aspentech

Technology That Loves Complexity

Aspen Exchanger

Design & Rating Family

- Reduce exchanger costs by 10-30%
- Improve reliability and process uptime
- Improve engineering efficiency by up to 30%
- Superior technology backed by Aspen HTFS research

The Challenge: Simplifying the Engineering Lifecycle

Heat exchangers can comprise up to 30% of capital equipment and impact 90% of the energy used in a process plant. The conventional workflow for heat exchanger design requires manual data transfer from process engineers to thermal and mechanical experts to a cost estimator. Calling for several iterations, this design process is time-consuming and prone to data transcription errors. The process engineer lacks visibility into problem details, making it difficult to investigate multiple process scenarios to choose the most optimal design.

The AspenTech Integrated Solution: Minimize Capital Cost and Improve Process Design

The Aspen Exchanger Design & Rating product family integrates rigorous process models with the industry's most comprehensive heat exchanger modeling capabilities.

Benefits include:
- Typical savings of 10-30% on the equipment cost per heat exchanger.
- Potential savings of millions of US dollars annually through integration with Aspen Plus® and Aspen HYSYS® to identify areas to reduce energy, capital and operational costs.
- Increased engineering efficiency, particularly fast-track front-end engineering, through fully integrated tools for process design.

Aspen HTFS® Research Network

Aspen HTFS Research Network compiles AspenTech's proprietary theoretical models and correlations developed through more than 40 years of experimental study and analysis. Customers can access the research network from Aspen EDR to validate their design practice against documented methods, models and source data.

Best-in-Class Physical Properties Methodsand Data

The Aspen EDR product family accesses the world's largest database of pure component and phase equilibrium data for conventional chemicals and electrolytes. The database is regularly updated from the U.S. National Institute of Standards and Technology (NIST), which ensures easy access to the best available experimental property data. Accurate transport properties and phase equilibrium data are essential to accurate exchanger design and simulation.

Wide Range of Applications

The products facilitate the full range of practical process applications for a wide range of exchanger types including: shell & tube, double pipe, multi-tube hairpin, air coolers, economizers, plate and frame, plate fin, coil-wound and fired heaters from conceptual design to operational troubleshooting. This flexibility allows process streams to be single phase, boiling or condensing vapors, single component or any mixture with or without non- condensable gases in any condition.

Common User Interface

All seven products in the Aspen EDR product family operate within a common user interface which automates data transfer from one program to another, allowing engineers to compare the advantages of different exchanger types. Access to AspenTech's world class property package with more than 25,000 components and 35+ vapor equilibrium methods is accessible in each program.

The Aspen EDR product family uses the power and flexibility of the Microsoft® Windows environment, allowing you to fully explore unit geometry and performance detail. Products support "drag & drop" interfacing with Microsoft Excel® as well as high-level communication with other software and the programs are tightly integrated with Aspen Simulation Workbook, providing easy and robust case studies within Microsoft Excel.

Meeting the Heat Transfer Needs of Process Engineers, Thermal Experts, and Fabricators

Features	Output
• Common Aspen EDR user interface • Design optimization (cost-based) • Run-time integration with Aspen Plus and Aspen HYSYS • Access to the world's largest property package • Aspen HTFS Research backed methods • Access to training materials, example models, and more from the product	• Ease of use reduces the need for training • Reduce equipment costs by 30% or more • Overall process optimization and improved process reliability • More dependable results and process consistency • High degree of accuracy

Process Simulation (Aspen HYSYS or Aspen Plus)

Air cooled Exchanger

Plate Fin Exchanger

Coil-wound Heat Exchanger

Plate Exchanger

Shell & Tube Exchanger

Fired Heater

Aspen Shell & Tube Exchanger, Aspen Plate Exchanger and Aspen Air Cooled Exchanger

Aspen Shell & Tube Exchanger, Aspen Plate Exchanger and Aspen Air Cooled Exchanger enable expert and casual users to realize optimum design, rating and simulation of their respective exchangers. High level run-time integration with Aspen Plus and/or Aspen HYSYS allows engineers to rigorously model heat exchanger operation and identify capital saving opportunities in the context of the overall process.

Aspen Shell & Tube Exchanger

Features	Output
• All TEMA style vessels • Bi-directional interface with Aspen Shell & Tube Mechanical • Run-time integration with Aspen Plus and Aspen HYSYS • Design, rating, simulation, and find fouling calculation modes • All common applications including knockback condensers, flooded evaporator, kettles, falling film evaporators, thermosiphons, multi-shell feed-effluent trains • Double-pipe and multi-tube hairpin exchangers • Multi-shell capability with no practical limits on shells • Plain, low finned, or longitudinally finned tubes and general tube side and shell side enhancement methods • Single, double, and triple segmental baffles, no tubes in window, rod baffles, and unbaffled exchangers • Proper handling of fluids with two immiscible liquid phases • Background ASME mechanical design for more accurate sizing, costing, and weight calculation	• Optimization path that identifies the most economical design selection, possible alternative designs and controlling design constraints • Extensive warning and error reporting identifies potential operational problems • Summary of exchanger thermal-hydraulic performance • Fully completed TEMA-style data sheet • Interactive tube layout and setting plan drawings • Comprehensive incremental output • Vibration analysis (using proprietary HTFS and TEMA methods) • Conceptual cost estimating, customized to your own labor and material costs • Extensive graphing capabilities • Thermosiphon stability checks and flow pattern evaluation
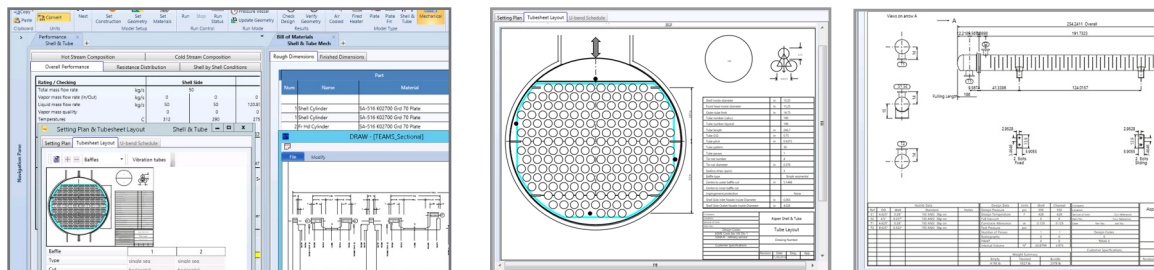
Program Results Include a Setting Plan & Interactive Graphical Tube Sheet Layout

Aspen Plate Exchanger

Features

- Run-time integration with Aspen Plus and Aspen HYSYS
- Up to five passes for either hot or cold streams
- Co-current or counter-current flow
- Evaluates flow maldistribution risk
- Handles non-Newtonian fluids
- Proper handling of fluids with two liquid phases
- Double banking
- Conceptual cost estimate
- User-supplied Colburn j and friction factors to model special proprietary plate types
- Database of commercially available plates from three leading suppliers

Thermal Output

- Optimization path identifies the most satisfactory design selection
- Extensive warning and error reporting
- Summary of exchanger thermal-hydraulic performance
- Detailed port and plate pressure drops for hot-side and cold-side
- Fully completed API-style data sheet
- Setting plan drawings for API-type units
- Comprehensive incremental output
- Extensive graphing capabilities
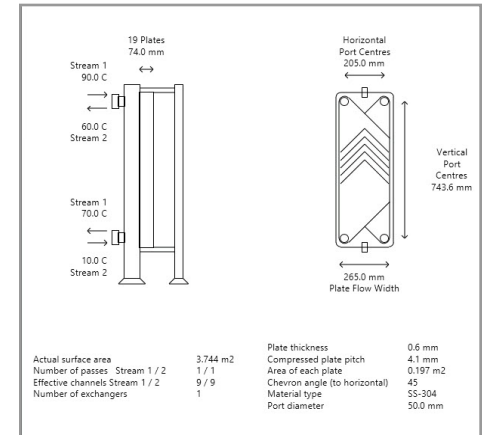
Plot Size is Shown in the Plate Exchanger Diagram

Aspen Air Cooled Exchanger

Features	Output

Features

- Supports three calculation modes:
  - Design – optimizes the selection based on capital and operating costs
  - Check (Rate) – determines if a given exchanger has sufficient area to achieve a specified duty
  - Simulation options – multiple simulation options (including natural convection) for predicting inlet/outlet temperatures, mass flows or process fouling

- Run-time integration with Aspen Plus and Aspen HYSYS

- Tube-side condensing or boiling heat recovery, de-humidification, air cooled and other tubular cross- flow exchangers, air conditioning, charge air coolers, A-frame and V-frame configurations

- X-side flow and thermal duty operating point for a defined fan performance curve

- Multiple tube, high fin and header types

- Up to 50 passes in simple and complex arrangements

- Bundle size: Two to 100 rows, with multiple bundles per bay and multiple bays per unit

- Draught: forced, induced, no fans

- Fouling: standard resistance or tubeside as a function of velocity, temperature, quality, phase or length; X-side as a function of row

- Automated handling of condensation with immiscible liquids

- Weight and budget cost estimates

Output

- Optimization path identifies the most economical design selection considering capital and operating cost

- Extensive warning and error reporting

- Summary of exchanger thermal-hydraulic performance

- Detailed tubeside, X-side and nozzle pressure drops

- X-side installation and fan noise data

- Fully completed API-style data sheet

- Interactive tube layout drawing and setting plan drawings for API-type units

- Comprehensive incremental output

- Extensive graphing capabilities

Optimization Path × Air Cooled +

Optimization Path

Current selected case: 11   Select

	Per Bundle						Per Unit							
	Tube	Rows	Tube		Bundle	Bays	Area			Pressure Drop				
	No.	Deep	Length	Pass	P	P	Actual	Required	Area ratio	Outside	Dp ratio Outside	Tube	Dp ratio Tube side	Price
			m				m2	m2	-	Pa	-	bar	-	Dollar(US)
1	53	3	10	6	1	1	970.5	1019	0.95	174	0.87	24.35022	135.28	27527
2	56	3	10	1	1	1	1025.4	1242.3	0.83	160	0.8	0.4096	2.28	28372
3	78	4	10	1	1	1	1428.2	1302.7	1.1	188	0.94	0.24449	1.36	33711
4	82	4	10	1	1	1	1501.5	1338.7	1.12	173	0.86	0.22616	1.26	35131
5	86	4	10	1	1	1	1574.7	1373.3	1.15	159	0.8	0.20998	1.17	36553
6	86	4	9.5	1	1	1	1493.7	1337.9	1.12	174	0.87	0.19953	1.11	35341
7	90	4	9.5	1	1	1	1563.2	1371.3	1.14	163	0.81	0.18588	1.03	37042
8	90	4	9	1	1	1	1478.5	1334.8	1.11	179	0.9	0.17614	0.98	35777
9	90	4	8.5	1	1	1	1393.7	1298.4	1.07	197	0.98	0.16641	0.92	34127
10	90	4	8	1	1	1	1309	1261	1.04	220	1.1	0.15668	0.87	32863
11	90	4	8.5	1	1	1	1393.7	1298.4	1.07	197	0.98	0.16641	0.92	34127

Aspen Shell & Tube Mechanical

Aspen Shell & Tube Mechanical provides a complete mechanical design package that greatly improves engineering efficiency in exchanger design. It provides a two-way interface to AspenTech's thermal design program, automating transfer of information and minimizing costly rework. It is the only program that optimizes the design of all mechanical components, producing detailed code calculations, customized cost estimates, a detailed drawing package, and complete bill of materials.

Aspen Shell & Tube Mechanical

Features	Output
• Calculation modes: Design, rating	• Summary of design specifications
• Codes and standards supported: ASME Section VIII, Div. 1 and Div 2, EN13445, AD Merkblätter, CODAP TEMA Classes B, C, & R, API 660	• Summary results for all geometries: Cylinders, formed heads, cones, body flanges, tubesheets, nozzles, supports, expansion joints
• Material databases: ASME/ASTM, DIN, AFNOR, EN, JIS	• Applicable code complete detailed results, including code paragraphs and specific sections
• Customized costing databases: Company operating, material, and welding standards, labor efficiencies, material costs	• Supplemental calculations:
• Incorporates all TEMA exchanger types	– Vertical and horizontal vessel support analysis (Zick)
• Expansion joints: Flanged only, flanged and flued, various types of bellows	– Minimum design metal temperatures,
	– Simultaneous internal/external pressure design
• Graphics: Fully dimensioned setting plan, tubesheet layout, and detailed component drawings	– External nozzle loads per WRC 107/537, HEI and TEMA-RGP RCB-10.7
• Interface to Autodesk Inventor 3D solid model	– Maximum allowable working pressures
• Handles up to 13 simultaneous load cases	– Material cladding calculations
	– Wind and seismic loads
	• Complete cost estimate through simulation of fabrication steps
	• Finished and rough bill of materials

Aspen Plate Fin Exchanger

Plate-fin heat exchangers are critical to many cryogenic gas separation processes and are increasingly found in many processing plants. This technology's high thermal effectiveness can deliver significant capital and operational savings. Plate-fin exchangers can handle many process streams in a single exchanger, providing a high degree of thermal integration. This minimizes primary energy consumption and benefits modular construction and plant layout. Plate-fin exchangers use lightweight constuction materials that provide highly efficient heat transfer and permit low-temperature operating conditions. Aspen Plate Fin Exchanger offers precise and flexible modeling of today's most challenging exchanger configurations.

Aspen Plate Fin Exchanger	
Features	**Thermal Output**
• Run-time integration with Aspen HYSYS • Simple layer-based geometry specification • Calculation modes include design, stream-by-stream simulation, layer-by-layer simulation, or checking • Up to 20 process streams • Co-current and counter-current flow with any complexity of exchanger inlet and outlet geometry • Simple and multi-pass cross flow • Core-in-shell (kettle type) • Single-phase and two-phase calculations • Checks for flow maldistribution • Vertical or horizontal exchanger orientation • Plain, wavy, serrated, perforated and hardway fins • Exchanger, distributor, header, and nozzle pressure drop calculations • Multiple exchangers in series/paralleles	• Summary of exchanger performance • Exchanger diagram and temperature graphs • Temperature and vapor quality profiles along the exchanger for all process streams • Comprehensive information on pressure drop including details of losses in nozzles, headers, and distributors • Fin performance data calculated by the program • Extensive calculation of metal temperatures • Longitudinal thermal conduction • Detailed summary of thermosiphon calculations • Extensive analytical graphics for longitudinal, cross- layer and inter-layer material temperatures

Aspen Fired Heater

The sophisticated modeling of Aspen Fired Heater allows designers to explore a wide range of heater configurations. Aspen Fired Heater brings modeling flexibility and ease-of-use with full integration of firebox and convection section heat transfer combined with draft calculations. It offers the reliability and robustness of Aspen HTFS models for process heat transfer and pressure drop along with the well-stirred or long-furnace models for firebox radiation. Aspen Fired

Heater simulations provide heater operators with insight into local process conditions, facilitating optimal operations and maximizing throughput and energy efficiency without compromising safety or reliability. It also allows users to examine local heat flux and tube metal temperatures in the firebox and convection section, thereby avoiding unstable flow regimes in two-phase.

Aspen Fired Heater

Features	Thermal Output
• Run-time integration with Aspen HYSYS • Combined modeling of firebox and convection section • Up to 10 process streams in a single heater • Handles cylindrical and cabin fireboxes • Firebox well-stirred and long-furnace radiation models • Firebox wall tubes (vertical horizontal and helical coil) • Central tubes and cell-type fireboxes • Up to 9 convection tube banks and process streams • Supports plain or finned tubes • Convection section tubes with high round fins, serrated fins, circular or rectangular cross section studs • Full process thermal and hydraulic calculations • Combustion calculations for up to 4 fuels • Evaluation of local process conditions	• Overall heater thermal performance summary, including details of the heat load and the thermal efficiency of the unit • Extensive warning and error reporting identifies potential operational problems • Overviews of thermal performance of each part of the heater, firebox, and convection section tube banks • Thermal overview of each stream in the heater • Combustion information and fuel details, including calculated flue gas composition for individual fuels and fuel mixtures • Comprehensive incremental output, including local temperatures, pressures, and heat flux • Radiation information including zonal analysis

Aspen Coil Wound Exchanger

Coil wound heat exchangers are widely used within low temperature process industries for the liquefaction of petroleum and natural gases and the evaporation of hydrocarbon mixtures and cryogenic fluids. Aspen Coil Wound Exchanger allows users to simulate the thermal and hydraulic behavior of these vital pieces of equipment.

Aspen Coil Wound Exchanger	
Features	**Thermal Output**
• Run-time integration with Aspen HYSYS • Calculation modes include checking and simulation • Up to 3 bundles • Up to 20 streams • Multiple tube side streams in a single bundle • Single-phase and two-phase calculations • Nozzle, bundle, inlet, outlet, and interbundle pressure drop calculations • User can specify their own calculations for heat transfer and pressure drop	• Summary of exchanger performance • Exchanger diagram • Detailed thermal and hydraulic information for each stream at each calculation point in the exchanger • Calculation details shown in graphs and tables for all streams • Comprehensive information on pressure drop including details of losses in nozzles, bundle, inlet, outlet and interbundle regions • Wall temperature profiles along the exchanger

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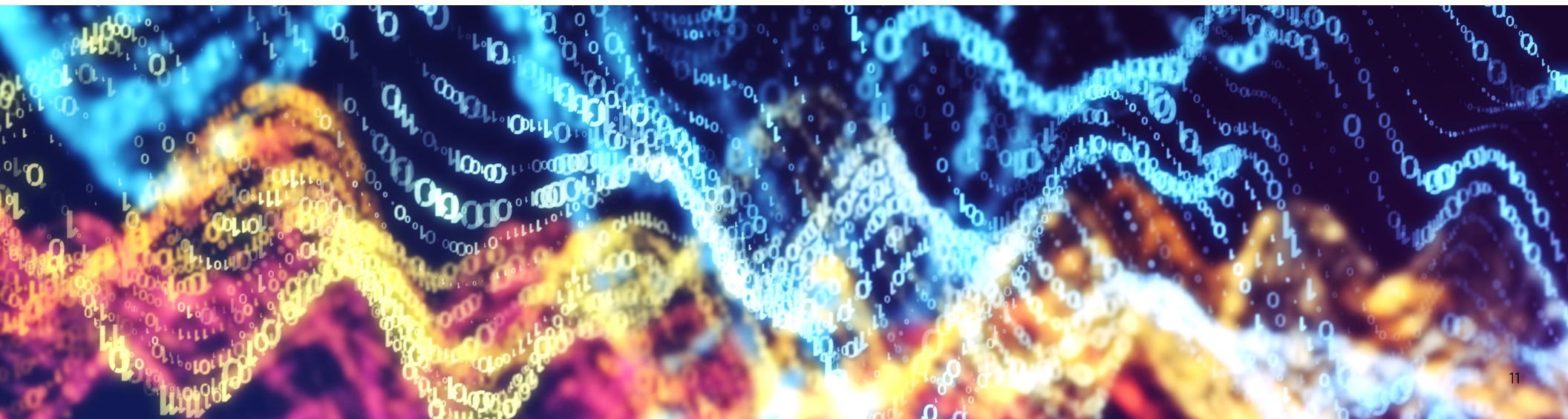
About Aspen Technology

Aspen Technology (AspenTech) is a leading software supplier for optimizing asset performance. Our products thrive in complex, industrial environments where it is critical to optimize the asset design, operation and maintenance lifecycle. AspenTech uniquely combines decades of process modeling expertise with machine learning. Our purpose-built software platform automates knowledge work and builds sustainable competitive advantage by delivering high returns over the entire asset lifecycle. As a result, companies in capital-intensive industries can maximize uptime and push the limits of performance, running their assets safer, greener, longer and faster. Visit AspenTech.com to find out more.

www.aspentech.com