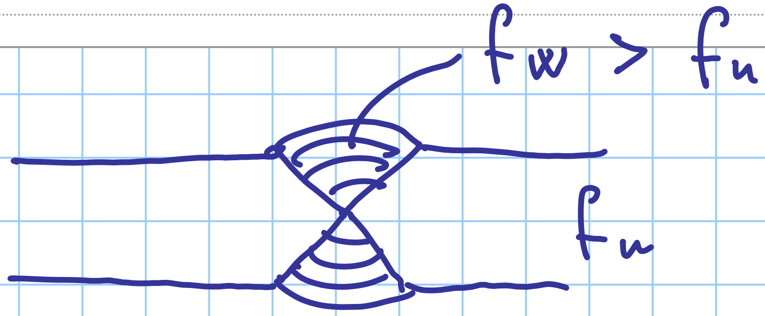
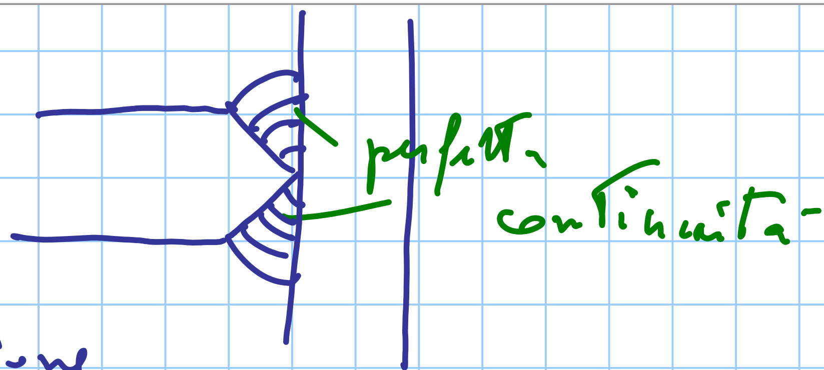
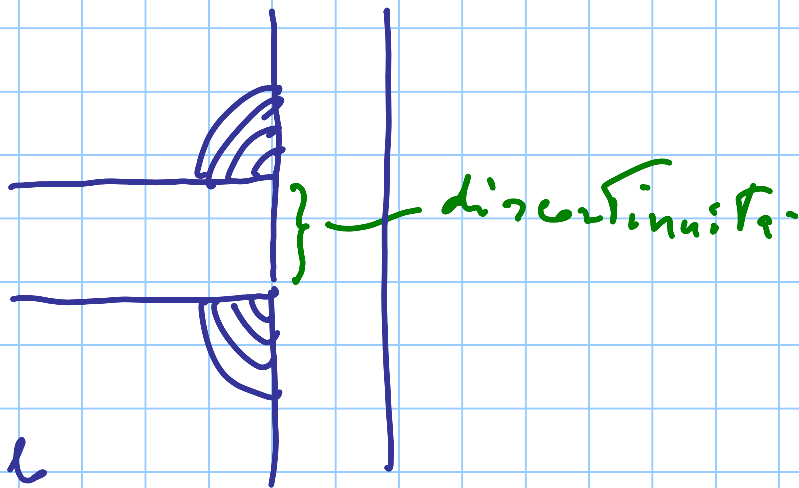
SALDATURA

Titolo nota 20/01/2015



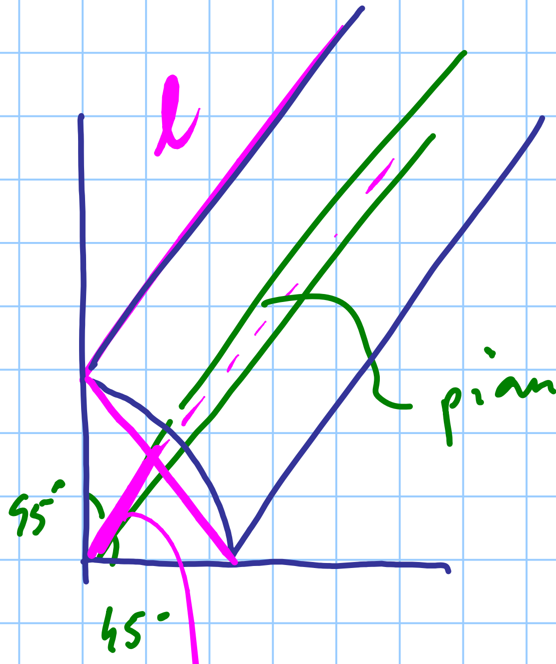
a completa penetrazione





a cordone
d'angolo

cordone d'angolo

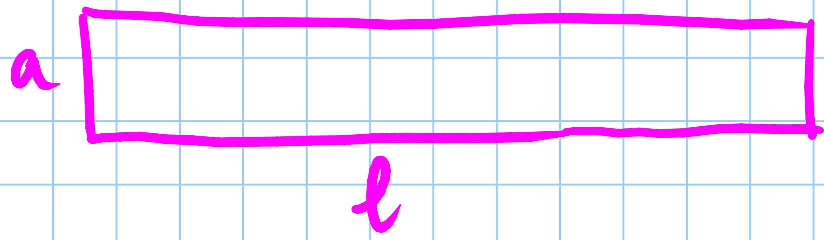


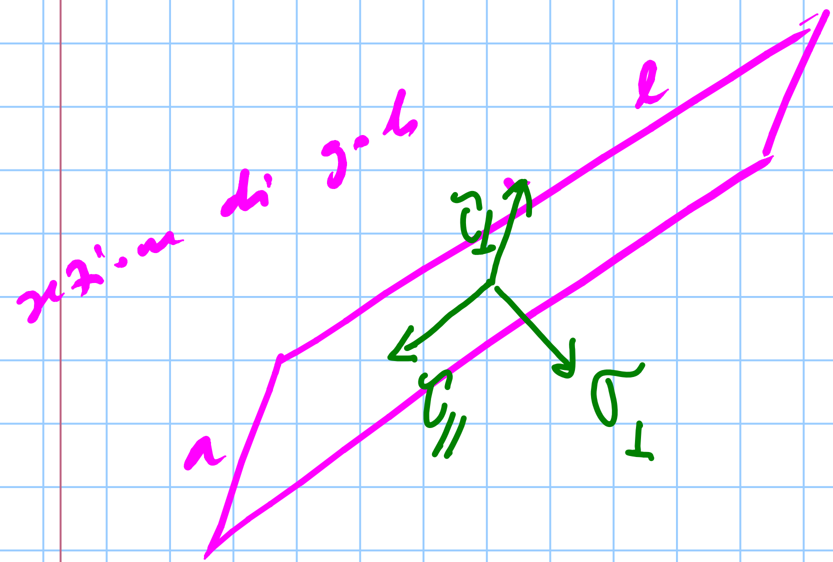
piano di gola

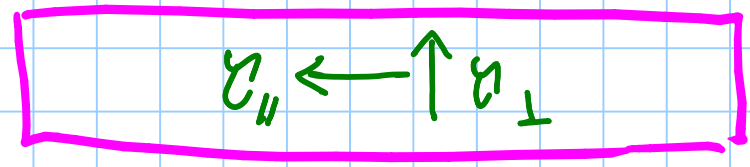
a altezza di gola

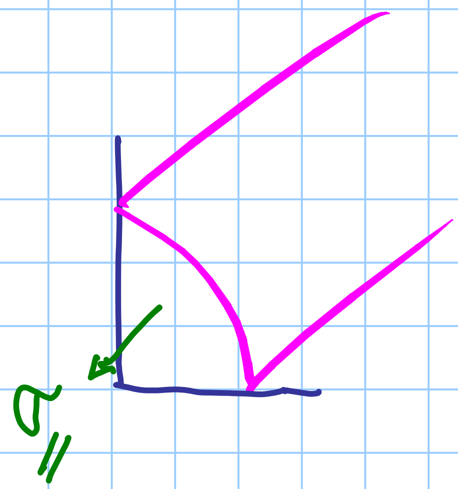
l lunghezza (efficace) della saldatura

sezione di gola

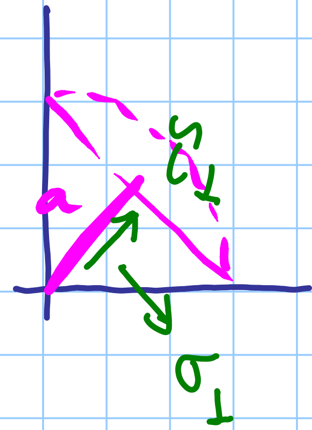






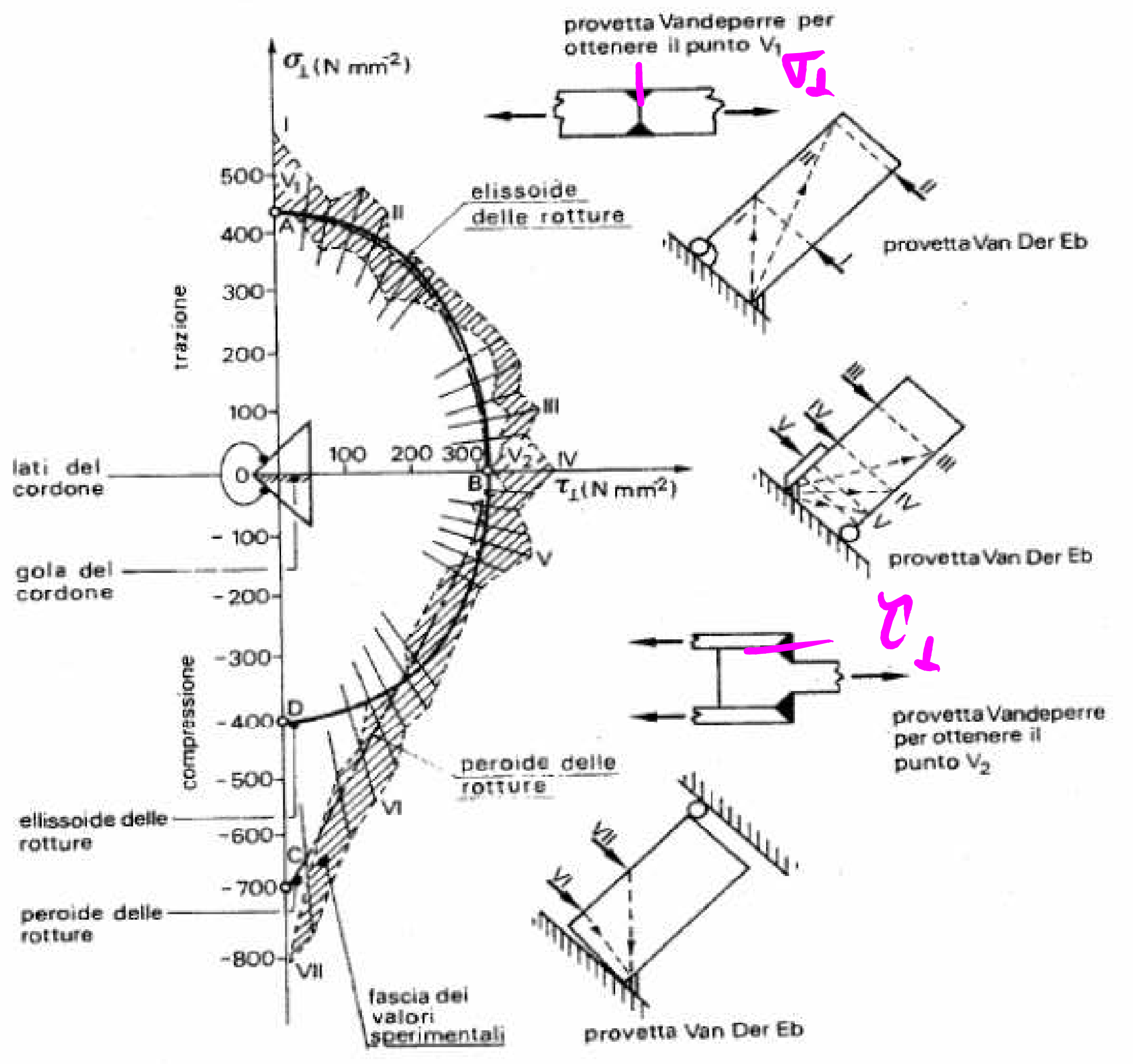


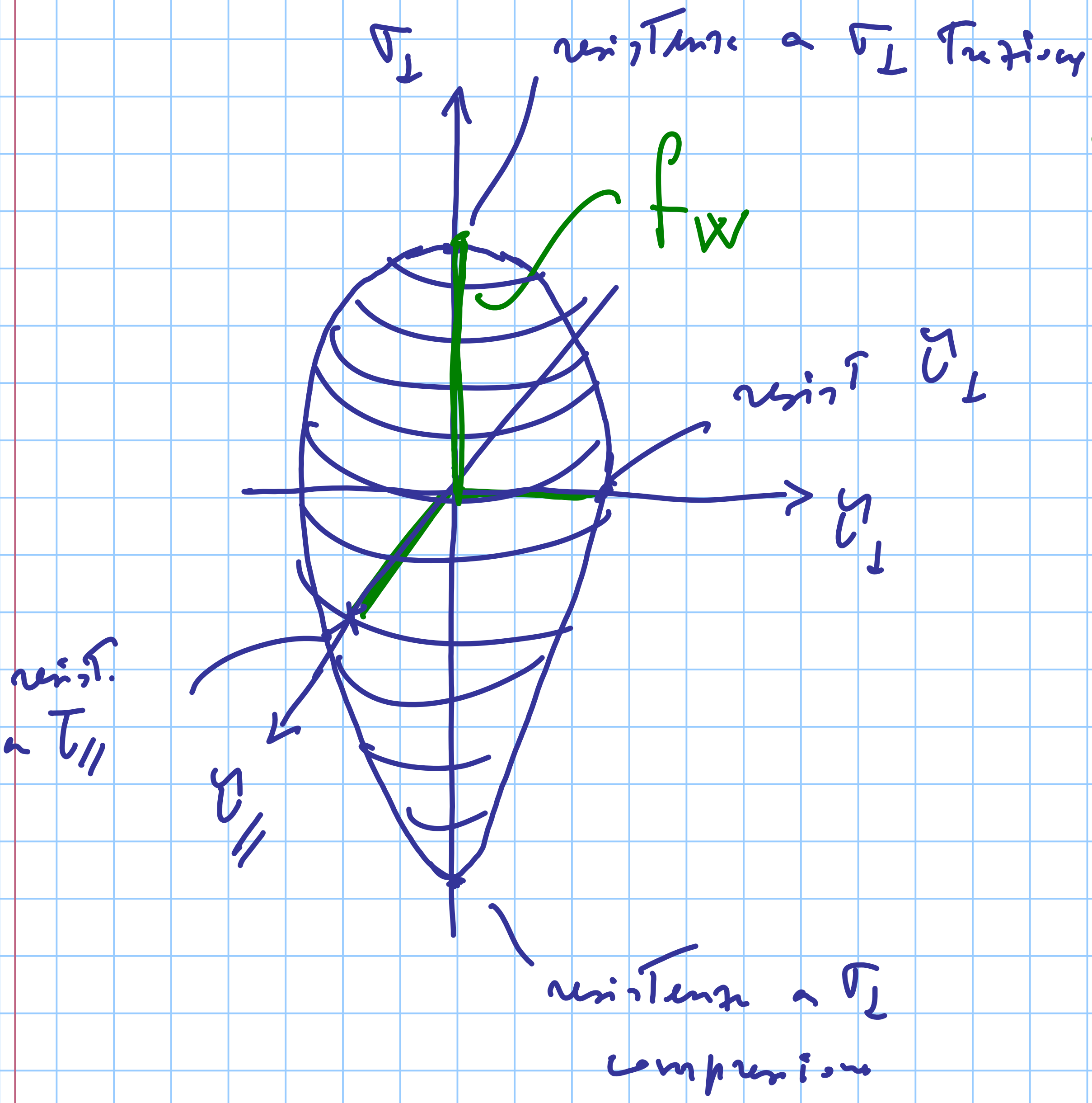
non ci interessano



DOMINIO DI RESISTENZA

$\sigma_\perp \quad \tau_\perp \quad \tau_{\parallel}$





PEROIDE

sperimentale

↓

forma semplificata

ELLISSOIDI

$$\left(\frac{x}{x_0}\right)^2 + \left(\frac{y}{y_0}\right)^2 + \left(\frac{z}{z_0}\right)^2 = 1$$

$$\left(\frac{\sigma_\perp}{f_w}\right)^2 + \left(\frac{\tau_{//}}{0.7\, f_w}\right)^2 + \left(\frac{\tau_\perp}{0.58\, f_w}\right)^2 = 1$$

ovvero $\quad \sigma_\perp^2 + 2\,\tau_{//}^2 + 3\,\tau_\perp^2 = f_w^2$

$$\sigma_\perp^2 + 1.8\left(\tau_\perp^2 + \tau_{//}^2\right) = f_w^2$$ ellissoidi

$$\sigma_\perp^2 + 3\left(\tau_\perp^2 + \tau_{//}^2\right) = f_w^2$$

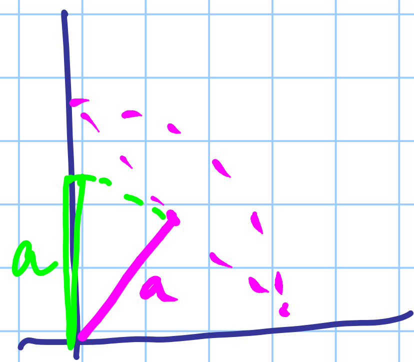
$$\sigma_\perp^2 + \tau_\perp^2 + \tau_{//}^2 = \left(0.58\, f_w\right)^2$$ sfera (inscritta nel prisoide)

oppure $\sigma_\perp^2 + \tau_\perp^2 + \tau_\parallel^2 = (0.7\, f_w)^2$ sfera $\left(\begin{matrix}\text{meno} \\ \text{cautelative}\end{matrix}\right)$

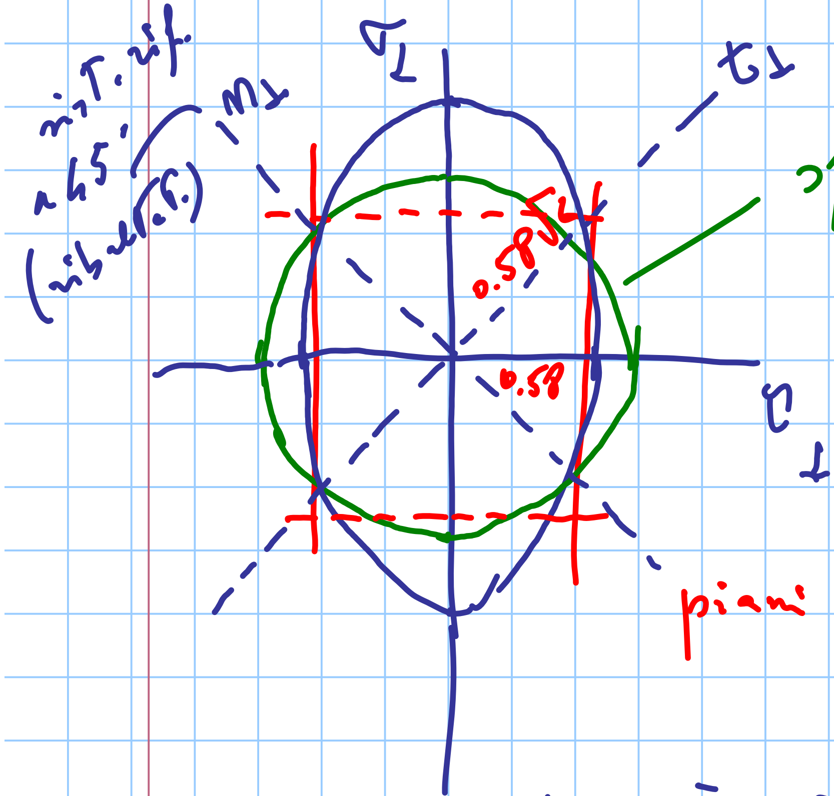
un dominio sferico evita di considerare
la sezione di gola indicata

$\downarrow$

Si può fare riferimento alla sezione
di gola ribaltata



dominio proposto dall'Italia



sfera $r = 0.7\, f_{v0}$ → SFERA MOZZA

piani che tagliano la sfera

$n_\perp$ è $\sigma_\perp$ nel piano ribaltato

$t_\perp$ è $\tau_\perp$ " " "

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2 possibilità

SFERA $\sqrt{\sigma_\perp^2 + \tau_\perp^2 + \tau_{//}^2} \leq \frac{f_{wd}}{\sqrt{3}} = f_{v,wd}$

ELLISSOIDE $\sqrt{\sigma_\perp^2 + 3(\tau_\perp^2 + \tau_{//}^2)} \leq f_{wd}$

$F \rightarrow$ F_x da cui $\sigma_\perp$

F_y $\tau_\perp$

F_z $\tau_{\parallel}$

$$\sqrt{F_x^2 + F_y^2 + F_z^2} = F$$

$$\sigma_\perp = \frac{F_x}{a\,l} \qquad \tau_\perp = \frac{F_y}{a\,l} \qquad \tau_{\parallel} = \frac{F_z}{a\,l}$$

$$\sqrt{\sigma_\perp^2 + \tau_\perp^2 + \tau_{\parallel}^2} \leq f_{v,wd} \Rightarrow F \leq a\,l\,f_{v,wd}$$

$$f_{wd} = \frac{1}{\beta_w} \frac{f_u}{\gamma_{M2}}$$

$\beta_w < 1$

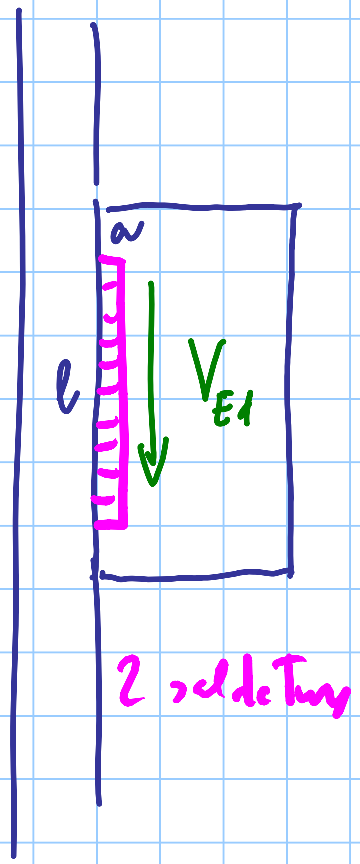
$$\beta_w = \begin{cases} 0.8 & S235 \\ 0.85 & S275 \\ 0.9 & S355 \end{cases}$$

$$f_{v,wd} = \frac{f_u}{\beta_w \sqrt{3}\, \gamma_{M2}}$$

S235

$$f_{wd} = \frac{360}{0.8 \times 1.25} = 360 \text{ MPa}$$

$$f_{v,wd} = 207.8 \text{ MPa}$$



$V_{Ed} = 250$ KN S235

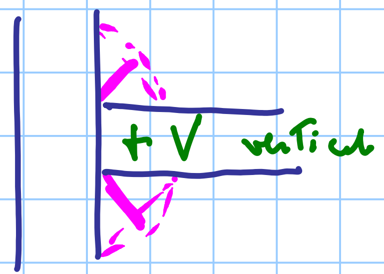
il singolo cordone può portare

mancano solo $\tau_{\parallel}$

$$V_{Ed} = 2\, a\, l\, f_{v,wd}$$

p.es. $a\, l = \dfrac{V}{2 f_{v,wd}} = 601{,}5\ mm^2$

$a = 5$ mm → $l = 120.3$ mm uso 125 mm

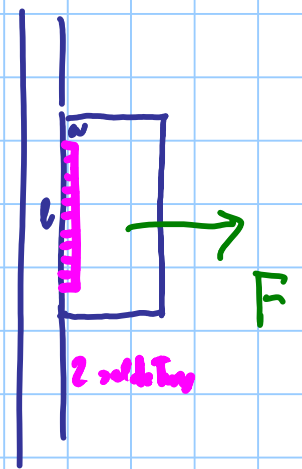


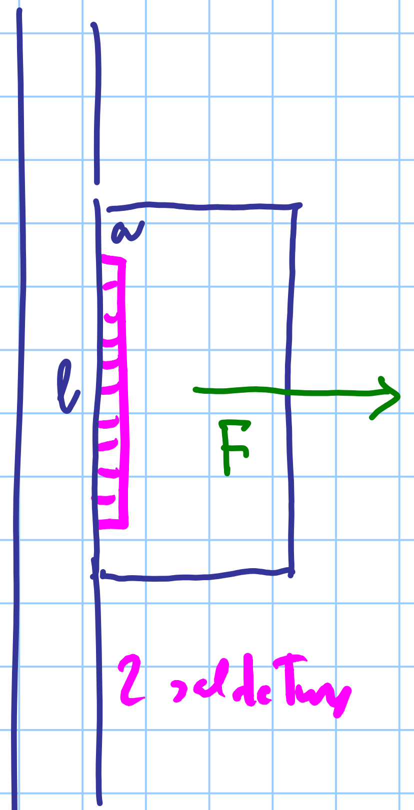
2 cordoni $\quad a = 5\,mm \quad l = 125\,mm \quad$ S235

$$F_{max} = 2\,a\,l\,f_{v,wd} = 259.8\ kN > 250\ kN \quad OK$$

dominio "sfera" $\quad$ posso portare 259.8 kN

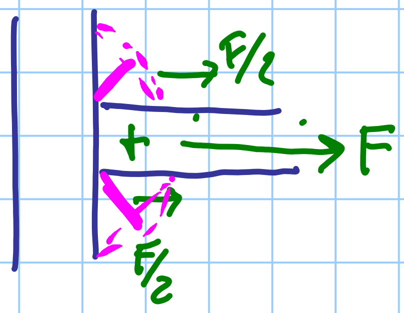
comunque orientati

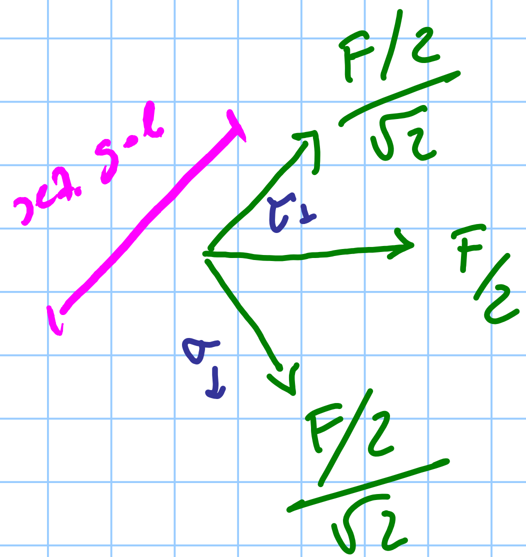




$$F_x = \frac{F}{2\sqrt{2}} \qquad \sigma_\perp = \frac{F_x}{a\,l}$$

$$F_y = F_x \qquad \tau_\perp = \frac{F_y}{a\,l}$$





per una saldatura

$$\sqrt{\sigma_\perp^2 + 3\left(\tau_\perp^2 + \tau_\parallel^2\right)} \le f_{wd}$$

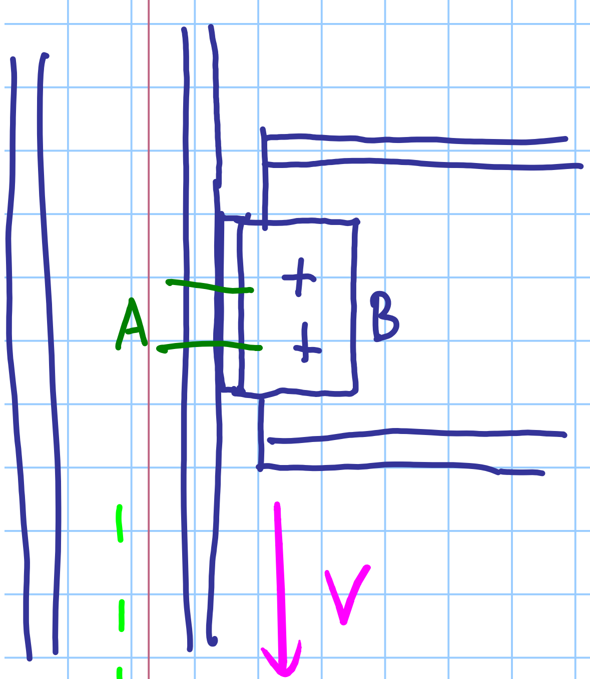
$$\sqrt{\left(\frac{F}{2\sqrt{2}\,a\ell}\right)^2 + 3\left(\frac{F}{2\sqrt{2}\,a\ell}\right)^2} \le f_{wd}$$

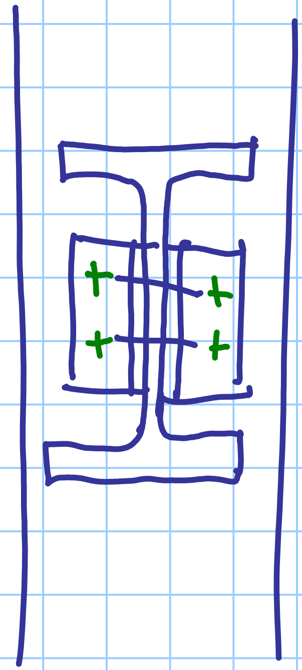
$$\frac{318.2}{259.8} = 1.22$$

$$\frac{F}{2\sqrt{2}\,a\ell}\sqrt{1+3} \le f_{wd}$$

$+22\%$

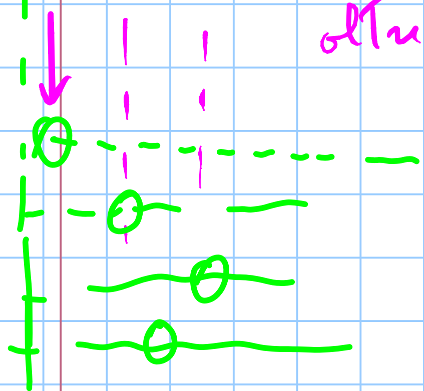
$$F \le \sqrt{2}\,a\ell\,f_{wd} = \sqrt{2} \times 5 \times 125 \times 360 \times 10^{-3} = 318.2\ \text{kN}$$





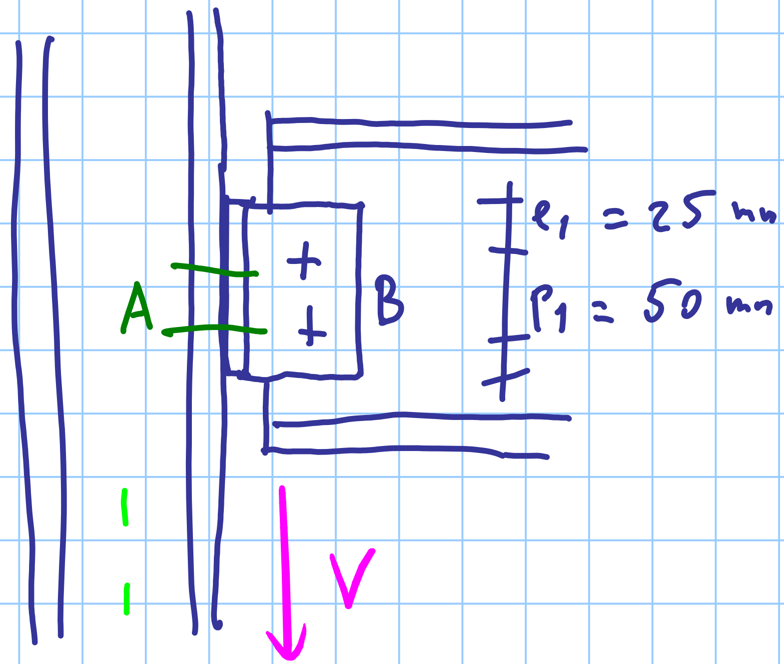
CERNIERA

oltre V c'è M



l'importante è essere coerenti

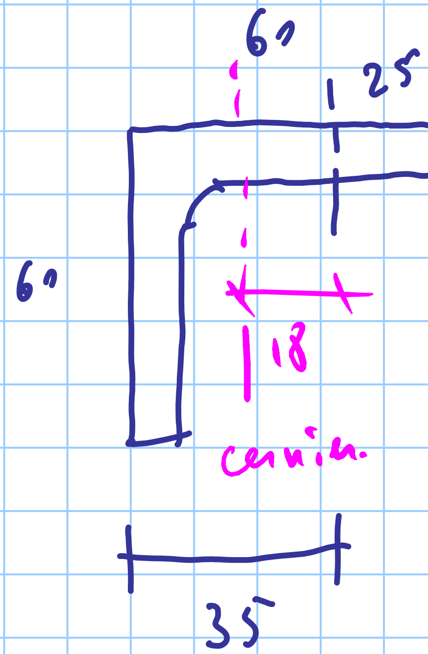
Momento "parassita" dovuto a eccentricità



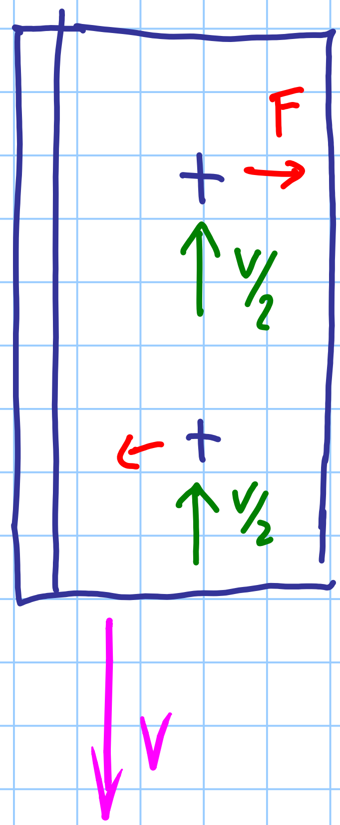
M16 classe 5.6 tutto filettato

$A_{res} = 157$ mm^2

$$F_{V,Rd} = 0.6\, A_{res} \frac{f_{ub}}{\gamma_{M2}} = 37.7 \text{ kN}$$



$$M_{pm} = V \times 18\text{ mm}$$

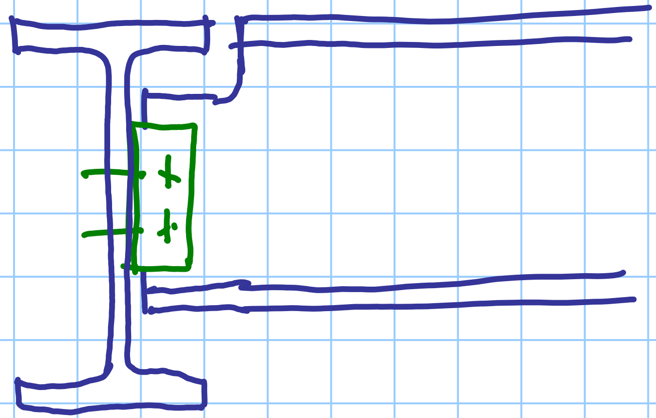


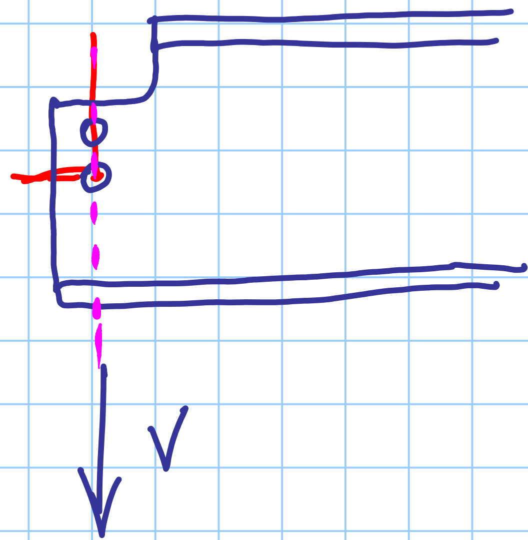
$$F = \frac{M_{pm}}{p_1} = \frac{V \times 18}{50} = 0.36\,V$$

p_1 / 50 mm

$$F_{V,Ed} = \sqrt{(0.5\,V)^2 + (0.36\,V)^2} = 0.616\,V$$

$+23\,\%$




V