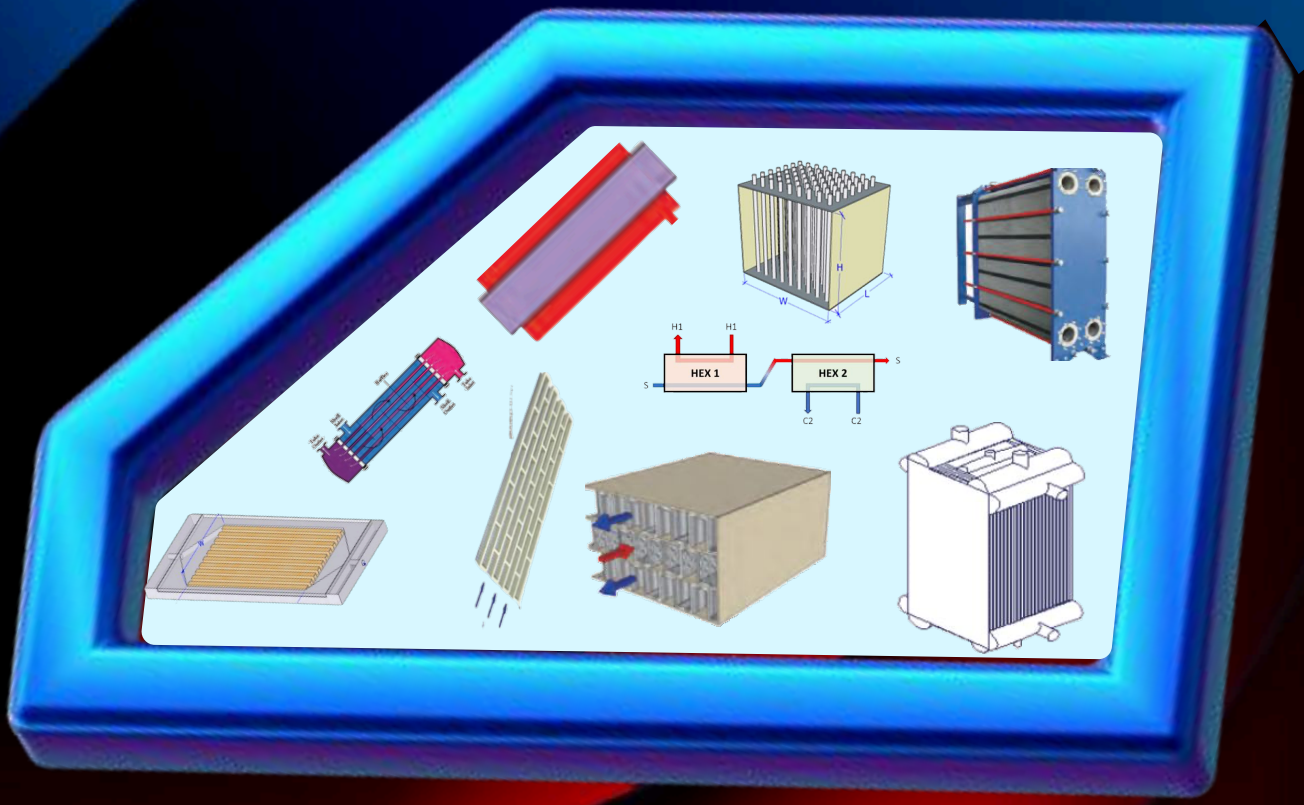
INSTED

Thermal Analysis Software

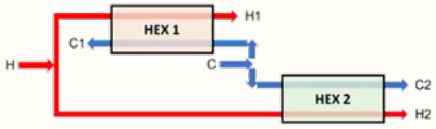


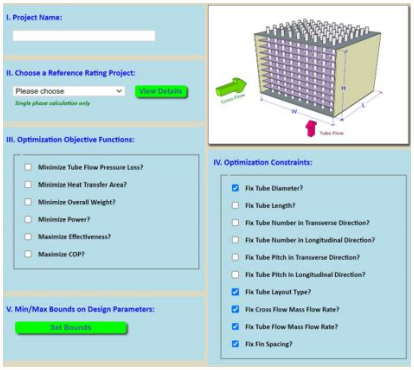
TTC Technologies, Inc.

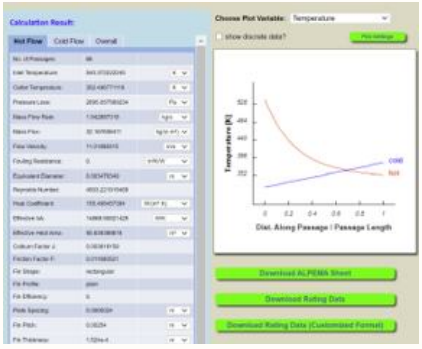
INSTED Modules

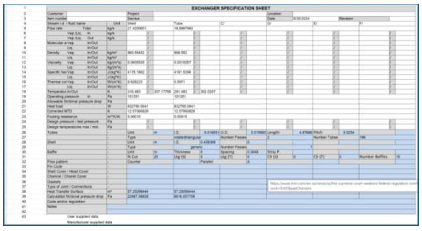
Heat Exchanger (HEX) Analysis Programs

- Plate-Fin Heat Exchanger
- Shell-and-Tubes Heat Exchanger
- Plate-Frame Heat Exchanger
- Concentric Tubes Heat Exchanger
- Cold Plate Heat Exchanger
- Cross-Flow Heat Exchanger
- Manifold-Microchannels
- Multiply-Connected Heat Exchangers
- Helix Heat Exchanger
- Triply Periodic Minimal Surface (TPMS) Heat Exchanger









Two-Phase Models

- 37 Boiling & Condensation Models
- Modification for Enhanced Surfaces
- Incremental Method

Multiple HEX Design Tools

- Performance Analysis (Rating)
- Parameter Analysis (Multiple Rating)
- Preliminary Design
- Sizing
- Optimization

Customizable Input Data

- Custom Fluid Properties
- Custom j/f Data
- Custom Fin Geometry

Advanced Optimization Algorithms

- Gradient Method
- Adjoint-Based Method
- Genetic Algorithm (GA)
- Advanced Sensitivity Analysis

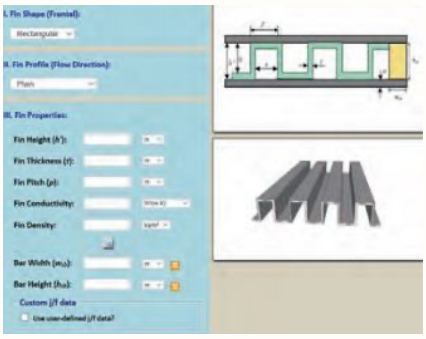
Engineering Tools

- Thermal-Hydraulic Database
- Advanced Math Calculation Tool
- Engineering Units Conversion

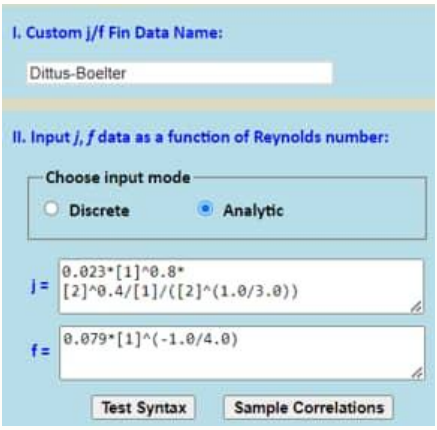
Plate-Fin Heat Exchangers

- Performance Analysis
- Parametric Rating Calculations
- Sizing & Optimization
- Custom j/f Data Input for Fins
- Kays & London Data for Fins
- User-Defined Fin Geometry Data
- Multiple Passes/Partitions

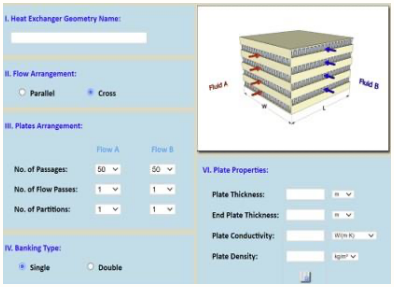
(Advanced Cooling Solutions)



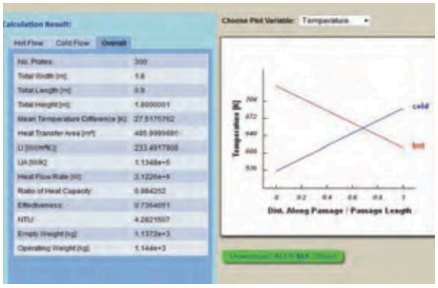
HEX Geometry



Custom j/f Data



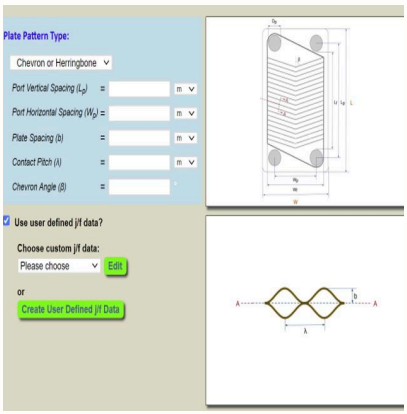
HEX Rating

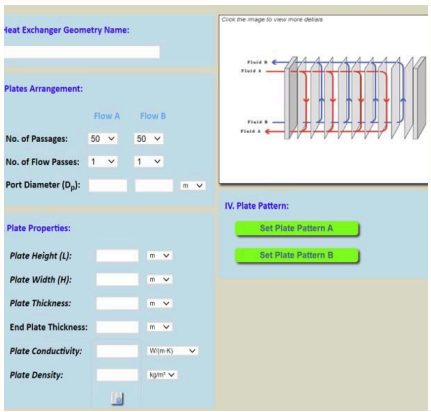


Calculation Results

Plate-Frame Heat Exchangers

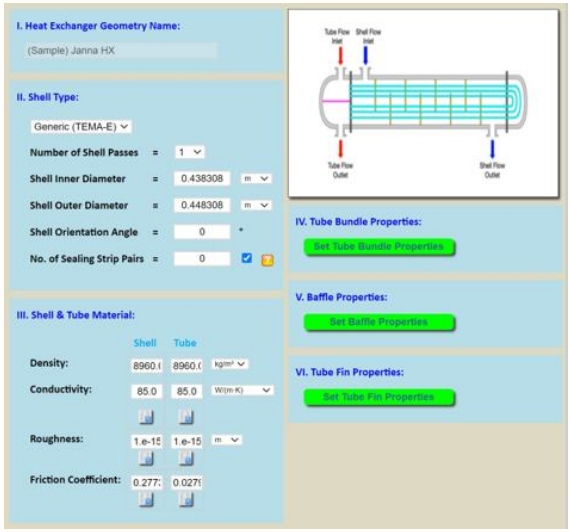
- Performance Analysis
- Parametric Rating Calculations
- Sizing & Optimization
- Custom j/f Data Input for Plate Patterns

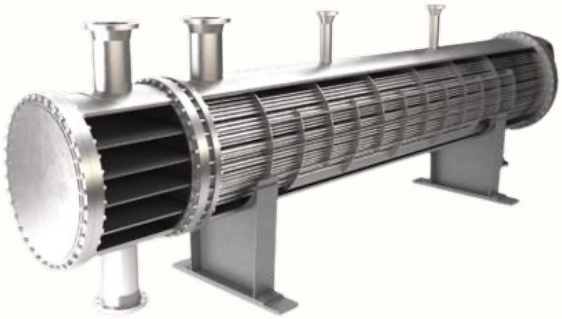


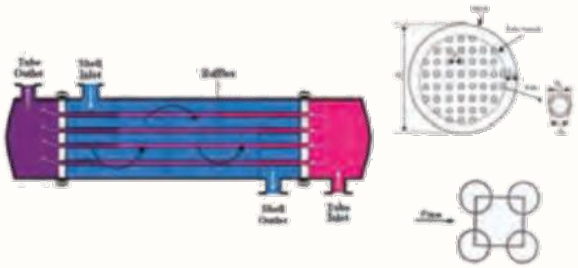


Shell and Tubes Heat Exchangers

- Performance Analysis
- Parametric Rating Calculations
- Preliminary Design
- Various Shell Types
- Various Tubes Bundle Types

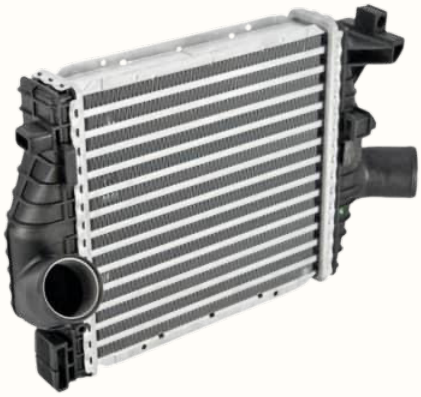


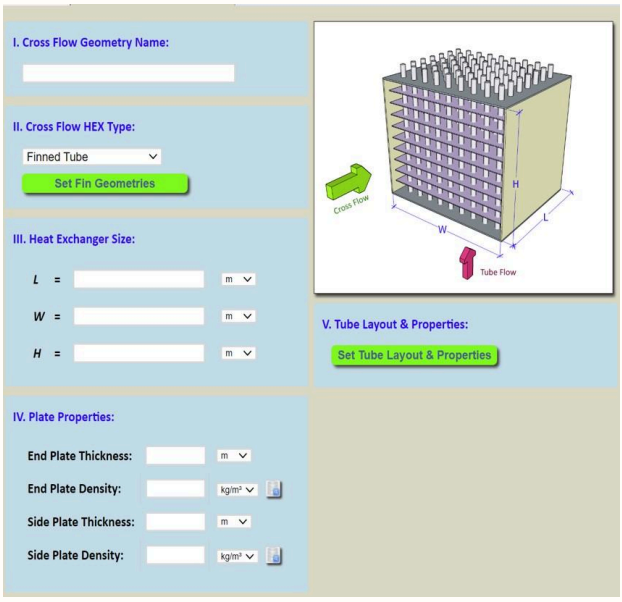


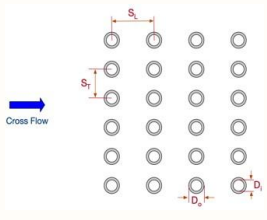


Cross-Flow Heat Exchangers

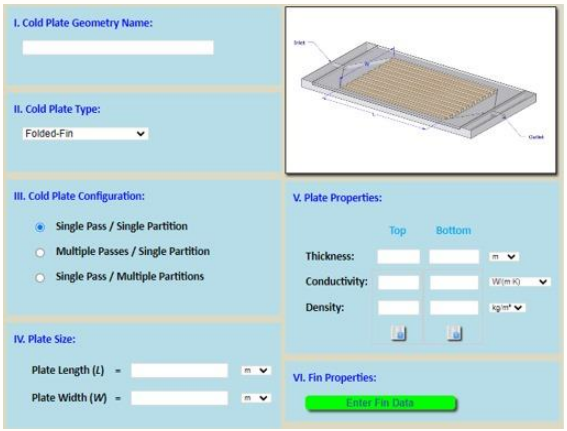
- Performance Analysis
- Parametric Rating Calculations
- Sizing & Optimization
- Finned and Unfinned
- Inline and Staggered Tube Bundles
- Multiple Tube Passes

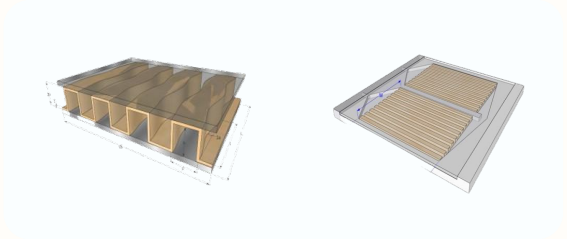




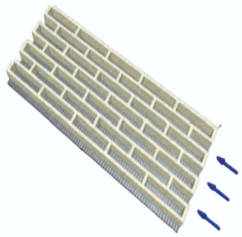


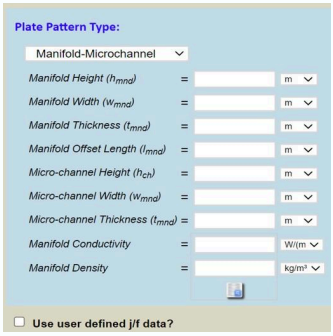
Cold-Plates

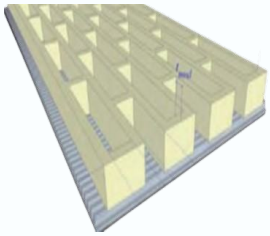


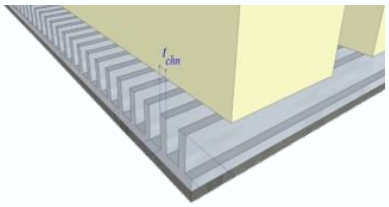


Manifold-Microchannels









Customizable Excel Output Data

Design #	Description (for example, flow arrangement, multipassing, single/two phase flow etc.)	HX Problem Statement										
		Performance Requirement			Operating Conditions -Hot				Operating Conditions -Cold			
		Q	Δp-hot	Δp-cold	Fluid Type	Flow Rate	Tin	Pin	Fluid Type	Flow Rate	Tin	Pin
		[kW]	[kPa]	[kPa]	[-]	[lb/s]	[°F]	[psi]	[-]	[lb/s]	[°F]	[psi]
1	Cross-flow, single banking					55.997	860	0		55.116	572.02	0

HX Problem Statement						HX Size, Weight and Performance- Output					
HX Core Design Input						HX Core Dimensions					
t-sp	t-ep	w-sb-hot	h-sb-hot	w-sb-cold	h-sb-cold	P-L	P-W	L-NF/S	Np-h	Np-c	W
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[-]	[-]	[lb]
0.012	0.012	0	0.224	0	0.224	35.43	70.9	70.9	150	150	2510

HX Size, Weight and Performance- Output								
Hot Side								
Type	N-Fin or Channel	H (Plate Spacing)	t-fin	l or λ	2a	dh	Ac	A
[-]	[1/in]	[in]	[in]	[in]	[in]	[in]	[in²]	[in²]
rectangular/plain	12.7	0.224	0.006			0.109	2148	376650

HX Size, Weight and Performance- Output								
Cold Side								
Type	N-Fin or Channel	H (Plate Spacing)	t	l or λ	2a	dh	Ac	A
[-]	[1/in]	[in]	[in]	[in]	[in]	[in]	[in²]	[in²]
rectangular/plain	12.7	0.224	0.006			0.109	1074	376650

HX Size, Weight and Performance- Output										
Cold Side										
Tout	T_{mean}	Δp	σΔP	P_{mean}	μ_{mean}	$c_{p\text{-}mean}$	$K_{p\text{-}mean}$	Re	Pr	Nu
[°F]	[°F]	[psi]	[kPa]	[lb/ft²]	[lb/(ft*s)]	[Btu/(lb*°F)]	[btu/(h*ft*°F)]	[-]	[-]	[-]
784.1	621.5	0.627		0.3034	0.0000215	0.253	0.029	3128	0.678	11.55

HX Size, Weight and Performance- Output								
Cold Side		Overall HX Core Performance						
ηhA	P	EB	C*	ε	Q	NTU	UA	COP
[btu/(h*°F)]	[Btu/h]	[%]	[-]	[-]	[Btu/h]	[-]	[btu/(h*°F)]	[-]
542442.6	75844		0.984	0.736	10654794.2	4.282	215110.8	9.05088

Two-Phase Models

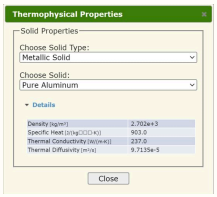
INSTED Database

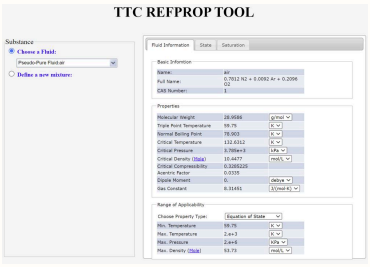
Thermophysical Properties Database:

- **Fluid Properties** — Sinlge phase fluid, two phase fluid at equilibrium state
- **Solid Properties** — Metallic/non-metallic solid, building material, insulation material

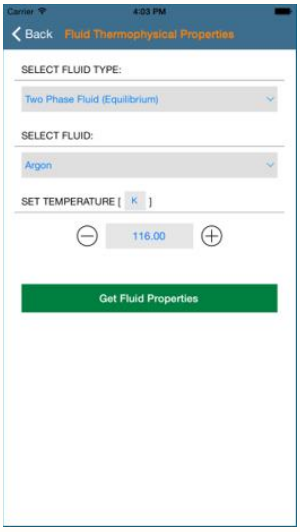
Thermal Analysis Database:

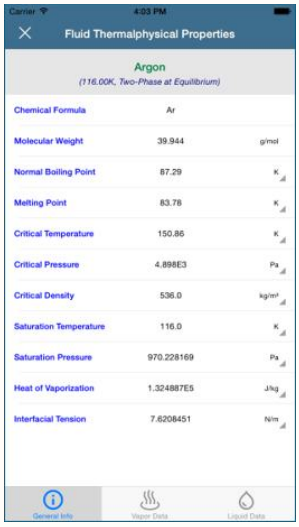
- **Pipe Schedules** — Access pipe dimensions
- **Tube Counts** — Tube count data for Shell and Tube heat exchanger systems
- **Minor Loss K-Factor** — K-factors associated with the flow pressure losses for piping system
- **Moody Charts** — Calculates friction factors for pipe flow.
- **Suggested Velocities** — Economic flow velocity range for pipes
- **Sample Film Coefficient** — Contains ballpark values of the heat transfer coefficients
- **Fouling Factors** — The resistances to heat flow due to the surface residues
- **Absolute Roughness** — Average absolute roughness data for various commercial pipes
- **Radiation Properties** — Contains the normal emissivity for various surfaces
- **NIST REFPROP** — NIST refrigerant properties (License validation required)





Free Mobile Apps





iOS

About TTC

TTC Technologies® is a commercial engineering software production and consulting firm, founded in New York in 1993 and rebranded in 2007. The company offers cutting-edge software solutions like INSTED® for thermal analysis and AEROFLO™ for high-fidelity CFD simulations.

Sample TTC Customers

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