



Fired Heater Simulation Technology

# USER GUIDE





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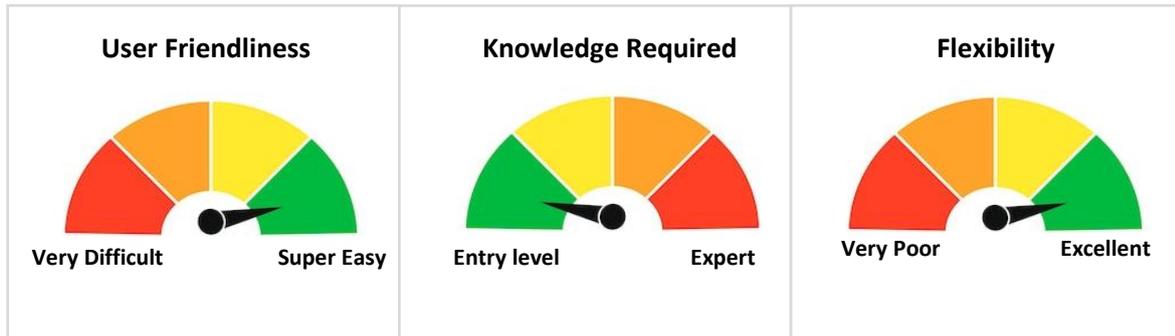


## 1. GENERAL INFORMATION

### Assumed User understanding & skills

This document is based on the assumption that the reader/user of the program has a basic level understanding of the sections and general components that comprise a fired heater. This document is not intended to train or instruct the reader on the design philosophies or recommendations.

### Experience Rating



### Security & Standards





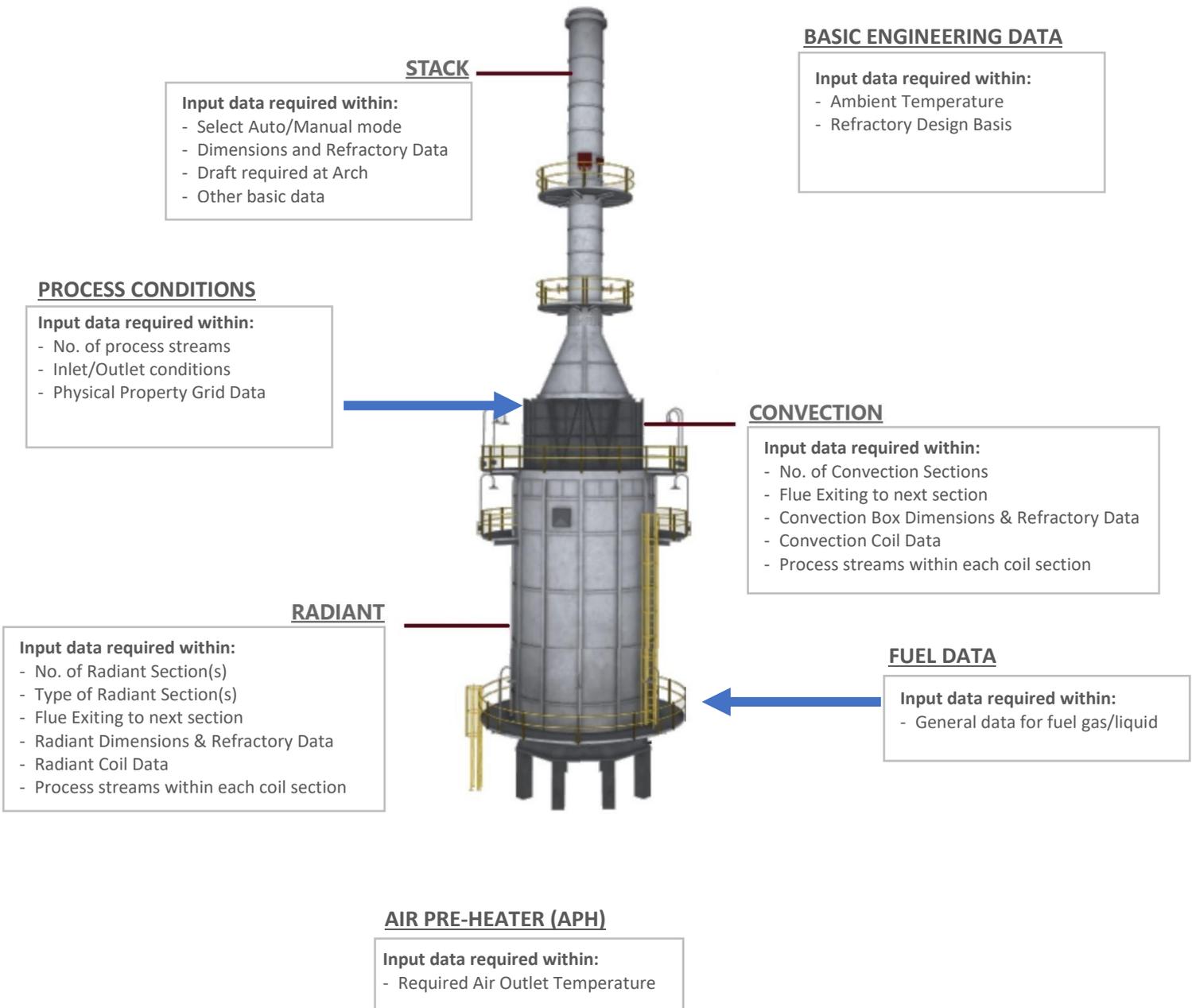
## 2. APPLICABLE HEATERS

Please see the general list below of applicable heater types and configurations that can be modelled within our program:

<b>Types</b>	<b>Configurations</b>
<p>Include, but not limited, to:</p> <ul style="list-style-type: none"><li>• API 560 Heater</li><li>• Bitumen Heater</li><li>• Charge Heater</li><li>• Column Reboiler Heater</li><li>• Crude Heater</li><li>• Crude Oil Heater</li><li>• Debutanizer Reboiler Heater</li><li>• Direct Fired Heater</li><li>• Dowtherm ® Heater</li><li>• Feed Heater</li><li>• Fractionator Reboiler Heater</li><li>• Glycol Heater</li><li>• HDS Reactor Heater</li><li>• Heat Medium Heater</li><li>• High Temperature Gas Heater</li><li>• Hot Oil Heater</li><li>• Heat Transfer Fluid Heater</li><li>• Large Vegetable Oil Heater</li><li>• LPG Cavern Storage Off Loading Heater</li><li>• Oxygen Heater</li><li>• Phenol Heater</li><li>• Pipeline Heater</li><li>• Platformer Heater</li><li>• Propane Storage Heating System</li><li>• Propane Vaporizer Heater</li><li>• Reactor Charge Heater</li><li>• Reactor Feed Heater</li><li>• Reboiler Heater</li><li>• Refinery Asphalt Heater</li><li>• Refinery Heater</li><li>• Reformer Heater</li><li>• Regeneration Gas Heater</li><li>• Splitter Reboiler Heater</li><li>• Stabilizer Reboiler Heater</li><li>• Steam Superheater</li><li>• Still Reboiler Heater</li><li>• Stripper Reboiler Heater</li><li>• Thermal Fluid Heater</li><li>• Thermal Liquid Heater</li><li>• Thermal Oil Heater</li><li>• Therminol ® Heater</li><li>• Tower Feed Heater</li><li>• Unifier Charge Heater</li><li>• Vacuum Heater</li><li>• Waste Heat Recovery Heater</li></ul>	<p>Include, but not limited, to:</p> <ul style="list-style-type: none"><li>• Vertical Cylindrical (Vertical Coils - - Single Fired)</li><li>• Vertical Cylindrical (Vertical Coils – Double Fired)</li><li>• Vertical Cylindrical (Helical Coil)</li><li>• Multi-Radiant Vertical Cylindrical Heaters</li><li>• Cabin / Box Heaters (Horizontal Coils – Single Fired)</li><li>• Cabin / Box Heaters (Horizontal Coils – Double Fired)</li><li>• Cabin / Box Heaters (Vertical Coils - Single Fired)</li><li>• Cabin / Box Heaters (Vertical Coils - Double Fired)</li><li>• Multi-Convection Box Fired Heaters</li><li>• WHRU / Convection Only Heaters</li></ul>



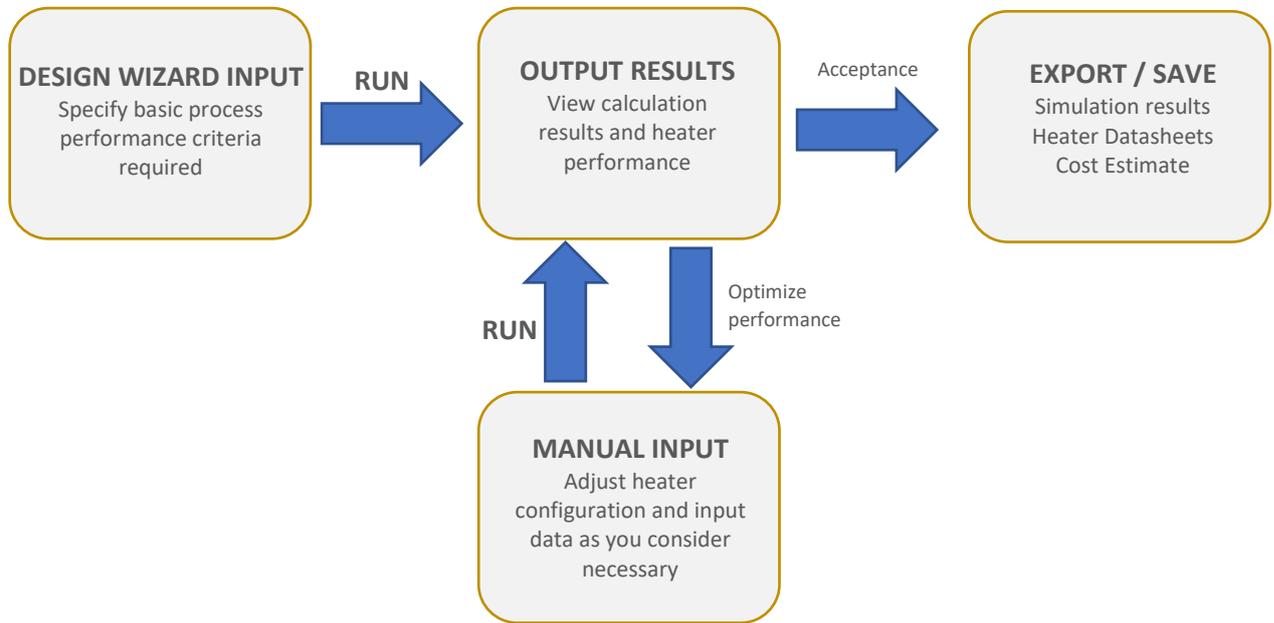
### 3. MAIN DATA INPUT SECTIONS - Fired Heater Model



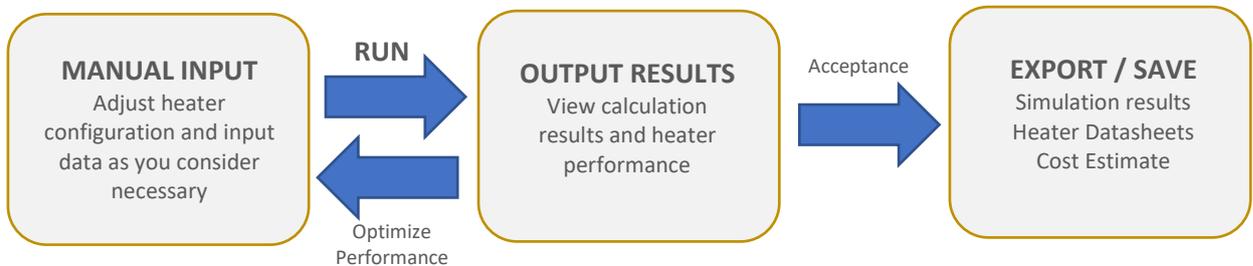


#### 4. SETTING UP THE FIRED HEATER MODEL

##### OPTION 1: DESIGN MODE (Design Wizard Tool)



##### OPTION 2: MANUAL MODE (Rating Mode)

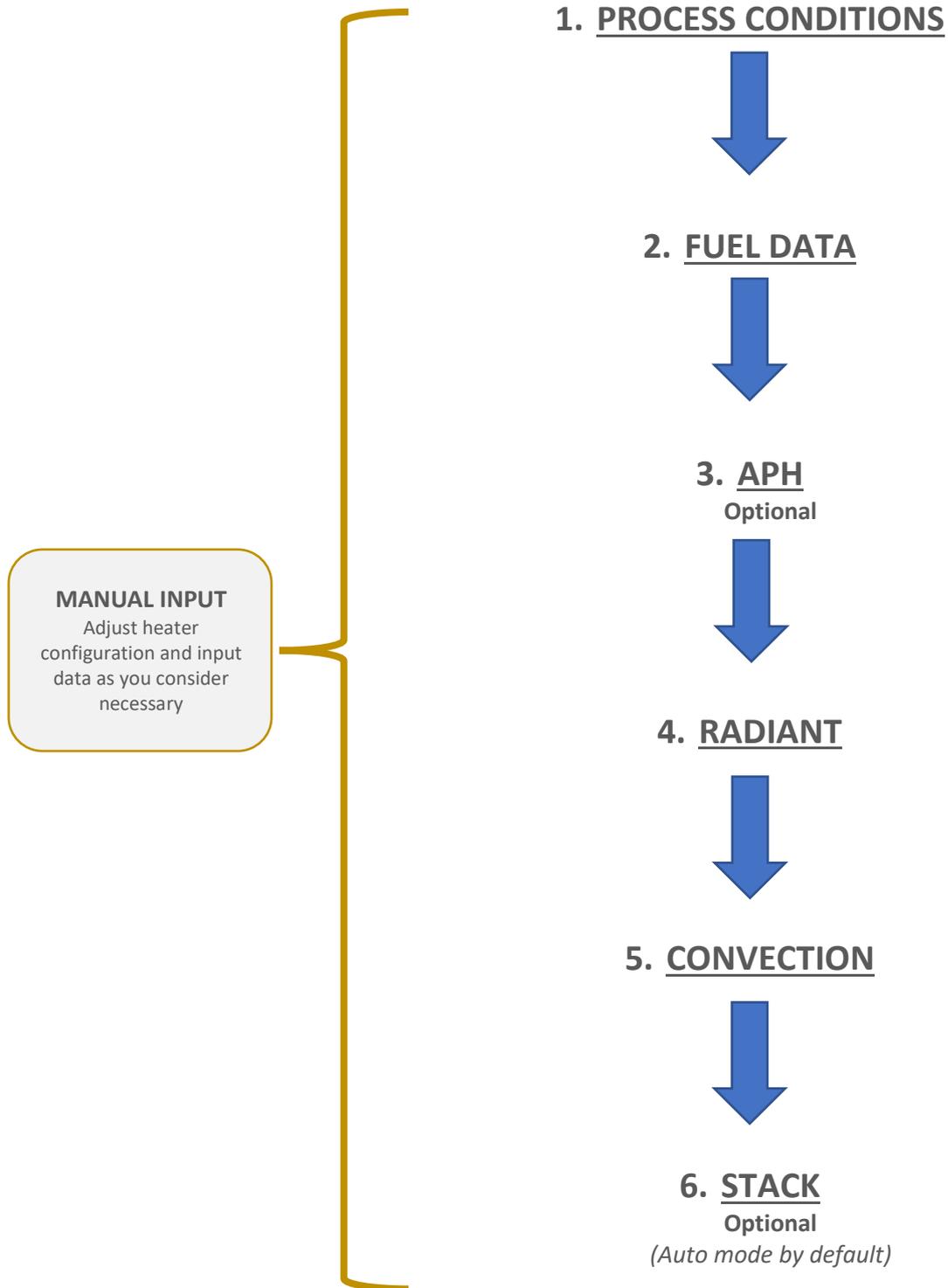




## 5. DATA ENTRY PHILOSOPHY

The program is entirely flexible to enter data in any order you wish. Users who are familiar with the program will develop their own personal preferences and styles when entering data and setting up models.

However, for beginner users, when first setting up a model, the ordered steps below is a solid approach:





## 6. PROCESS DATA

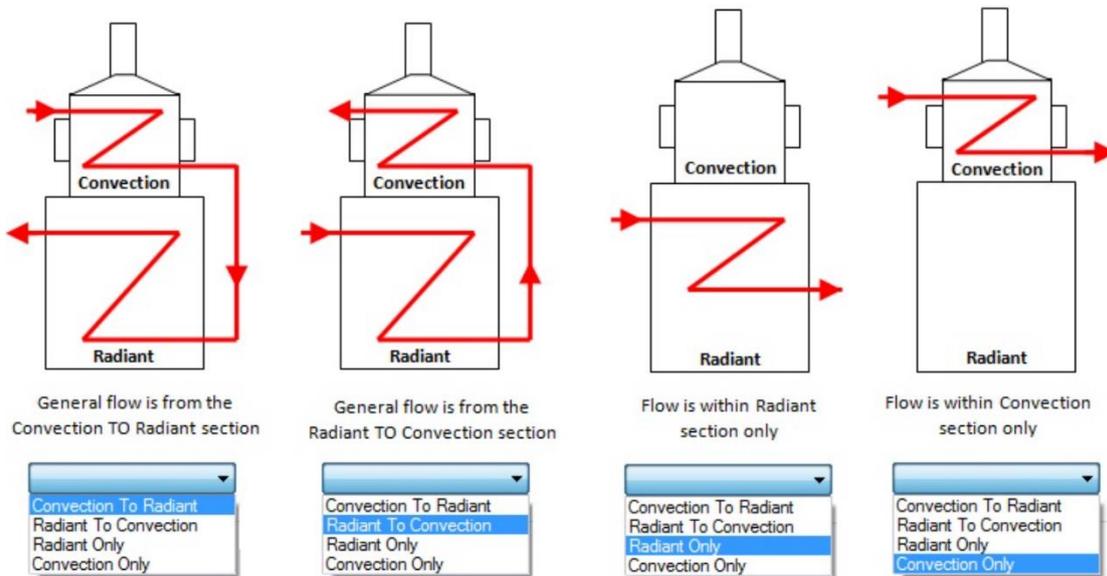
PROCESS STREAMS		Options ▾	<b>CONTINUE</b>	cancel
Process No.		1		
Process Name		Therminol XP ▾		
Mass flow rate * <small>use per hour</small>	lb/s	88.2		
Duty *	MMBTU/hr	32.675		
<b>INLET CONDITIONS</b>				
Temperature (IN) *	°F	212		
Pressure (IN) * <small>abs./gauge</small>	psi a	108.8		
<b>OUTLET CONDITIONS</b>				
Temperature (OUT) *	°F	392		
Pressure (OUT) * <small>abs./gauge</small>	psi a	50.8		
Fouling Factor *	hr ft <sup>2</sup> F/BTU	0		
Coking Thickness *	inch	0		
Process Location		Rad. & Conv. Sections ▾		
General Flow Direction [?]		Conv. To Rad. ▾		
Run Basis		Fixed Inlet ▾		



- 6.1. **Process Name:** newly created Fluids will be listed under this option
- 6.2. **Duty:** A numeric value must be entered for this field. However, if a value is specified within the Radiant Section where this process is located, the duty value will be ignored and calculations will proceed until convergence is achieved for the specified firing rate.
- 6.3. **Fouling Factor:** this value represents the heat resistance of the fluid at the film within tubes. The fouling factor will impact the inner film temperature, not the pressure drop within the coils.
- 6.4. **Coking thickness:** This will impact the pressure drop of the flowing process stream within the coils. This value will not impact the tube or film fluid temperature.
- 6.5. **Process location:** This field must be specified on the basis of where the process is generally located (please also see information on the 'General Flow Direction').



### General Flow Direction:



6.6. **Run Basis:** this allows you to specify how the simulation will be carried out.



- Fixed Inlet:** this is our recommended setting. The program will respect the specified inlet temperature and pressure, performing the necessary calculations until convergence is achieved to match the specified duty, or specified firing rate within the radiant section where the process is located.
- Fixed Outlet:** with this option, the program will try to match the specified outlet temperature and pressure.

### OPTIONS

Options ▾	
Add Fluid	This will create a new fluid, which can either be defined manually or automatically using our physical property grid tools
Add Stream	Adds an additional process stream into the heater. To be used in cases where heating multiple process streams is required.
Delete Stream	Removes a process stream
Edit Physical Properties	Edits the physical property data of the fluids that have been created. Note: the physical property data of built-in fluids cannot be edited
Steam Injection	Adds steam to be mixed with the fluid (sometimes required for heaters with Crude Oil process streams)



## 7. RADIANT SECTION

### Dimensions

RADIANT CELL 1

Options ▼
CONTINUE
cancel

Dimensions
Firing
Refractory
Coils
Advanced Options

#### Firebox Dimensions

<b>Radiant Cell</b>		1	
<b>Radiant Type</b>			Vertical Cylindrical ▼
<b>Auto. calc. dimensions</b>			Active ▼
<b>Diameter *</b>	<b>Ft</b>		Auto
<b>Length *</b>	<b>Ft</b>		Auto
<b>Height *</b>	<b>Ft</b>		Auto
<b>Flue Exit Width *</b>	<b>Ft</b>		6.499
<b>Flue Exit Length *</b>	<b>Ft</b>		10.869



Radiant Type: select the type of radiant section you require

- a) Vertical Cylindrical
- b) Cabin
- c) Box

Note: Cabin and Box options are physically the same, however the term 'Cabin' will denote that the tubes are horizontal, whilst the term 'Box' typically indicate that the tubes will be vertical.

**7.1. Auto Calc. Dimensions:** When this option is ACTIVE, the program will automatically calculate the main dimensions of the radiant section, such as width, length and height. When this option is set as 'NOT USED', the user is able to manually the values for radiant dimensions.



## RADIANT SECTION

### Firing

**RADIANT CELL 1** Options ▾ **CONTINUE** cancel

Dimensions **Firing** Refractory Coils Advanced Options

#### Firing Conditions

<b>Radiant Cell</b>		1
<b>Fuel No.</b>		Fuel No. 1 ▾
<b>Conv. Sect Flue Flows To</b>		Conv. Box 1 ▾
<b>Draft Type</b>		Natural ▾
<b>Air Inlet</b>		Ambient ▾
<b>Firing Rate *</b>	<b>MMBTU/hr</b>	<input type="text"/>
<b>Heat loss *</b> <small>(typically 1.5%)</small>	<b>%</b>	1.5
<b>No. Burners</b>		Auto ▾
<b>Excess Air *</b>	<b>%</b>	20
<b>Flue Recirc. to burners</b>	<b>%</b>	0 ▾
<b>Gas Emissiv. Basis</b>		HeaterSIM Standard ▾



7.2. **Fuel No.:** specify which fuel will be used within this particular Radiant Section

7.3. **Conv. Sect Flue Flow To:** specify where the flue gas from this Radiant Section will flow to. For most heaters, this will simply be the Convection Section. However, for complex heaters with multiple Radiant and Convection sections, this option provides the ability to specify the flue gas routing.

7.4. **Draft type:** Specify the draft flow type. In cases where an Air Pre-heater is required, please ensure that this option is set to 'Forced'.

7.5. **Air Inlet:** Specify the source of the air to be used for combustion within this Radiant Section. In cases where an Air Pre-heater (APH) is required, please ensure that 'APH' is selected instead of 'Ambient'.

7.6. **Firing Rate:** If this value is specified, the program will attempt to converge to satisfy this value and the process duty will be calculated consequentially (the duty values specified for any process streams located within this section will be ignored).

7.7. **Heat Loss:** This value is typically 1.5% for heaters without APH, and 2.5% for heaters with APH.

7.8. **Flue Recirc. To Burners:** this value represents the percentage of the flue gas created from combustion, to be recirculated and mixed with the combustion air.

7.9. **Gas Emissivity Basis:** the flue gas emissivity is calculated internally within the program. This option allows for the basis of the calculation to be modified as described.



## RADIANT SECTION

### Refractory

**RADIANT CELL 1**Options ▾**CONTINUE**cancel

---

DimensionsFiringRefractoryCoilsAdvanced Options

#### Refractory Insulation

**Radiant Cell** 1

**Refractory Design Mode** Automatic ▾

**FLOOR**

**Floor Hot-Face Material** MW Castable ▾

**Floor Hot-Face Thickness \*** inch 2.95

**Floor Back-Up Material** ULW Castable ▾

**Floor Back-Up Thickness \*** inch 5.91

**WALL**

**Wall Hot-Face Material** Fibre (High Density) ▾

**Wall Hot-Face Thickness \*** inch 2.95

**Wall Back-Up Material** None ▾

**Wall Back-Up Thickness \*** inch 0

Other input areas are available upon scrolling within the program

7.10. **Refractory Design Mode:** When set to 'Automatic', the program will automatically select the refractory material and calculate the necessary thicknesses in order to achieve the specified casing temperature conditions.

In 'Manual' mode, you're able to specify the material type and specify the thicknesses of each section as you wish.

Note:

- 1) The program uses the following abbreviated names to denote different material types:
  - a. HW Castable = Heavy Weight Castable
  - b. MW Castable = Medium Weight Castable
  - c. LW Castable = Light Weight Castable
  - d. ULW Castable = Ultra
  - e. Fibre (High Density) = Fibre Blanket or Module (@ 128 kg/m<sup>3</sup> or 8 lb/ft<sup>3</sup>)
  - f. Fibre (Low Density) = Fibre Blanket or Module (@ 96 kg/m<sup>3</sup> or 6 lb/ft<sup>3</sup>)



## RADIANT SECTION

### Coils

RADIANT CELL 1

Options ▾
CONTINUE
cancel

---

Dimensions
Firing
Refractory
Coils
Advanced Options

#### Coil Arrangement

More Options
[Add Coil](#)
[Delete Coil](#)

Coil Section			Coil Section 1
Process Name			Process 1: Therminol XP ▾
Tube OD <a href="#">edit list</a>	inch		141.3mm OD / 5 inch NB ▾
Effective Length *	Ft		33.084
Straight Length *	Ft		31.775
Tube Wall Thk <a href="#">edit list</a>	inch		Sch 40 ▾
Tube Spacing <a href="#">edit list</a>	inch		SR ▾
Distance to Wall <a href="#">edit list</a>	inch		Auto ▾
No. Tubes *			52
No. Passes *			2
Tube Material			Carbon Steel ▾
Orientation			Vertical ▾
Single or Double Fired			Single ▾
Location			Wall ▾
Inlet Location			Top ▾

The ability to Add/Remove coil sections within the specific radiant section.

This option is useful if you require different types of tubes within the radiant section.

7.11. **Process Name:** All the Process Streams that you have created will be listed and available for selection in this dropdown, thereby specifying the process fluid running within the specific coil section

Note: you're able to specify different process stream coils within a single radiant section. In such cases, only one process fluid will be the basis of convergence in accordance with its specified duty in the PROCESS SECTION.

7.12. **Distance to Wall:** Selecting 'Auto' will mean the program will consider the tube to be spaced at 1.5 x their Nominal Tube diameter (from centre of the tube to the wall)

**Note:** Process flow order will always be from "Coil Section n " TO "Coil Section n+1 "

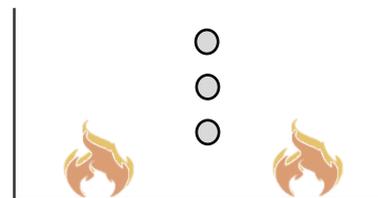


7.13. **Single or Double Fired:** This specifies firing regime that a particular coil section will experience within the radiant section. Tubes within a Coil Section can be either ‘Single Fired’ or ‘Double Fired’, as defined below:

- a) Single Fired – whereby radiation from the flames is directly received by 1 side of the tubes
- b) Double Fired – where radiation from the flames is received by both sides of the tubes



Horizontal tubes being single fired



Horizontal tubes being double fired

#### 7.14. Additional Options

**RADIANT CELL 1**Options ▾ CONTINUE cancel

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Dimensions   Firing   Refractory   CoilsAdvanced Options

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**Additional Options**

More Options Add Coil Delete Coil

Coil Section	Coil Section 1
<b>Tube conductivity</b> (opti) BTU/ft F °C	<input type="text"/>
<b>Tube emissivity</b> (optional)	<input type="text"/>
<b>Fouling factor</b> (optional)	<input type="text"/>
<b>Coking thickness</b> (optional) inch	<input type="text"/>
<b>Bend K Loss Factor *</b> inch	<input type="text" value="1.5"/>
<b>Tube Roughness</b> (optional)	<input type="text"/>

These Additional Options can be accessed by clicking this button

The following options can be left as blank, since they will be internally calculated by the program:

7.15. **Tube conductivity:** if blank, will be internally calculated by program

7.16. **Tube Emissivity:** if blank, will be internally calculated by program

7.17. **Fouling factor:** if blank, zero value or the value specified in the Process Section will be considered

7.18. **Coking Thickness:** if blank, zero value or the value specified in the Process Section will be considered

7.19. **Bend K Loss factor:** Default value is pre-populated, but can be edited as required. Value entry is required for this field

7.20. **Tube Roughness:** if blank, a standard reference value will be used

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### 7.21. Advanced Options

RADIANT CELL 1 Options ▾ **CONTINUE** cancel

Dimensions Firing Refractory Coils **Advanced Options**

#### Advanced Options

<b>Radiant Cell</b>	1
<b>Rad. Exchange Factor *</b>	<input type="text"/>
<b>Flux Fcir Factor *</b>	<input type="text"/>
<b>Flux FI Factor *</b>	<input type="text"/>
<b>Flux Ft Factor *</b>	<input type="text"/>

These Advanced Options can be accessed by clicking this button

All the items within this section are optional and will be internally calculated by the program if left blank.

**Note:**

The Radiant Exchange Factor relates to the effectiveness of radiant heat transfer exchange within the Radiant Section. The program will calculate this value using rigorous calculation methods, however, specifying a value for this item will override the calculated value.

The Fcir, FI and Ft factors are in relation to factors used within the Maximum Tube Temperature calculation method as described with API 530 Standard. These values are internally calculated by the program, however, specifying a value for this item will override the calculated value.



## 8. CONVECTION SECTION

### Dimensions

CONVECTION BOX 1 Options ▾ **CONTINUE** cancel

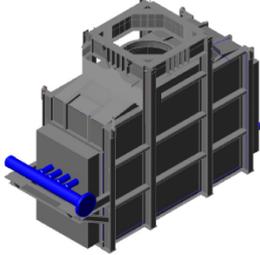
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Dimensions   Refractory   Misc.   Coils

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#### Convection Dimensions

Convection Section		1
Auto. calc. dimensions		Active ▾
Width *	Ft	Auto
Height *	Ft	Auto
Effective Length *	Ft	19.144
Straight Length *	Ft	Auto
Flue Flow To		Stack No. 1 ▾
Shock Row Radiation		Direct From Flames ▾



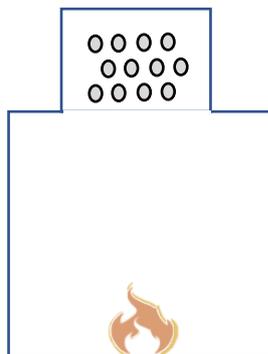
- 8.1. **Auto Calc. Dimensions:** When this option is ACTIVE, the program will automatically calculate the main dimensions of the radiant section, such as width, straight length and height. When this option is set as 'NOT USED', the user is able to manually the values for radiant dimensions.

Notice that you'll still need to specify the 'Effective Length'

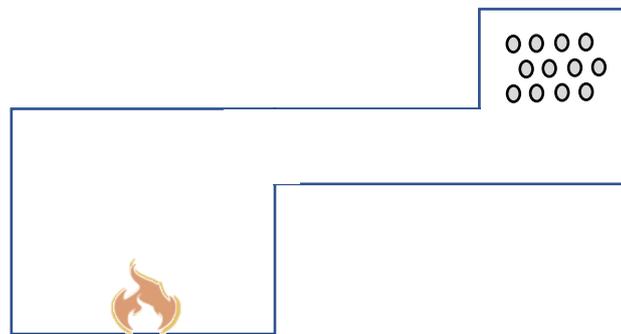
- 8.2. **Flue Flow To:** you'll need to specify where the flue gas flows is routed once it has exited the Convection Section. Usually, the flue gas will exit the Convection Section and then flow to the Stack. However, in some stances, you may not want it flowing to the Stack. For example, with APH specified, the flue gas will flow to the APH.

- 8.3. **Shock Row Radiation:** The 'Shock Rows' refer to the three lowest rows in the convection section, which will usually be designed with bare tubes only. In older heaters, the lowest two rows were considered as the Shock Rows.

This option specifies whether the 'Shock Rows' receive radiation directly from the flames within the radiant section. This will be true for most heaters, but in some cases where the convection section is not mounted directly on the radiant, the radiation will not be received directly.



Direct from flames



Indirect from flames



## CONVECTION SECTION

### Refractory

**CONVECTION BOX 1** Options ▾ **CONTINUE** cancel

Dimensions **Refractory** Misc. Coils

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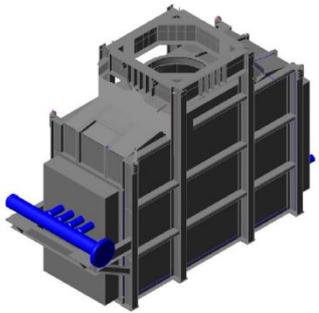
#### Refractory Insulation

Convection Section 1

Refractory Design Mode Automatic ▾

**SIDE WALLS**

Con. Wall Hot-Face Material		LW Castable ▾
Con. Wall Hot-Face Thickness *	inch	2.95
Con. Wall Back-Up Material		ULW Castable ▾
Con. Wall Back-Up Thickness *	inch	2.95



8.4. **Refractory Design Mode:** When set to 'Automatic', the program will automatically select the refractory material and calculate the necessary thicknesses in order to achieve the specified casing temperature conditions.

In 'Manual' mode, you're able to specify the material type and specify the thicknesses of each section as you wish.

Note:

- 1) The program uses the following abbreviated names to denote different material types:
  - a. HW Castable = Heavy Weight Castable
  - b. MW Castable = Medium Weight Castable
  - c. LW Castable = Light Weight Castable
  - d. ULW Castable = Ultra
  - e. Fibre (High Density) = Fibre Blanket or Module (@ 128 kg/m<sup>3</sup> or 8 lb/ft<sup>3</sup>)
  - f. Fibre (Low Density) = Fibre Blanket or Module (@ 96 kg/m<sup>3</sup> or 6 lb/ft<sup>3</sup>)



## CONVECTION SECTION

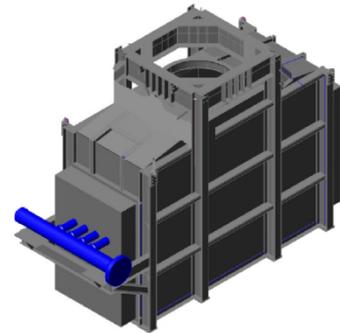
### Miscellaneous

**CONVECTION BOX 1** Options ▾ **CONTINUE** cancel

Dimensions Refractory **Misc.** Coils

### Miscellaneous

<b>Convection Section</b>		1
<b>Additional No. Rows *</b>		<input type="text" value="2"/>
<b>No. Sootblower Lanes *</b>		<input type="text" value="0"/>
<b>Sootblower lane height *</b>	<b>Ft</b>	<input type="text" value="0"/>
<b>Additional Height *</b>	<b>Ft</b>	<input type="text" value="4.593"/>



Note: these inputs fields generally relate to the additional height to be considered in the overall convection height. The program will calculate the overall height required, unless you have inputted a specific value for the convection height in the Dimensions section.

However, if the specific height that you have specified is conflicts with the data specified in this section, the program will ignore your specified value for Convection Height and internally calculate a suitable value.

The height of the Convection Section is important for the flue gas pressure profile calculations within the heater.

- 8.5. **Additional No. Rows:** this refers to the additional spare rows located at the top that are usually specified on new equipment supply projects.
- 8.6. **No. Sootblower Lanes:** For some Fired Heaters that utilise fuel oil, Sootblowers are often installed to clean the soot deposited on the convection coils during operation. Each lane, will increase the height of the convection section.
- 8.7. **Sootblower lane height:** this value is the height of each Sootblower lane (typically 0.75 m / 2.5 ft).
- 8.8. **Additional Height:** you can also specify additional height required for other purposes (e.g. to accommodate inspection doors).



## CONVECTION SECTION

### Coils

These options Add/Remove entire Convection Sections

CONVECTION BOX 1
Options ▾ **CONTINUE** cancel

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Dimensions Refractory Misc. **Coils**

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**Convection Coils**
More Options **Add Coil** **Delete Coil**

Note: Coil sections are in ascending order, going up the convection section.

Coil Section	Coil Section 1	Coil Section 2	Coil Section 3
Process Name	Process 1: Therminol XP ▾	Process 1: Therminol XP ▾	Process 1: Therminol XP ▾
Flow Order * [?]	3	2	1
Tube OD <a href="#">edit</a>	141.3mm OD / 5 inch NB ▾	141.3mm OD / 5 inch NB ▾	
Tube Wall Thk <a href="#">edit</a>	Sch 40 ▾	Sch 40 ▾	
No. Tubes Per Row *	8	8	
No. Passes *	2	2	2
Tube Material	Carbon Steel ▾	Carbon Steel ▾	Carbon Steel ▾
No. Rows *	3	2	3
Horiz. Tube Spacing (Horiz) <a href="#">edit</a>	SR ▾	SR ▾	SR ▾
Vert. Row Spacing (Vert) <a href="#">edit</a>	Auto ▾	Auto ▾	Auto ▾
Vert. Row Spacing (Vert) <a href="#">edit</a>	Auto ▾	Auto ▾	Auto ▾
Flow Direction	Counter-current ▾	Counter-current ▾	Counter-current ▾
Coil Alignment	Staggered ▾	Staggered ▾	Staggered ▾
Corbel Width	1/2 Tube Space ▾	1/2 Tube Space ▾	1/2 Tube Space ▾
Fin Type	None ▾	Solid ▾	Solid ▾
Fin Material	None ▾	Carbon Steel ▾	Carbon Steel ▾
Fin Height *		0.75	1
Fin Thickness *		0.05	0.05
Serrated Fin Wn *			
Fin Density *		48	60

These options Add/Remove Coil sections to the convection section.

8.9. **Process Name:** All the Process Streams that you have created will be listed and available for selection in this dropdown, thereby specifying the process fluid running within the specific coil section

Note: you're able to specify different process stream coils within a single radiant section. In such cases, only one process fluid will be the basis of convergence in accordance with its specified duty in the PROCESS SECTION.

### 8.10. Dropdown selections

**(Tube OD, Tube Wall Thk, Tube Material and Tube Spacing)**

Note that the mentioned dropdown items each have an [edit](#) button nearby. In case a particular option that you require is not available within the pre-defined list, the [edit](#) button will allow you to add items to the dropdown list



## The Flow Ordering

### Convection Coils

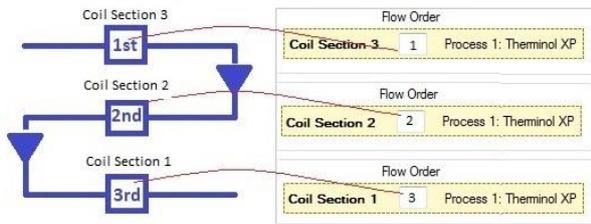
Coil Section	Coil Section 1	Coil Section 2	Coil Section 3
Flow Order * [?]	<input type="text" value="3"/>	<input type="text" value="2"/>	<input type="text" value="1"/>

8.11. **Flow Order:** this refers to the general sequence order of the process between each specified coil section. Please see the diagram below for explanation

#### Process Fluid Flow Path

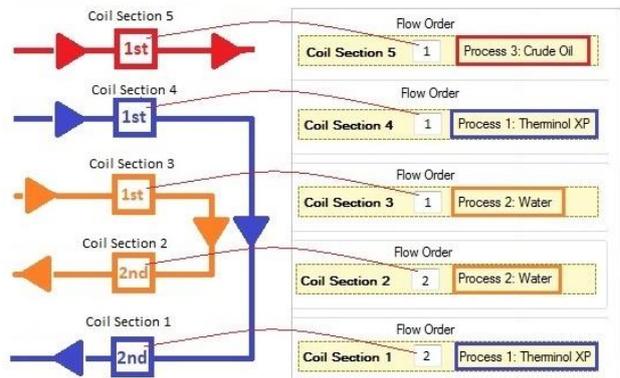
##### Example 1:

##### Standard/most common flow path:



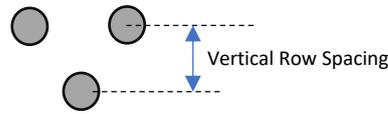
##### Example 2:

##### Multiple process streams & Nested Streams



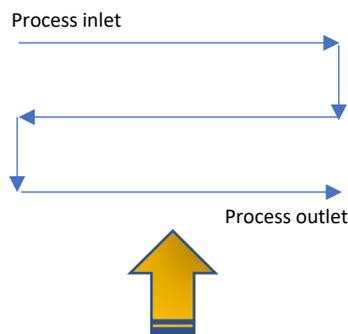


8.12. **Vertical Row Spacing:** If you select 'Auto' the program will automatically consider an equalilateral triangular pitch spacing basis and thereby calculate the vertical height between tubes in adjacent rows.

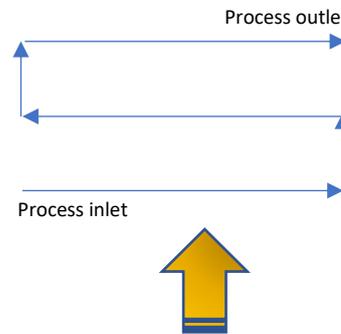


8.13. **Flow Direction:** this option defines the general flow direction of the process fluid in relation to the flue gas flowing over the coils. In most cases, this option will be 'COUNTER-CURRENT' however, in some heaters, you may wish to define the process flow with a general flow CO-CURRENT with the flue gas.

Regeneration Gas heaters with low process inlet temperatures are sometimes designed with co-current flows in order to raise tube temperatures in the convection section and minimise potential for flue gas condensation.

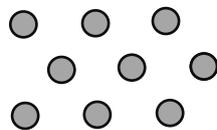


Counter-current

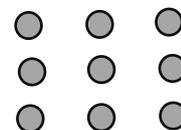


Co-current

8.14. **Coil Alignment:** Usually, this will be staggered. However, in very rare circumstances, you may wish to use an in-line arrangement.



Staggered Arrangement



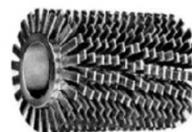
In Line Arrangement

8.15. **Fin Type:** this dropdown option has four different options:

- None (bare tube)
- Solid
- Serrated
- Studs



SOLID FINS



SERRATED FINS



STUDS



## 9. STACK

**CONTINUE** cancel

Design   Refractory   K Losses

---

**Design**

Stack No. 1

Design Mode Automatic ▾

Stack Diameter \*      **Ft**     

Stack Height \*        **Ft**     

Cone Diameter \*      **Ft**     

Minimum Height \*    **Ft**        
(height of stack itself only)

Flue Gas Exit Velocity \*   **mph**     

Draft @ Arch \*        **inchH2Og**     

Heater Elevation \*    **Ft**        
(elevation from sea level)

Ambient Temperature \*   **°F**     

Overdesign Margin \*    **%**     



9.1. **Design Mode:** when 'Automatic' is selected, the program will calculate the height and diameter of the Stack required to satisfy the draft specified at the arch.

If the 'Manual' is selected, the calculation will be performed based on the diameter and height values that you'll need to specify. Within the results, there will be notifications on whether the calculated draft created is sufficient to overcome the overall pressure losses of the flue gas.

9.2. **Cone Diameter:** this is the diameter at the stack exit, which may be smaller than the main stack body in order to increase the exit velocity

9.3. **Minimum Height:** this value refers to the height of the stack itself (not the exit height from grade). This value is used when the calculation is in 'Automatic' mode, and will respect the minimum height specified.

9.4. **Draft at Arch:** this value is used by the Automatic Calculator when it deduces a solution that satisfies this value.

9.5. **Ambient Temperature:** This is the design ambient temperature that will be considered for the stack performance calculations (this value is not used for combustion calculations).

9.6. **Overdesign Margin:** will be used by the Automatic calculator to produce an appropriate solution.



## 10. AIR PRE-HEATER (APH)

**CONTINUE**

cancel

<b>APH</b>	1
<b>Activity</b>	Not Used
<b>Outlet Air Temp. req'd</b> °F	302
<b>Flue Flow To</b>	Stack No. 1



10.1. **Activity:** you'll need to select 'Active' to allow the program to consider an Air Pre-heater

10.2. **Outlet Air Temperature:** specify the air temperature to enter the burners and be used for combustion.

The program will carry out a heat balance of the APH on the basis of attempting to achieve this specified air temperature. In case the hot flue gas entering, doesn't have sufficient energy to achieve the specified air temperature, a note will be clearly visible in the results to indicate the non-feasibility of the APH performance.

10.3. **Flue Flow To:** similar to Convection Section, you'll need to specify where the flue gas will flow to once it exits the APH.

### IMPORTANT:

To run the simulation properly with an APH, make sure you also do the following:

- In the Convection section (or very unusually, the Radiant Section) please specify the APH as the 'Flue Flow To' destination.
- In the appropriate Radiant section, please specify the APH as the Air Source Inlet (within the Firing section options)

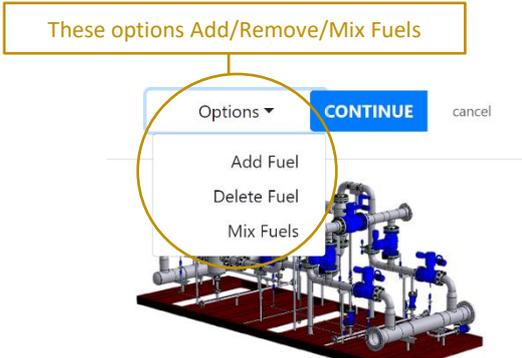


## 11. FUEL DATA

### 11.1. Gaseous Fuels

In case of gaseous fuels, complete as follows:

Fuel No.	1	
DataTitleRow	Composition Mol%	
Fuel Type	Gas Fuel <input type="text"/>	
Methane	Mol%	<input type="text" value="100"/>
Ethane	Mol%	<input type="text" value="0"/>
Propane	Mol%	<input type="text" value="0"/>
Butane	Mol%	<input type="text" value="0"/>
Pentane	Mol%	<input type="text" value="0"/>
Hexane	Mol%	<input type="text" value="0"/>
Ethylene	Mol%	<input type="text" value="0"/> <input type="text" value="0"/>
Propylene	Mol%	<input type="text" value="0"/> <input type="text" value="0"/>



Fuel Type: select either 'Fuel Gas' or 'Fuel Oil'. Depending on your selection, you'll need to enter data for the related fields.

### 11.2. Liquid Fuels

In case of liquid fuel, complete as follows:

Options  **CONTINUE** cancel

Fuel Oil LHV	BTU/lb	<input type="text" value="17792.7"/>
C/H Ratio	(wt:wt)	<input type="text" value="8.16"/>
API		<input type="text"/>
Specific Gravity (@15C/60F)		<input type="text"/>
Sulphur	%wt	<input type="text" value="1.6"/>
Water	%wt	<input type="text"/>
Ash	%wt	<input type="text"/>



## 12. FURTHER ASSISTANCE

For any additional information or assistance not covered within this document, please don't hesitate to contact us directly:

Email: [contact@heatersim.com](mailto:contact@heatersim.com)

Website: [www.heatersim.com](http://www.heatersim.com)

