How to get started in Aspentech

Dll needs to be installed on the user's machine **Aspen Shell&Tube V7.21 should be installed.**

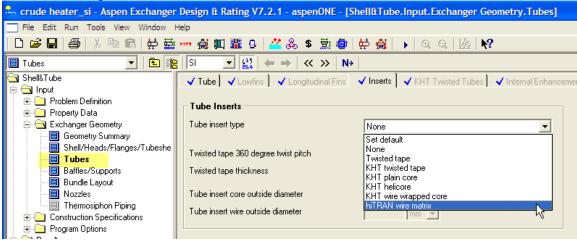
Release of V7.3 which was released beginning of January 2011 is not recommended since there are some minor inconsistencies which are not present in V7.21

If possible Calculations should be done with Version 7.21

Limitations: Single Phase Flow only

Shell&Tube

The hiTRAN option can be found as shown in the screenshot:



Once the hiTRAN option is clicked the hiTRAN wire Matrix Frame is activated and the drop down list populated with the following options:

Find optimum Insert Use previous Insert

Specify new Insert

🗸 Tube 🖌 🗸 Lowfins 🗍 🗸 Longitudinal Fins	s 🖌 Inserts 🖌 🗸 KHT Twisted Tubes 🖌 🗸 Internal Enhancements
Tube Inserts	
Tube insert type	hiTRAN wire matrix
Twisted tape 360 degree twist pitch Twisted tape thickness	mm 💌
Tube insert core outside diameter	mm
Tube insert wire outside diameter	mm
hiTRAN Wire Matrix Inserts	
hiTRAN insert calculation type	Find Optimum insert
hiTRAN Part No.	Find Optimum insert
hiTRAN Part No. (previous)	Use previous insert Specify new insert
	hiTRAN Info

Once selected the tube side heat transfer and pressure drop calculations are based on Cal Gavin data.

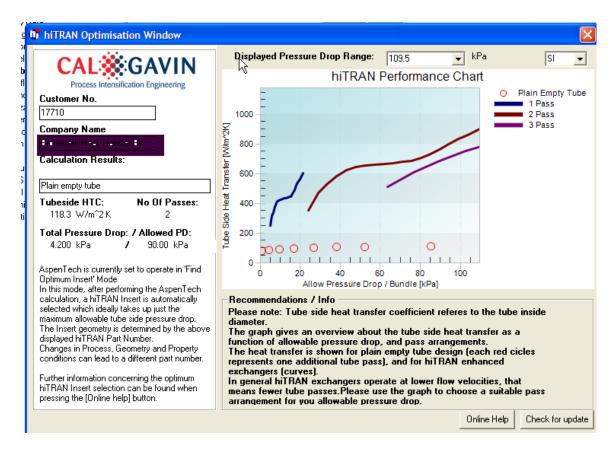
Depending on the selected Calculation Mode in Aspen (Find optimum Insert ; Use previous Insert) The plug in behavior differs as explained below:

Find optimum Insert / (rating / checking) mode

In order to run this mode in Aspen Shell&Tube under calculation option [rating / checking] has to be selected. The hiTRAN plug in will try to find a Insert geometry (Loopdensity) which just takes up all the allowable pressure drop in order to give the highest tube side heat transfer. Main parameters to influence the result are:

- Allowable tube side pressure drop
- Number of tube passes per bundle

In order to see what kind of combination is useful the hiTRAN Info button can be clicked. !Prior of doing this, the case to be run once in Shell&Tube! The following Info Graph will be shown:

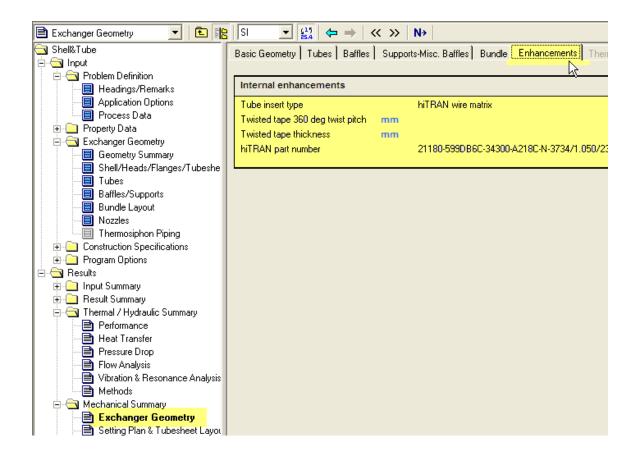


This graph gives additional Information how to choose the pass arrangement with hiTRAN in order to stay within the allowable pressure drop. In an optimised design the allowable pressure drop should equal the calculated pressure drop

The case can be run and in the Output summary the hiTRAN pressure drop and heat transfer can be seen.

Rating / Checking		-	Shell		1 400	e Side
Total mass flow rate	kg/s		().4		12
Vapor mass flow rate (In/Out)	kg/s		0.4	0	0	0
Liquid mass flow rate	kg/s		0	0.4	12	12
Vapor mass quality			1	0	0	0
Temperatures	*C		212.6	212.6	120	150
Dew / Bubble point	*C		212.6	212.6		
Operating pressures	bar		20	19.98599	50	49.10098
Film coefficient (mean)	₩/(m² K)		9119	9.5	(816
Fouling resistance (OD based)	m² K/W		0.000	009	0.0	00042
Velocity (highest) m/s			m/s 0.75			0.34
Pressure drop (allow./calc.)	bar		0.3 /	0.01401	0.9	/ 0.89903
Total heat exchanged	kW		757.6	6 Unit BES	2 pass	1 ser 1 pa
Overall clean coef (plain/finned)	₩/(m² K)	72	3.7/	Shell size	640- 6000	mm Ho
Overall dirty coef (plain/finned)	₩/(m² K)	52	8.7/	Tubes Pla	in	
Effective area (plain/finned)	m²	10	1.7/	Insert hiT	RAN wire matrix	
Effective MTD	*C		76.6	No. 226	OD 25.4 Tk	ւ <mark>s 2.11 mm</mark>
Actual/required area ratio(dirty/clean)		5.44	/ 7.44	Pattern 30	Pit	ch 31.75 mm
Vibration problem (Tasc/TEMA)		No	/ No	Baffles Singl	e segmental – C	Cut(%d) 37.11
RhoV2 problem			No	Total cost	40448	Dollar(US)
Heat Transfer Resistance				•		
Shell side / Fouling / Wall / Fouling /	/ Tube side					
Shell Side						Tube Sid

It can be seen that the Insert Geometry is chosen to take up all the allowable pressure drop. The Insert Part Number which describes the Geometry can be found under



The Part Number can also be found in the TEMA specification sheet.

Use previous Insert / (simulation) mode

In Simulation Mode the Insert is fixed. This means different process conditions can be simulated with a fixed Insert Geometry. To do this the following steps needs to be undertaken:

1.

Prior to simulation the case has to be run in Rating checking mode in order to find an optimized Insert.

hiTRAN insert calculation type	Find Optimum insert
hiTRAN Part No.	
hiTRAN Part No. (previous)	21180-599DB6C-34300-A218C-N-3734/1.050/236
	hiTBAN Info

In this mode a part number is calculated and displayed under *hiTRAN Part No.* (*previous*)

When in the drop down list *Use previous Insert* is clicked. The part number is copied into this box and the part number fixed.

hiTRAN Wire Matrix Inserts	
hiTRAN insert calculation type	Use previous insert
hiTRAN Part No.	21180-599DB6C-34300-A218C-N-3734/1.050/236
hiTRAN Part No. (previous)	21180-599DB6C-34300-A218C-N-3734/1.050/236
	hiTBAN Info

Now the Calculation mode in Shell&Tube can be changed to simulation and the Insert Geometry will be fixed for all calculations.

In General now the calculated pressure drop will differ from allowable pressure drop.

AirCooled

In AirCooled the hiTRAN option can be found as shown in the screenshot:

👆 lubeoil cooler_si - Aspen Exchange	r Design & Rating V7.2.1 - asp	enONE - [AirCooled.Input.Program Option
Tile Edit Run Tools View Window H	Help	
🗅 🚅 🖬 🎒 X 🖻 🖻 🖶 🚔	🚥 🍓 🌉 🏙 🧕 🎽 🖧 🧐	\$ 鼓鹵 🖶 🏭 🕨 🔍 🖉 🔛
🗏 Methods/Correlations 📃 主 🞼	SI ▼ 🟭 🔶 → <	< >> N→
AirCooled AirCooled Problem Definition Property Data Exchanger Geometry Construction Specifications Program Options Design Options Thermal Analysis Methods/Correlations Outside Distribution Results Dutside Distribution	✓ Tube Side ✓ Outside ✓ T Enhancement type	Tube Side Enhancement Control

Once selected the tube side heat transfer and pressure drop calculations are based on Cal Gavin data and the following frame appears.:

🗸 Tube Side 📔 🗸 Outsid	le 🗸 Tube Side Enhancement 🛛 🗸 Outside Enhancement 🗎	
Enhancement type	hiTRAN wire matrix	
– hiTRAN Wire Matrix Inser	ts	hiTRAN Info
Number of insert types	1 insert type Allowable pressure drop	1.5 bar 💌
Start End pass	Calculation type hiTRAN Part No.	
1 1 2	Find Optimum insert	

Default setting is:

Number of insert types [**1 insert type**] this means. This means for the Start Pass number until the End Pass Number an Insert Geometry is selected which should take up just the maximum Allowable pressure drop. In the case above, in a two pass exchanger the 1

Insert type is specified to be installed in each pass. This would be the normal first default choice.

Depending on the selected Calculation type in Aspen (Find optimum Insert ; Use previous Insert) The plug in behavior differs as explained below:

Find optimum Insert / (rating / checking) mode

In order to run this mode in Aspen AirCooled under Program calculation mode [rating / checking] has to be selected. The hiTRAN plug in will try to find a Insert geometry (Loopdensity) which just takes up all the allowable pressure drop in order to give the highest tube side heat transfer. Main parameters to influence the result are:

- Allowable tube side pressure drop
- Number of tube passes per bundle

In order to see what kind of combination is useful the hiTRAN Info button can be clicked. !Prior of doing this, the case to be run once in Shell&Tube!

The following Info Graph will be shown:

hiTRAN Optimisation Window									
CAL CAVIN	Displayed Pressure Drop Range: 182.5 VRa	SI 💌							
Process Intensification Engineering Customer No. 17710 Company Name Encrowerk Heet Transfer HV Calculation Results: hiTRAN Part No.: 20600-6754954-34300-A218C-N-3734/1.050/2 Tubeside HTC: No Of Passes:	hiTRAN Performance Chart	Plain Empty Tube 1 Pass 2 Pass 3 Pass 4 Pass							
699.9 W/m ² K 2 Total Pressure Drop: / Allowed PD: 149.0 kPa / 150.0 kPa AspenTech is currently set to operate in 'Find Optimum Insert' Mode	200 50 100 150 Allow Pressure Drop / Bundle [kPa]	Ŗ							
In this mode, after performing the AspenTech calculation, a hiTRAN Insert is automatically selected which ideally takes up just the maximum allowable tube side pressure drop. The Insert geometry is determined by the above displayed hiTRAN Part Number. Changes in Process, Geometry and Property conditions can lead to a different part number. Further information concerning the optimum hiTRAN Insert selection can be found when pressing the [Online help] button.	Recommendations / Info Please note: Tube side heat transfer coefficient referes to the tul diameter. Calculated hiTRAN tubeside pressure drop equals allowable pres Please check on the graph display, whether a different pass arra will yield a higher heat transfer coefficient.	sure drop.							
	Online Help	Check for update							

This graph gives additional Information how to choose the pass arrangement with hiTRAN in order to stay within the allowable pressure drop. In an optimised design the allowable pressure drop should equal the calculated pressure drop

The case can be run and under Results / Performance the hiTRAN pressure drop and heat transfer can be seen.

Rating / Checking			Out	side	Tub	e Side	
Total mass flow rate		kg/s	108.	333	1	4.1667	
Vapor mass		kg/s	108.333	108.333	0	0	
Liquid mass		kg/s			14.1667	14.10	667
Vapor mass quality			0	0	0	0	
Temperature		*C	42	46.18	71.1	54.9	99
Dew / bubble point temperatures		*C					
Humidity ratio							
Operating pressure	Pa	/ bar	101326	101326	6	4.502	294
Film coefficients		₩/(m² K)	694	4.1		567.6	
Fouling resistance		m² K/W	0)		0	
Velocity (highest)		m/s	4.66 /	4.72	0.25	/ 0.25	5
Pressure drop (allow/calc.)	Pa	/ bar	10000 /	100	1.5	/ 1.497	06
Total heat exchanged	k₩	454.6	Bay per unit	1	Tube OD	25.4	п
Overall bare coeff. (dirty/clean)	₩/(m² K)	313.37 308	Bundles/bay	1	Tube tks	2.4	п
Effective MTD	*C	18.21	Tubes/bundle	400	Tube Length	10.7	
Effective surface (bare tube)	m²	341.5	Rows deep	8	Fin OD	50.8	п
Effective surface (total)	m²	5502.1	Tube passes	2	Fin tks	0.28	п
Area ratio: actual/required		4.29	Fans/bay	3	Fin frequency	394	#/
Heat Transfer Resistance			•				-
Outside / Fouling / Wall / Foulin	g / Tube side						
Outside						Tube side	

Overall Performance Resistance Distribution Tube sideComposition

It can be seen that the Insert Geometry is chosen to take up all the allowable pressure drop.

The Insert Part Number which describes the Geometry can be found under

🖹 Exchanger Data 🗾 主 🔢	$ SI \blacksquare SI II SI II SI II SI S$	
🔄 AirCooled ⊫- 🔄 Input	General Fan Details Circular Tubes/Fins Non-Circular Tubes/Fins Nozzles/Hea	aders Weights/Volumes hiTRAN inserts
Problem Definition Headings/Remarks		`
Application Options	Start pass End pass hiTRAN part number No.	es drop coefficient
Property Data Exchanger Geometry	1 2 20600-6754954-34300-A218C-N-3734/1.050/201 40	bar W/(m² K) 0 1.48876 552
Geometry Summary		
Tubes		
Headers & Nozzles		
Structure/Walkways Construction Specifications		
Program Options		
Thermal Analysis Methods/Correlations		
Outside Distribution		
Input Summary Result Summary		
Thermal / Hydraulic Summary Performance		
Heat Transfer		
Mechanical Summary Exchanger Data		

Use previous Insert / (simulation) mode

In AirCooled Simulation Mode the Insert is fixed. This means different process conditions can be simulated with a fixed Insert Geometry. To do this the following steps needs to be undertaken:

Prior to simulation the case has to be run in Rating checking mode in order to find an optimized Insert!

In Calculation type the dropdown list has to be set to [previous insert]

🗸 T	ube Side 🛛	🗸 Outsi	de 🛛 🗸 Tube Side Enhan	cement 🛛 🗸 Outside Enhancement 📄		
Enh	ancement	type	hiTRAN wire m	atrix		
⊢ hiTl	RAN Wire	Matrix Inse	rts			
					hiTRAN Info	
Nur	nber of inse	ert types	1 insert type	▼ Allowable p	ressure drop 1.5 bar	•
	Start	End pass	Calculation type	hiTRAN Part No.		
1	1	2	Use previous insert 🛛 🚽	20600-6754954-34300-A218C-N-3734/1.	050/201	
						_

! Note: When you change the dropdown list the hiTRAN Part number field will stay blank, please click once with the mouse into the part number field to show the part number (unresolved bug)!

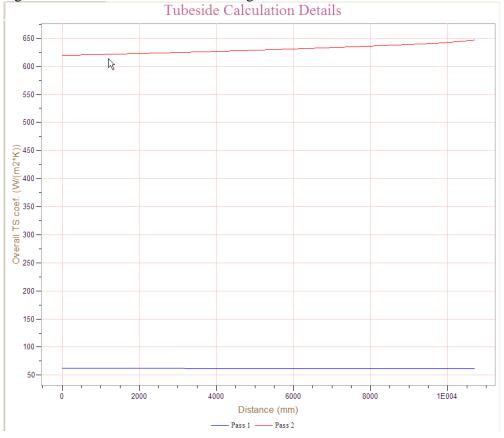
Assigning one Insert type only for certain tube passes in AirCooled

In AirCooled it is possible to assign hiTRAN Inserts to certain tubes only.

In our example we could assign the 1 insert type only to the second pass in the air Cooler:

1	- hiTE	AN Wire	Matrix Inse	irts				
							hiTRAN Info	5
	Num	ber of inse	ert types	1 insert type	•	Allowable pressure drop	1.5 bar	•
		Start	End pass	Calculation type	hiTRAN Part No.			
	1	2	2	Find Optimum insert 🛛 🖵				

Again there would be a dramatic change in heat transfer from the first to the second pass:



The Simulation option is here also available.

Assigning different Insert types for certain tube passes in AirCooled

In AirCooled it is possible to use up to 3 different Insert types in one bundle.

Example

Target pressure drop for the whole exchanger 1.2 bar

 For the first set of Insert from pass 1 to pass 2 a estimate pressure drop has to be chosen: Chosen 0.5 bar

Calculation with screenshots:

			creensnots.						
🗸 T)	ube Side	🗸 Outsid	le 🛛 🗸 Tube Side Enhan	cement 📔 🗸 Outsia	le Enhancement				
	Enhancement type hiTRAN wire matrix								
	hiTRAN Wire Matrix Inserts Number of insert types 1 insert type Allowable pressure drop 0.5 bar								
	Start	End pass	Calculation type	hiTRAN Part No.					
1	1	1	Find Optimum insert						
2	2		-						

Rating / Checking	Outside				Tube Side					
Total mass flow rate		kg/s	108.333				14.1667			
Vapor mass	108.333		108.333		0		0	1		
Liquid mass		kg/s					14.1667		14.16	667
Vapor mass quality			0		0		0		0	1
Temperature		*C	42		46.17		71.1		55.0	01
Dew / bubble point temperatures		*C								
Humidity ratio										
Operating pressure	Pa /	bar	101326		101326		6		5.49	818
Film coefficients	694.2				209.5					
Fouling resistance		m² K∕₩		0				0		
Velocity (highest)		m/s	4.66	1	4.72		0.25	1	0.25	5
Pressure drop (allow/calc.)	Pa /	bar	10000	/	100		0.5	1	0.501	82
Total heat exchanged	kW	454	Bay per uni	t	1	Tub	be OD		25.4	m
Overall bare coeff. (dirty/clean)	W/(m² K) 159.8	3/ 159.8	Bundles/ba	y	1	Tub	be tks		2.4	m
Effective MTD	*C	18.08	Tubes/bun	dle	400	Tub	oe Length		10.7	1.1
Effective surface (bare tube)	m²	341.5	Rows deep		8	Fin	OD		50.8	m
Effective surface (total)	m²	5502.1	Tube passe	es	2	Fin	tks		0.28	m
Area ratio: actual/required		2.17	Fans/bay		3	Fin	frequency		394	#7

The calculation result will be an bundle 1 Pass equipped with hiTRAN second pass empty plain. Overall pressure drop 0.5 bar.

2. In a next step 2 Insert types are selected. This means a second Insert is populated

🗸 T	ube Side	🗸 Outsi	de 🗸 T	ube Side Enhar	ncement	🗸 Outsid	e Enhano	cement		
Enh	ancement	type		hiTRAN wire n	natrix 💌]				
_ hiTf	RAN Wire	Matrix Inse	erts							
									hiTl	RAN Info
Nun	nber of ins	ert types		2 insert types	-	l		Allowable pressure drop	0.5	bar 💌
	1	F 1	01.10	Set default	ľ	4				
	Start	End pass		1 insert type		art No.				
1	1	1	Find Optir	2 insert types 3 insert types						
2	2		Find Optir	mum insert 📃 🖣	•	_				
	•									

Now the first Insert type has to be kept fixed with Calculation Mode use previous Insert. And the second Insert type has to work in find optimum Insert Mode.

In addition the allowable pressure drop has to be increased in this case to the desired 1.2 bar

🗸 Tube Side 🛛 🗸 Outside 🚽 Tube Side Enhancement 📄 🗸 Outside Enhancement														
Enhancement type hiTRAN wire matrix														
- hi	hiTRAN Wire Matrix Inserts													
N	uml	ber of inse	ert types		2 insert typ	es	•			Allowable p	pressure drop	1.2	bar	•
		Start	End pass	Calculatio	on type		hiTRAN Pa	rt No.						
1		1	1	Use prev	rious insert	•	20600-3D3	DD8C-343	300-A21	8C-N-3734/	1.050/201			
2		2	2	Find Opti	mum insert	•								

The results are shown below:

Rating / Checking	Outside			Tube Side					
Total mass flow rate		kg/s	108.	333		1	4.166	57	
Vapor mass		kg/s	108.333	108.33	з	0		0)
Liquid mass		kg/s				14.1667		14.1	667
Vapor mass quality			0	0		0		0)
Temperature		*C	42	46.15		71.1		55.1	01
Dew / bubble point temperatures		*C							
Humidity ratio									
Operating pressure	Pa /	bar	101326	10132	6	6		4.78	513
Film coefficients	v	√/(m² K)	694	4.1			499.6	ŝ	
Fouling resistance		m² K/W	()			0		
Velocity (highest)		m/s	4.66 /	4.72		0.25	1	0.2	5
Pressure drop (allow/calc.)	Pa /	bar	10000 /	100		1.2	1	1.214	87
Total heat exchanged	kW	453.9	Bay per unit	1	Tub	e OD		25.4	
Overall bare coeff. (dirty/clean)	W/(m² K) 289.4	1/ 286.8	Bundles/bay	1	Tub	ie tks		2.4	п
Effective MTD	*C	[^] 18.24	Tubes/bundle	400	Tub	e Length		10.7	
Effective surface (bare tube)	m²	341.5	Rows deep	8	Fin (OD		50.8	п
Effective surface (total)	m²	5502.1	Tube passes	2	Fint	tks		0.28	п
Area ratio: actual/required		3.97	Fans/bay	3	Ein (frequency		394	#/

The Total Pressure drop is 1.2bar as required and two different Insert types are used.

Under Exchanger data the detailed Information about hiTRAN Geometry and pressure drop can be found:

6	ieneral Fa	an Details	Circular Tubes/Fins Non-Circular Tubes/Fins Nozzl	es/Headers	Weights/V	olumes hiTRA	N inserts
			[No. of	Pressure	Heat transfer	
	Start pass	End pass	hiTRAN part number	tubes	drop	coefficient	
					bar	W/(m² K)	
	1	1	20600-3D3DD8C-34300-A218C-N-3734/1.050/201	200	0.43321	445.3	
	2	2	20600-67180D0-34300-A218C-N-3734/1.050/201	200	0.77335	587.6	
						\searrow	
						2	