Weld-2

1.
- Fillet weld, $F_y = 36$ ksi, $F_u = 58$ ksi

ASD Method should be used.

Thickness of plate $\frac{5}{8}$ inch $> \frac{1}{4}$ inch

$S_{max} = \frac{5}{8} - \frac{1}{16} = \frac{9}{16}$ inch

$S_{min} = \frac{1}{4}$ (From chart)

so, we choose, $a = \frac{8}{16} = \frac{1}{2} = 0.5$ inch

effective throat, $t_e = 0.707a = 0.707 \times 0.50 = 0.3535$

E60XX Electrode is chosen.

For Weld Material:

$$R_{nw} = (0.6 \times F_{EXX}) \times t_e \times 1 = 0.60 \times 60 \times 0.3535$$
$$= 12.726 \text{ kip/inch}$$

In ASD $\longrightarrow \frac{R_{nw}}{\Omega} = \frac{12.726}{2} = 6.4$ kip/inch

For Base Metal:

(a) yielding $= (0.6 \times F_y) \times t \times 1 = 0.6 \times 36 \times \frac{5}{8} = 13.5$ kip/in

In ASD $\longrightarrow \frac{R_n}{\Omega} = \frac{13.5}{1.5} = 9$ kip/inch

(b) Rupture $= (0.6 \times F_u) \times t \times 1 = 0.6 \times 58 \times \frac{5}{8} = 21.75$ k/in

In ASD $\longrightarrow \frac{R_n}{\Omega} = \frac{21.75}{2} = 10.875$ k/in

So, strength Governs 6.4 kip/in

load = 95k

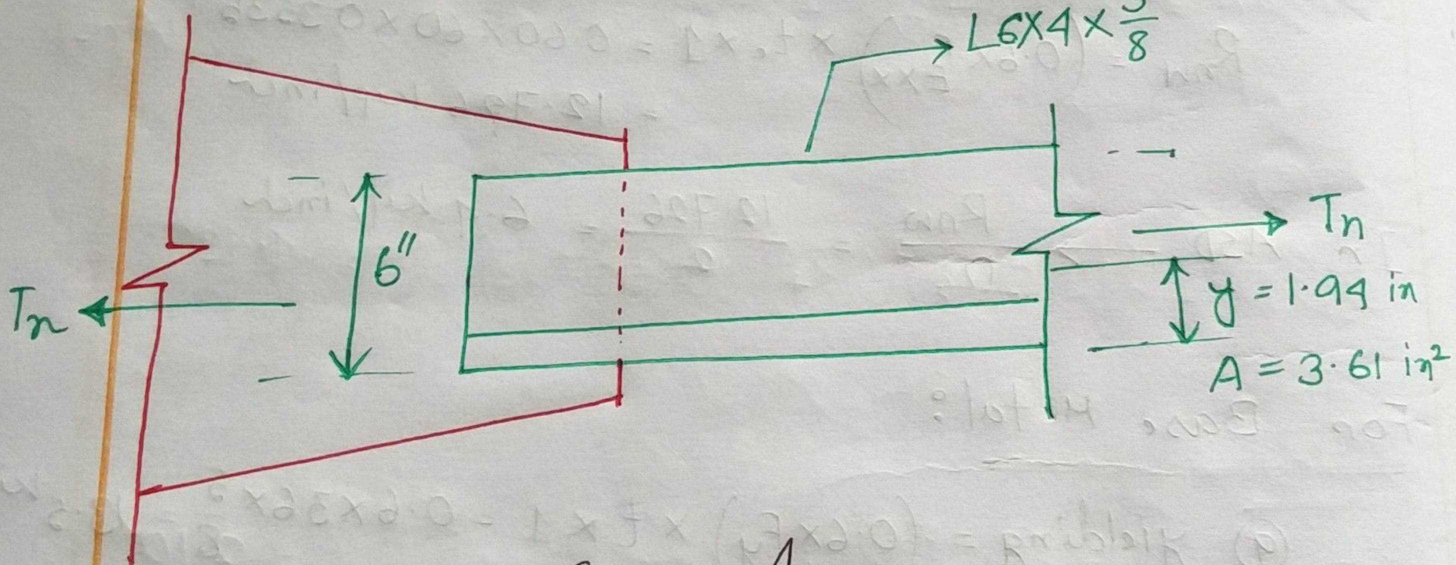
So, Required length of welding $= \frac{95}{6.4} = 14.84$

≈ 15 inch

$7\frac{1}{2}''$ on each side

2. ASD Method should be Used:

Fillet weld to develop the full strength of Angle Section.



① Yielding On Gross Area

$$T_n = F_y A_g = 50 \times 3.61 = 180.5$$

$$\frac{T_n}{\Omega} = \frac{180.5}{1.67} = 107.8^k \text{ (govern)}$$

② Fracture /Rupture on effective Net

$$\frac{T_n}{\Omega} = \frac{F_u A_e}{2} = \frac{1}{2} \times 65 \times (U A_g) = \frac{1}{2} \times 65 \times 0.95 \times 3.61$$

$$\frac{T_n}{\Omega} = 111.50^k$$

$S_{max} = \frac{3}{8} - \frac{1}{16} = \frac{5}{16}$

$S_{min} = \frac{3}{16}$; $a = \frac{1}{4}$

$t_e = 0.707 \times a$

** Base Metal:

U.K.

① $\frac{R_n}{\Omega} = \frac{1}{1.5}(0.6 \times F_y \times t \times 1) = 7.5$ k/"

② $\frac{R_n}{\Omega} = \frac{1}{2.0}(0.6 \times F_u \times t \times 1) = 7.31$ k/"

Weld Metal:

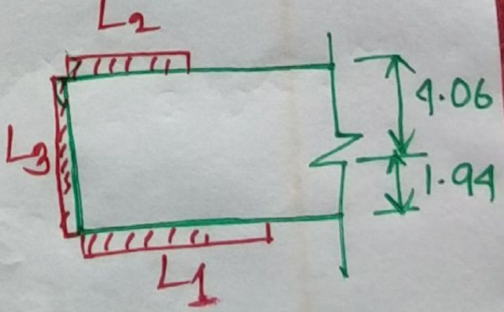
① $\frac{R_{nw}}{\Omega} = \frac{1}{2} \times (0.6 \times F_{E70XX} \times t_e \times 1) = 3.72$ k/" (Governs)

Total length Required $= \frac{107.8}{3.72} = 29$ inch

weld is provided in Three direction

After 6" welding;

$L_1 + L_2 = 29 - 6 = 23''$



So, $L_1 = \frac{1}{1+2.1} \times 23 = 7.41 \simeq 7.5''$

$L_3 = 6''$

$L_2 = 23 - 7.41 = 15.59 \simeq 16''$

$\frac{L_1}{L_2} = \frac{4.06}{1.94} = 2.10$

So, Total Length $= 6 + 16 + 7.5 = 29.5''$

So, Strength $= 29.5 \times 3.72 = 109.7 > \frac{T_n}{\Omega}$

** check U:

$U = \left(1 - \bar{x}/L\right)$; $\bar{x} = 0.933$

$L = \frac{16 + 7.5}{2} = 11.75$

$= 1 - \frac{0.933}{11.75}$

$= 0.92$

• Yielding Gross Area Govern करे।

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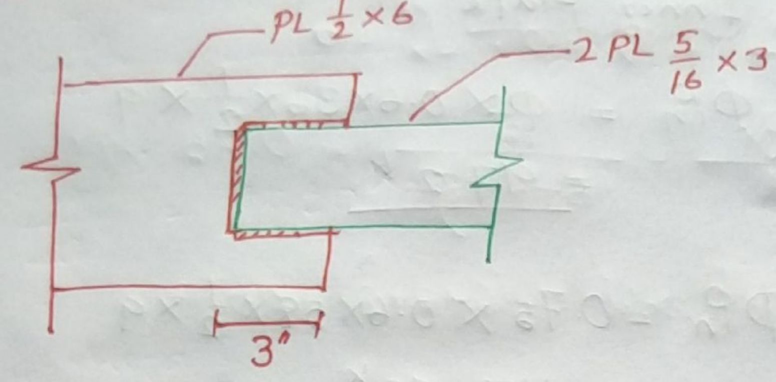

E70xx is used

$\phi P_n = ??$

$a = \frac{1}{4}$ inch

$t_e = 0.707a$

$= 0.177$ inch

① For weld Metal:

$R_{nw} = (0.6 \times F_{E70xx}) \times t_e \times L$

$= (0.6 \times 70) \times 0.177 \times (3+3+3) \times 2 = 133.8^k$

$\phi R_{nw} = \phi P_n = 0.75 \times 133.8 = 100.4^k$

② For Base Metal: (outer plate)

ⓐ Yielding $= (0.6 \times F_y) \times t \times L$

$= 0.6 \times 36 \times \frac{5}{16} \times 18 = 121.5^k$

$\phi P_n = \phi R_n = 1 \times R_n = 121.5^k$

ⓑ Rupture $= 0.6 \times F_u \times t \times L = 0.6 \times 58 \times \frac{5}{16} \times 18$

$= 195.75^k$

$\phi P_n = \phi R_n = 0.75 \times 195.75 = 146.8^k$

Inner Plate

(a) Yielding; $\phi P_n = \phi \times 0.6 \times 36 \times \frac{1}{2} \times 9$

$[\phi = 1.0]$ $= 97.2^k$

(b) Rupture, $\phi P_n = 0.75 \times 0.6 \times 58 \times \frac{1}{2} \times 9$

$= 117.45^k$

So, $\boxed{\phi P_n = 97.2^k}$

Weld-3

- Direct shear stress:

$$f_x' = \frac{P_x}{A} \; ; \; f_y' = \frac{P_y}{A}$$

- Shear stress due to torsion:

$$f_x'' = \frac{T}{I_p} \times y \; ; \; f_y'' = \frac{T}{I_p} \times x$$

- $I_p = \Sigma I_{xx} + \Sigma A \bar{y}^2 + \Sigma I_{yy} + \Sigma A \bar{x}^2$

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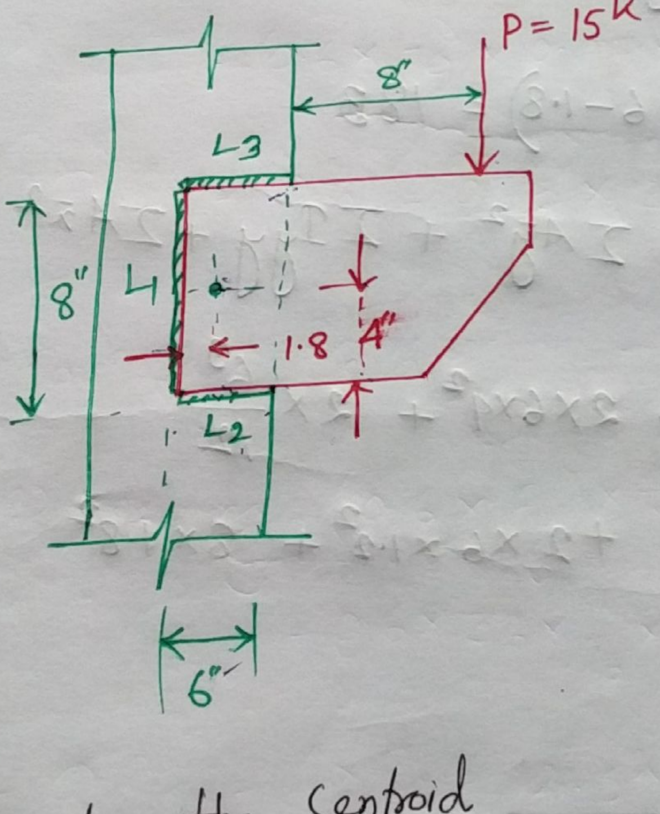


ⓐ locate the centroid

$$\bar{x} = \frac{L_1 x_1 + L_2 x_2 + L_3 x_3}{L_1 + L_2 + L_3} = \frac{0 + 6\times3\times2}{6+6+8} = 1.8''$$

$$\bar{y} = \frac{8}{2} = 4''$$

(b) Direct Shear stress:

$$f_x' = \frac{P_x}{A}, \quad P_x = 0; \; f_x' = 0$$

$$f_y' = \frac{P_y}{A} = \frac{15}{(6+6+8)} = 0.75 \text{ k/''}$$

$$A = \text{Area of weld} = (6+6+8) = 20 \text{ in}^2$$

(c) shear stress due to torsion:

$$f_x'' = \frac{T}{I_p} \times y$$

$$\therefore T = 15 \times (8+6-1.8) = 183$$

$$I_p = \Sigma I_{xx} + \Sigma A\bar{y}^2 + \Sigma I_{yy} + \Sigma A\bar{x}^2$$

* Here, $I = \frac{8^3}{12} + 2\times6\times4^2 + 2\times\frac{6^3}{12}$

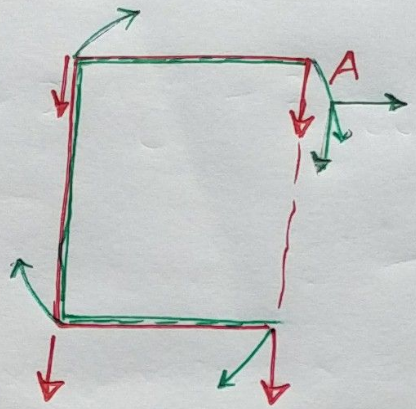
$$+ 2\times6\times1.2^2 + 8\times1.8^2$$

$$I_p = 314 \text{ in}^3$$

Scanned by CamScanner

$$f''_x = \frac{183}{314} \times 4 = 2.33^{k/''}$$

$$f''_y = \frac{183}{314} \times (6 - 1.8) = 2.5^{k/''}$$



Ⓐ $\longrightarrow$ $f'_x = 0$; $f'_y = 0.75^{k/''} \downarrow$

$f''_x = 2.33^{k/''} \longrightarrow$; $f''_y = 2.5^{k/''} \downarrow$

so, $A = \sqrt{(2.33)^2 + (0.75 + 2.5)^2} = 4$ kip/in

<u>Ans</u>