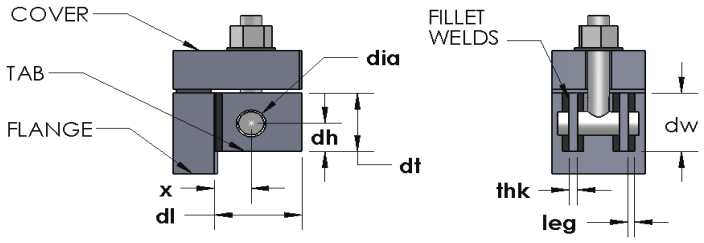
Swing Bolt attachment Calculations, ver.3.1



Details:

F	=	4,291	lbf, force per bolt
dt	=	2.625	in, tab overall height
dl	=	2	in, tab overall length
thk	=	0.25	in, thickness of each tab
x	=	1	in, distance to bolt centre
dia	=	0.75	in, hole diameter
dh	=	1.3125	in, hole height
		SA-240 B04	Tab Material
S	=	16,500	psi, Allowable tensile stress in tab
dw	=	2.625	in, fillet weld height
leg	=	0.125	in, fillet weld leg length
dp	=	0.625	in, pin diameter
		SA-195 B7	Pin material
Sp	=	25,000	psi, Allowable tensile stress in pin

Simplifying Assumptions:

-No torsion in welds
-Bolt material is covered by Appendix-2 calculations
-No out-of-plane effects such as buckling or dishing are accounted for here.

Material Properties: Allowable Stress

Ss	=	0.8*S	
	=	0.8*16500	
	=	13,200	psi, Allowable Shear stress in tab (80% per ASME IID Notes Table 1a)
Sb	=	1.5*S	
	=	1.5*16500	
	=	24,750	psi, Allowable Bending stress in tab (ASME VIII-1 UG-23 (c))
Sbe	=	1.6*S	
	=	1.6*16500	
	=	26,400	psi, Allowable Bearing stress in tab hole (1.6 times per ASME IID Notes Table 1a)
Sws	=	0.49*S	
	=	0.49*16500	
	=	8,085	psi, Allowable Shear stress in Fillet weld (UW-15(c)(3))
Sp	=	0.8*Sp	
	=	0.8*25000	
	=	20,000	psi, Allowable pin Shear stress (80% per ASME IID Notes Table 1a)

Calculations:

Ap	=	pi*dp^2/4	
	=	3.14*0.625^2/4	
	=	0.306640625	sq.in, single shear area of pin
M	=	x*[F/2]	
	=	1*(4291/2)	
	=	2,146	in-lb, Bending moment in tab

See Page 2

Weld Stress:

Sws = F/[cos(45)*leg*dw*4]
= 4291/(cos(45)*0.125*2.625*4)
= 4,624 psi, Weld shear stress — **Weld Shear Stress is Acceptable**

Swb = M*[dw/2]/[leg*dw^3/6]
= 2145.5*(2.625/2)/(0.125*2.625^3/6)
= 7,473 psi, Weld bending stress — **Weld Bending Stress is Acceptable**

Tab Stress:

Sts = F/[2*dw*thk]
4291/(2*2.625*0.25)
= 3,269 psi, Tab shear stress at support — **Tab Shear Stress is Acceptable**

Stb = M*[dw/2]/[thk*dw^3/12]
= 2145.5*(2.625 / 2) / (0.25*2.625^3/12)
= 7,473 psi, Tab maximum bending stress — **Tab Bending Stress is Acceptable**

Stbe = F/[2*dp*thk]
= 4291/(2* 0.625 * 0.25)
= 13,731 psi, Tab bearing stress — **Tab Bearing Stress is Acceptable**

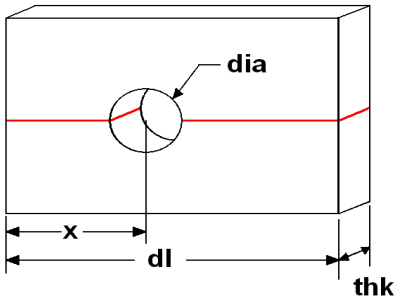
Pin Tear-out calculation*

*Failure modes as per ASME BTH-1-2005 for pinned-pinned connections.

Mode 1: Tensile pull-out:

St1 = F/[2*thk*[dl - x - 0.5*dia]]
= 4291 / [2*0.25 * (2 - 1 - 0.5*0.75)]
= 13,731 psi, Tensile pull-out stress

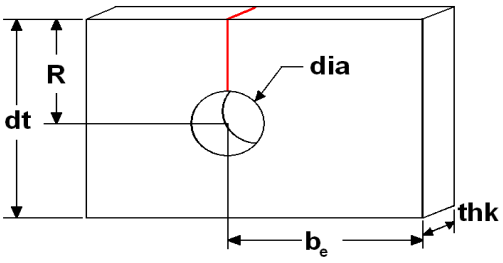
Mode 1 Stress is Acceptable



Mode 2: Allowable Single Plane Fracture Strength (tensile)

St2 = F/[2*thk*[1.13*(R-dia/2) + 0.92*be/(1 + be/dia)]]
= 4291/[2*0.25*[1.13*(1.3125-0.75/2) +
0.92*0.625/(1 + 0.625/0.75)]]
= 6,250 psi, Single plane shear stress

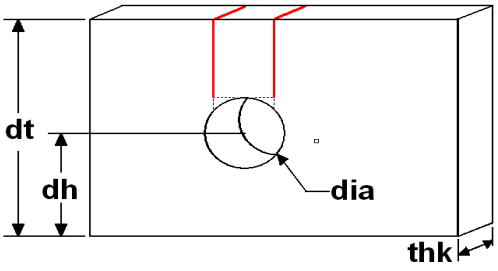
Mode 2 Stress is Acceptable



Mode 3: Double plane shear stress

St3 = F/[2*2*thk*[dt - dh - 0.5*dia]]
= 4291 / [2*2*0.25 *(2.625 - 1.3125 - 0.5*0.75)]
= 4,577

Mode 3 Stress is Acceptable



Pin Shear Stress:

Stp = F/[Ap*2]
= 4291/(0.3066*2)
= 6,997 psi, Pin shear stress — **Pin Shear Stress is Acceptable**