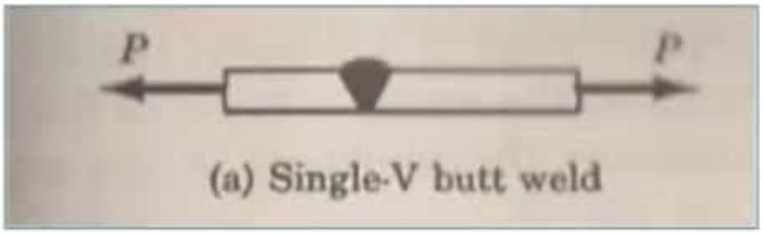
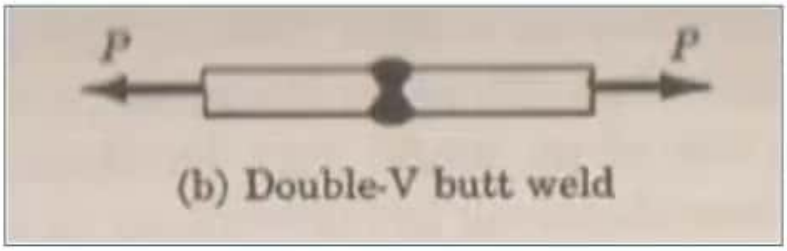
Welding

- Welding is Method of Joining Metals by Fusion.
- Types of Weld –
  - Single – V Butt Weld



(a) Single-V butt weld

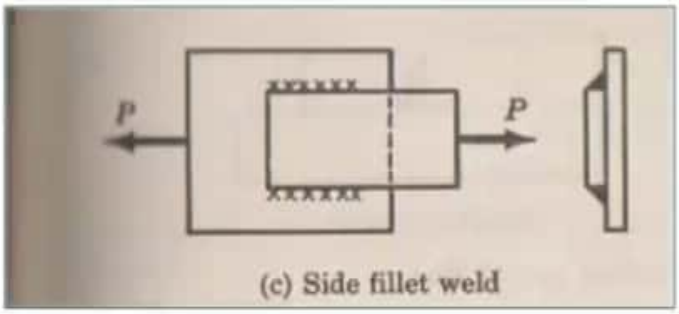
  - Double – V Butt Weld



(b) Double-V butt weld

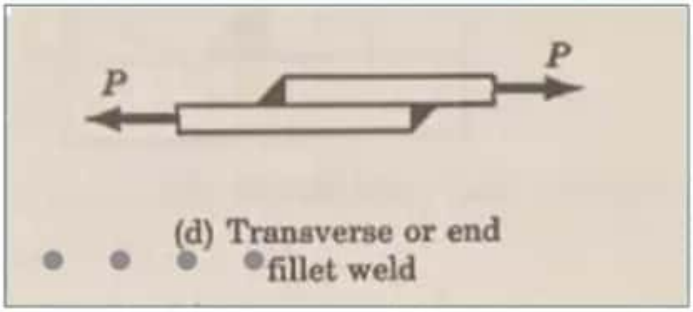
Welding

- Side Fillet Weld
  - (Round Edge)



(c) Side fillet weld

- Transverse of End Fillet Weld
  - (Square Edge)



(d) Transverse or end fillet weld

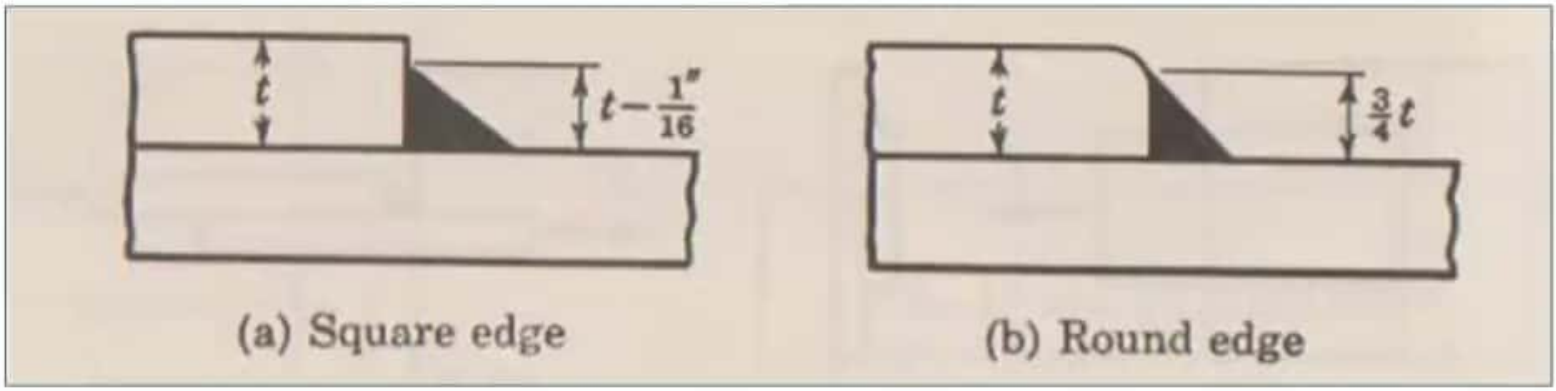
Allowable Stress

- According to American Welding Society (AWS) –
- Tension / Compression = 20,000 psi
- Shear = 13,600 psi

man's screen

Size of Fillet

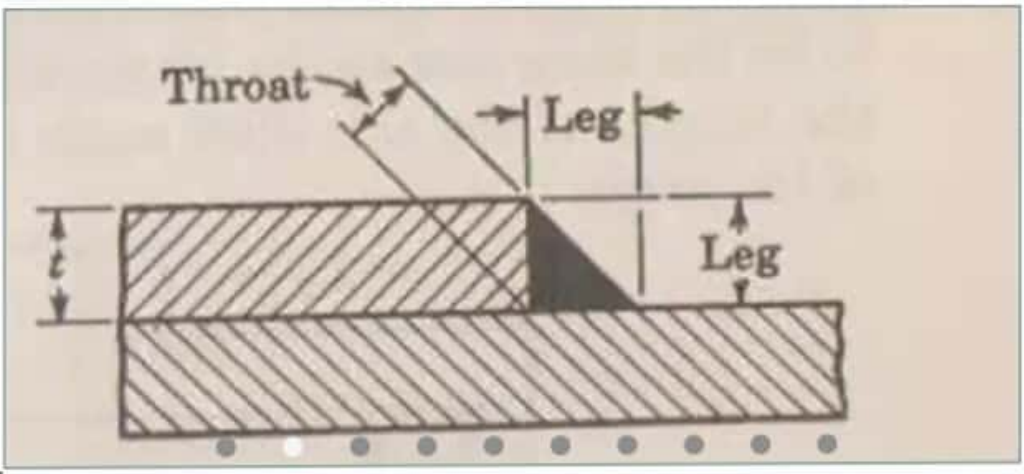
- Maximum Size of Fillet is -



(a) Square edge (b) Round edge

Strength of Weld

- Strength of Weld is –
  - $P = A \times S_s = L \times t \times Sin\ 45° \times 13600$
    $= L \times (0.707) \times t \times 13600 = 9616.65tL$



Microsoft PowerPoint - [Weld_Lecture 2]

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Outline Slides

2 Problem 1

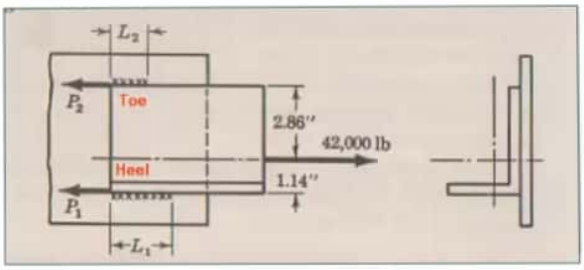
3 Solution (Part 1)

4 Weld Size & Strength (Part 1)

5 Solution (Part 2)

Problem 1

- Determine the Length of Side Fillet Welds at Heel and Toe of an Angle Section (4" x 4" x ⅜").
- Determine the Length of Side Fillet Welds if a Transverse Fillet Weld is Added at Heel and Toe of an Angle Section.



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Slide 2 of 8 Echo English (U.S.)

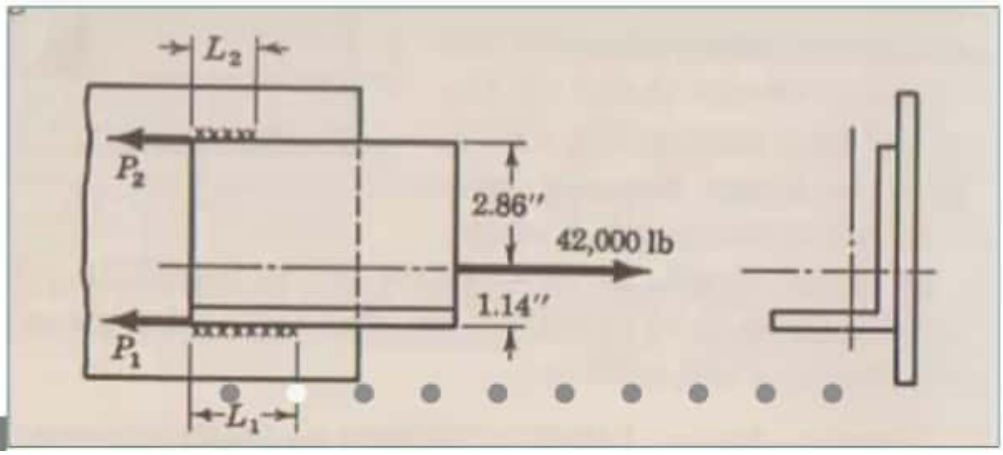
Md Kamruzzaman's screen

Solution (Part 1)

- Reaction at Weld
- P_1 & P_2 = Resisting Force

$\Sigma M_{P2} = 0 \rightarrow 4P_1 = 42000 \times 2.86 \rightarrow P_1 = 30{,}030$ lb

$\Sigma M_{P1} = 0 \rightarrow 4P_2 = 42000 \times 1.14 \rightarrow P_2 = 11{,}970$ lb



Weld Size & Strength (Part 1)

- Size of Fillet Weld for Round Edge is ¾ of Thickness

  = ¾ × ⅜ = 9/32 inch.

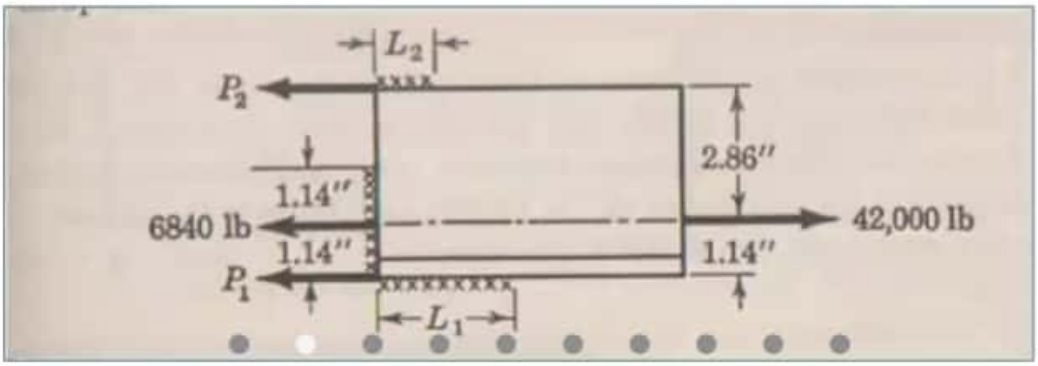
Hence, the Required Length of Weld are –

$$L_1 = \frac{P_1}{F} \quad \Rightarrow L_1 = \frac{30030}{9616.65 \times \frac{9}{32}} \quad \Rightarrow L_1 = 11.1 \ inch$$

$$L_2 = \frac{P_2}{F} \quad \Rightarrow L_2 = \frac{11970}{9616.65 \times \frac{9}{32}} \quad \Rightarrow L_2 = 4.43 \ inch$$

Solution (Part 2)

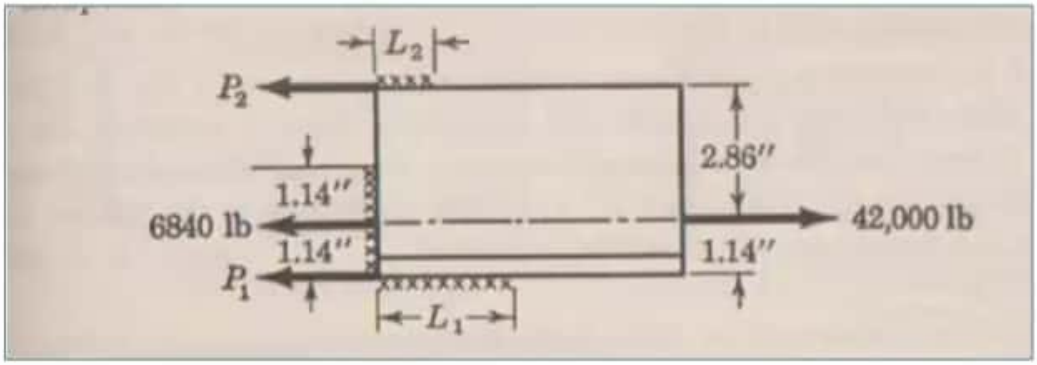
- Weld Should be Symmetrically Applied About the Action Line of the Applied Load in Order to Avoid Eccentricity of Loading.
- So, the Length of Transverse Weld = 2 x 1.14 = 2.28 inch.



Solution (Part 2)

- Thickness of Transverse Fillet Weld (Square Edge) is – $\frac{3}{8} - \frac{1}{16} = \frac{5}{16}\ inch$
- Strength per Inch = $9616.65 \times \frac{5}{16} = 3005.2\ lb/inch$
- Strength at 2.28 Inch = $3005.2 \times 2.28 = 6852\ \ lb$

Solution (Part 2)



- P_1 & P_2 = New Resisting Force

$\Sigma M_{P2} = 0$

$4P_1 = (42000 - 6851.86) \times 2.86$

$P_1 = 25{,}130.92$ lb

$\Sigma M_{P1} = 0$

$4P_2 = (42000 - 6851.86) \times 1.14$

$P_2 = 10017.22$ lb

Solution (Part 2)

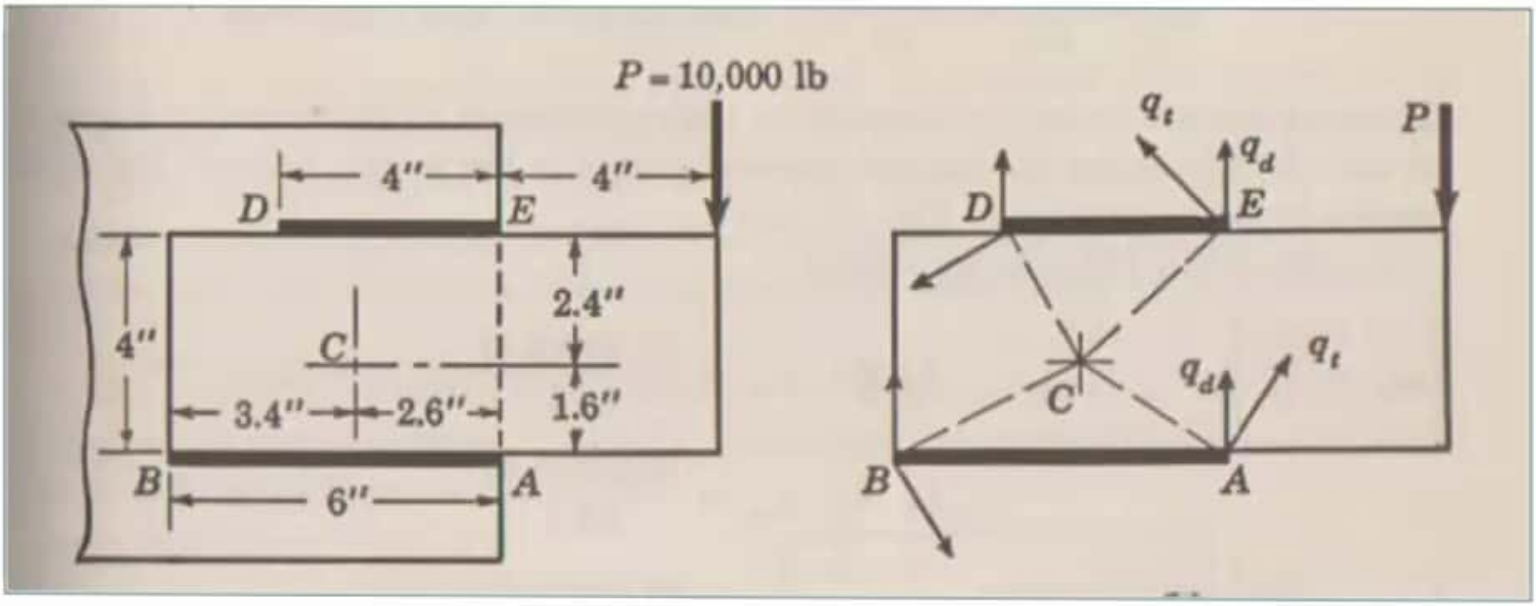
$$L_1 = \frac{P_1}{F} \quad \Rightarrow L_1 = \frac{25130.92}{9616.65 \times \frac{9}{32}} \quad \Rightarrow L_1 = 9.29 \ inch$$

$$L_2 = \frac{P_2}{F} \quad \Rightarrow L_2 = \frac{10017.22}{9616.65 \times \frac{9}{32}} \quad \Rightarrow L_2 = 3.71 \ inch$$

(Ans.)

Problem 2

- Determine the Size of Welds to Resist a Vertical Load of 10,000 lb.



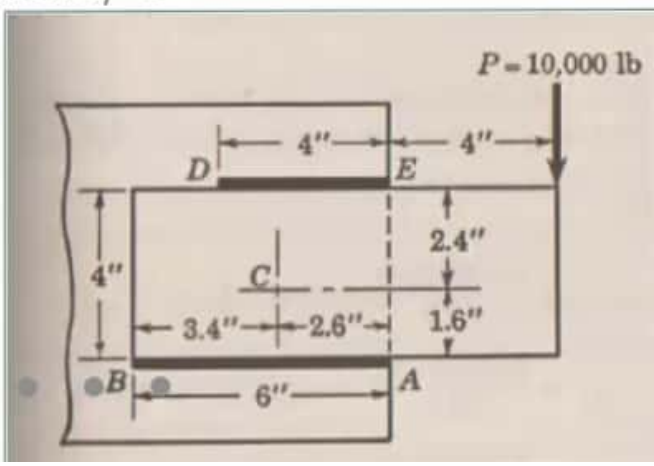
Solution

- The Centroid of the Weld Lines With Respect to Origin at 'A' is –

$$L\bar{x} = \sum lx \quad \Rightarrow \quad (4+6)\bar{x} = 4(2)+6(3) \Rightarrow \bar{x} = 2.6''$$

$$L\bar{y} = \sum ly \quad \Rightarrow \quad (4+6)\bar{y} = 4(4) \quad \Rightarrow \bar{y} = 1.6''$$

- The Moment of 'P' About Centroid, C
  - T = P x e
  - = 10 x (2.6+4)
  - = 66 kip-inch.

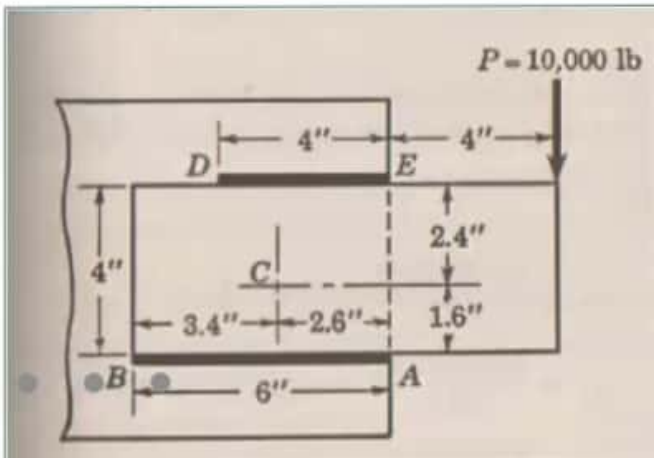


Solution

$$J = L\left(\frac{L^2}{12} + \bar{x}^2 + \bar{y}^2\right) \quad \Rightarrow \quad J_{AB} = 6\left(\frac{6^2}{12} + 0.4^2 + 1.6^2\right) = 34.3 \ in^3$$

$$J = L\left(\frac{L^2}{12} + \bar{x}^2 + \bar{y}^2\right) \quad \Rightarrow \quad J_{DE} = 4\left(\frac{4^2}{12} + 0.6^2 + 2.4^2\right) = 29.81 \ in^3$$

$$J = \sum J = 34.3 + 29.8 = 64.1 \ in^3$$



Solution

$$The\ Component\ of\ Direct\ Load,\ q_{dy} = \frac{P}{\sum_{i=1}^{n} L} = \frac{10000}{10} = 1{,}000\,lb/in(\uparrow)$$

$$q_{tx} = \frac{T_y}{J} \quad \Rightarrow \quad At\ E,\ \ q_{tx} = \frac{66000 \times 2.4}{64.1} = 2{,}471.13\,lb/in(\leftarrow)$$

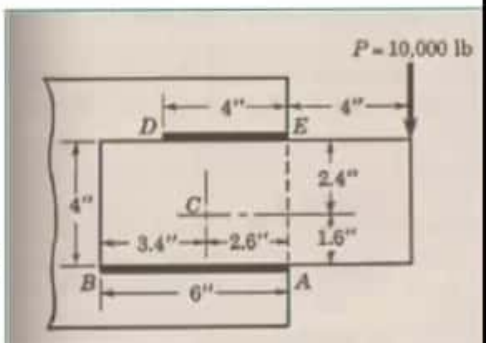
$$\Rightarrow \quad At\ A,\ \ q_{tx} = \frac{66000 \times 1.6}{64.1} = 1{,}647.42\,lb/in(\rightarrow)$$

$$q_{ty} = \frac{T_x}{J} \quad \Rightarrow \quad At\ E\ \&\ A,\ \ q_{ty} = \frac{66000 \times 2.6}{64.1} = 2{,}677\,lb/in(\uparrow)$$

$$q = \sqrt{(\sum qx)^2 + (\sum qy)^2}$$

$$q_E = \sqrt{(2471.13)^2 + (1000 + 2677)^2} = 4430\,lb/in.$$

$$q_A = \sqrt{(1647.42)^2 + (1000 + 2677)^2} = 4029\,lb/in.$$



Solution

Hence the Size of Weld,

$$q_E = 4430 = 9616.65 \times t \qquad \Rightarrow t = 0.46\ in$$

Which requires the Use of $\frac{1}{2}$ *inch Weld at 'E'.*

Again, $$q_A = 4029 = 9616.65 \times t \qquad \Rightarrow t = 0.418\ in$$

Which requires the Use of $\frac{7}{16}$ *inch Weld at 'A'.* *(Ans.)*