

How to get started in HTRI

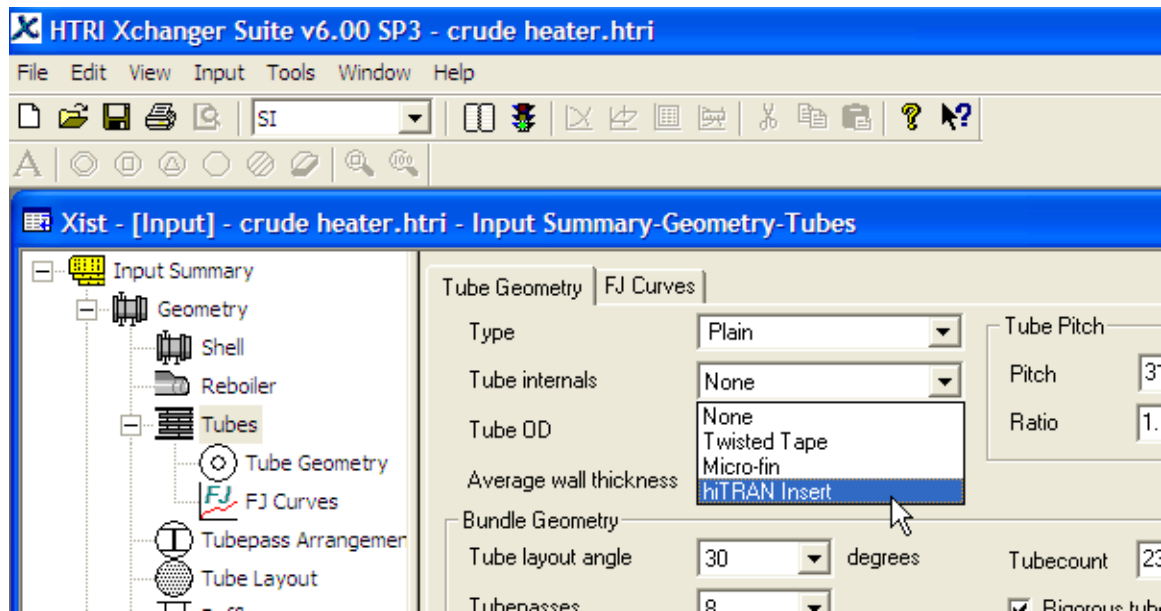
Dll needs to be installed on the user's machine

HTRI V6 SP3 has to be installed!

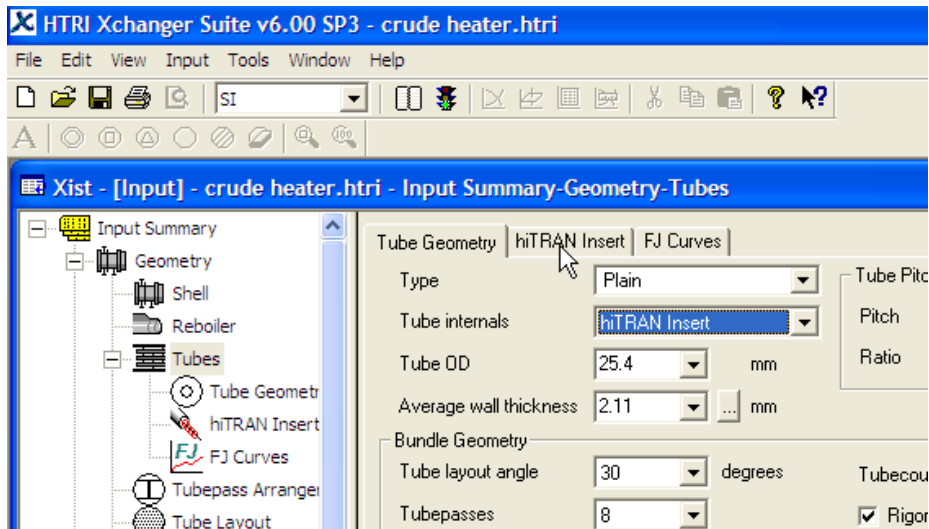
Limitations: Single Phase Flow only

Xist

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



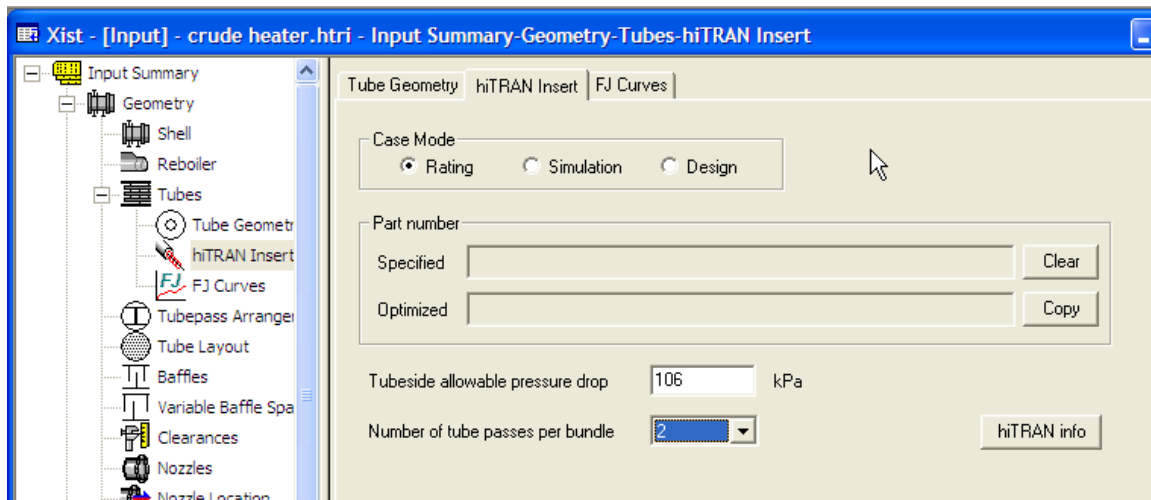
Once the option is clicked a new Tab **hiTRAN Insert** is added. Also on the left in the tree view the hiTRAN Insert Tab is added



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

Depending on the selected Calculation Mode in HTRI (Rating; Simulation)
The plug in behavior differs as explained below:

The user needs to click the [hiTRAN Insert] tab in order to access the hiTRAN Input Panel:



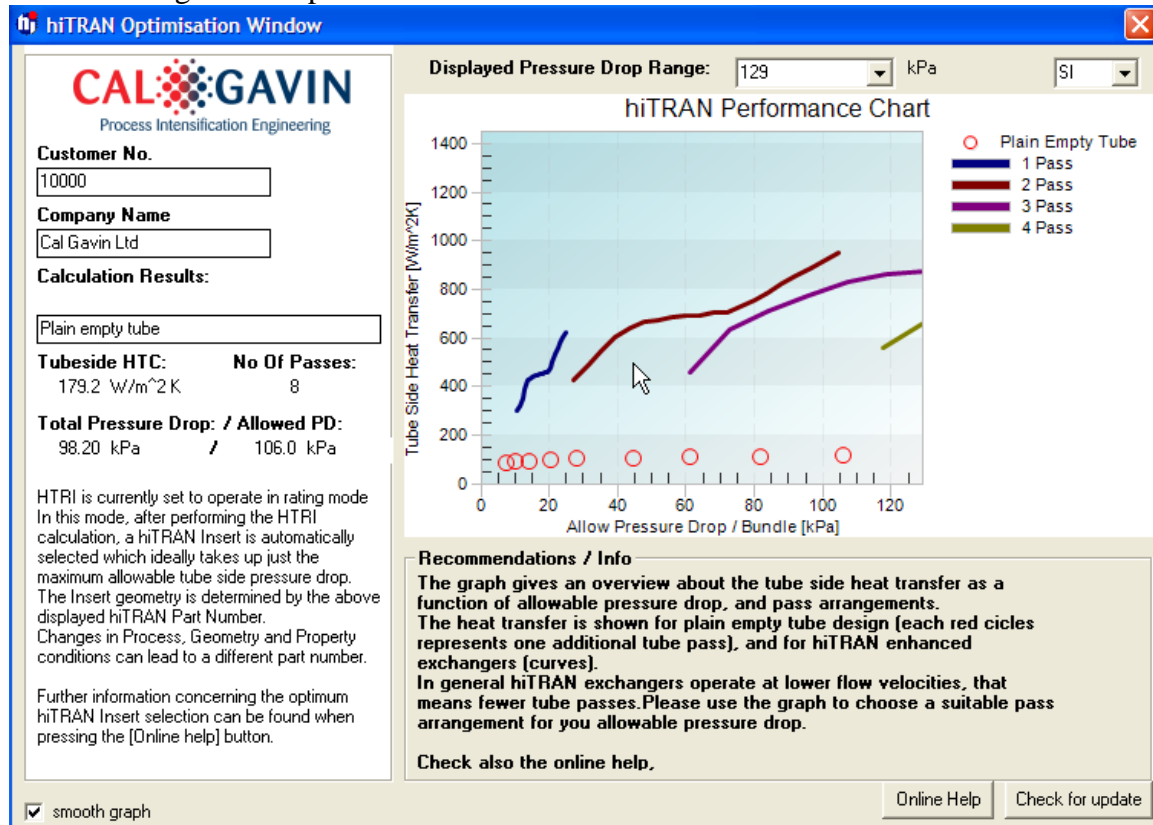
Rating Case / Optimizing Insert Geometry

In case rating is 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 HTRI!

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.

Xist - [Reports] - crude heater.htri - Output Summary Page 1

- Output Summary
- Run Log
- Data Check Messages
- Runtime Messages
- Final Results
- Shellside Monitor
- Tubeside Monitor
- Vibration
- Rating Data Sheet
- TEMA Spec Sheet
- CalGavin hiTRAN**
- Property Monitor
- Stream Properties
- Input Reprint

Output Summary
Released to the following HTRI Member Company:
Cal Gavin LTD
Peter Droegemueller

Xist (CalGavin) Ver. 6.00 SP3 13/01/2011 14:54 SN: 1500213339 **SI Units**

heated by steam
Hydrocarbon preheater
Rating - Horizontal Multipass Flow TEMA AES Shell With Single-Segmental Baffles
See Data Check Messages Report for Informative Messages.
See Runtime Message Report for Warning Messages.

Process Conditions		Hot Shellside		Cold Tubeside	
Fluid name		Steam		Hydrocarbon	
Flow rate (kg/s)		0.6030		12.0001	
Inlet/Outlet Y (Wt. frac vap.)		1.000	0.000	0.000	0.000
Inlet/Outlet T (Deg C)		212.37	212.26	120.00	165.00
Inlet P/Avg (kPa)		2000.03	1997.70	5000.07	4955.07
dP/Allow. (kPa)		4.662	0.000	90.004	90.001
Fouling (m2-K/W)		0.000090		0.000500	

Exchanger Performance

Shell h (W/m2-K)	20164.0	Actual U (W/m2-K)	534.25
Tube h (W/m2-K)	1101.15	Required U (W/m2-K)	154.57
Hot regime (--)	Gravity	Duty (MegaWatts)	1.1393
Cold regime (--)	Sens. Liquid	Area (m2)	109.559
FMTD (Deg C)	67.3	Overdesign (%)	245.64

There is also an additional Cal Gavin Report tab in the output tree.
Here the so called part number which determines the Geometry is displayed:

HTRI Xchanger Suite v6.00 SP3 - [Xist - [Reports] - crude heater.htri - Output Summary] Page

- Output Summary
- Run Log
- Data Check Messages
- Runtime Messages
- Final Results
- Shellside Monitor
- Tubeside Monitor
- Vibration
- Rating Data Sheet
- TEMA Spec Sheet
- CalGavin hiTRAN**
- Property Monitor
- Stream Properties
- Input Reprint


Process Intensification Engineering
Cal Gavin Limited
Minerva Mill Technology Centre
Station Road, Alcester
Warwickshire B49 5ET, UK
Tel: +44 (0)1789 400401
Fax: +44 (0)1789 400411
Email: engineering@calgavin.com

Calculation Results:
hiTRAN® Wire Matrix Inserts
Part Number: **21180-39ADA00-1D77C-5B874-N-1916/1.050/501**
to suit Tubes: 25.4 mm OD x 2.11 mm wall thickness x 6 m length
Total No. of Inserts: 234

For final verification / quotation of the results please submit the HTRI file to quotation@calgavin.com

Please also include the required material for the hiTRAN® Wire Matrix Inserts.

The Part number is also displayed in the supplementary Result sheet and under Remarks in the TEMA sheet

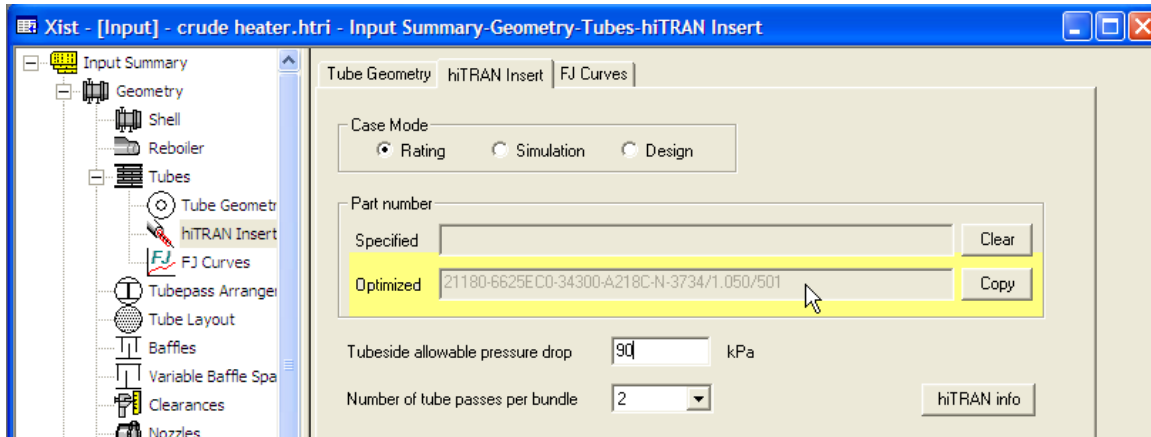
<ul style="list-style-type: none"> Output Summary Run Log Data Check Messages Runtime Messages Final Results Shellside Monitor Tubeside Monitor Vibration Rating Data Sheet TEMA Spec Sheet CalGavin hiTRAN Property Monitor Stream Properties Input Reprint 			Supplementary Results Page 3	
	Released to the following HTRI Member Company: <i>Cal Gavin LTD</i> <i>Peter Droegemueller</i>			
	Xist (CalGavin) Ver. 6.00 SP3 13/01/2011 15:32 SN: 1500213339 SI Units			
	heated by steam Hydrocarbon preheater Rating - Horizontal Multipass Flow TEMA AES Shell With Single-Segmental Baffles			
Externally Enhanced Tube Geometry		Internally Enhanced Tube Geometry		
Type Plain		Type hiTRAN Insert		
Fin density (fin/meter)		Part number		
Fin height (mm)		21180-42C1D80-1D77C-5B874-N-1916/1.050/501		
Fin thickness (mm)				
Root diameter (mm)				
Area/length (m2/m)				

Simulation Case / Runs case with fixed Insert Geometry

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.



Xist - [Input] - crude heater.htri - Input Summary-Geometry-Tubes-hiTRAN Insert

Tube Geometry | hiTRAN Insert | FJ Curves

Case Mode
☒ Rating ☐ Simulation ☐ Design

Part number

Specified

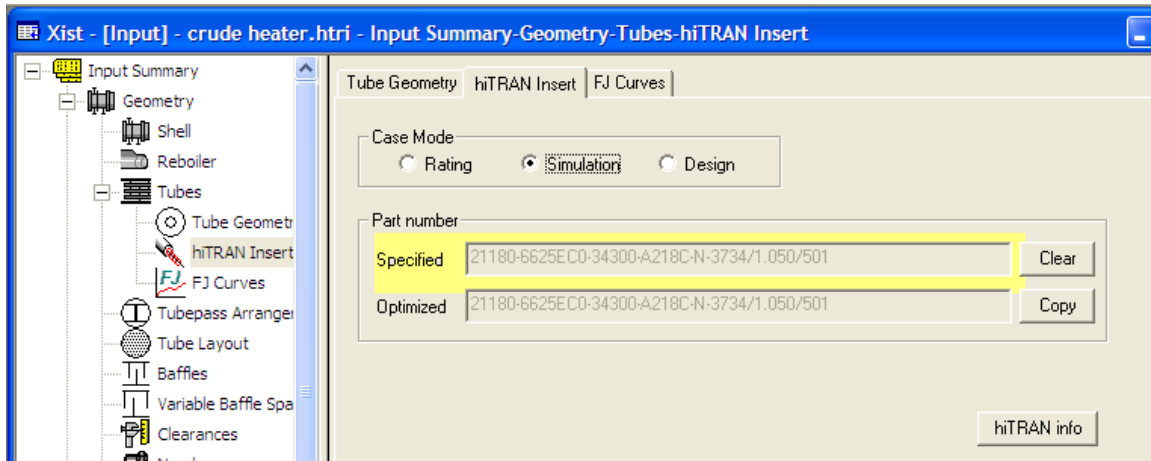
Optimized

Tubeside allowable pressure drop kPa

Number of tube passes per bundle

In this mode a part number is calculated and displayed under **Optimized**.

To keep this Part Number fixed in a next step this part number has to be copied to the Specified field. This is done by pressing the **Copy** button.



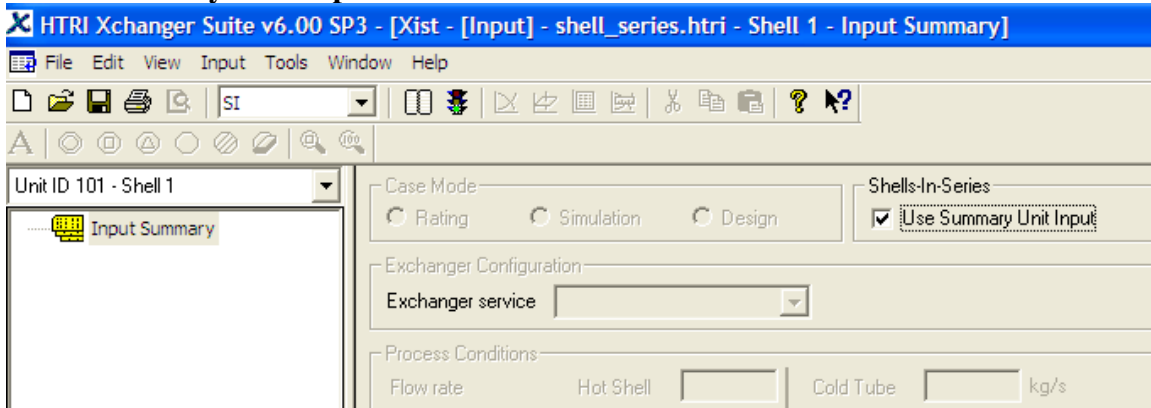
This Part number stays fixed when running in simulation Mode.

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

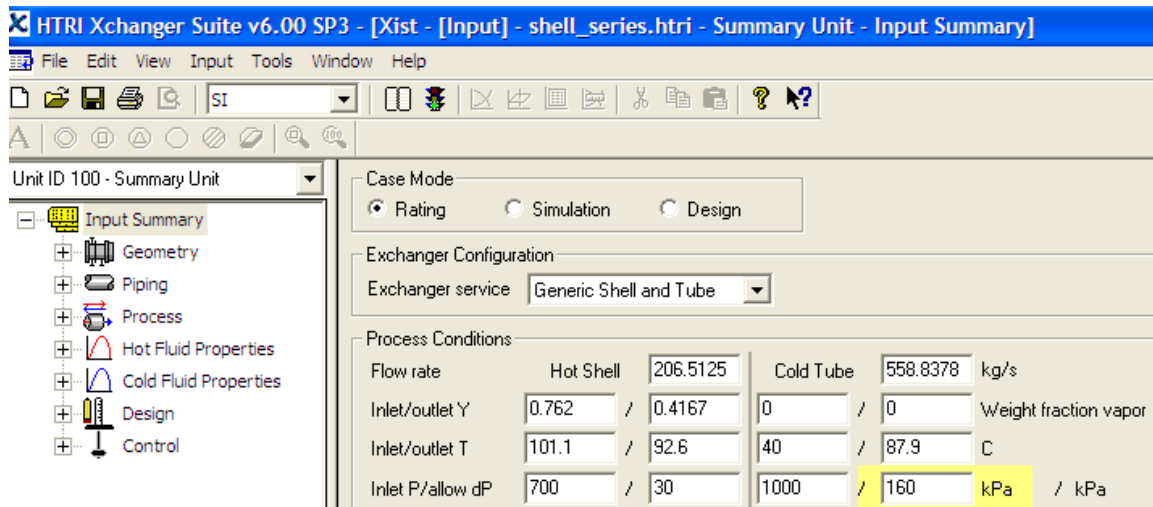
Shells in Series:

When designing a heat exchanger for shells in series the hiTRAN option can also be used. There are two different possibilities

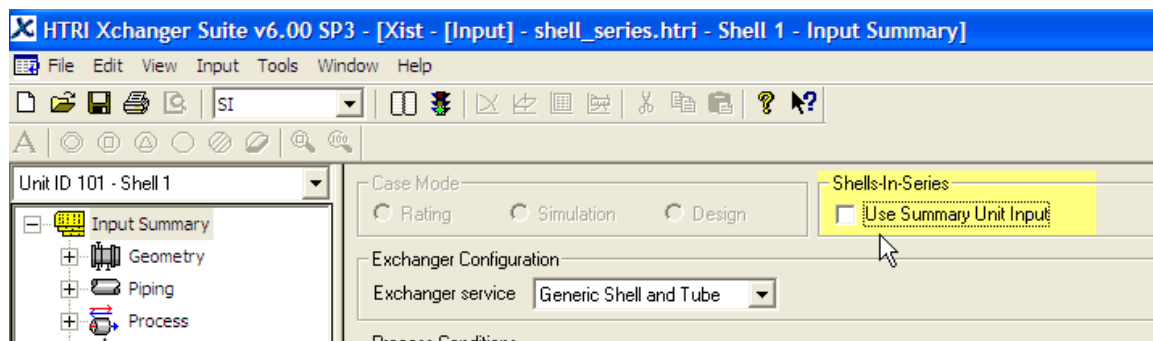
1. Use summary Unit Input:



If this is chosen the allowable pressure drop entered will be used for each shell as allowable pressure drop. This means this value will determine the hiTRAN Geometry. In the example below with two shells in series the end result for the total pressure drop would be 320kPa because for each shell a Insert Geometry will be selected which takes up just the 160kPa.



1. No Summary Input is used:



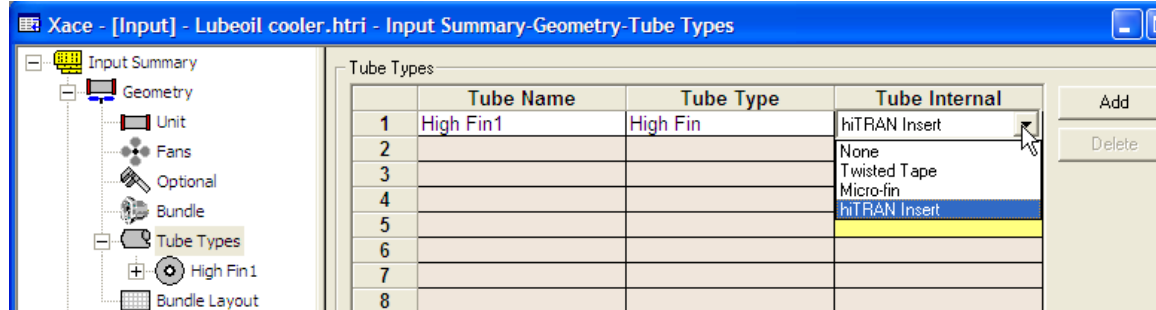
In this case for each bundle an **“individual”** allowable pressure drop can be used. The total allowable pressure drop will be the added allowable pressure drop of all the shells in series.

Tip: Part Number can be copied when exporting the Cal Gavin Result sheet. It can also be copied when using the hiTRAN Info Button

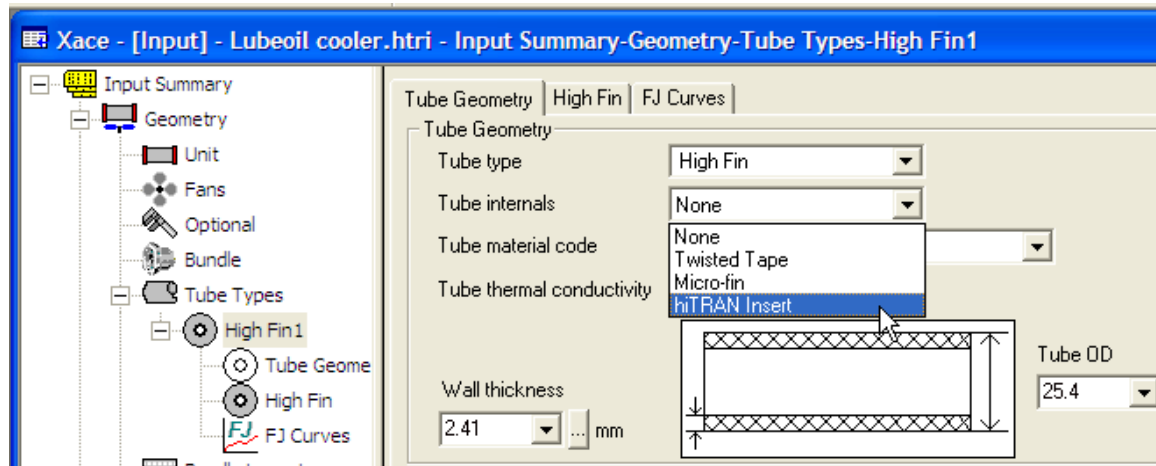
Xace

Once the hiTRAN plug in is installed, the hiTRAN option can be found as shown in the screenshot:

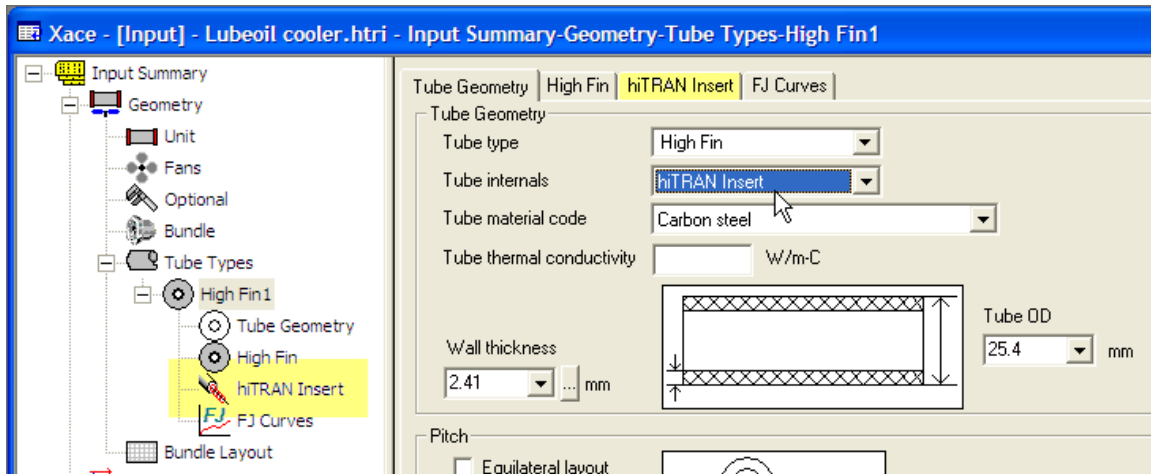
1. Under Tube Types and Tube internals



2. In addition for each tube type the tube internal can be set as shown in the picture below

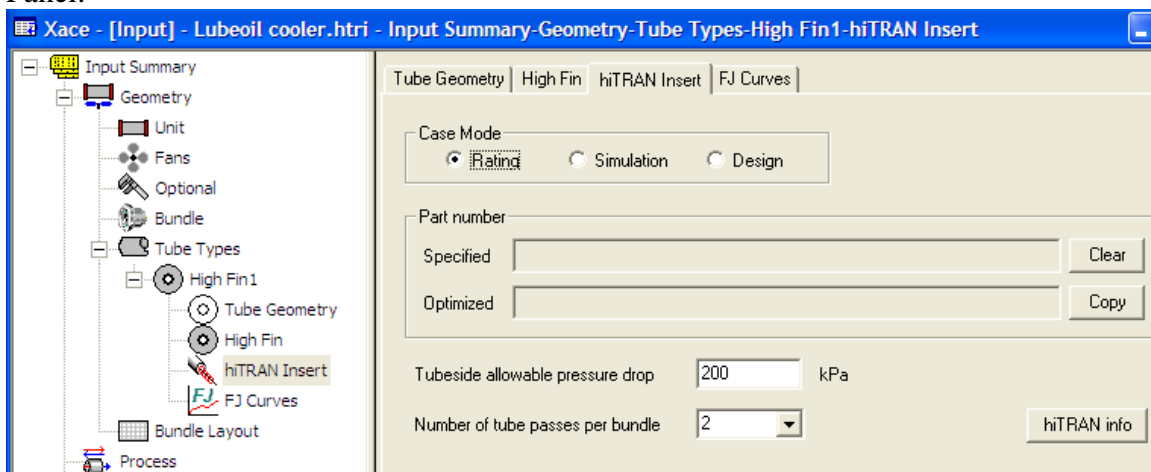


Once selected the tube side heat transfer and pressure drop calculations are based on Cal Gavin data.



The hiTRAN Insert tab is generated similar to the Xist programme.

The user needs to click the [hiTRAN Insert] tab in order to access the hiTRAN Input Panel:



**Depending on the selected Calculation Mode in HTRI (Rating; Simulation)
The plug in behavior differs as explained below:**

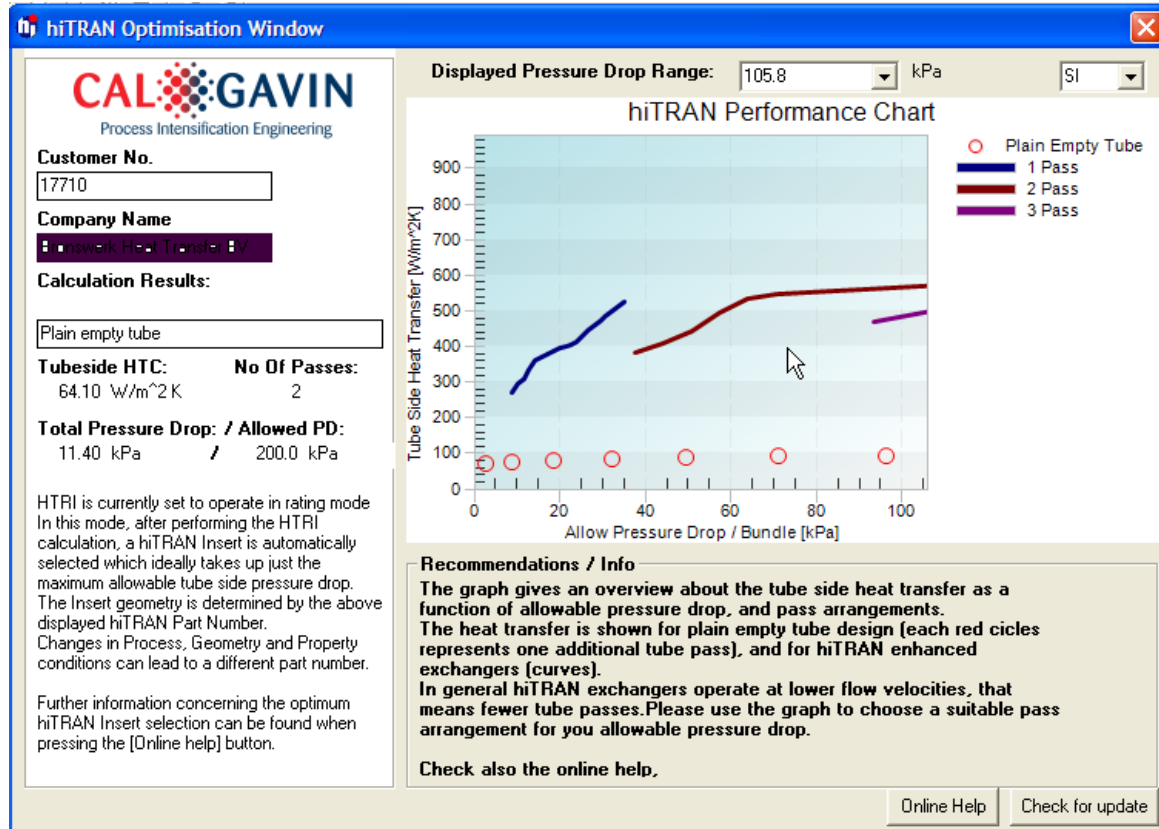
Rating Case / Optimizing Insert Geometry

In case rating is 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 HTRI!



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.

Output Summary

Run Log

Data Check Messages

Runtime Messages

Final Results

Outside Monitor

Tubeside Monitor

Temperature Monitor

Pressure Drop Monitor

API661 Spec Sheet

CalGavin hiTRAN

Property Monitor

Stream Properties

Input Reprint

HTRI

Output Summary

Released to the following HTRI Member Company:

Cal Gavin LTD

Peter Droegemueller

Xace (CalGavin) Ver. 6.00 SP3

13/01/2011 16:45

SN: 1500213339

SI Units

Aircooler example

Lube oil cooler

Rating-Horizontal air-cooled heat exchanger forced draft countercurrent to crossflow

See Data Check Messages Report for Warning Messages.

See Runtime Message Report for Warning Messages.

Process Conditions		Outside		Tubeside	
Fluid name				Oil	
Fluid condition		Sens. Gas		Sens. Liquid	
Total flow rate	(kg/s)	130.592		14.167	
Weight fraction vapor, In/Out		1.000	1.000	0.000	0.000
Temperature, In/Out	(Deg C)	38.00	41.46	71.10	55.00
Skin temperature, Min/Max	(Deg C)	44.33	53.12	45.14	54.70
Pressure, Inlet/Outlet	(kPa)	101.334	101.184	600.009	449.845
Pressure drop, Total/Allow	(Pa) (kPa)	149.44	210.37	150.164	150.002
Midpoint velocity	(m/s)	5.66		0.25	
- In/Out	(m/s)			0.25	
Heat transfer safety factor	(--)	1		1	
Fouling	(m2-K/W)	0.000000		0.000100	

Exchanger Performance

Outside film coef	(W/m2-K)	48.93	Actual U	(W/m2-K)	18.537
Tubeside film coef	(W/m2-K)	645.80	Required U	(W/m2-K)	3.565
Clean coef	(W/m2-K)	19.247	Area	(m2)	5415.49

There is also an additional Cal Gavin Report tab in the output tree.
Here the so called part number which determines the Geometry is displayed:

HTRI Xchanger Suite v6.00 SP3 - [Xist - [Reports] - crude heater.htri - Output Summary]

File Edit View Reports Tools Window Help

SI

Output Summary

Run Log

Data Check Messages

Runtime Messages

Final Results

Shellside Monitor

Tubeside Monitor

Vibration

Rating Data Sheet

TEMA Spec Sheet

CalGavin hiTRAN

Property Monitor

Stream Properties

Input Reprint

CALGAVIN

Process Intensification Engineering
Cal Gavin Limited
Minerva Mill Technology Centre
Station Road, Alcester
Warwickshire B49 5ET, UK
Tel: +44 (0)1789 400401
Fax: +44 (0)1789 400411
Email: engineering@calgavin.com

Calculation Results:
hiTRAN® Wire Matrix Inserts
Part Number: 21180-39ADA00-1D77C-5B874-N-1916/1.050/501
to suit Tubes: 25.4 mm OD x 2.11 mm wall thickness x 6 m length
Total No. of Inserts: 234

For final verification / quotation of the results please submit the HTRI file to quotation@calgavin.com
Please also include the required material for the hiTRAN® Wire Matrix Inserts.

The Part number is also displayed in the supplementary Result sheet and under Remarks in the TEMA sheet

Clipboard18 - IrfanView (Zoom: 1204 x 903) (Selection: 1, 1; 629 x 778; 0.808)

File Edit Image Options View Help

HTRI Xchanger Suite v6.00 SP3 - [Xace - [Reports] - Lubeoil cooler.htri - Output Summary]

File Edit View Reports Tools Window Help

Output Summary

- Run Log
- Data Check Messages
- Runtime Messages
- Final Results
- Outside Monitor
- Tubeside Monitor
- Temperature Monitor
- Pressure Drop Monitor
- API661 Spec Sheet
- CalGavin hTRAN
- Property Monitor
- Stream Properties
- Input Reprint

HTRI

Final Results
Released to the following HTRI Member:
Cel Gavlin LTD
Peter Droegemuller

Xace (CalGavin) Ver: 6.00 SP3 13/01/2011 10:45 SN: 1500213339
Problem-Air cooler example
Case-Lube oil cooler:
Rating Horizontal air cooled heat exchanger forced draft countercurrent to process flow

Straight length	(m)	10.700
Unfinned length	(mm)	0.000
Unheated length	(mm)	168.275
Tube form	(-)	U-tubes
Type 1		
Transverse pitch	(mm)	67.000
Longitudinal pitch	(mm)	61.000
Outside diameter	(mm)	25.400
Inside diameter	(mm)	20.500
Tube type	High-finned	
Area ratio (out/in)	(-)	19.8834
Over fin diameter	(mm)	50.800
Area ratio (fin/bare)	(-)	10.1102
Fins per unit length	(fin/meter)	393.7
Fin root diameter	(mm)	25.400
Fin height	(mm)	12.700
Fin thickness at base	(mm)	0.280
Fin thickness at tip	(mm)	0.280
Wall thickness (finned)	(mm)	2.410
Fin type	()	Plain round
Fin efficiency	(%)	84.3
Split segment height	(mm)	--
Split segment width	(mm)	--
Rectangular fin height	(mm)	--
Rectangular fin width	(mm)	--
Tube material	Carbon steel	
Fin material	Aluminum 1100-annealed	
Internal tube type	hTRAN Insert	
Part number	20580-68833E8-3/1300-A2*8C-N-373/1*1,050,229	

Simulation Case / Runs case with fixed Insert Geometry

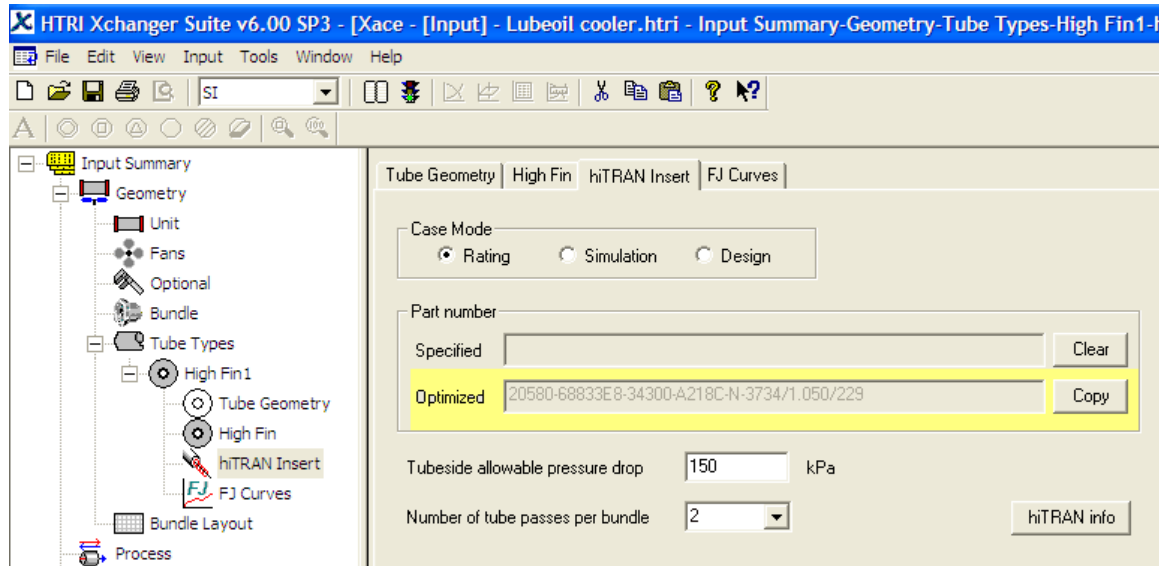
In Simulation Mode the Insert is fixed. This means different process conditions can be simulated with a fixed Insert Geometry. To do this the following steps needs to be undertaken:

Simulation Case / Runs case with fixed Insert Geometry

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:

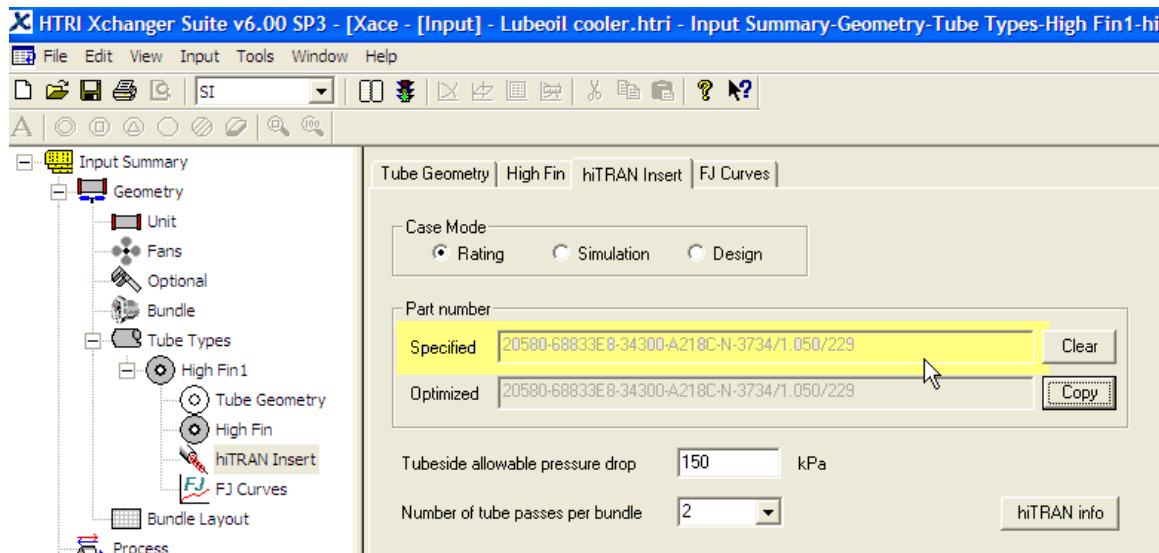
1.

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



In this mode a part number is calculated and displayed under *Optimized*.

To keep this Part Number fixed in a next step this part number has to be copied to the Specified field. This is done by pressing the *Copy* button.

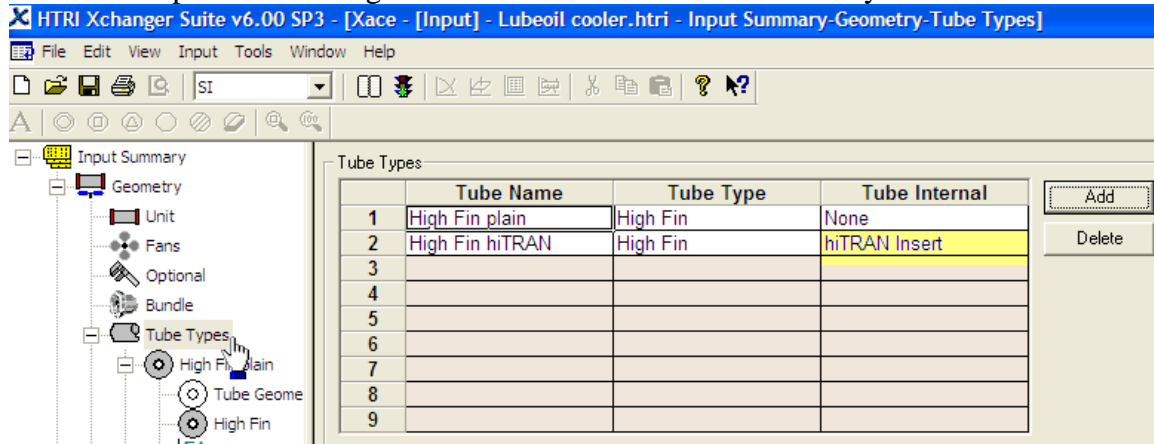


This Part number stays fixed when running in simulation Mode.

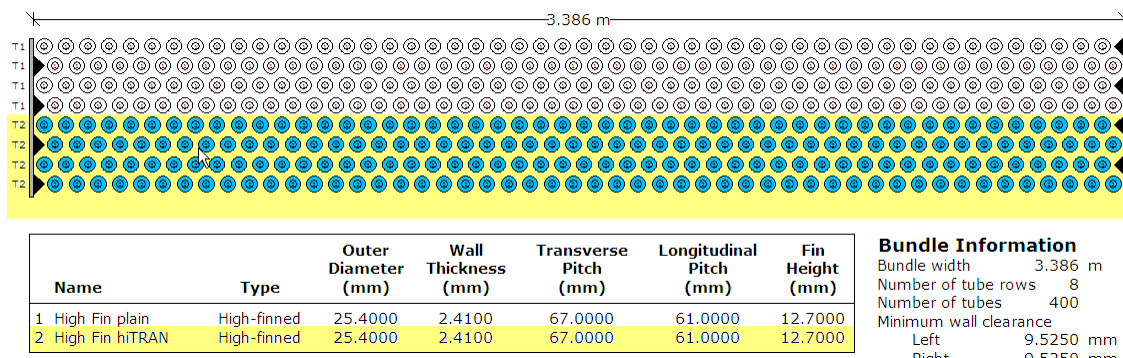
In General now the calculated pressure drop will differ from allowable pressure drop.

Assigning Inserts only for certain tube passes in Xace

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



Under tube types a tube type with hiTRAN Internals can be added. This tube type then has to be assigned in the **Bundle Layout** to different tubes within the exchanger. In reality it should be only assigned to tubes of an entire tube pass.



In this example hiTRAN has been assigned to tubes in the second tube pass. The first tube pass is set to plain empty

When running the calculation the plug in will try to find an Insert Geometry which will take up the allowable pressure drop for the whole bundle. This takes into account the plain empty tube pressure drop. When showing the graph for tube side heat transfer the difference can be noted:

