

Release Notes

INSTED CLOUD Ver. 8.01



TTC TECHNOLOGIES, INC.

October 25, 2015

Release Features

INSTED CLOUD Ver. 8.01

INSTED is your one-stop software suite for empirical thermal and hydraulic analysis of engineering systems and components, with a focus on finned and un-finned heat exchangers, flow over tube banks, performance of isolated fins and fin arrays, analysis of heat conduction in composite solids, internal and external flow and heat transfer, performance analysis of flows in piping systems, design analysis of pipe flows, and power calculations for pump selection. INSTED calculations are very fast, leading to fast turnaround in the analysis cycle. The interface is easy and fun to use. With the CLOUD deployment of INSTED, you can carry out your thermal-hydraulic analysis of heat exchangers and other engineering systems/components anytime, anywhere, and even on your smartphones or tablets.

The most recent version of INSTED (Ver. 8.1) includes significant enhancements, changes, and bug fixes, to further improve the user experience on INSTED CLOUD. The new features include the following.

Improved Plate-Fin Solver

- Add option to user to choose “Bulk” or “Discrete” method for rating calculation.
- Allow “REFPROP” and “Custom Fluids” to be used for “Bulk” calculation.
- Additional error messages to alert user that the fluid temperature cannot be out of the range of available data for REFPROP fluid.
- The search schemes in “Sizing” and “Optimization” calculations are improved to avoid “no realization found” issue in some cases.

Bug Fixing in Plate Fin Module

- Fix the bug that cannot pass back the fluid properties from “REFPROP Tool” to “INSTED” when using Internet Explorer.
- Fix the bug that when calculating “Multiple Rating” project, sometimes got “no fluid found” error.
- Fix the bug that cannot copy the plate-fin sample problem "Che.510 (with custom j/f data)" to user account.
- Fix bug that after 20 minutes inactivity of user, INSTED return "lost connection" error

New Features in Plate Fin

- "Calculation Method" input tab is added. User can choose "Default", "Bulk", or "Discrete" method for the rating calculation.
- Can plot "Density", "Specific Heat", "Thermal Conductivity", "Viscosity" curves along the streams for the rating result.
- Allow to save one of “Multiple-Rating” calculation results into a regular rating project.
- Allow to save “Sizing” calculation result into a regular rating project.
- Allow to save one of “Optimization” realization result into a regular rating project.
- Can export an existing project into a plain XML text file.
- Can import an XML project file back to INSTEAD.
- In “Project Management”, allow user to open project directly by just clicking the projects.

Improvements on user interface

- For “Recent Projects” list under the “Start Page”, if the project name is too long and some words are truncated, by putting the mouse on the project name, the project information will automatically scroll from right to left to show additional information.
- Allow user to choose “REFPROP” and “Custom Fluids” directly in the “Rating Details” tab.

Changes for Other Modules in INSTED

- “Preliminary Design” module is added for “Shell & Tubes HEX”
- “Length Calculation” module is added for “Concentric Tubes HEX”
- “Multiple Rating” module is added for “Plate Frame HEX”
- “Bulk/Discrete” options are also added for the rating modules of “Shell & Tubes” and “Concentric Tubes” heat exchangers.
- Can plot "Density", "Specific Heat", "Thermal Conductivity", "Viscosity" curves along the streams for the rating result for all heat exchangers.
- Can save one “Preliminary Design” realization result into a regular rating project for “Shell & Tubes HEX”
- Can save “Length Calculation” result into a regular rating project for “Concentric Tubes HEX”
- Can save one “Multiple Rating” result into a regular rating project for “Plate Frame HEX”
- Additional error messages for “Plate-Frame” solver.
- Can “Export” an existing project into a XML file and also can “Import” the exported XML project file back to INSTED for all modules.

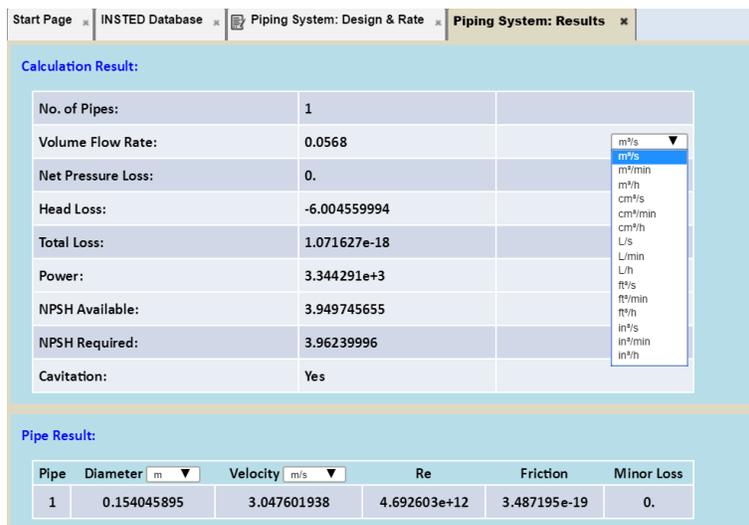
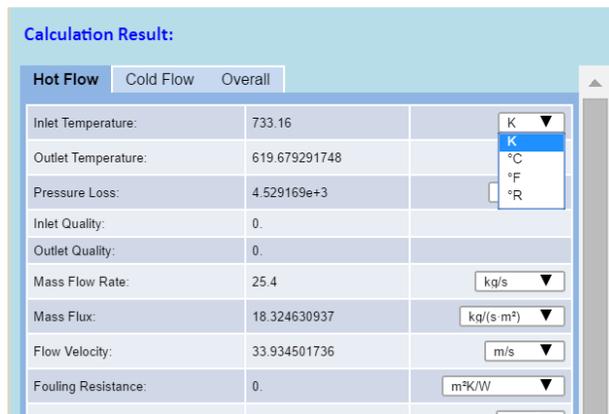
More details on the release features can be found in the following sections.

New Features

Many new features have been added to INSTED in this new version.

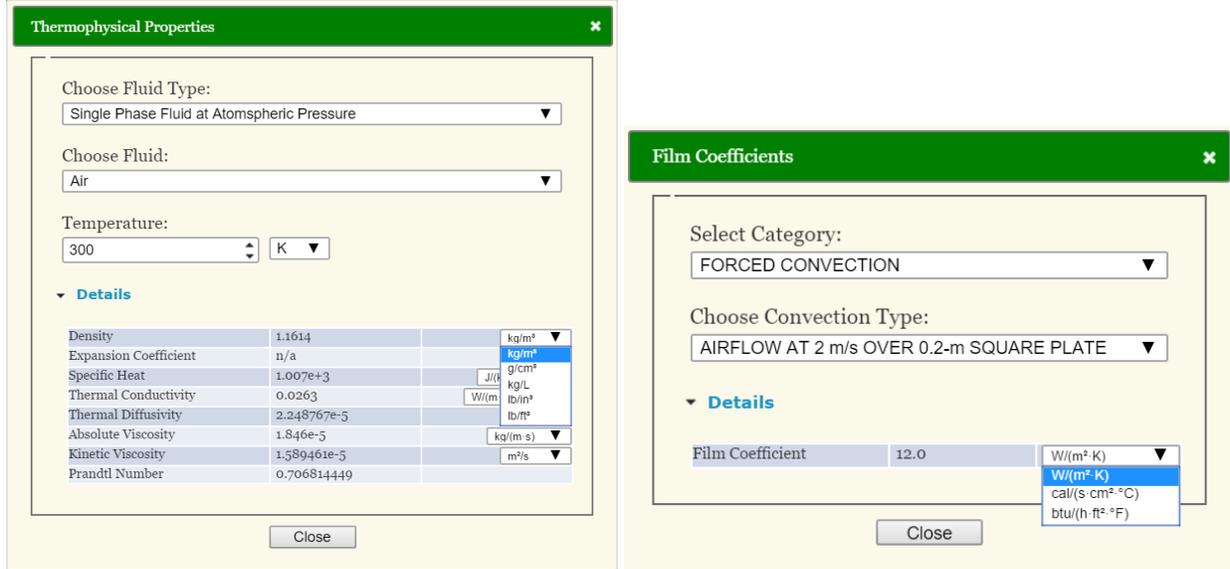
#1. Support for multiple units in the calculated results

The calculated results in INSTED can now be viewed in multiple units. Also, on-the-fly conversion of the units of the results is now supported.



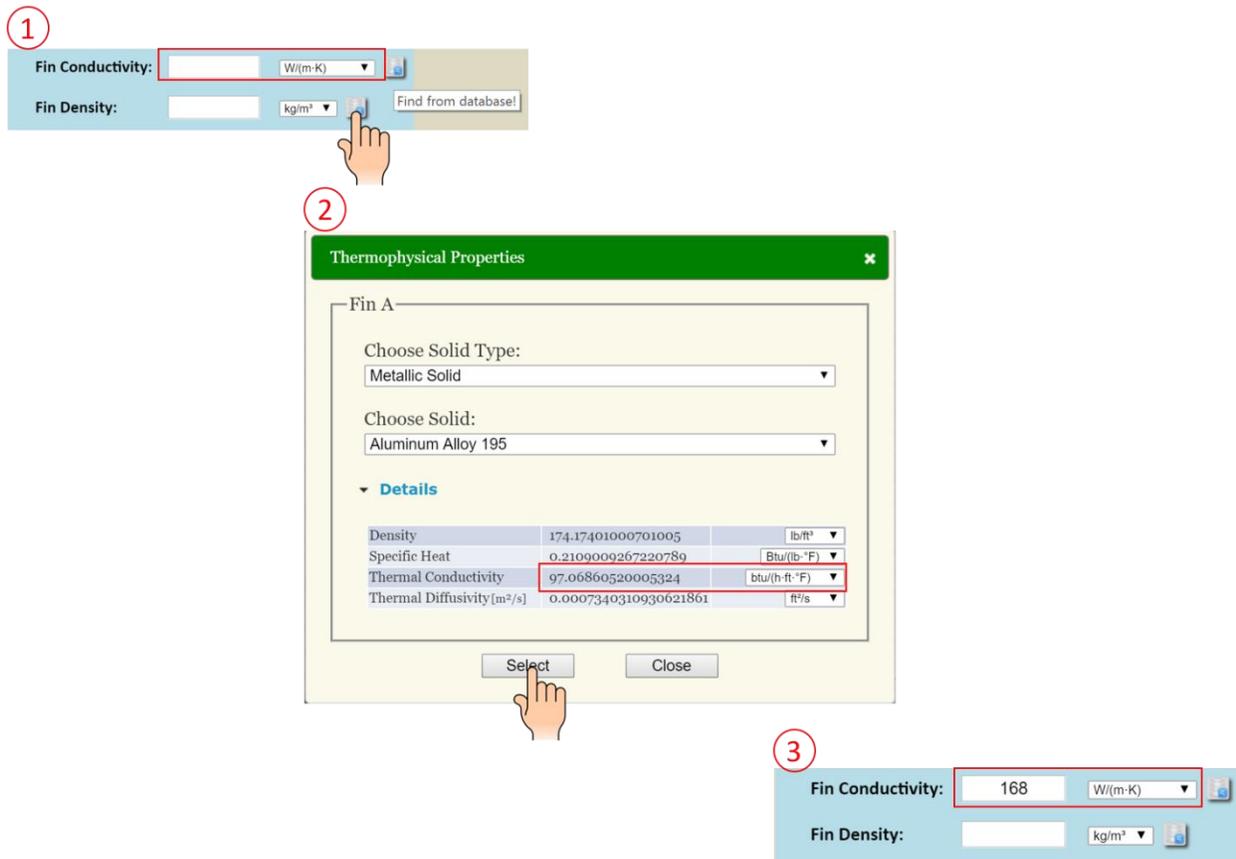
#2. Multiple unit support in INSTED Database

All INSTED Database sub-modules now support multiple units and on-the-fly unit conversion.

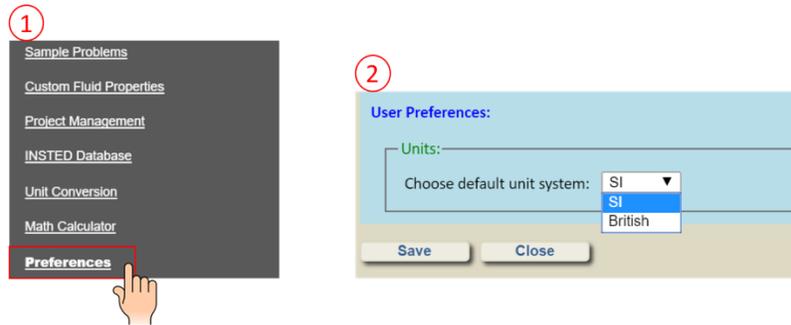


#3. When you obtain data from INSTED Database during analysis, the units in the called and calling environments are now synchronized

Example:



#4. You can choose a globally-preferred unit system (SI or British) in “Preferences” menu



The preferred unit system will be applied to:

- Input data when you open a new project
- Input data when you load an existing project
- Calculated results
- Units for INSTED database

#5. Support for multiple units in the various modules

Multiple unit support has been enabled for the following modules:

- Kays & London compact heat exchanger fin data
- Design constraints for plate-fin sizing and optimization
- Pump curve data input for the piping system analysis modules

Kays & London fin data

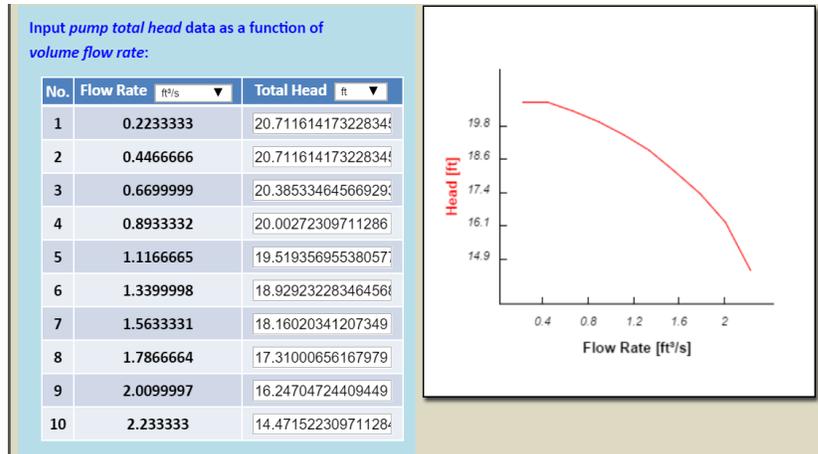
Use fin data from Kays & London?

Choose a Kays & London Fin: plain plate-fin: 2.0

Name:	2.0	Fin Area / Total Area:	0.606
Heat Exchanger Type:	plain plate-fin	Base Width of Fin [m ▼]:	0.013589
Fin Shape (frontal):	trapezoidal	Top Width of Fin [m ▼]:	0.01016
Fin Spacing (flow direction):	plain	Fin Length (parallel to flow direction) [m ▼]:	0
Fin Shape (flow direction):	plain	Gap Space (perpendicular to flow direction) [m ▼]:	0
Fin Pitch (per meter ▼):	78.74	Reverse Placement:	0
Plate Spacing [m ▼]:	19.05e-3	Number of Splitters:	0
Hydraulic Diameter [m ▼]:	14.453e-3	Splitter Ratio:	0
Fin Thickness [m ▼]:	0.813e-3	Splitter Thickness [m ▼]:	0
Total Heat Transfer Area / Volume	249.672		
Between Plates [1/m ▼]:			

Heat Exchanger Design Constraints:

Max. Hot Flow Rate	=	80.0	kg/s ▼
Min. Hot Flow Rate	=	0.006	kg/s ▼
Max. Cold Flow Rate	=	80.0	kg/s ▼
Min. Cold Flow Rate	=	0.006	kg/s ▼
Max Plate Length	=	8.0	m ▼
Min Plate Length	=	0.004	m ▼



#6. Displaying of the discrete data used in generating plots

Clicking “Show discrete data” checkbox will display the discrete data used for each plot.

1

Choose Plot Variable: Temperature

show discrete data? [Set units of plotting variables](#)

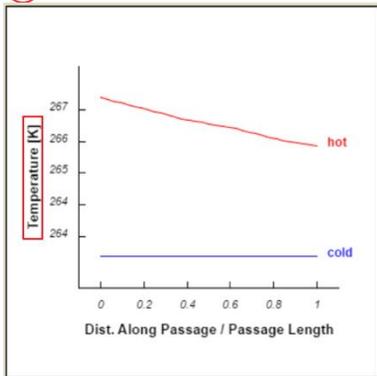
2

No.	Dist. Along Passage / Passage Length	Temperature [K]
1	0.	267.0488892
2	0.03125	267.008032478
3	0.0625	266.967605098
4	0.09375	266.927602546
5	0.125	266.886718822
6	0.15625	266.84370539
7	0.1875	266.801188549
8	0.21875	266.759162564
9	0.25	266.71596775
10	0.28125	266.670025072
11	0.3125	266.624675599
12	0.34375	266.579911678

#7. Changing the units in plots

Clicking “Set units of plotting variables” button will change the units of the plotted variables. This will affect both the plots and the discrete data.

1



2

Choose Plot Variable: Temperature

show discrete data? [Set units of plotting variables](#)

3

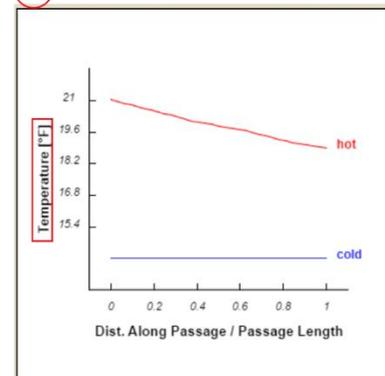
Set Units of Plotting Variables

Set Units

Unit for Temperature: °F

Close

4



#8. Choosing a unit system when downloading “ALPEMA/TEMA” sheet

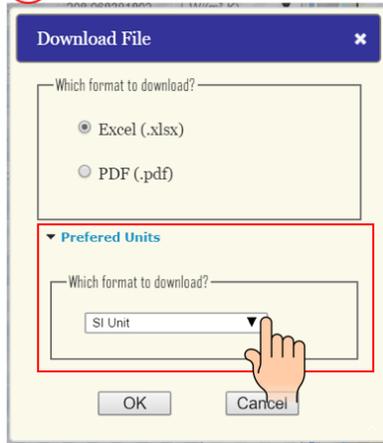
You may choose to download ALPEMA/TEMA sheet in either SI or British units.

1

Download ALPENA Sheet



2



3

BRAZED ALUMINUM PLATE-FIN HEAT EXCHANGER SPECIFICATION													
Parameter	Project	Unit	Value	Cost	Of								
Item number													
Item name													
Flow rate	Total	kg/s	25.4	25		25		25					
Vap. Liq. In	kg/s		25.4			25.4							
	kg/s												
Vap. Liq. Out	kg/s												
	kg/s												
Molecular wt Vap.	kg/s												
	kg/s												
Density	kg/m ³												
	kg/m ³												
Viscosity	kg/m·s												
	kg/m·s												
Specific heat Vap.	kJ/kg·K												
	kJ/kg·K												
Thermal cond. Vap.	W/m·K												
	W/m·K												
Thermal cond. Liq.	W/m·K												
	W/m·K												
Thermal conductivity	W/m·K												
	W/m·K												
Thermal expansion coefficient	1/K												
	1/K												
Allowable thermal pressure drop	MPa												
	MPa												
Conductivity	W/m·K												
	W/m·K												
Thermal resistance	K·m ² /W												
	K·m ² /W												
Design temperature rise rate	°C/s												
	°C/s												
Number of cores and assemblies	in parallel												
	in series												
Flow pattern	in parallel												
	in series												
Number of layers (including dummy)	in parallel												
	in series												
Approx. weight	kg												
	kg												
Number of layers	in parallel												
	in series												
Effective thermal length	mm												
	mm												
Heat transfer surface area	m ²												
	m ²												
Core opening size	mm												
	mm												
Core number / size	mm												
	mm												
Manufactured plate size	mm												
	mm												
Calculated thermal pressure drop	MPa												
	MPa												
Flowing area (single banking)	mm ²												
	mm ²												
Notes													
User supplied data													
Manufacturer supplied data													

#9. A standalone REFPROP tool

An interface for a standalone NIST’s REFPROP tool is now available in INSTED. The tool supports various kinds of fluid blends, including: “pure fluid”, “pseudo-pure fluid”, “pre-defined mixture”, and “user-defined mixture.” You may also obtain fluid thermo-physical properties for either “a thermal-physical state” or “a two-phase-equilibrium state.” Multiple units are supported with on-the-fly unit conversion. To access the tool, choose “NIST REFPROP” in INSTED Database. (Note that only organizations that have been legally licensed to use REFPROP, for example by DOE’s ESTC, can have access to the REFPROP capability in INSTED.)

INSTED Database:



Thermophysical Properties
Fluid (single-phase or two-phase) and solid thermophysical properties



Absolute Roughness
Average absolute roughness data for various commercial pipes



Pipe Schedules
Access pipe dimensions



Sample Film Coefficient
Contains ballpark values of the heat transfer coefficients



Suggested Velocities
Economic flow velocity range for pipes



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.



Fouling Factors
The resistances to heat flow due to the surface residues



Radiation Properties
Contains the normal emissivity for various surfaces



NIST REFPROP
NIST refrigerant properties
(License validation required)

TTC REFPROP TOOL

Substance

Choose a Fluid:

Pure Fluid: R134a ▼

Define a new mixture:

Fluid Information
State
Saturation

Basic Information

Name:	R134a
Full Name:	1,1,1,2-tetrafluoroethane
CAS Number:	811-97-2

Properties

Molecular Weight	102.032	g/mol ▼
Triple Point Temperature	169.85	K ▼
Normal Boiling Point	247.076	K ▼
Critical Temperature	374.21	K ▼
Critical Pressure	4.0593e+3	kPa ▼
Critical Density (Mass)	511.8999517	kg/m ³ ▼
Critical Compressibility	0.2600461	
Acentric Factor	0.32684	
Dipole Moment	2.058	debye ▼
Gas Constant	8.314471	J/(mol-K) ▼

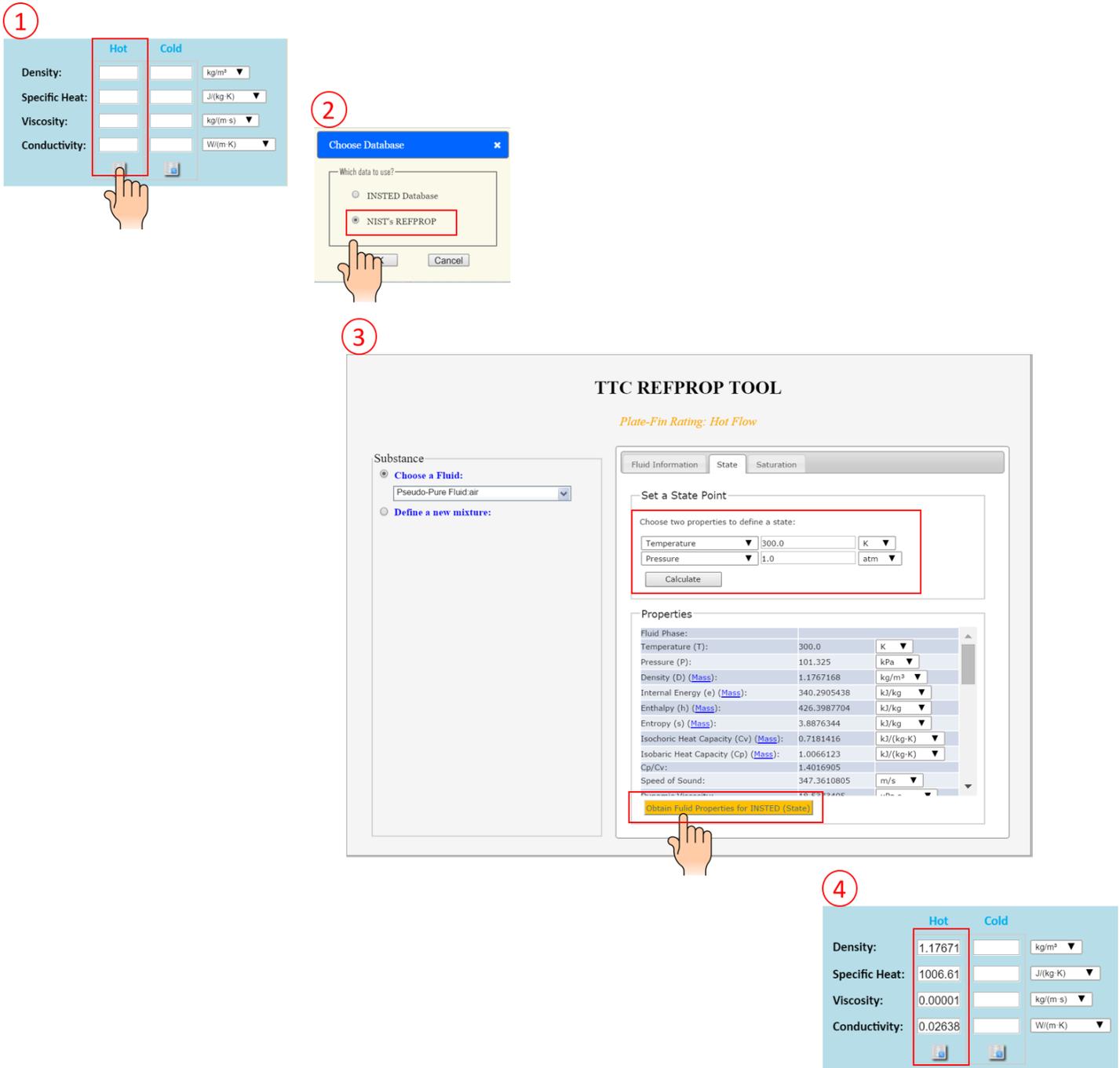
Range of Applicability

Choose Property Type: Equation of State ▼

Min. Temperature	169.85	K ▼
Max. Temperature	455.0	K ▼
Max. Pressure	7.e+4	kPa ▼
Max. Density (Mass)	1.5917e+3	kg/m ³ ▼

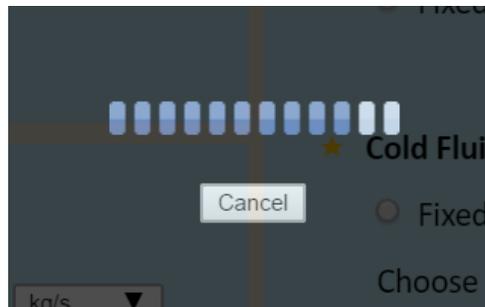
#10. Obtaining single-point thermal-physical fluid properties from REFPROP

During analysis in any of the modules of INSTED, you can obtain single-point thermal-physical fluid properties from the new REFPROP tool.

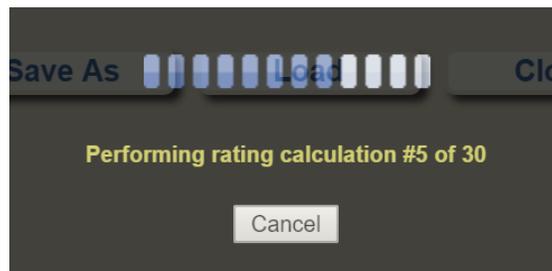


#11. Aborting “Save/Computing” operations

During the “Save/Compute” operations, a “Cancel” button has now been added to enable you abort execution in situations where access to INSTED servers on the cloud is taking too long for you.



#12. Can view calculation progress during “Multiple Rating” in Plate-fin

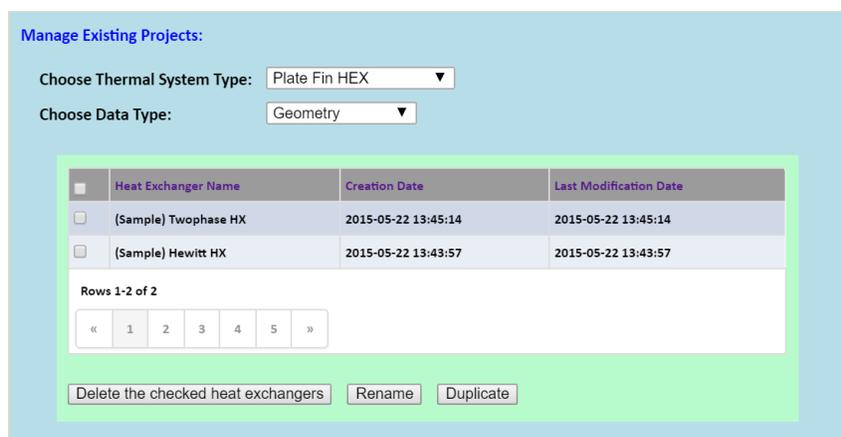


#13. Checking and preventing duplicated project names

A project saved on INSTED Cloud is distinguished only by its name. If you try to save another project with the name of an existing project, an error message “A project with this name already exists. Duplicated project names are not allowed” will be shown.

#14. Can “rename” and “duplicate” an existing project in “Project Management” menu

On the menu panel, “Data Management” has been renamed “Project Management.” In addition to allowing you to “Delete” existing projects, “Project Management” also allows you to “Rename” and “Duplicate” an existing project.



Changes

The features below have been changed to enhance your experience with INSTED.

#1. “Start Up” page (below) has been re-designed to give a cleaner user interface

The screenshot displays the 'Start Page' of the INSTED Thermal Analysis Software. The page features a dark blue header with the text 'INSTED — THERMAL ANALYSIS SOFTWARE'. Below the header, the content is organized into several sections:

- Recent Projects:** A list of project entries, each with a sample name and a brief description in parentheses. The entries are: (Sample) Twophase Rating (Plate-Fin Rating), MultiRate Test (Plate-Fin Multiple Rating), MultiRate - Hewitt (Plate-Fin Multiple Rating), (Sample) Hewitt Rating (Plate-Fin Rating), (Sample) Janna.186 (Piping System Analysis), (Sample) Janna.174 (Piping System Analysis), (Sample) Chapman.46 (Heat Conduction Analysis), (Sample) Kreith.6 (Heat Conduction Analysis), test (Heat Conduction Analysis), and Chapman.353 (Tube Banks Analysis).
- Account Information:** Displays the user 'wenhai' as an Administrator with a link to 'Account Setting'.
- Subscription Information:** Shows the subscription is 'Active', 'Unlimited', and provides links for 'Enroll / Extend'.
- Video Tutorial (YouTube):** Two video thumbnails are shown:
 - Create your own data:** Tutorial: How to rate a plate-fin heat exchanger. The video thumbnail shows the text 'How to Rate a Plate-Fin Heat Exchanger'.
 - Start from sample problems:** Tutorial: How to run a sample problem. The video thumbnail shows the text 'How to Run a Sample Problem'.

#2. A “Save As” button has been added after an existing project has been loaded

When creating a new project, only the “Save” button is shown. After the project has been saved, or if you are loading an existing project, the “Save As” button will now be shown.

#3. Project name is locked for existing project

For a new heat exchanger rating project, the project name is a required input. After the project has been saved, or if an existing project is loaded, the project name will be locked and not allowed to change. This is due to the fact that project name is the only ID that is used to distinguished different projects. Note that renaming an existing project can be done in “Project Management.”

#4. For a heat exchanger rating project, an edit box for the inlet flow quality is shown only if “Two-Phase Flow” problem is being analyzed

The screenshot displays the 'V. Two Phase Flow?' section with a dropdown menu set to 'Boiling' and a green 'Select Two Phase Model' button. Below it, the 'VI. Flow Conditions:' section is shown with two columns for 'Hot' and 'Cold' fluid properties. The 'Inlet Quality' field for the hot fluid is highlighted with a red box and contains the value '0.1'.

	Hot	Cold	
Inlet Flow Rate:	1.053	0.0196	kg/s
Inlet Temperature:	267.04	263.16	K
Inlet Pressure:	10132	20068	Pa
Inlet Quality:	0.1		

#5. For a heat exchanger rating project, the input for “Fixed Fluid Properties” fields (density, specific heat, viscosity, and thermal conductivity) are only shown if the “Fixed” radio button is checked under “Hot/Cold Fluid Properties.” If “Variable/Custom” or “REFPROP” options are chosen, those inputs will be hid ed automatically

The screenshot shows the 'VII. Fluid Properties:' section. Under 'Hot Fluid Properties', the 'Fixed' radio button is selected and highlighted with a red box. Under 'Cold Fluid Properties', the 'REFPROP' radio button is selected. The 'Choose Cold Fluid:' dropdown is set to 'R134a'. The 'Hot' fluid properties are listed below, with a red box around the 'Density', 'Specific Heat', 'Viscosity', and 'Conductivity' fields.

	Hot	
Density:	1818.03	kg/m ³
Specific Heat:	900.108	J/(kg·K)
Viscosity:	0.00454	kg/(m·s)
Conductivity:	0.065	W/(m·K)

Fixes

Bugs fixed:

#1. The HTML5 codes have been refined and improved

The INSTED software now runs more smoothly and responds faster. The code has been tested in multiple Internet browsers, including those on the mobile devices. Many compatibility issues in browsers have been resolved.

#2. Fixed issues that sometimes occurred when computation had been completed

In the previous version of INSTED, when calculation was completed, sometimes the calculated data was not shown due to a bug in JavaScript. You had to click “Hot Flow/Cold Flow/Overall” tabs first to see the data inside each tab for the calculated result. This bug has now been fixed.

#3. Fixed issues with plate image in the Plate-Frame module

In the previous version of INSTED, when you opened the Plate-Frame Geometry module and “Set the Plate Pattern,” when the pattern of the palate was changed, the plate image for the corresponding pattern was not changed automatically. This bug has now been fixed in the new version.

#4. Fixed issues with the storage of custom Plate-frame j/f ~ Re data

In the previous version of INSTED, if you already created a new custom plate data by inputting j/f ~ Re data in the Plate-Frame module, after you had saved the Custom Data and clicked “Create User Defined j/f Data” button to create another custom plate data, the old j/f ~ Re data was still kept, rather than being reset to zero. Now the bug is fixed.

#5. Fixed a bug that prevented the deletion of custom data in Plate-Frame

In the previous version of INSTED, under “Project Management”, the custom (j/f ~Re) data for Plate-Frame module could not be deleted. This bug has now been fixed.

#6. Fixed the bugs associated with updating the data for an existing project in the event of a network failure

In the previous version of INSTED, when you tried to update an existing project and sent the updated data to the server, if the server did not respond due to a network problem, the data saved in HTML5 code was found to be a new one, instead of the old, rolled-back, data. This bug has now been fixed.

#7. Fixed issues associated with deleting the data for multiple projects

In the previous version of INSTED, when deleting multiple projects at once under “Project Management,” sometimes some of the projects selected for deletion were not deleted. This bug has now been fixed.

#8. User-defined custom fluid properties now supported by all the HEX modules

In the previous version of INSTED, the user-defined custom fluid capability was only available for the Plate-Fin module. Now, all the four heat exchanger (HEX) modules in INSTED have this capability.

#9. Fixed an automatic unit conversion problem in Shell & Tubes HEX tubed-fin geometry setup

In the previous version of INSTED, if the user changed the units for “Fin Thickness (Top)” and “Fin Thickness (Root)” for a trapezoidal fin in Shell and Tubes, the values of those inputs were not changed automatically with the change in units. This bug has now been fixed.

#10. Fixed a Custom/Variable Fluid-data bug in Shell & Tubes, Concentric-Tubes, and Plate-Frame rating projects

In the previous version of INSTED, if the user chose “Custom/Variable” fluid for the heat exchanger streams in a rating project, and the project was saved, it was the case that when you re-loaded the project, your data would have been lost. The bug has now been fixed.

#11. Fixed a bug associated with saving data on the cloud server when Custom Data is used

In the previous version of INSTED, if you chose “Custom/Variable” fluid option and directly clicked the “Compute” button, you would have observed that, during the computation, the “Custom/Variable” selection was not correctly saved on the server. This bug has now been fixed.

#12. Fixed a bug in the Heat Conduction module

In the previous version of INSTED, when you saved a new “Heat Conduction” project for the case of Multiple Layers, the layer thickness data was actually not saved. This bug has now been fixed.

#13. Fixed a bug pertaining to layer thickness input when carrying out the “Critical Radius” Task in the Heat Conduction module

If analysis task is “Critical Radius” in a “Heat Conduction” project, the use of multiple layers is not allowed and the thickness input for the only layer should automatically be set to “Unknown” by the code. However, in the previous version of INSTED, the code was still asking you to provide the value of this thickness. Now this bug has been fixed.

