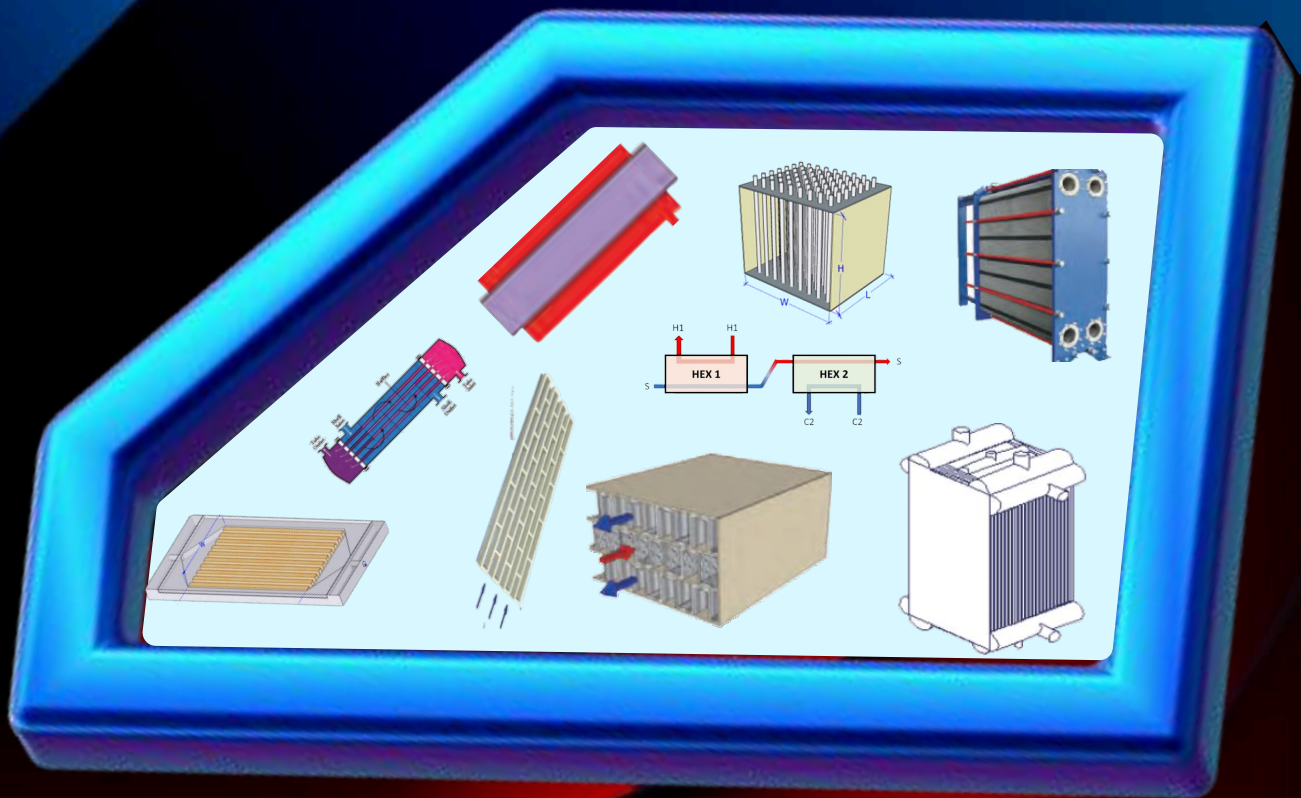


INSTED

Thermal Analysis Software

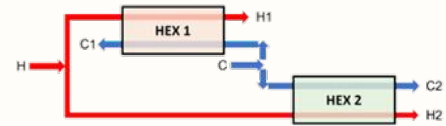
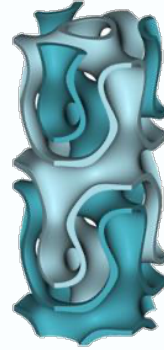


TTC Technologies, Inc.

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



Multiple HEX Design Tools

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

Advanced Optimization Algorithms

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

Two-Phase Models

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

Customizable Input Data

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

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
- Keys & London Data for Fins
- User-Defined Fin Geometry Data
- Multiple Passes/Partitions



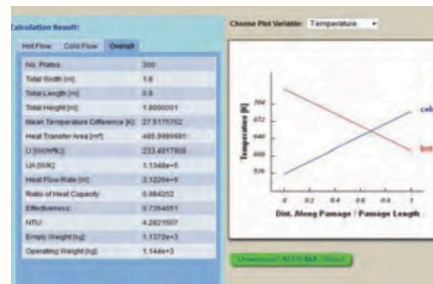
(Advanced Cooling Solutions)



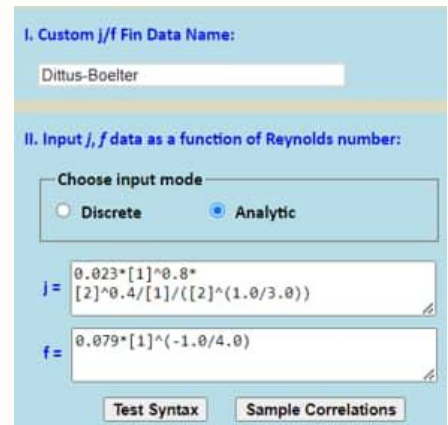
HEX Geometry



HEX Rating



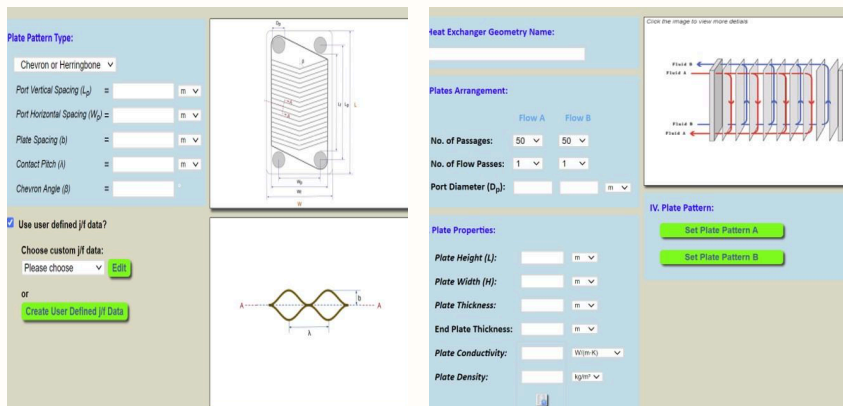
Calculation Results



Custom j/f Data

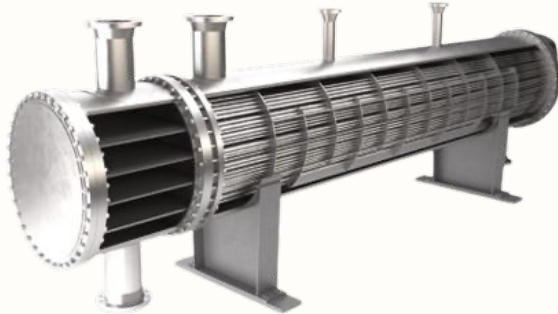
Plate-Frame Heat Exchangers

- 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



I. Heat Exchanger Geometry Name:
(Sample) Janna HX

II. Shell Type:
Generic (TEMA-E)

Number of Shell Passes = 1

Shell Inner Diameter = 0.438308 m

Shell Outer Diameter = 0.448308 m

Shell Orientation Angle = 0 °

No. of Sealing Strip Pairs = 0

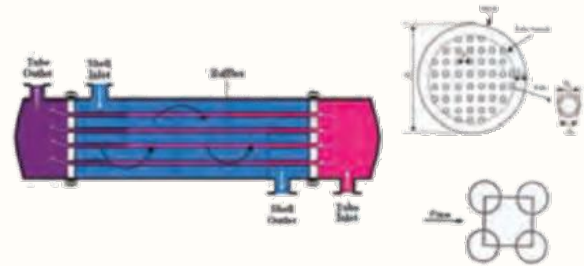
III. Shell & Tube Material:

Property	Shell	Tube
Density:	8960.1 kg/m ³	8960.1 kg/m ³
Conductivity:	85.0 W/m·K	85.0 W/m·K
Roughness:	1.e-15 m	1.e-15 m
Friction Coefficient:	0.277	0.0271

IV. Tube Bundle Properties:

V. Baffle Properties:

VI. Tube Fin Properties:



Cross-Flow Heat Exchangers

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



I. Cross Flow Geometry Name:

II. Cross Flow HEX Type:
Finned Tube

III. Heat Exchanger Size:

L = m

W = m

H = m

IV. Plate Properties:

End Plate Thickness: m

End Plate Density: kg/m³

Side Plate Thickness: m

Side Plate Density: kg/m³

V. Tube Layout & Properties:

Tube Layout & Properties:

Tube Layout Type: Inline

Tube Type: Circular Tube

No. of Tube Passes: 1

No. of Tubes in Transverse Dir.:

No. of Tubes in Longitudinal Dir.:

Tube Inner Diameter (D_i): m

Tube Outer Diameter (D_o): m

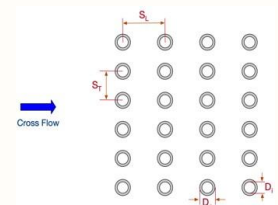
Tube Length: m

Tube Transverse Pitch (S_T): m

Tube Longitudinal Pitch (S_L): m

Tube Conductivity: W/m·K

Tube Density: kg/m³



Cold-Plates

I. Cold Plate Geometry Name:

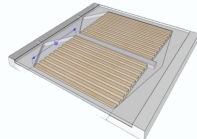
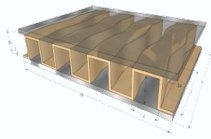
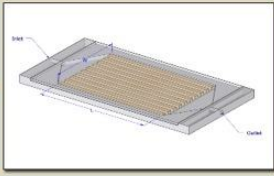
II. Cold Plate Type:
 Folded-Fin

III. Cold Plate Configuration:
 Single Pass / Single Partition
 Multiple Passes / Single Partition
 Single Pass / Multiple Partitions

IV. Plate Size:
 Plate Length (L) = m
 Plate Width (W) = m

V. Plate Properties:
 Thickness: m
 Conductivity: W/(m·K)
 Density: kg/m³

VI. Fin Properties:



Manifold-Microchannels

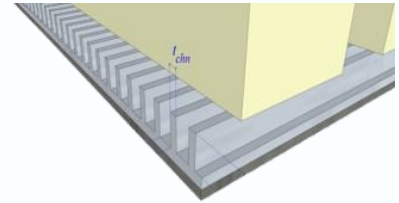
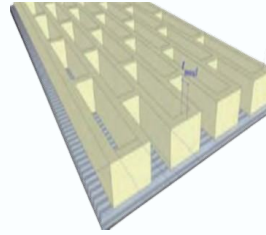
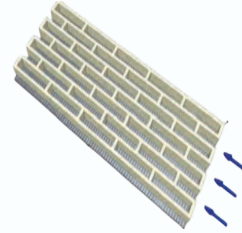


Plate Pattern Type:
 Manifold-Microchannel

Manifold Height (H_{mnd}) = m
 Manifold Width (W_{mnd}) = m
 Manifold Thickness (t_{mnd}) = m
 Manifold Offset Length (L_{mnd}) = m
 Micro-channel Height (H_{ch}) = m
 Micro-channel Width (W_{mch}) = m
 Micro-channel Thickness (t_{mch}) = m
 Manifold Conductivity = W/(m·K)
 Manifold Density = kg/m³

Use user defined j/f data?

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	T_{in}	P_{in}	Fluid Type	Flow Rate	T_{in}	P_{in}
1	Cross-flow, single banking	[kW]	[kPa]	[kPa]	[-]	[lb/s]	[°F]	[psi]	[-]	[lb/s]	[°F]	[psi]
						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-NFS	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	Tmean	Δp	$\sigma \Delta P$	Pmean	μ_{mean}	$C_{p,mean}$	$K_{p,mean}$	Re	Pr	Nu
[°F]	[°F]	[psi]	[kPa]	[lb/ft²]	[lb/(ft·s)]	[Btu/(lb·°F)]	[btu/(h·ft²·°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/(h²·°F)]	[Btu/h]	[%]	[-]	[-]	[Btu/h]	[-]	[btu/(h²·°F)]	[-]	
542442.6	75844		0.984	0.736	10654794.2	4.282	215110.8	9.05088	

Two-Phase Models

Please choose two-phase calculation models:

Two-Phase Heat Transfer Models

Condensation Models for Hot Flow:

- Fujii
- Carpenter-Colburn
- Kosky-Staub
- Shah
- Haraguchi
- Akers
- Travis
- Cavallini & Zecchin
- Moser
- Dobson
- Azer
- Jaster-Kosky
- Tang
- Thome-EI Hajal-Cavallini
- Cavallini
- Cavallini (#2)
- Shah (#2)
- Webb
- Yu-Koyama
- Palen

Boiling Models for Cold Flow:

- Chen
- Kandlikar
- Gugnor and Winterton
- Shah
- Gugnor & Winterton (#2)
- Chen (#2)
- Rohsenow
- Tran-Wambsgans
- Liu & Winterton
- Steiner-Taborek
- Tran
- Lazarek-Black
- Kew-Cornell
- Warrior
- Yu
- Cooper
- Fujii

Two-Phase Pressure Loss Models

Frictional Pressure Loss Models for Hot Flow:

- Friedel
- Lockhart-Martinelli
- Chisholm
- Wambsgans

Frictional Pressure Loss Models for Cold Flow:

- Friedel
- Lockhart-Martinelli
- Chisholm
- Wambsgans

[Comparison of plate-fin two-phase models](#)

INSTED Database

Thermophysical Properties Database:



Fluid Properties

Single 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



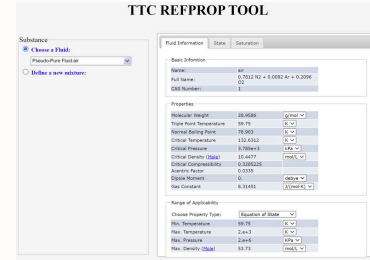
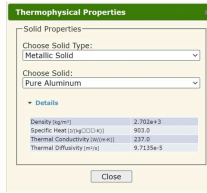
Radiation Properties

Contains the normal emissivity for various surfaces

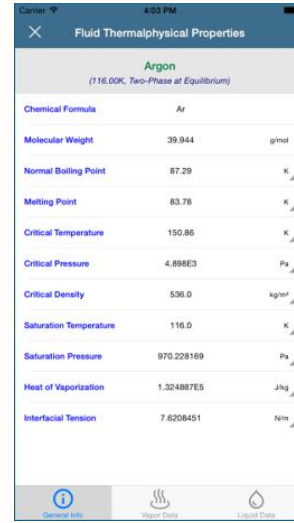
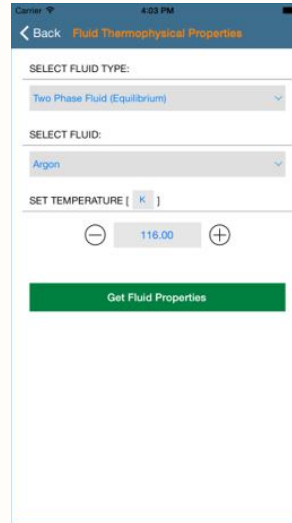


NIST REFPROP

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.

Contact Us

Email: info@ttctech.com

Website: www.ttctech.com

Phone: +1 (631) 285-7127 X 310

Address:

TTC Technologies, Inc.
Suite 206B,
2100 Middle Country Road
Centereach, New York 11720, USA.

Sample TTC Customers



ASSEMBLY INGENIEROS

