical weld along the end of the angle next to the girder web because of poor accessibility. Check whether just two fillet welds would be sufficient, assuming the pipe's weight on the hanger is 300 lbs and a possible horizontal force of approximately 200 lbs is applied to the hanger during erection of the pipe.

$$\begin{aligned} N_y &= \frac{b^2}{2(b + d)} \\ &= \frac{(3)^2}{2(3 + 4)} \\ &= .643'' \end{aligned}$$

$$\begin{aligned} N_x &= \frac{d^2}{2(b + d)} \\ &= \frac{(4)^2}{2(3 + 4)} \\ &= 1.142'' \end{aligned}$$

*properties of weld treated as a line*

1. For twist about connection's center of gravity, due to  $P_v$

$$\begin{aligned} J_w &= \frac{(b + d)^4 - 6 b^2 d^2}{12 (b + d)} \\ &= \frac{(3 + 4)^4 - 6(3)^2(4)^2}{12 (3 + 4)} \\ &= 18.3 \text{ in.}^3 \end{aligned}$$

2. For bending about (y-y) axis, due to  $P_h$

$$\begin{aligned} S_w &= \frac{4 b d + b^2}{6} \\ &= \frac{4(3)(4) + 3^2}{6} \\ &= 9.5 \text{ in.}^2 \end{aligned}$$

*twisting force on weld*

1. Horizontal

$$\begin{aligned} f_{h1} &= \frac{T c_h}{J_w} \\ &= \frac{(300 \times 10)(2.858)}{(18.3)} \\ &= 470 \text{ lbs/in.} \end{aligned}$$

2. Vertical

$$\begin{aligned} f_{v1} &= \frac{T c_v}{J_w} \\ &= \frac{(300 \times 10)(.643)}{(18.3)} \\ &= 105 \text{ lbs/in.} \end{aligned}$$

*vertical shear*

$$\begin{aligned} f_{v2} &= \frac{P}{L} \\ &= \frac{(300)}{(3 + 4)} \\ &= 43 \text{ lbs/in.} \end{aligned}$$

*bending force on weld (about y-y), due to  $P_h$*

$$\begin{aligned} f_{h2} &= \frac{M}{S_w} \\ &= \frac{(200 \times 10)}{(9.5)} \\ &= 211 \text{ lbs/in.} \end{aligned}$$

*resultant force on weld at bottom of connection*

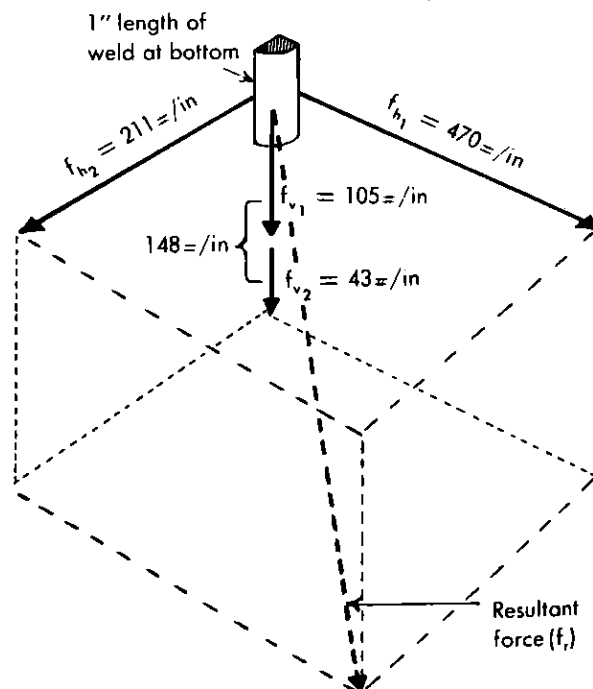


FIGURE 26

$$\begin{aligned} f_r &= \sqrt{f_{h1}^2 + f_{h2}^2 + f_v^2} \\ &= \sqrt{(470)^2 + (211)^2 + (148)^2} \\ &= 536 \text{ lbs/in.} \end{aligned}$$