Modeling Stacked Exchangers in PV Elite

Intergraph CAS

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Here is a typical stacked exchanger:



Here are some steps to model stacked exchangers in PV Elite:

- 1. Model the two exchangers in separate models.
- 2. If the weight of the top exchanger acts on the bottom exchanger then get the weight of the top exchanger from its output and apply that on the bottom exchanger using the Miscellaneous weight icon.



Add miscellaneous weights on the lower exchanger where the weight of the top exchangers acts. So, you may have to distribute the weight among the saddle connection points.

Waight/Diping Dialog					x	
From Node :	20		Select the Active Cases for this Weight/Mass			
Detail Description :	TOP EXCHANGER - 1		Empty Case :			
Distance from "From" Node :	1	ft.	Operating Case :			
Layout Angle :	0 deg.		HydroTest Case :			
Offset From Element Centerline :	30	in.	· · ·			
Miscellaneous Weight :	10000	lbm	Is this a Welded Internal 2 :			
			15 0 15 6 1761060			
- Area of the weight/mass/equipment	for the Wind Load Ca	alc				
Area of External Weight/Piping/Equipment : 1000 in ²						
Dista - Datail				4		
Piping Detail						
Is this a Piping Detail ? : 🔄				1	_	
	Pipe Outside Diameter :		0	in. Pipe Lookup		
	Pipe Thickness :			j in.		
Fluid Specific Gravity : 0						
	Insulation Thickness :		0	in.		
Insulation Density : 0 lb./ft3						
Compute Weight and Area						
Wght:[1 of 1]						
Previous Weight Add New Weig	jht <u>D</u> elete		ок с	ancel <u>H</u> elp		

Be sure to offset the weights. This will transfer the weight and wind/seismic load from the top exchanger to the bottom exchanger.

3. The bottom exchanger will look something like this after both weights have been specified.



4. You may have to consider the <u>bundle pullout</u> effect of the top exchanger, as it loads the bottom saddles as well. Let's look at that picture again,



The bundle pullout is specified as load FL1 and FL2 for the lower and upper exchangers. In PV Elite, for the bottom exchanger you will specify bundle pull out load as Miscellaneous Force in X-direction (along the axis of horizontal vessel)



This horizontal force is converted to vertical load acting on the saddle as,

QL1 = FL1 * B / L

Since, at this time PV Elite does not have the option to specify the bundle pullout for the top exchanger; we have to use a *trick*. The vertical reaction due to bundle pullout for the top exchanger would be,

QL2 = FL2 * B2 / L

Since, in PV Elite we specify B (and not B2). Hence, we can back calculate an equivalent bundle pullout load to work with B as,

FLeq = QL2 * L / B = FL2 * B2 / B

FLeq = (FL2 * B2) / B

Now, specify the FLeq on the bottom exchanger as *Miscellaneous Force*.

Force/Moment Dialog		_	_	x			
From Node: 10 Detail Description: FLeq							
Distance from "F	rom" Node: 0	ft.					
Axis Direction	X	Y	Z				
Applied Forces	3000	0	0	в.			
Applied Moments	0	0	0	ft.lb.			
Note: -Y Force	Note: -Y Forces act Downward. +Y Forces act Uoward.						
Compute Stresses due to	Compute Stresses due to Applied Loads						
Compute L	ongituainai stresses	bw normally added	to the wind Case.				
[√] Compute L	ongitudinal Stresses	BS normally added t	o the Seismic Case.				
⊂ Force/Moment Combinati ⊚ SRSS (Mor	Force/Moment Combination Method						
Notes :							
These values ac rate the nozzle f	These values act globally over the entire vessel. These values will not be used to rate the nozzle flange.						
Moments on horizontal vessels are not included in the saddle support design for the determination of Q the saddle support load.							
Moments should be converted to equivalent force(s) on horizontal vessels for support load consideration.							
F/M:[1 of 1]						
Previous For/Mom Add New For/Mom Delete OK Cancel Help							

This will produce the correct vertical load on top of the saddle for the bottom exchanger. Moreover, this will also be transferred as shear load to the saddle, saddle base plate and bolts. The program assumes that one of the saddles is sliding and hence the entire longitudinal load is taken by one of the saddles.

 Additionally, if the saddle of the top exchanger is acting over a small area of the bottom exchanger then you may have to consider the local stress in the shell of the bottom exchanger. In that case you can use the *Clip dialog*.

ted.PVI:1 - PVElite				
Auxiliary Analyze Output T	fools 3D Diagnostics Esl Help			
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	# ×			
Generic Clip Local Stress Analysis per WRC 107				
From Node :	20			
Description of Clip :	top saddle 1	HA (HO HIS		
Distance from 'From' Node :	1 ft.	Cry Critter		
Layout Angle :	0 degrees			
Clip Parameters	Is the Clip Circular?			

This is how the bottom exchanger may look like,

