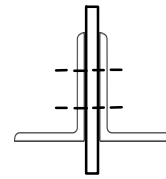
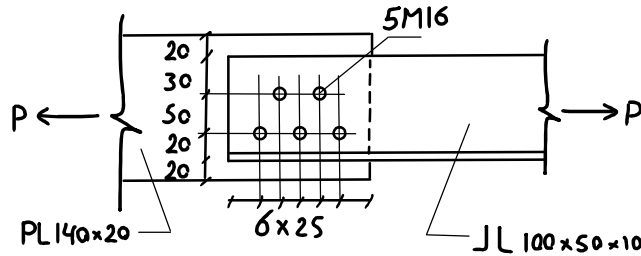


مثال: مهارت موجود برای عضو ورق اتصال را به دست آورید.



$L 100 \times 50 \times 10$

$A_g = 14.1 \times 10^2 \text{ mm}^2$

$e_y = 12 \text{ mm}$

$M16 \rightarrow d = 20$

For Member

① Yield of Gross Section

$\phi P_n = 0.9 F_y A_g = 0.9 \times 235 \times (2 \times 14.1 \times 10^2) = \underline{590} \text{ kN}$

② Fracture of Net Section

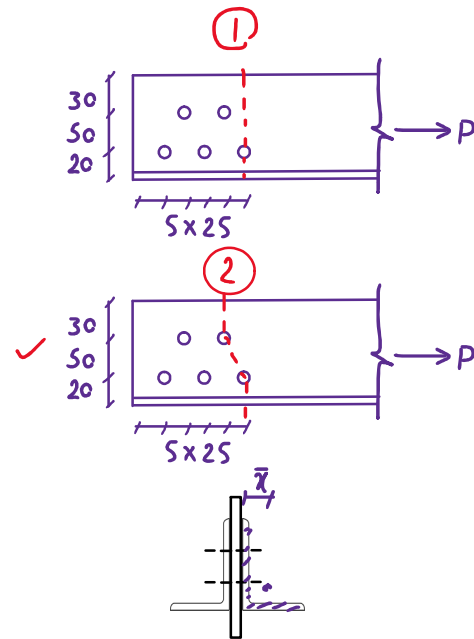
① $A_n = 2 [14.1 \times 10^2 - 20 \times 10] = 24.2 \times 10^2$

② $A_n = 2 [14.1 \times 10^2 - 2(20 \times 10) + \frac{25^2}{4 \times 50} \times 10] = \underline{20.8} \times 10^2$

Case 2 $U = 1 - \frac{\bar{x}}{l} = 1 - \frac{12}{100} = \underline{0.904} \geq \frac{A_1}{A_g} \checkmark$ Case 8: NA

$A_e = U A_n = 0.904 \times 20.8 \times 10^2 = 18.8 \times 10^2 \text{ mm}^2$

$\phi P_n = 0.75 F_u A_e = 0.75 \times 360 \times 18.8 \times 10^2 = \underline{508} \text{ kN}$



③ Block shear Fracture

Block No. 1

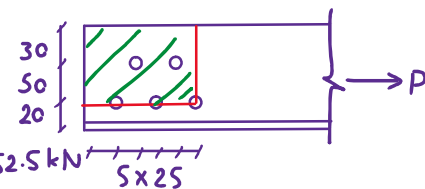
$\phi P_n = 0.75 [\min(0.6 F_u A_{nv}, 0.6 F_y A_{gv}) + F_u A_{nt}]$

$A_{gv} = 2 [125 \times 10] = 25 \times 10^2$

$\rightarrow \left\{ \begin{aligned} 0.6 F_y A_{gv} &= 0.6 \times 235 \times 25 \times 10^2 = 352.5 \text{ kN} \\ 0.6 F_u A_{nv} &= 0.6 \times 360 \times 15 \times 10^2 = 324 \text{ kN} \end{aligned} \right.$

$A_{nv} = 2 [(125 - 2.5 \times 20) \times 10] = 15 \times 10^2$

$A_{nt} = 2 [(20 - 0.5 \times 20) \times 10] = 14 \times 10^2 \rightarrow F_u A_{nt} = 360 \times 14 \times 10^2 = \underline{504} \text{ kN}$



$$\phi P_n = 0.75 (324 + 504) = \underline{621} \text{ kN}$$

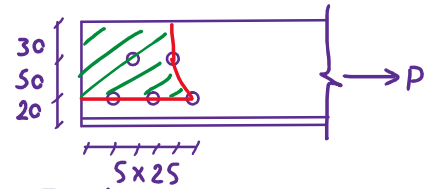
Block No.2

$$A_{gv} = 25 \times 10^2$$

$$A_{nv} = 15 \times 10^2$$

$$A_{nt} = 2 \left[(80 - 1.5 \times 20 + \frac{25^2}{4 \times 50}) \times 10 \right] = 10.6 \times 10^2 \rightarrow F_u A_{nt} = 360 \times 10.6 \times 10^2 = \underline{382} \text{ kN}$$

$$\rightarrow \begin{cases} 0.6 F_y A_{gv} = 352.5 \text{ kN} \\ 0.6 F_u A_{nv} = \underline{324} \text{ kN} \end{cases}$$



$$\phi P_n = 0.75 (324 + 382) = \underline{530} \text{ kN} \leftarrow$$

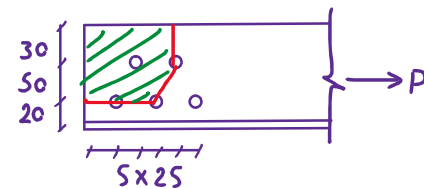
Block No.3

$$A_{gv} = 2 [75 \times 10] = 15 \times 10^2$$

$$A_{nv} = 2 [(75 - 1.5 \times 20) \times 10] = 9 \times 10^2$$

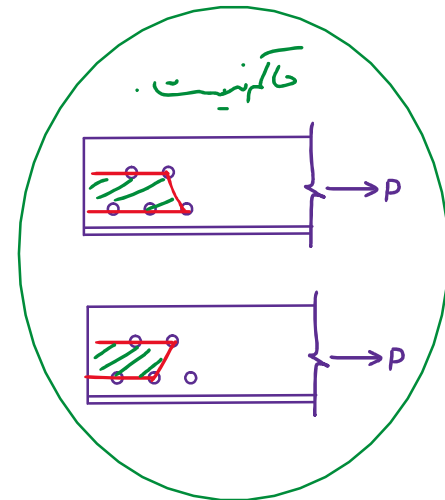
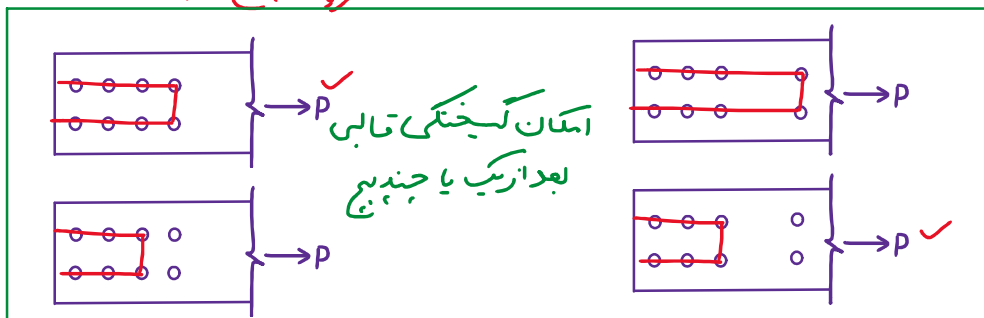
$$A_{nt} = 10.6 \times 10^2$$

$$\rightarrow \begin{cases} 0.6 F_y A_{gv} = 211.5 \text{ kN} \\ 0.6 F_u A_{nv} = \underline{194.4} \text{ kN} \\ F_u A_{nt} = 382 \text{ kN} \end{cases}$$



$$\phi P_n = \frac{5}{4} \times 0.75 (194.4 + 382) = \underline{540} \text{ kN}$$

اشرف تا پیچ



Limit States ϕP_n for JL 100x50x10

yield

596 kN

fracture

508 kN \leftarrow Controls

block shear

530 kN

* متفاوت موجود برای عضو 508 kN است.

For Gusset Plate

① Yield of Gross Section

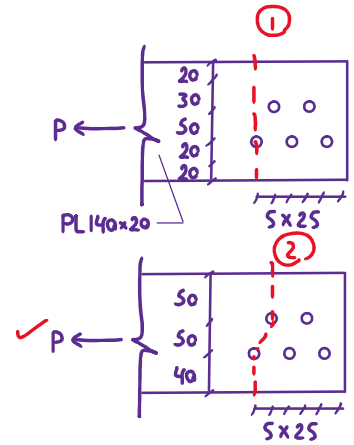
$$\phi P_n = 0.9 F_y A_g = 0.9 \times 235 \times (28 \times 10^2) = \underline{592} \text{ kN}$$

② Fracture of Net Section

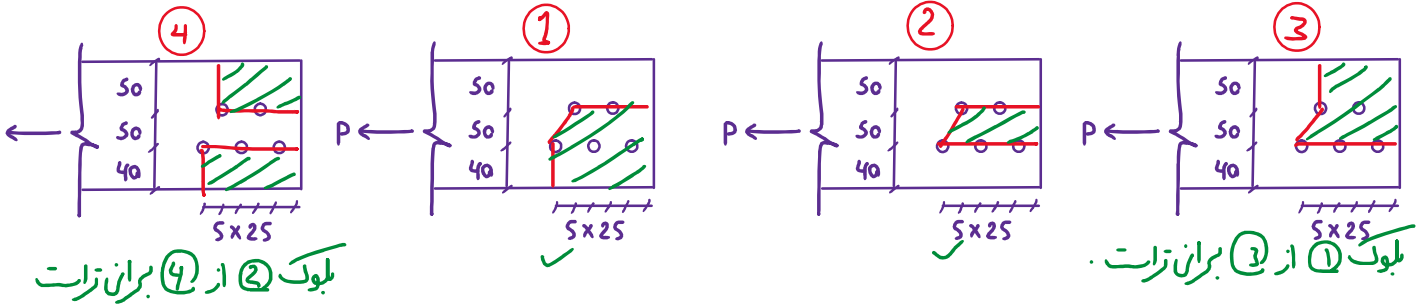
$$\textcircled{1} A_n = (140 - 20) \times 20 = 24 \times 10^2$$

$$P \quad \textcircled{2} A_n = \left(140 - 2 \times 20 + \frac{25^2}{4 \times 50}\right) \times 20 = \underline{20.6} \times 10^2$$

$$\phi P_n = 0.75 F_u A_e = 0.75 F_u A_n = 0.75 \times 360 \times 20.6 \times 10^2 = \underline{556} \text{ kN}$$



③ Block shear Fracture



Block No. 1

$$A_{gv} = 100 \times 20 = 20 \times 10^2$$

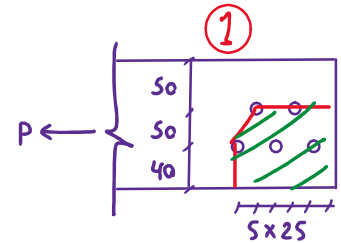
$$A_{nt} = (100 - 1.5 \times 20) \times 20 = 14 \times 10^2$$

$$A_{nt} = \left(90 - 1.5 \times 20 + \frac{25^2}{4 \times 50}\right) \times 20 = 12.62 \times 10^2$$

$$\phi P_n = 0.75(282 + 454) = \underline{552} \text{ kN}$$

$$\rightarrow \begin{cases} 0.6 F_y A_{gv} = 282 \text{ kN} \\ 0.6 F_u A_{nt} = 302 \text{ kN} \end{cases}$$

$$F_u A_{nt} = 454 \text{ kN}$$



Block No. 2

$$A_{gv} = (100 + 125) \times 20 = 45 \times 10^2$$

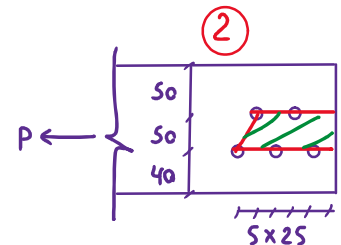
$$A_{nt} = [(100 - 1.5 \times 20) + (125 - 2.5 \times 20)] \times 20 = 29 \times 10^2$$

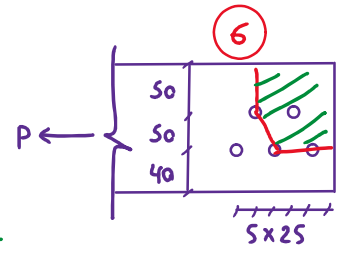
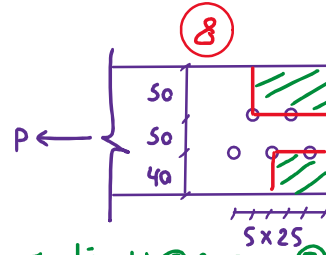
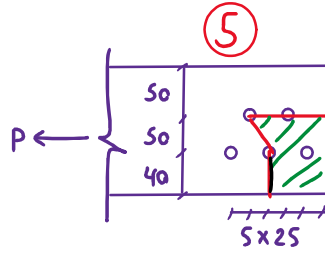
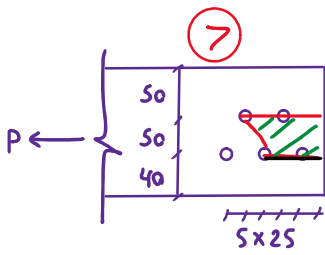
$$A_{nt} = \left(50 - 1 \times 20 + \frac{25^2}{4 \times 50}\right) \times 20 = 6.6 \times 10^2$$

$$\phi P_n = 0.75(626.4 + 238.5) = \underline{649} \text{ kN}$$

$$\rightarrow \begin{cases} 0.6 F_y A_{gv} = 634.5 \\ 0.6 F_u A_{nt} = 626.4 \end{cases}$$

$$\rightarrow F_u A_{nt} = 238.5 \text{ kN}$$





بلوک 7 نسبت به 8 بران نرات .

Block No. 5

$$A_{gv} = 20 \times 10^2 \rightarrow 0.6 F_y A_{gv} = 282 \text{ kN}$$

$$A_{nv} = 14 \times 10^2 \rightarrow 0.6 F_u A_{nv} = 302 \text{ kN}$$

$$A_{nt} = 12.6 \times 10^2 \rightarrow F_u A_{nt} = 454 \text{ kN}$$

$$\phi P_n = \frac{5}{4} \times 0.75 (282 + 454) = 690 \text{ kN}$$

با توجه به اختلاف زیاد این مقادیر با 552 kN در قیمت
تبل، من توانیم نتیجه را حساب نکنیم.

Block No. 6

$$A_{gv} = 15 \times 10^2 \rightarrow 0.6 F_y A_{gv} = 211.5 \text{ kN}$$

$$A_{nv} = 9 \times 10^2 \rightarrow 0.6 F_u A_{nv} = 194 \text{ kN}$$

$$A_{nt} = 14.6 \times 10^2 \rightarrow F_u A_{nt} = 525.6 \text{ kN}$$

$$\phi P_n = \frac{5}{4} \times 0.75 (194 + 525.6) = 675$$

Block No. 7

$$A_{gv} = 35 \times 10^2 \rightarrow 0.6 F_y A_{gv} = 483 \text{ kN}$$

$$A_{nv} = 23 \times 10^2 \rightarrow 0.6 F_u A_{nv} = 497 \text{ kN}$$

$$A_{nt} = 6.6 \times 10^2 \rightarrow F_u A_{nt} = 238 \text{ kN}$$

$$\phi P_n = \frac{5}{4} \times 0.75 (483 + 238) = 678$$

* مقادیر موجود برای درج اتصال 552 است .

Limit States ϕP_n for L 100x50x10

yield 592 kN

fracture 556 kN

block shear 552 kN ← Controls

* مقادیر موجود (ϕP_n) برای مجموعه عضو درج اتصال 508 است .