SUPERMETAL STRUCTURES
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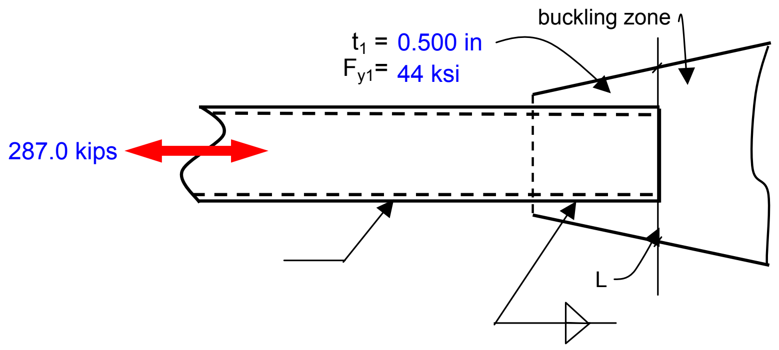
NOTES DE CALCUL / DESIGN BRIEF	No DOCUMENT /DOCUMENT
	C2887 SK 18 REV 0
	févr 05 -04
TS 6x6x0.375	Préparé par / Prepared by: Marc Robitaille ing.

Slotted HSS/Gusset plate Connection (Axial Tension/Compression).



Hss Brace Size	
	6x6x0.375
B =	6.00 in
H =	6.00 in
t =	0.349 in
Fy =	42 ksi
Fu =	58 ksi
Ag=	7.58 in²
L =	36.022 in

Weld	
W_w =	0.250 in
F_{EXX} =	70 ksi

1 - Strength based on member shear

(a) Shear strength at welds

$\varphi R_n = \varphi V_n$ ***=823.2 kips*** ***o.k.***

where:

$V_n = 0.6F_yA_e$	=914.7 kips
$A_e = 4L_wt$	=36.30 in²
$L_w \geq 1.0H$	=26.00 in
t = HSS wall thickness (in)	=0.35 in
H = depth of HSS section (in)	=6.00 in

(b) Shear lag fracture in the HSS

$\varphi R_n = \varphi F_uA_e$ ***=287.3 kips*** ***o.k.***

$A_n = A_g - 2t(t_1)$	=7.23 in²
$A_e = A_nU$	=6.61 in²
$\bar{x} = \dfrac{B^2 + 2BH}{4(B+H)}$	=2.25 in
$U = 1 - (\bar{x}/L_w) \leq 0.9$	=0.91
B = width of HSS section (in)	=6.00 in
H = depth of HSS section (in)	=6.00 in
t = HSS wall thickness (in)	=0.35 in
t_1 = gusset plate thickness (in)	=0.50 in
$L_w \geq 1.0H$	=26.00 in

(c) Tension capacity of the member (net section)

$\varphi R_n = \varphi A_nF_u$ ***=312.7 kips*** ***o.k.***

$A_n = A_g - 2[(pl_{thick} + 1/16)Wall_{thick}]$ =7.19 in²

2 - Strength of the weld connecting the gusset plate to the HSS

$\varphi R_n = \varphi F_wA_w, (kips)$ ***=434.3 kips*** ***o.k.***

$\varphi = 0.75$	
$F_w = 0.60F_{EXX}(1 + 0.5\sin^{1.5}\theta)$	=42.0 ksi
$A_w = 4(0.707)W_eL_w$	=13.79 in²
$W_e = W_w - 1/16$	=0.1875 in
H = depth of HSS section (in)	=6.00 in
$L_w \geq 1.0H$	=26.00 in ***o.k.***

3 - Strength based on the gusset plate shear

The procedure below is based on the minimum thickness that matches the shear yielding strength of the gusset plate with the strength of the weld metal.

φR_n ***=434.3 kips*** ***o.k.***

$\varphi V_n = 0.9(0.6F_{y1}t_1)$
$\varphi V_w = 0.75(0.6F_{EXX}W_w)(0.707)2$
$\varphi V_n \geq \varphi V_w$

$t_1 = \dfrac{1.18F_{EXX}W_w}{F_{y1}}$ =0.469 in ***N/A.***

4 - Strength based on buckling of the gusset plate

φR_n ***=331.6 kips*** ***o.k.***

$\varphi_cP_n = \varphi_cA_gF_{cr}$	*=565.1 kips*
P_u = required compressive strength (kips)	=287.0 kips
P_n = nominal compressive strength (kips)	
l = laterally unbraced length of gusset (in)	=2.000 in
$r = \dfrac{t_1}{\sqrt{12}}$	=0.144 in
$\lambda_c = \dfrac{Kl}{r}\sqrt{\dfrac{F_{y1}}{E}}$	=0.648
F_{cr} = critical compressive strength (kips)	
$F_{cr} = (0.658^{\lambda_c^2})F_{y1}$, for $\lambda_c \leq 1.5$	=36.91 ksi
$F_{cr} = \left[\dfrac{0.877}{\lambda_c^2}\right]F_{y1}$, for $\lambda_c > 1.5$	N/A

$\varphi_bM_n = \varphi_bF_{y1}Z$	*=89.2 kip-in*
M_n = nominal flexural strength of the gusset plate (kip-in)	
$Z = \dfrac{Wt_1^2}{4}$	=2.251 in³
W = width of gusset (in)	=36.022 in
t_1 = gusset thickness (in)	=0.500 in

$P_u \leq \dfrac{1}{\dfrac{1}{\varphi_cP_n} + \dfrac{4}{9}\dfrac{e}{\varphi_bM_n}}$ ***=331.6 kips*** $\dfrac{Pu}{\varphi_cP_n} \geq 0.2$ 0.586743

$P_u \leq \dfrac{1}{\dfrac{1}{2\varphi_cP_n} + \dfrac{e}{\varphi_bM_n}}$ ***=218.6 kips*** $\dfrac{Pu}{\varphi_cP_n} < 0.2$ 0.386888

$e = \dfrac{t_1}{2}$ =0.250 in