

Improve Fidelity of your Process Models by Sizing Rigorous Heat Exchanger Models

Using Aspen HYSYS®

Objective

This guide will demonstrate how you can increase the fidelity of your process model by sizing heat exchangers from Aspen HYSYS.

We will cover the following types of heat exchanger units:

- Shell & Tube heat exchanger
- Air Cooled heat exchanger

For this exercise we will use:

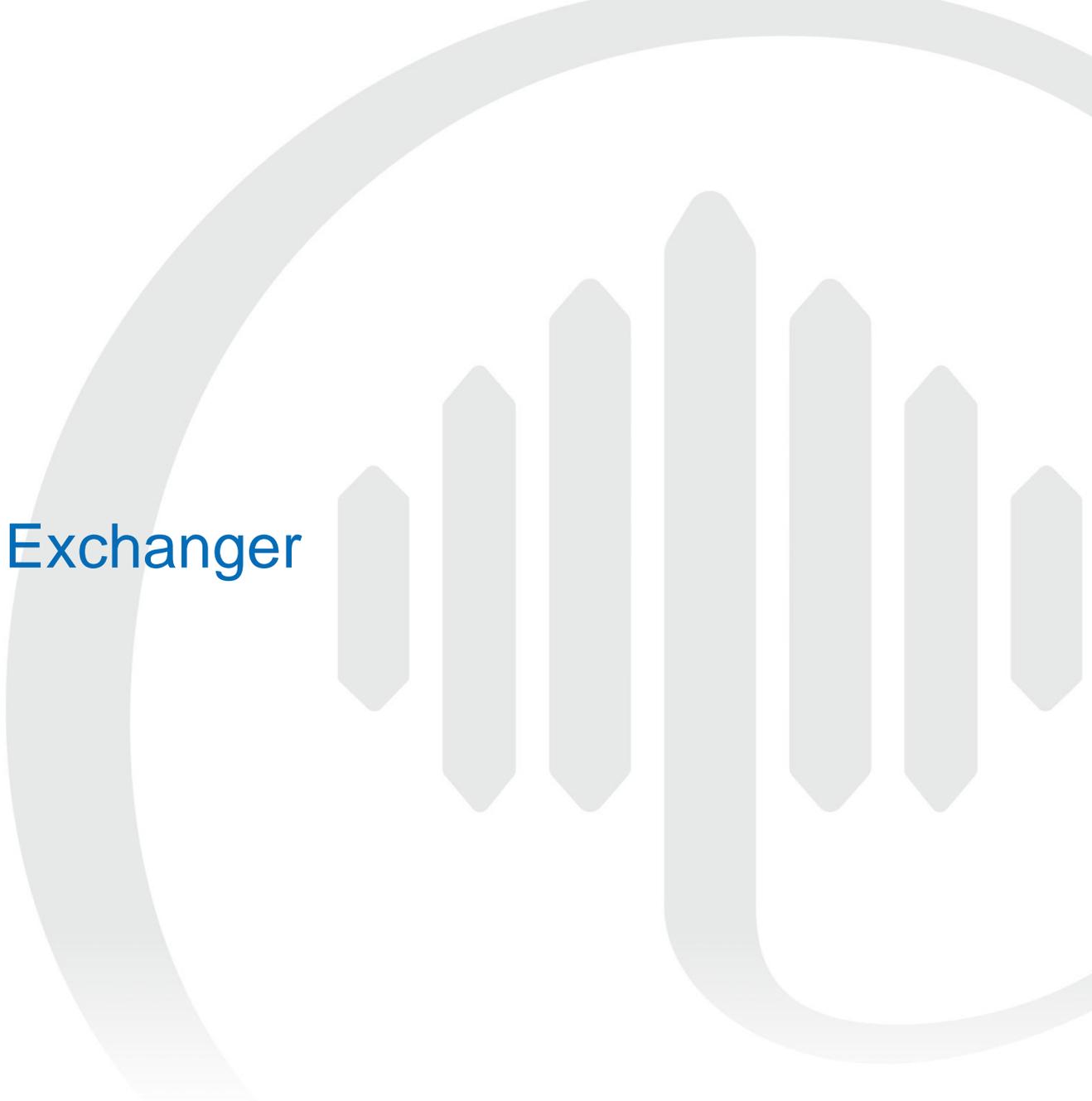
- EDR Template Files
- Aspen HYSYS model of the Crude Distillation Unit

To download the above files please visit Aspen Tech's customer support site.

(Refer to Knowledge Base Solution ID: 143028 at the following location
<http://support.aspentech.com/webteamasp/KB.asp?ID=143028>)



Shell & Tube Exchanger

A large, light gray, stylized graphic of a shell and tube exchanger is positioned in the background. It features a large, rounded rectangular shell on the right side, with several vertical tubes of varying heights extending from the shell's interior towards the left. The tubes are arranged in a row, with the tallest tube in the center and shorter tubes on either side, creating a symmetrical pattern.

Demonstration Workflow

Here is the order of tasks this guide will walk you through:

1. Identify the Simple Heat Exchanger Model
2. Convert the simple model to a rigorous model using an EDR Template
3. Learn how to read heat exchanger dimensions such as length, weights, etc.
4. Convert a rigorous model back to a simple model
5. Learn how to interactively size the heat exchanger using EDR and compare between different design options
6. Learn how to take offline one of the parallel shells in a shell & tube exchanger and analyze its implication

Open the Process Model

CDU_Model.hsc - Aspen HYSYS V8.8 - aspenONE

File Home Economics Dynamics View Customize Resources Flowsheet/Modify Format

Search aspenONE Exchange

Models and Streams Palette

Rotate Flip Horizontal Flip Vertical Attach Auto Attach Auto Position Break Connection Swap Connection Size Zoom Pan

Find Object Recycle Advisor Tools

Name Temperature Pressure Stream Label

Go to Parent Enter Subflowsheet Hierarchy

Move to Parent Move into Subflowsheet Ignore

Default Colour Scheme Editor Display Legend Conditional Formatting

Economics
Capital Cost Utility Cost
USD USD/Year off

Energy
Available Energy Savings
MW % of Actual off

EDR Exchanger Feasibility
Unknown OK At Risk
3 5 0

Flowsheet Case (Main) - Solver Active

Navigation Pane

Raw Crude
TEE-100
E-104
E-102
E-103
E-105
RCY-1
RCY-2
RCY-3
HT Crude Copy
HT Crude
Pre Flash
Pre Flash Vap
Pre Flash Liq
T-100
T-101
AC-102
AC-101
Condensate 2
Condensate 1
O/N Gas
Waste Water
Almor Cond
Naphtene
Kerosene
Diesel
AGO
Residue
Main Steam
Kero_SS_ToReb_2
Kero_SS_Boll Up_2
SS Reb Steam

SPRDSHT-Profile Flows

Resid_Recycle_Copy
Resid Run Down

HT Crude Copy

Pre Flash

Pre Flash Vap

Pre Flash Liq

T-100

T-101

AC-102

AC-101

Condensate 2

Condensate 1

O/N Gas

Waste Water

Almor Cond

Naphtene

Kerosene

Diesel

AGO

Residue

Main Steam

Kero_SS_ToReb_2

Kero_SS_Boll Up_2

SS Reb Steam

Open 'CDU_Model.hsc'

Locate the Heat Exchanger

CDU_Model.hsc - Aspen HYSYS V8.8 - aspenONE Flowsheet

File Home Economics Dynamics View Customize Resources Flowsheet/Modify Format

Search aspenONE Exchange

Default Colour Scheme Editor Display Legend Conditional Formatting

Economics
Capital Cost Utility Cost
USD USD/Year off

Energy
Available Energy Savings
MW % of Actual off

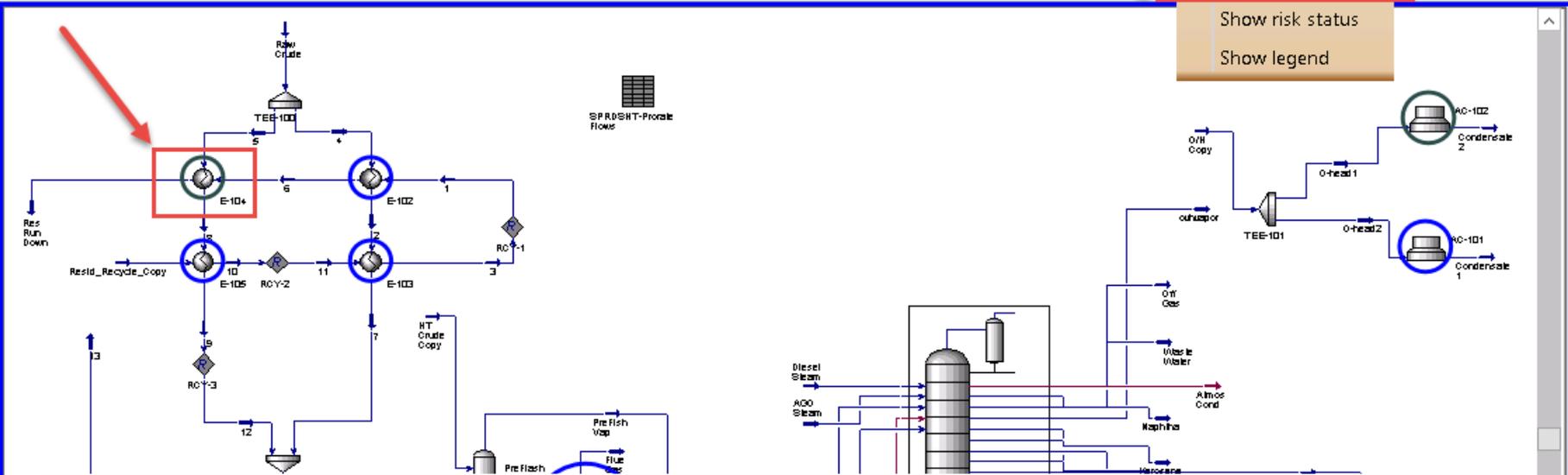
EDR Exchanger Feasibility
Unknown OK At Risk
3 5 0

1 

2 

Show model status
Show risk status
Show legend

Navigation Pane



Note that the Blue rings indicate rigorous models and the Grey rings indicate simple models.

Main Steam T-100 Residue

Convert to Rigorous Model

The screenshot displays the Aspen HYSYS V8.8 interface. At the top, the title bar reads "CDU_Model.hsc - Aspen HYSYS V8.8 - aspenONE Flowsheet". The menu bar includes "File", "Home", "Economics", "Dynamics", "View", "Customize", "Resources", "Flowsheet/Modify", and "Format".

Three panels are visible at the top right:

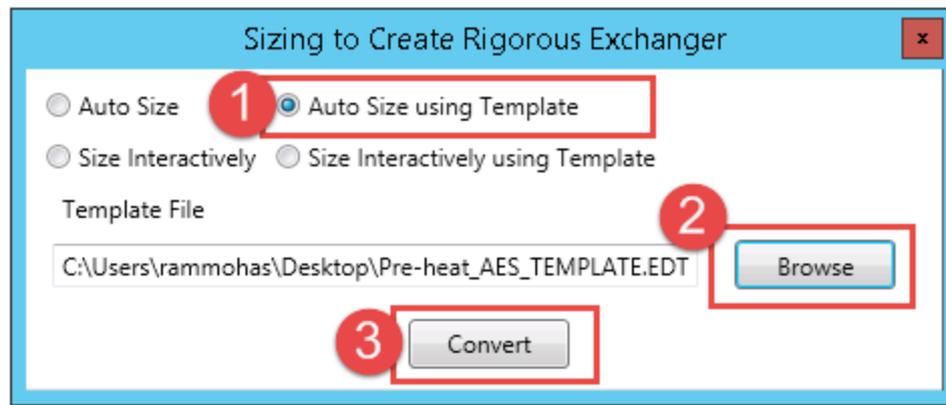
- Economics:** Capital Cost (USD), Utility Cost (USD/Year), and a toggle switch for "off".
- Energy:** Available Energy Savings (MW, % of Actual), and a toggle switch for "off".
- EDR Exchanger Feasibility:** A table with columns "Unknown", "OK", and "At Risk". The values are 3, 5, and 0 respectively.

The main workspace shows a process flowsheet with a central distillation column (F-100) and various heat exchangers (E-104, E-102, E-101). A blue arrow labeled "1" points to a green circle around the heat exchanger E-104. A tooltip for "Heat Exchanger: E-104" is open, showing the following properties:

Property	Value	Unit
Model Type	Simple End Point	
Tube Side Delta T	14.44	C
Shell Side Delta T	-15.82	C
Tube Side Pressure Drop	0.4	bar
Shell Side Pressure Drop	0.4	bar
Duty	3070	kW

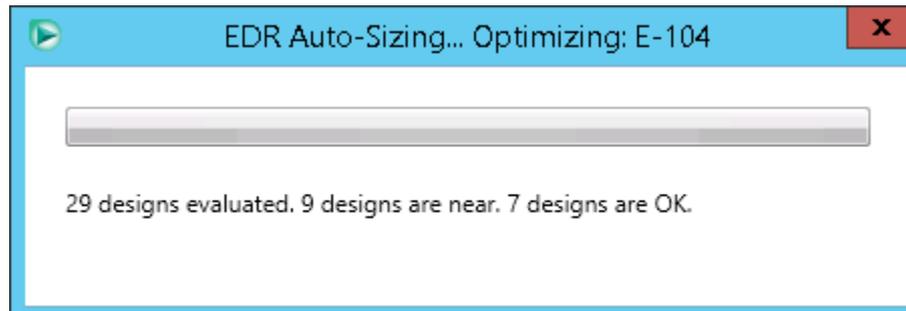
Below the properties, a red box labeled "2" highlights the "Size Rigorous" button. Below it is the "Specify Rigorous" button. The flowsheet also includes a reboiler (R-100), condenser (C-102), and other heat exchangers (E-102, E-101) connected to the distillation column.

Select the EDR Template for Auto Sizing



Choose the template: 'Pre-heat_AES_TEMPLATE.EDT' for sizing.

Auto-Sizing



View Model Details

Economics

Capital Cost Utility Cost

USD USD/Year off

Energy

Available Energy Savings

MW % of Actual off

1 EDR Exchanger Feasibility

Unknown	OK	At Risk
2	6	0

Click inside box to open 'Exchanger Summary Table'

Flowsheet Case (Main) - Solver Active

Exchanger Summary Table

Exchanger Name	Model Status	Summary
AC-101	Revert to Simple	6 OK
AC-102	Convert to Rigorous	
E-103	Revert to Simple	●
E-104	Revert to Simple	●
E-105	Revert to Simple	●
E-102	Revert to Simple	●

Heat Exchanger: E-104

Rigorous Shell&Tube

Shell&Tube

Application

Exchanger

Process

Property Ranges

Results Summary

Setting Plan

Tube Layout

Profiles

TEMA Type

Front End Head Type	A - channel & removable cover
Shell Type	E - one pass shell
Rear End Head Type	S - floating head with backing device

Tubes

Tube OD [mm]	19.05	Tube Thickness [mm]	2.108
Tube Length [mm]	6000	Tubes Pitch [mm]	25.40
Effective Tube Count	749.0	Tube Pattern	45-Rotated Sqr.

Shell

Orientation	Horizontal
Exchangers in Parallel	1.000
Exchangers in Series	1.000
Tubeside Passes	2.000

5

Model Details...

Review TEMA Sheet

File Home Economics Dynamics View Customize Resources Exchanger Design Search aspenUNiT Exchange

Set Units Hysys SI Convert Values Next Set Process Data Set Properties Set Geometry Set Construction Connected Run Stop Run Status Design (Sizing) Find Fouling Check Performance Review Spec Sheet Verify Geometry Review Profiles

Units Model Setup Model Readiness Run Control Run Mode Results

Capital: ___ USD Utilities: ___ USD/Year Energy Savings: ___ MW (___%) Exchangers - Unknown: 2 OK: 6 Risk: 0

Flowsheet Case (Main) - Solver Active Exchanger Details: E-104

TEMA Sheet

1	Company:					
2	Location:					
3	Service of Unit:		Our Reference:			
4	Item No.:		Your Reference:			
5	Date:	Rev No.:	Job No.:			
6	Size:	900 - 6000	mm	Type:	AES Horizontal	Connected in: 1 parallel 1 series
7	Surf/unit(eff.)	256.6	m ²	Shells/unit	1	Surf/shell(eff.) 256.6 m ²

PERFORMANCE OF ONE UNIT					
Fluid allocation	Shell Side		Tube Side		
10 Fluid name	6->Res Run Down		5->8		
11 Fluid quantity, Total	kg/h 274165		288189		
12 Vapor (In/Out)	kg/h 0	0	0	2493	
13 Liquid	kg/h 274165	274165	288189	285697	

		Shell Side		Tube Side		
32						
33 Design/vacuum/test pressure	kPa	500	/ /	900	/ /	
34 Design temperature	C	265		230		
35 Number passes per shell		1		2		
36 Corrosion allowance	mm	3.18		3.18		
37 Connections	In mm	1	304.8 / -	1	202.72 / -	
38 Size/Rating	Out	1	254.51 / -	1	254.51 / -	
39 ID	Intermediate	/ -		/ -		
40 Tube No.	749	OD	19.05	Tks Average	2.11	
			mm	Length	6000	
				mm	Pitch	25.4
						mm



Here you can view the performance and construction details of the heat exchanger. (Length etc)

Verify Geometry

The screenshot shows the Aspen Plus software interface. In the top toolbar, the 'Verify Geometry' button is highlighted with a red box and a red '1'. Below the toolbar, the 'Exchanger Details: E-104' worksheet is active. The main drawing area displays a technical drawing of an exchanger shell and tube bundle. The drawing includes a side view with dimensions: 346, 412, 330, 5195 (labeled '7201 Overall'), and 3600. It also shows nozzle details for '2 Bolts Fixed' and '2 Bolts Sliding'. The drawing is titled 'Views on arrow A'.

Nozzle Data			Design Data		Units	Shell	Channel	Components	
Ref	OD	Wall	Standard	Notes	Design Pressure	bar	5	9	Component location
S1	324 mm	9.5 mm	150 ANSI Slip on		Design Temperature	C	265	230	Service of tube
S2	273 mm	9.3 mm	150 ANSI Slip on		Full Vacuum				Clearance of tube

Aspen Shell & Tube Exchanger

Verify Weights

The screenshot displays the Aspen HYSYS V8.8 interface for an Exchanger Design. The top menu bar includes File, Home, Economics, Dynamics, View, Customize, Resources, and Exchanger Design. The Exchanger Design ribbon contains options like Set Units, Convert Values, Set Process Data, Set Properties, Set Geometry, Set Construction, Run, Stop, Run Status, Design (Sizing), Find Fouling, Rating / Checking, Simulation, and Results. The status bar shows Capital: ___ USD, Utilities: ___ USD/Year, Energy Savings: ___ MW (___%), and Exchangers - Unknown: 2 OK: 6 Risk: 0.

The EDR Navigation pane on the left shows a tree view with 'Cost / Weights' selected, indicated by a red box and a red circle with the number 1. The main window displays the 'Costs/Weights' table for Exchanger E-104, with the 'Total weight - filled with water' row highlighted by a red box and a red circle with the number 2.

Weights	kg	Cost data	Dollar(US)
Shell	2363	Labor cost	52350
Front head	931	Tube material cost	12860
Rear head	322.7	Material cost (except tubes)	13669
Shell cover			
Bundle	4967.3		
Total weight - empty	8584	Total cost (1 shell)	78879
Total weight - filled with water	12918.2	Total cost (all shells)	78879

Convert Back to Simple Model

Set Units: Hysys SI, Convert Values
 Next, Set Process Data, Set Properties, Set Geometry, Set Construction
 Model..., Run Control: Run, Stop, Run Status
 Run Mode: Design (Sizing), Find Fouling, Rating / Checking, Simulation, Check Performance, Review Spec Sheet

Economics
 Capital Cost: USD
 Utility Cost: USD/Year (off)

Energy
 Available Energy Savings: MW, % of Actual (off)

EDR Exchanger Feasibility

Unknown	OK	At Risk
2	6	0

Click inside box to open 'Exchanger Summary Table'

Flowsheet Case (Main) - Solver Active | Exchanger Details: E-104

EDR Navigation << Costs/Weights

Exchanger Summary Table

Enabled by Aspen Exchanger Design and Rating (EDR)

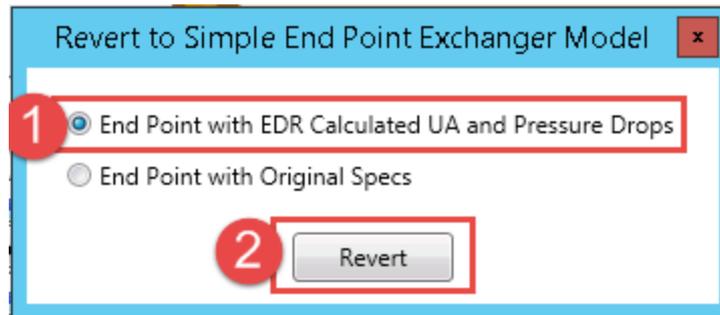
Exchanger Name	Model Status	Summary	Pressure	Temperature	Vibration	Erosion: RhoV2
AC-101	Revert to Simple	6 OK	●	●	●	●
AC-102	Convert to Rigorous					
E-103	Revert to Simple	●	●	●	●	●
E-104	Revert to Simple	●	●	●	●	●
E-105	Revert to Simple	●	●	●	●	●
E-102	Revert to Simple	●	●	●	●	●
Kero SS Reboiler	Convert to Rigorous					

Dollar(US)
52350
12860
13669
78879
78879

2

Red arrow pointing to the 'Revert to Simple' button for exchanger E-104.

Revert to Simple End Point Model



Edit Pressure Drops (Optional)

The screenshot shows the Aspen Plus software interface for editing a heat exchanger model. The window title is "Heat Exchanger: E-104". The "Design" tab is selected, and the "Parameters" sub-tab is active. The "Heat Exchanger Model" is set to "Simple End Point". The "Heat Leak/Loss" options are "None", "Extremes", and "Proportional", with "None" selected. The "End Point Model" section shows the "Overall UA [kJ/C-h]" as $3.385e+005$. The "Specified Pressure Drop [bar]" table is highlighted, with the "SHELL-SIDE" value of 0.5000 and the "TUBE-SIDE" value of $5.000e-002$ circled in red. Below this, a table shows the configuration: "Use Ft" is unchecked, "Tube Passes" is 2, "Shell Passes" is 1, "Shells In Series" is 1, "First Pass" is "Counter", and "Shell Type" is "E". The "Convert to Rigorous Model" section contains a text box and two buttons: "Size Exchanger" and "Specify Geometry".

Heat Exchanger: E-104

Design Rating Worksheet Performance Dynamics Rigorous Shell&Tube

Heat Exchanger Model: Simple End Point

Heat Leak/Loss: None Extremes Proportional

End Point Model

Overall UA [kJ/C-h]: $3.385e+005$

	SHELL-SIDE	TUBE-SIDE
Specified Pressure Drop [bar]	0.5000	$5.000e-002$

Use Ft	Tube Passes	Shell Passes	Shells In Series	First Pass	Shell Type
<input type="checkbox"/>	2	1	1	Counter	E

Convert to Rigorous Model

You can replace any simple exchanger model by a fully rigorous model in your simulation defining a geometry by sizing or by direct specification via input or by importing a prepared file.

Size Exchanger Specify Geometry

Specify the following:

- Shell-Side Pressure Drop: 0.5 bar
- Tube-Side Pressure Drop: 50 mbar

Convert Simple to Rigorous Model

Economics
Capital Cost Utility Cost
USD USD/Year off

Energy
Available Energy Savings
MW % of Actual off

1 EDR Exchanger Feasibility
Unknown OK At Risk
3 5 0

Click inside box to open 'Exchanger Summary Table'

Flowsheet Case (Main) - Solver Active

Exchanger Summary Table

Enabled by Aspen Exchanger Design and Rating (EDR)

Exchanger Name	Model Status	Summary	Pressure	Temperature	Vibration	Erosion: RhoV ²
AC-101	Revert to Simple	5 OK	●	●	●	●
AC-102	Convert to Rigorous					
E-103	Revert to Simple	●	●	●	●	●
E-104	Convert to Rigorous					
E-105	Revert to Simple	●	●	●	●	●

2

Size Interactively

Convert to Rigorous Exchanger

Select Conversion Method

Size Exchanger Specify Exchanger Geometry

Size Exchanger

Auto Size Auto Size using Template

1 Size Interactively Size Interactively using Template

Template File

Specify Exchanger Geometry

Input Key Geometry

Import EDR File

2

Size Interactively

EDR Sizing Console: E-104

✓ Geometry ✓ Process ✓ Errors & Warnings ✓ Run Status

Calculation mode: Design (Sizing) Recent Previous ● Setting Plan ○ Tube Layout

Configuration

TEMA Type: B - E - M -

Tube layout option: New (optimum) layout

Location of hot fluid: Shell side

Tube OD \ Pitch: mm 19.05 \ 23.81

Tube pattern: 30-Triangular

Tubes are in baffle window: Yes

Baffle type: Single segmental

Baffle cut orientation: Horizontal

Default exchanger material: Carbon Steel 1

Size

Specify some sizes for Design: No

Shell ID \ OD: mm \

Tube length: mm

Baffle spacing center-center: mm

Number of baffles:

Number of tube \ passes: \

Shells in series:

Shells in parallel:

Overall Results

Excess surface (%):

Dp-ratio Shellside \ Tubeside: \

Total cost (all shells): Dollar(US)

Stream Temperatures

TS Bulk Temp (C) + SS Bulk Temp (C)

Distance from End (mm)

— TS Bulk Temp (C) — SS Bulk Temp (C)

Size Accept Design Save Cancel

Design with Parallel Shells

EDR Sizing Console: E-104

✓ Geometry ✓ Process ✓ Errors & Warnings ✓ Run Status

Calculation mode: Design (Sizing) Recent Previous

Configuration

TEMA Type:	B - E - M -	BEM
Tube layout option:	New (optimum) layout	
Location of hot fluid:	Shell side	Shell side
Tube OD \ Pitch:	mm 19.05 \ 23.81	19.05 \ 23.81
Tube pattern:	30-Triangular	30
Tubes are in baffle window:	Yes	Yes
Baffle type:	Single segmental	Single segmental
Baffle cut orientation:	Horizontal	H
Default exchanger material:	Carbon Steel 1	Carbon Steel

Size

1 Specify some sizes for Design:	Yes	No
Shell ID \ OD:	mm \ mm	700 \ 720
Tube length:	mm	4950
Baffle spacing center-center:	mm	485
Number of baffles:		8
Number of tube \ passes:	\	641 \ 1
Shells in series:		1
2 Shells in parallel:	2	1

Overall Results

Excess surface (%):		4
Dp-ratio Shellside \ Tubeside:	0.6948 \ 0.9216	
Total cost (all shells):	Dollar(US)	46174

3 Size Accept Design Save Cancel

Design with Parallel Shells

Geometry
 Process
 Errors & Warnings
 Run Status

Calculation mode: Design (Sizing)

	Recent	Previous
Configuration		
TEMA Type:	BEM	BEM
Tube layout option:		
Location of hot fluid:	Shell side	Shell side
Tube OD \ Pitch:	19.05 \ 23.81	19.05 \ 23.81
Tube pattern:	30	30
Tubes are in baffle window:	Yes	Yes
Baffle type:	Single segmental	Single segmental
Baffle cut orientation:	H	H
Default exchanger material:	Carbon Steel	Carbon Steel
Size		
Specify some sizes for Design:	Yes	No
Shell ID \ OD:	539.75 \ 558.8	700 \ 720
Tube length:	4650	4950
Baffle spacing center-center:	285	485
Number of baffles:	14	8
Number of tube \ passes:	374 \ 1	641 \ 1
Shells in series:	1	1
Shells in parallel:	2	1
Overall Results		
Excess surface (%):	0	4
Dn-ratio Shellside \ Tubeside:	0.6374 \ 0.7043	0.6948 \ 0.9216
Total cost (all shells):	64940	46174

Total cost (all shells): Dollar(US)

Size **Accept Design** Save Cancel

Here you can compare the two designs (total costs, etc.)

View Key Model Results

Economics
Capital Cost Utility Cost
USD USD/Year off

Energy
Available Energy Savings
MW % of Actual off

EDR Exchanger Feasibility
Unknown OK At Risk
2 **6** **0**

Flowsheet Case (Main) - Solver Active

Navigation Pane

Raw Crude
TEE-100
E-102
E-103
E-104
E-105
RCY-1
RCY-2
RCY-3
Resid_Recycle_Copy
HT Crude Copy
Res Run Down
SPRDSHT-Prorate Flows

Double click on the Heat Exchanger Block to open the form.

Diesel Steam
AGD Steam

View Key Model Results

Heat Exchanger: E-104

Design Rating Worksheet Performance Dynamics **Rigorous Shell&Tube**

Shell&Tube

- Application
- Exchanger
- Process
- Property Ranges
- Results Summary**
- Setting Plan
- Tube Layout
- Profiles

Calculated Exchanger Performance

Duty [kW]	3124
Effective Surface Area [m ²]	204.5
Effective MTD [C]	32.94
Overall Clean Coeff [kJ/h-m ² -C]	1669
Overall Dirty Coeff [kJ/h-m ² -C]	1669
Vibration Problem	No
RhoV ² Problem	No

	SHELL-SIDE	TUBE-SIDE
Film Coefficient [kJ/h-m ² -C]	5181	2549
Calculated Pressure Drop [bar]	0.3188	3.517e-002
Allowable Pressure Drop [bar]	0.5000	5.000e-002
Velocity (Highest) [m/s]	1.527	1.051

Make a Note of the Results.

Import... Export... Model Details...

Display both errors and warnings

Delete OK Update Ignored

Take One Shell Offline

Heat Exchanger: E-104

Design Rating Worksheet Performance Dynamic **Rigorous Shell&Tube**

Shell&Tube

Application
Exchanger
Process
Property Ranges
Results Summary
Setting Plan
Tube Layout
Profiles

TEMA Type

Front End Head Type	<i>B - bonnet bolted or integral with tubesheet</i>
Shell Type	<i>E - one pass shell</i>
Rear End Head Type	<i>M - bonnet</i>

Tubes

Tube OD [mm]	19.05	Tube Thickness [mm]	2.108
Tube Length [mm]	4650	Tubes Pitch [mm]	23.81
Effective Tube Count	374.0	Tube Pattern	30-Triangular

Shell

Orientation	<i>Horizontal</i>
Exchangers in Parallel	1.000
Exchangers in Series	1.000
Tubeside Passes	1.000

Transfer Geometry from HYSYS

Transfer UA To End Point

Import... Export... Model Details...

In order to take one of the two shells offline, change number of exchangers in parallel from 2 to 1.

View Implications of the Change

Heat Exchanger: E-104

Design Rating Worksheet Performance Dynamics **Rigorous Shell&Tube**

Shell&Tube

- Application
- Exchanger
- Process
- Property Ranges
- Results Summary**
- Setting Plan
- Tube Layout
- Profiles

Calculated Exchanger Performance

Duty [kW]	2679
Effective Surface Area [m2]	102.3
Effective MTD [C]	34.90
Overall Clean Coeff [kJ/h-m2-C]	2702
Overall Dirty Coeff [kJ/h-m2-C]	2702
Vibration Problem	No
RhoV2 Problem	Yes

	SHELL-SIDE	TUBE-SIDE
Film Coefficient [kJ/h-m2-C]	8177	4274
Calculated Pressure Drop [bar]	1.170	0.1210
Allowable Pressure Drop [bar]	0.5000	5.000e-002
Velocity (Highest) [m/s]	3.053	2.001

Import... Export... Model Details...

Display both errors and warnings

Delete **OK** Update Ignored

Compare the Implications of the Change

Calculated Exchanger Performance

Duty [kW]	3124
Effective Surface Area [m ²]	204.5
Effective MTD [C]	32.94
Overall Clean Coeff [kJ/h-m ² -C]	1669
Overall Dirty Coeff [kJ/h-m ² -C]	1669
Vibration Problem	No
RhoV2 Problem	No



	SHELL-SIDE	TUBE-SIDE
Film Coefficient [kJ/h-m ² -C]	5181	2549
Calculated Pressure Drop [bar]	0.3188	3.517e-002
Allowable Pressure Drop [bar]	0.5000	5.000e-002
Velocity (Highest) [m/s]	1.527	1.051

Calculated Exchanger Performance

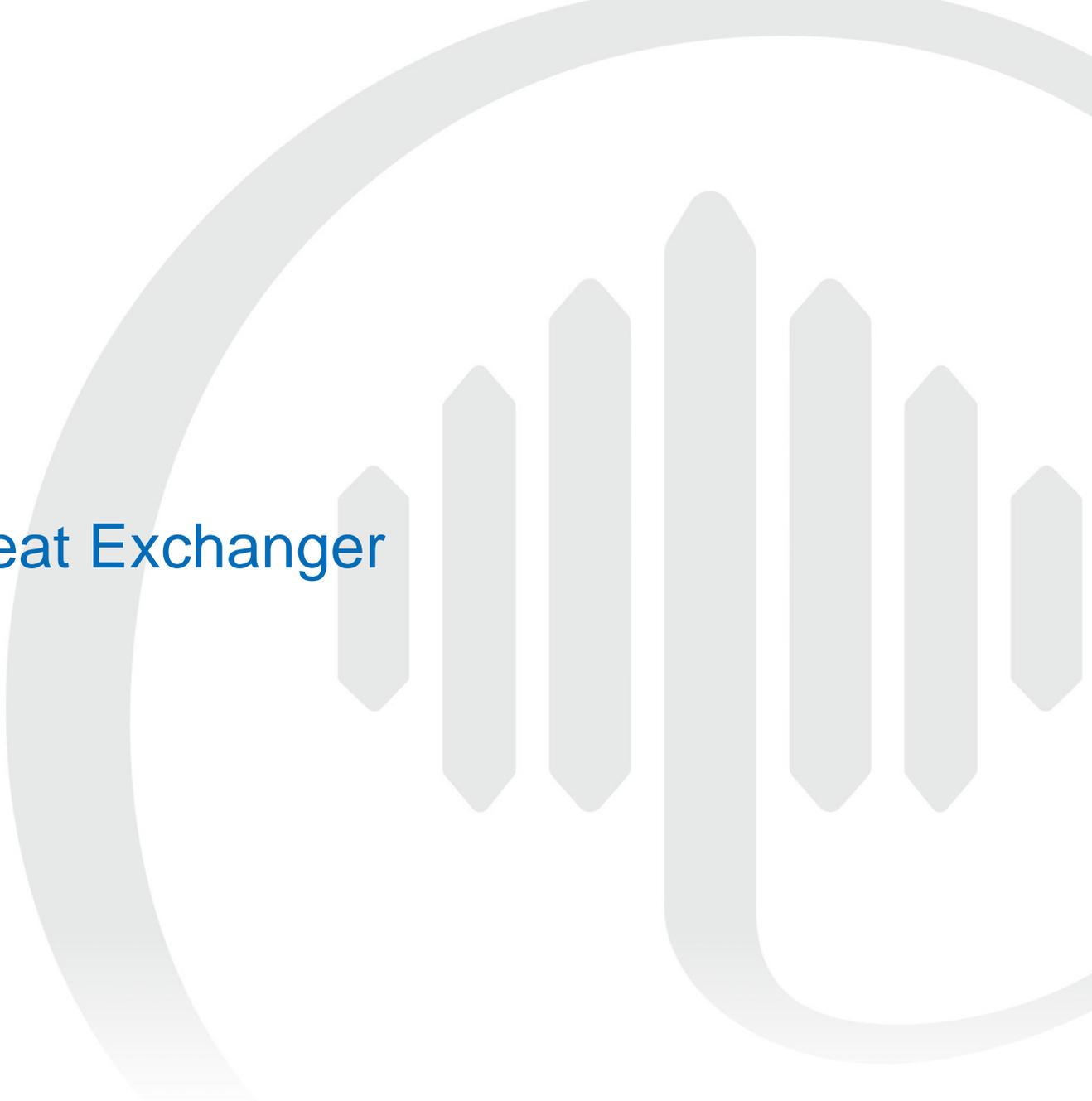
Duty [kW]	2679
Effective Surface Area [m ²]	102.3
Effective MTD [C]	34.90
Overall Clean Coeff [kJ/h-m ² -C]	2702
Overall Dirty Coeff [kJ/h-m ² -C]	2702
Vibration Problem	No
RhoV2 Problem	Yes



	SHELL-SIDE	TUBE-SIDE
Film Coefficient [kJ/h-m ² -C]	8177	4274
Calculated Pressure Drop [bar]	1.170	0.1210
Allowable Pressure Drop [bar]	0.5000	5.000e-002
Velocity (Highest) [m/s]	3.053	2.001



Air Cooled Heat Exchanger



Demonstration Workflow

Below is the order of tasks we will follow next:

1. Identify the Simple Heat Exchanger Model
2. Convert the simple model to a rigorous model
3. Compare the performance between the parallel Air Cooler models
4. Convert the rigorous model back to a simple model
5. Size the heat exchanger using EDR Template
6. Learn how to view key performance results
7. Change geometric configuration of the exchanger
8. Compare the implications of the change to the previous design

Open the Process Model

The screenshot displays the Aspen HYSYS V8.8 interface. The top ribbon is set to 'Flowsheet/Modify', showing various toolbars for editing the process model. Below the ribbon, there are three summary panels: 'Economics' (Capital Cost, Utility Cost), 'Energy' (Available Energy Savings), and 'EDR Exchanger Feasibility' (Unknown: 3, OK: 5, At Risk: 0). The main workspace shows a detailed process flow diagram for a CDU (Crude Distillation Unit) model. The diagram includes a 'Raw Crude' input, several heat exchangers (E-101, E-102, E-103, E-104, E-105), reboilers (RCY-1, RCY-2, RCY-3), and a distillation column (T-100). A blue callout box with the text 'Open 'CDU_Model.hsc'' is overlaid on the diagram. The interface also features a 'Navigation Pane' on the left and a 'Search aspenONE Exchange' bar at the top right.

Locate the Heat Exchanger

Economics
Capital Cost Utility Cost
USD USD/Year off

Energy
Available Energy Savings
MW % of Actual off

EDR Exchanger Feasibility
Unknown OK At Risk
3 **5** **0**

Flowsheet Case (Main) - Solver Active

- Show model status
- Show risk status
- Show legend

SPRDSHT-Prorate Flows

Navigation Pane

PreFlash Vap

Diesel Steam

AGO Steam

Atm

Off Gas

Waste Water

Naphtha

Atmos Cond

OH Copy

ovhvapor

TEE-101

O-head1

O-head2

AC-102

Condensate 2

AC-101

Condensate 1

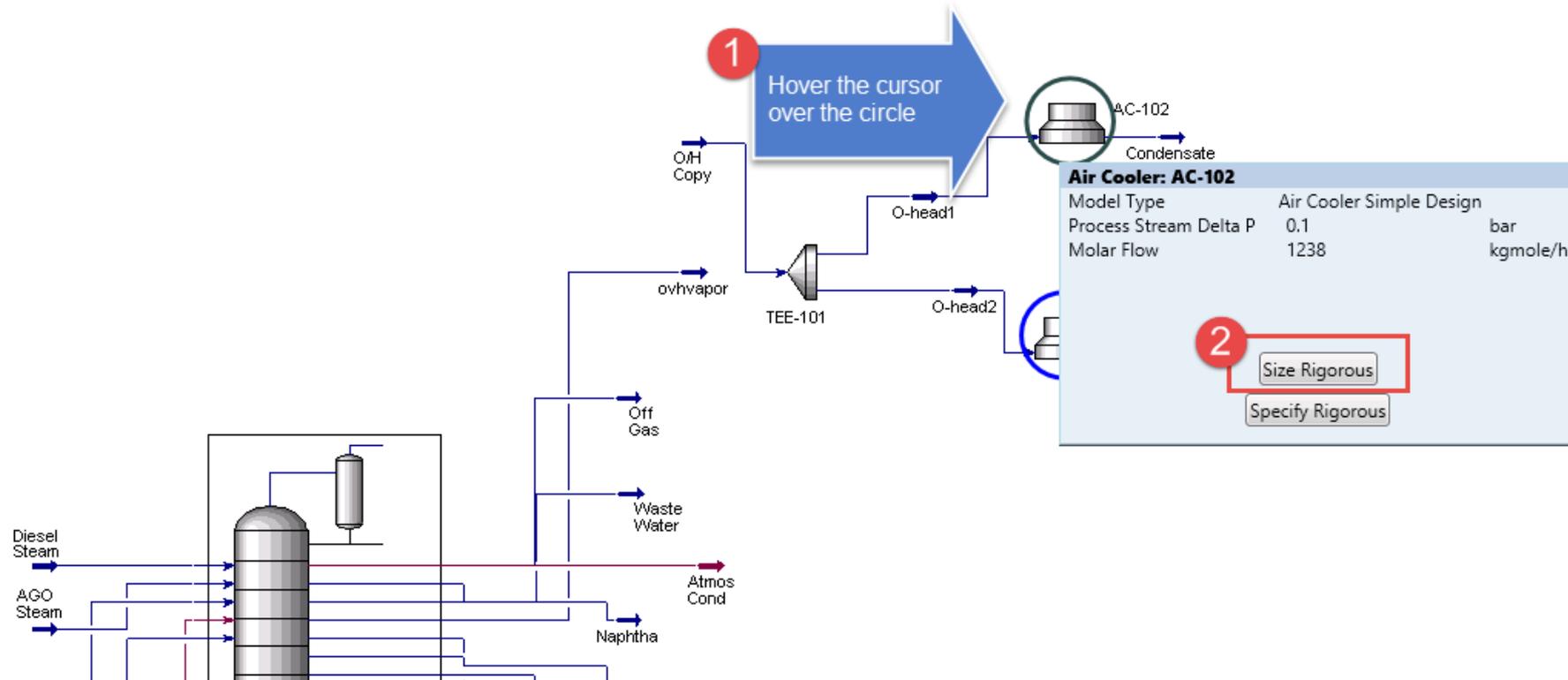
Kero_SS_BoilUp_2

Note that the Blue rings indicate rigorous models and the Grey rings indicate simple models.

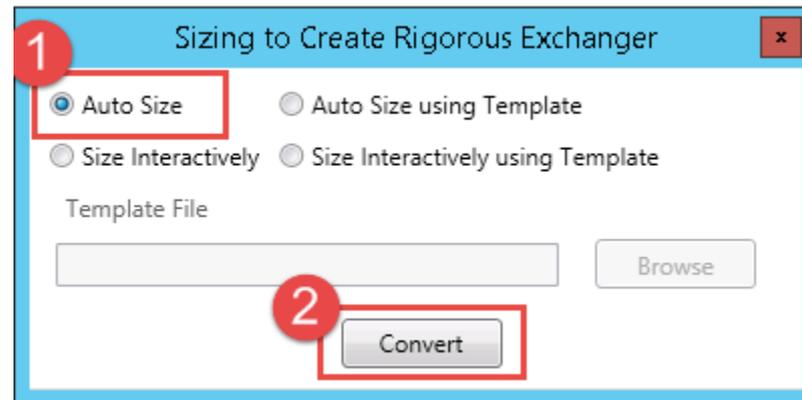
Convert to Rigorous Model

Economics		Energy		EDR Exchanger Feasibility		
Capital Cost	Utility Cost	Available Energy Savings		Unknown	OK	At Risk
USD	USD/Year	MW	% of Actual	3	5	0
<input type="checkbox"/> off		<input type="checkbox"/> off				

Flowsheet Case (Main) - Solver Active x +



Auto Size to create a Rigorous Model



Compare Between the Parallel Air Coolers

Clipboard | Units | Simulation | Solver | Summaries | Analysis | Safety Analysis

Economics
Capital Cost Utility Cost
USD USD/Year off

Energy
Available Energy Savings
MW % of Actual off

EDR Exchanger Feasibility
Unknown OK At Risk
2 **5** **1**

Click inside box to open 'Exchanger Summary Table'

Flowsheet Case (Main) - Solver Active | Exchanger Details: AC-101

Navigation Pane

Exchanger Summary Table

Enabled by Aspen Exchanger Design and Rating (EDR)

Exchanger Name	Model Status	Summary	Pressure	Temperature	Vibration	Erosion
AC-101	Revert to Simple	1 Warning	●	●	●	●
AC-102	Revert to Simple	●	●	●	●	●
E-103	Revert to Simple	●	●	●	●	●
E-104	Convert to Rigorous	●	●	●	●	●
E-105	Revert to Simple	●	●	●	●	●

O-head1

AC-102

Condensate 2

TEE-101

O-head2

AC-101

Click on AC-101 and AC-102 to open their respective detail forms.

Compare Between the Parallel Air Coolers

The image displays two screenshots of the Aspen HYSYS software interface, showing the performance data for two parallel air coolers, AC-101 and AC-102. The screenshots are annotated with red boxes and numbers 1 and 2 to highlight specific data points.

AC-101 Performance Data:

Results Summary	
Total Heat Load [kW]	1.655e+004
Effective Surface Area [m2]	1.836e+004
Effective MTD [C]	47.25
Overall Dirty Coeff [kJ/h-m2-C]	1620
Overall Clean Coeff [kJ/h-m2-C]	1638

Stream	Tube Side	Air Side
Film Coefficient [kJ/h-m2-C]	2613	4592
Calculated Pressure drop [bar]	9.155e-002	1.553e-003
Allowable Pressure drop [bar]	0.1000	2.000e-003
Velocity In (Highest) [m/s]	19.59	7.095
Velocity Out (Highest) [m/s]	0.2597	7.802

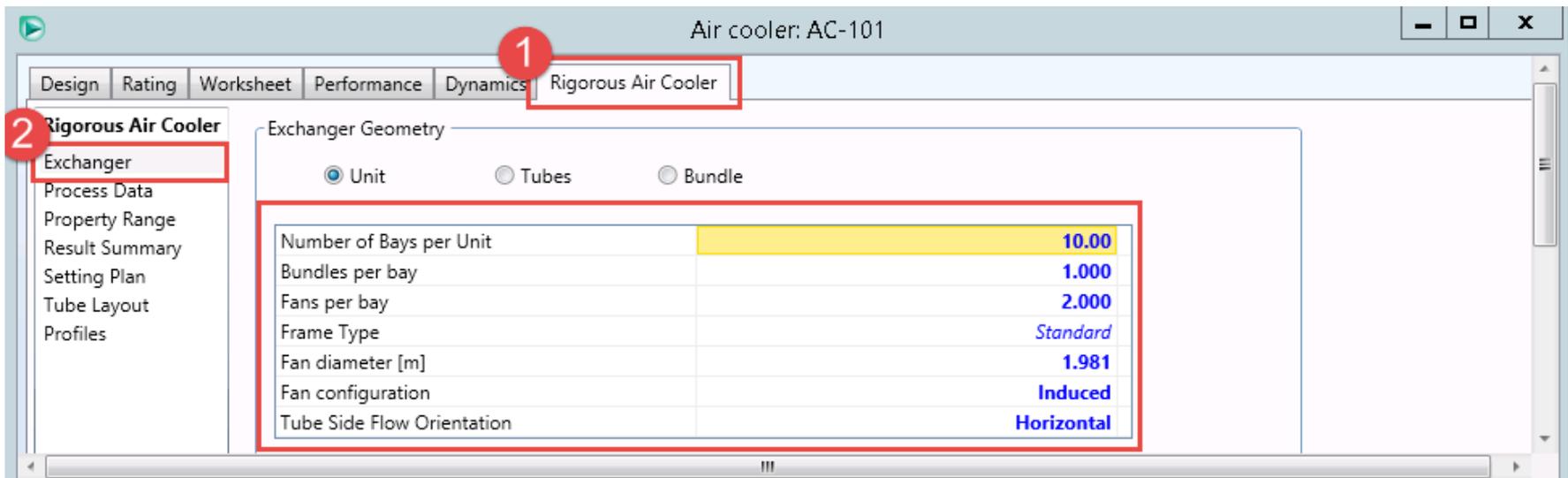
AC-102 Performance Data:

Results Summary	
Total Heat Load [kW]	1.704e+004
Effective Surface Area [m2]	2.711e+004
Effective MTD [C]	45.51
Overall Dirty Coeff [kJ/h-m2-C]	1168
Overall Clean Coeff [kJ/h-m2-C]	1168

Stream	Tube Side	Air Side
Film Coefficient [kJ/h-m2-C]	1611	4397
Calculated Pressure drop [bar]	7.903e-002	1.975e-003
Allowable Pressure drop [bar]	0.1979	2.000e-003
Velocity In (Highest) [m/s]	20.07	8.748
Velocity Out (Highest) [m/s]	0.1321	9.179

Note the difference in performance between the two parallel Air coolers.

Compare Between the Parallel Air Coolers



Air cooler: AC-101

Design Rating Worksheet Performance Dynamics Rigorous Air Cooler

Rigorous Air Cooler

Exchanger

Process Data

Property Range

Result Summary

Setting Plan

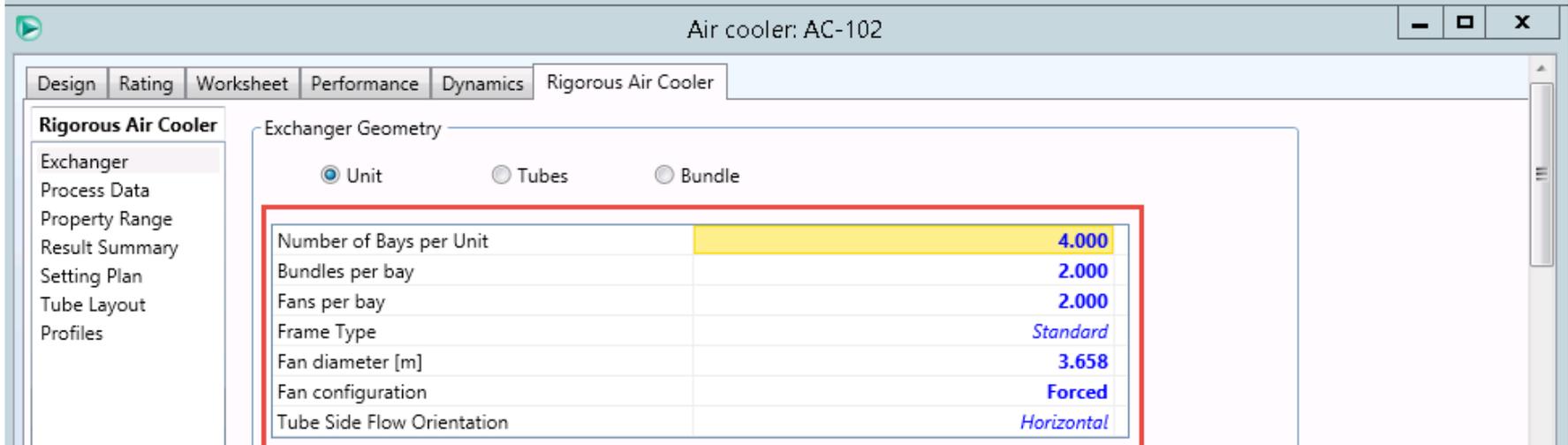
Tube Layout

Profiles

Exchanger Geometry

Unit Tubes Bundle

Number of Bays per Unit	10.00
Bundles per bay	1.000
Fans per bay	2.000
Frame Type	Standard
Fan diameter [m]	1.981
Fan configuration	Induced
Tube Side Flow Orientation	Horizontal



Air cooler: AC-102

Design Rating Worksheet Performance Dynamics Rigorous Air Cooler

Rigorous Air Cooler

Exchanger

Process Data

Property Range

Result Summary

Setting Plan

Tube Layout

Profiles

Exchanger Geometry

Unit Tubes Bundle

Number of Bays per Unit	4.000
Bundles per bay	2.000
Fans per bay	2.000
Frame Type	Standard
Fan diameter [m]	3.658
Fan configuration	Forced
Tube Side Flow Orientation	Horizontal

Note the difference in geometry between the two parallel Air coolers.

Convert Back to Simple Model

Economics
Capital Cost Utility Cost
USD USD/Year off

Energy
Available Energy Savings
MW % of Actual off

EDR Exchanger Feasibility
Unknown OK At Risk
2 5 1

Flowsheet Case (Main) - Solver Active Exchanger Details: AC-101

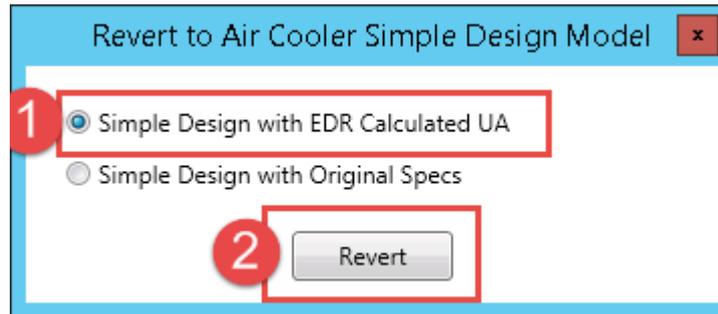
1 Show model status
Show risk status
Show legend

2 Hover the cursor over the circle

3 Revert to Simple Design

Rigorous Model	AirCooled	
Surface Area	2.711e+04	m2
Total Heat Load	1.704e+04	kW
Fan Configuration	Forced	
Bays per Unit	4	
Bundles per Bay	2	
Fans per Bay	2	

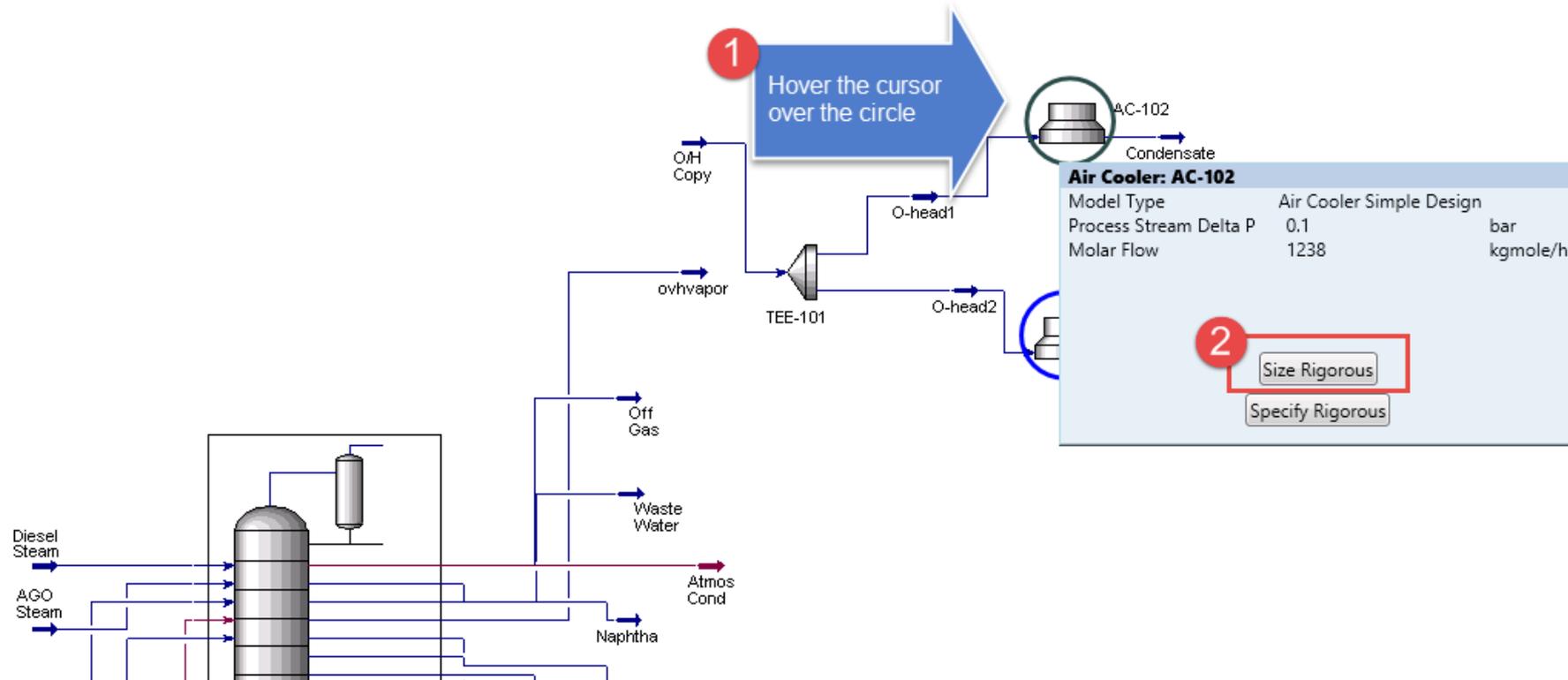
Convert Back to Simple Model



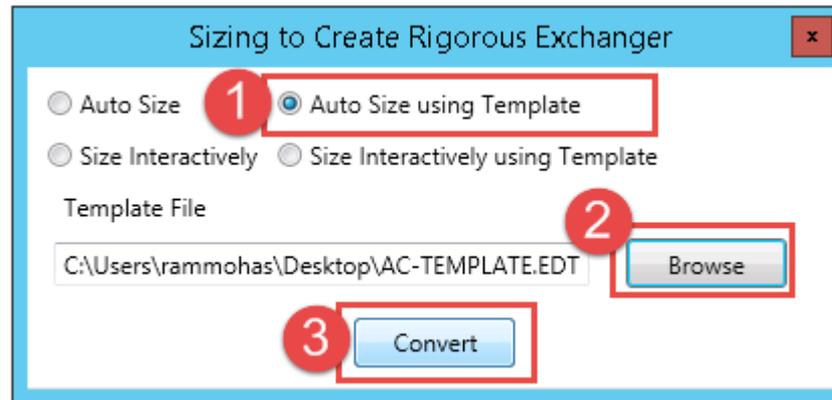
Convert Simple to Rigorous Model

Economics		Energy		EDR Exchanger Feasibility		
Capital Cost	Utility Cost	Available Energy Savings		Unknown	OK	At Risk
USD	USD/Year	MW	% of Actual	3	5	0
<input type="checkbox"/> off		<input type="checkbox"/> off				

Flowsheet Case (Main) - Solver Active x +



Auto Size using Template



Choose the template: 'AC-TEMPLATE.EDT' for sizing.

View Key Model Results

Economics

Capital Cost

Utility Cost

USD

USD/Year

off

Energy

Available Energy Savings

MW

% of Actual

off

EDR Exchanger Feasibility

Unknown

OK

At Risk

2

5

1



Flowsheet Case (Main) - Solver Active x +

Air cooler: AC-102

Design Rating Worksheet Performance Dynamics Rigorous Air Cooler

Rigorous Air Cooler

Exchanger

Process Data

Property Range

Result Summary

Setting Plan

Tube Layout

Profiles

Results Summary

Total Heat Load [kW]	1.699e+004
Effective Surface Area [m2]	3.050e+004
Effective MTD [C]	46.84
Overall Dirty Coeff [kJ/h-m2-C]	1006
Overall Clean Coeff [kJ/h-m2-C]	1075

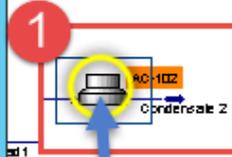
Stream	Tube Side	Air Side
Film Coefficient [kJ/h-m2-C]	1538	3683
Calculated Pressure drop [bar]	5.362e-002	8.635e-004
Allowable Pressure drop [bar]	0.1979	2.000e-003
Velocity In (Highest) [m/s]	13.38	5.832
Velocity Out (Highest) [m/s]	0.1763	6.119

Make a note of the results.

Import...

Export...

Model Details...



Double Click

Make Changes to Heat Exchanger Geometry

Air cooler: AC-102

Design Rating Worksheet Performance Dynamics **Rigorous Air Cooler**

Rigorous Air Cooler

2 Exchanger
Process Data
Property Range
Result Summary
Setting Plan
Tube Layout
Profiles

3 Unit Tubes Bundle

4

Number of Bays per Unit	10.00
Bundles per bay	2.000
Fans per bay	2.000
Frame Type	Standard
Fan diameter [m]	3.658
Fan configuration	Forced
Tube Side Flow Orientation	Horizontal

Transfer UA to simple design

Change the number of bays per unit to 10.

Display both errors and warnings

Delete OK

Make Changes to Heat Exchanger Geometry

1

2

3

4

Change to:

- Number of Passes: 2
- Number of Rows: 4

Parameter	Value
Number of Passes	2.000
Number of Rows	4.000
Number of Tubes	184.0
Type of Bundle	Staggered-even rows to right
Transverse Pitch [mm]	60.00
Tube layout angle [deg]	30.00

View Key Model Results

1 Air cooler: AC-102

Design | Rating | Worksheet | Performance | Dynamics | **Rigorous Air Cooler**

2 Rigorous Air Cooler

- Exchanger
- Process Data
- Property Range
- Result Summary**
- Setting Plan
- Tube Layout
- Profiles

3 Results Summary

Total Heat Load [kW]	1.710e+004
Effective Surface Area [m ²]	6.777e+004
Effective MID [C]	42.25
Overall Dirty Coeff [kJ/h-m ² -C]	505.1
Overall Clean Coeff [kJ/h-m ² -C]	505.1

4

Stream	Tube Side	Air Side
Film Coefficient [kJ/h-m ² -C]	613.5	2924
Calculated Pressure drop [bar]	3.391e-002	4.405e-004
Allowable Pressure drop [bar]	0.1979	2.000e-003
Velocity In (Highest) [m/s]	8.026	3.499
Velocity Out (Highest) [m/s]	5.277e-002	3.672

Import... Export... Model Details...

Display both errors and warnings

Delete OK

Compare the Performance Between Two Designs

Total Heat Load [kW]	1.699e+004
Effective Surface Area [m ²]	3.050e+004
Effective MTD [C]	46.84
Overall Dirty Coeff [kJ/h-m ² -C]	1006
Overall Clean Coeff [kJ/h-m ² -C]	1075

Stream	Tube Side	Air Side
Film Coefficient [kJ/h-m ² -C]	1538	3683
Calculated Pressure drop [bar]	5.362e-002	8.635e-004
Allowable Pressure drop [bar]	0.1979	2.000e-003
Velocity In (Highest) [m/s]	13.38	5.832
Velocity Out (Highest) [m/s]	0.1763	6.119



Design (Using EDR Template)

Design (Modified Geometry)

Total Heat Load [kW]	1.710e+004
Effective Surface Area [m ²]	6.777e+004
Effective MTD [C]	42.25
Overall Dirty Coeff [kJ/h-m ² -C]	505.1
Overall Clean Coeff [kJ/h-m ² -C]	505.1

Stream	Tube Side	Air Side
Film Coefficient [kJ/h-m ² -C]	613.5	2924
Calculated Pressure drop [bar]	3.391e-002	4.405e-004
Allowable Pressure drop [bar]	0.1979	2.000e-003
Velocity In (Highest) [m/s]	8.026	3.499
Velocity Out (Highest) [m/s]	5.277e-002	3.672

Additional Resources & Contacts

- AspenTech Support Website (<http://support.aspentech.com>)
- AspenTech Courseware Available in Classroom and Online Versions
- AspenTech Business Consultants

Contact Name	Contact Email
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