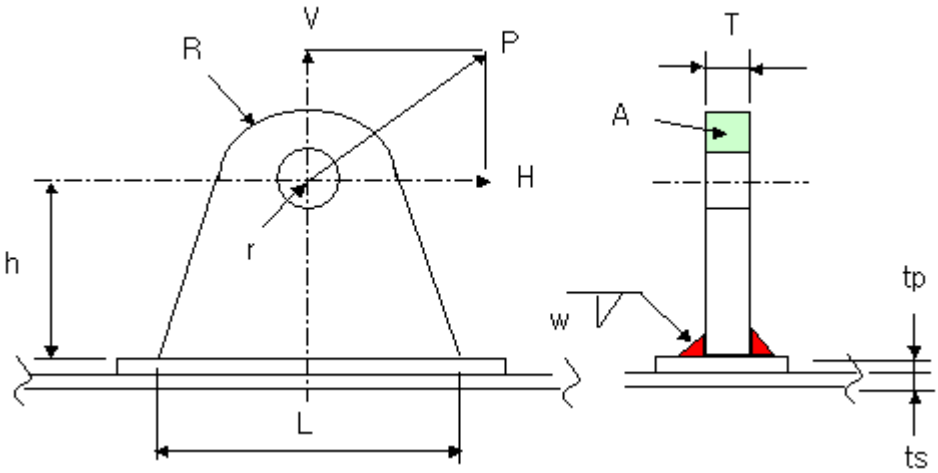
HEAT EXCHANGER STRENGTH CALCULATION

LIFTING LUG CALCULATION

INPUT DATA 계산실행 ***V1.0***

* ITEM NO.	PES21-01		* DESCRIPTION	PES21	
SHELL SIDE DESIGN DATA			TUBE SIDE DESIGN DATA		
* Lug Material	SS400		* Pad Material	SS400	
* Applied equipment weight, Wi=	4000	Kg	* Number of lifting lug, N=	4	
* Shell Thickness (Corroded), ts=	10.5	mm	* Lug pad thickness, tp=	13	mm
* Lug Thickness, T=	30	mm	* Lug Length at Bottom, L=	200	mm
* Lug hole radius, r=	30	mm	* Lug outside radius, R=	80	mm
* Shell inside radius (Corroded), Rs=	1219	mm	* Height of lug hole, h=	180	mm
* Weld leg length at Lug to Pad,w=	10	mm	* Angle of lifting, α=	30	o
* Impact factor, Df	1.25				



RESULT OF CALCULATION

* Lug Yield strength, Sya	21.09	Kg/mm^2	* Pad Yield strength,Syb	21.09	Kg/mm^2
* Lug Allowable stress, Sa=Sya*0.6	12.66	Kg/mm^2	* Pad Allowable stress, Sb=Syb*0.6	12.66	Kg/mm^2

1. Considering Dynamic Effect on Equipment

* W=Wi*Df	5,000	Kg	* Vertical Load per Lug, V=W/N	1,250	Kg
* Lifting Load per Lug, P=V/Sin(α * 3.14/180)	2,500	KG	* Horizontal Load per Lug, H=V/Tan (α * 3.14/180)	2,165	Kg

2. Shear stress at top of Lug

* A=Tx(R-r)	1,500	mm^2	* S1= W/(N*A)	0.83	Kg/mm^2
* Allowable stress	12.66	Kg/mm^2			
* Judgement				O.K	

3. Stress at lug to shell junction

* ML= H x h	389,712	Kg-mm
* Bending stress due to H, S2=3ML/(LxLxw)		
=3*389,711.83/(200*200*7.1)	4.13	Kg/mm^2
* Bending stress due to V, S3= V/(N*w(L+T)		
=1,250/(4*7.1*(200+30))	0.19	Kg/mm^2
* Shear stress due to H, S4= H/(N*w(L+T))		
=2,165/(4*7.1*(200+30))	0.33	Kg/mm^2

4. Combined stress

* C1=S1=	0.83	Kg/mm^2
* Allowable stress=0.8xSa	10.12	Kg/mm^2
* Judgement	O.K	
* C2 = ((S2+S3)^2 + S4^2)^0.5	4.34	Kg/mm^2
* Allowable stress=0.55xSa	6.96	Kg/mm^2
* Judgement	O.K	

5. Local stress due to V & ML

* F1= 6ML/(L*L) =	58.46	Kg/mm	* F2= V/L =	6.25	Kg/mm
* S5= 1.17*((Rs*(ts+tp))^0.5*(F1+1.5*F2)/(ts+tp)^2					
=1.17*(1219*(10.5+13))^0.5*(58.46+(1.5*6.25))/(10.5+13)^2				24.32	Kg/mm^2
* Allowable stress = 2xSb				25.31	Kg/mm^2
* Judgement				O.K	

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