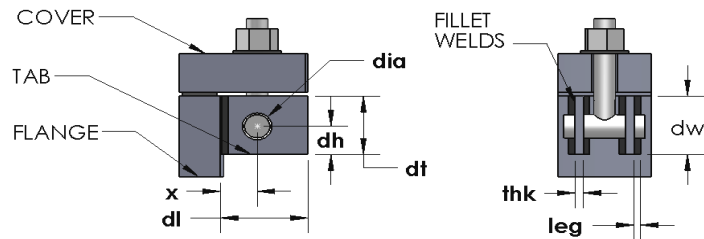


## Swing Bolt attachment Calculations, ver.3.1



### 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

### Weld Stress:

See Page 2

Note: This calculation sheet is a sample, and is supplied for information purposes only.

$$\begin{aligned}
 S_{ws} &= F/[\cos(45)*leg*dw*4] \\
 &= 4291/(\cos(45)*0.125*2.625*4) \\
 &= 4,624 \text{ psi, Weld shear stress} \\
 S_{wb} &= M*[dw/2]/[leg*dw^3/6] \\
 &= 2145.5*(2.625/2)/(0.125*2.625^3/6) \\
 &= 7,473 \text{ psi, Weld bending stress}
 \end{aligned}$$

**Weld Shear Stress is Acceptable**

**Weld Bending Stress is Acceptable**

#### Tab Stress:

$$\begin{aligned}
 S_{ts} &= F/[2*dw*thk] \\
 &= 4291/(2*2.625*0.25) \\
 &= 3,269 \text{ psi, Tab shear stress at support} \\
 S_{tb} &= M*[dw/2]/[thk*dw^3/12] \\
 &= 2145.5*(2.625/2)/(0.25*2.625^3/12) \\
 &= 7,473 \text{ psi, Tab maximum bending stress} \\
 S_{tbe} &= F/[2*dp*thk] \\
 &= 4291/(2*0.625*0.25) \\
 &= 13,731 \text{ psi, Tab bearing stress}
 \end{aligned}$$

**Tab Shear Stress is Acceptable**

**Tab Bending Stress is Acceptable**

**Tab Bearing Stress is Acceptable**

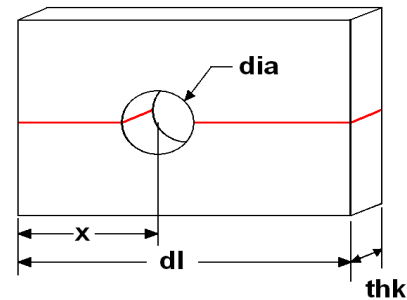
#### Pin Tear-out calculation\*

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

##### Mode 1: Tensile pull-out:

$$\begin{aligned}
 S_{t1} &= F/[2*thk*[dl - x - 0.5*dia]] \\
 &= 4291 / [2*0.25 * (2 - 1 - 0.5*0.75)] \\
 &= 13,731 \text{ psi, Tensile pull-out stress}
 \end{aligned}$$

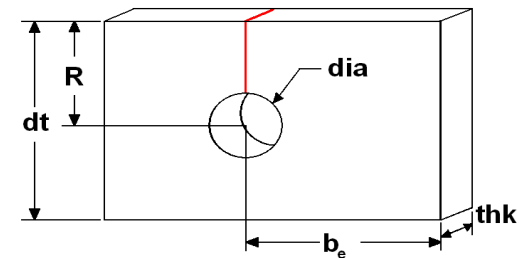
**Mode 1 Stress is Acceptable**



##### Mode 2: Allowable Single Plane Fracture Strength (tensile)

$$\begin{aligned}
 S_{t2} &= F/[2*thk*[1.13*(R-dia/2) + 0.92*be/(1 + be/dia)]] \\
 &= 4291/[2*0.25*[1.13*(1.3125-0.75/2) + \\
 &\quad 0.92*0.625/(1 + 0.625/0.75)]] \\
 &= 6,250 \text{ psi, Single plane shear stress}
 \end{aligned}$$

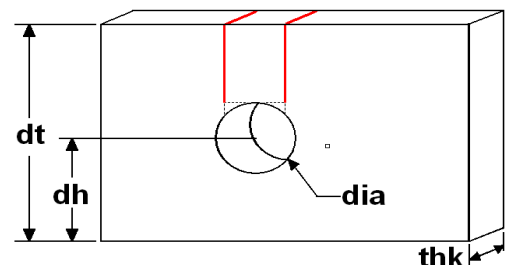
**Mode 2 Stress is Acceptable**



##### Mode 3: Double plane shear stress

$$\begin{aligned}
 S_{t3} &= F/[2*2*thk*[dt - dh - 0.5*dia]] \\
 &= 4291 / [2*2*0.25 *(2.625 - 1.3125 - 0.5*0.75)] \\
 &= 4,577
 \end{aligned}$$

**Mode 3 Stress is Acceptable**



#### Pin Shear Stress:

$$\begin{aligned}
 S_{tp} &= F/[A_p*2] \\
 &= 4291/(0.3066*2) \\
 &= 6,997 \text{ psi, Pin shear stress}
 \end{aligned}$$

**Pin Shear Stress is Acceptable**