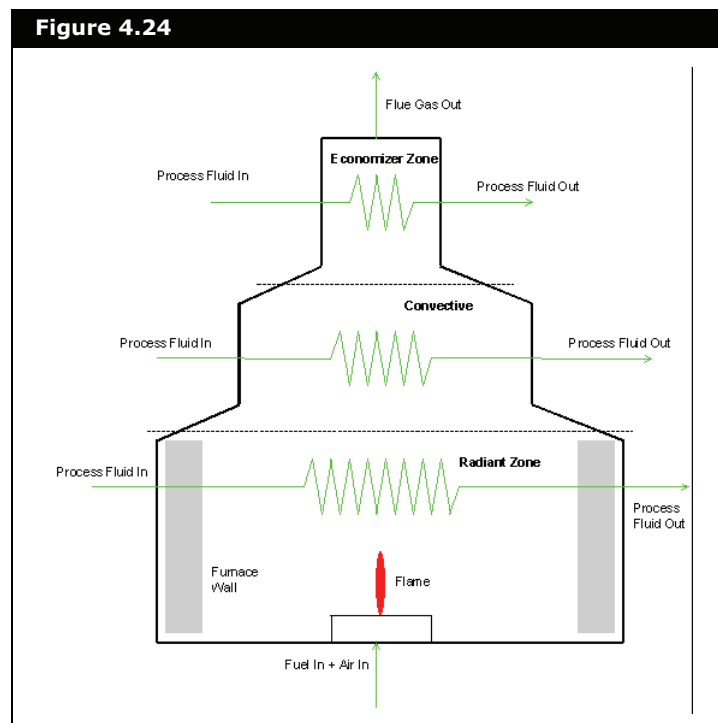


## 4.3 Fired Heater (Furnace)

The Fired Heater (Furnace) operation performs energy and material balances in steady state or dynamic modes to model a direct Fired Heater type furnace. This type of equipment requires a large amount of heat input. Heat is generated by fuel combustion and transferred to process streams. A simplified schematic of a direct Fired Heater is illustrated in the figure below.



In general, a Fired Heater can be divided into three zones:

- Radiant zone
- Convective zone
- Economizer zone

**To define the number of zones required by the Fired Heater, enter the number in #External Passes field on Connections page of the Design tab.**

The Fired Heater operation allows multiple stream connections at tube side in each zone and optional economizer, and convection zone selections. The operation incorporates a single burner model, and a single feed inlet and outlet on the flue gas side.

## Fired Heater Steady State Operation

The Fired Heater in steady state is based only on the energy balance and the system is limited to one degree of freedom.

**Fuel and air streams:** The steady state fired heater supports multiple, simultaneous fuel streams and an independent air stream.

**Note:** The dynamic mode does not support multiple fuel streams, but uses one combined fuel/air stream. If there are multiple fuel streams defined for steady state, when switching from steady state to dynamics a new stream is created from the sum of the fuel streams and the air stream defined in steady state. When switching back to steady state, one fuel and one air stream is created from the dynamic settings.

**Variables** supported as possible unknown/calculated variables are:

- Outlet temperature of the process streams
- Flow rate of the process streams
- Flow rate of *one* fuel stream. The ratio fuel/air as well as the fuel compositions should be fully defined by the user.
- Flue gas temperature
- Efficiency

**Economizer and Convection Zone** - In steady state mode, by default the external passes in the economizer and convection zone are set to zero and the number of external passes in the radiant zone is set to 1. If you set more than one external pass in the radiant zone, the heat energy is divided equally between all the process streams in the radiant zone.

## Fired Heater Dynamic Operation

The following are some of the major features of the dynamic Fired Heater operation:

- Flexible connection of process fluid associated in each Fired Heater zone. For example, radiant zone, convective zone, or economizer zone. Different Fired Heater configurations can be modeled or customized using tee, mixer, and heat exchanger unit operations.
- A pressure-flow specification option on each side and pass realistically models flow through Fired Heater operation according to the pressure gradient in the entire pressure network of the plant. Possible flow reversal situations can therefore be modeled.
- A comprehensive heat calculation inclusive of radiant, convective, and conduction heat transfer on radiant zone enables the prediction of process fluid temperature, Fired Heater wall temperature, and flue gas temperature.
- A dynamic model which accounts for energy and material holdups in each zone. Heat transfer in each zone depends on the flue gas properties, tube and Fired Heater wall properties, surface properties of metal, heat loss to the ambient, and the process stream physical properties.
- A combustion model which accounts for imperfect mixing of fuel, and allows automatic flame ignition or extinguished based on the oxygen availability in the fuel air mixture.

## Switching Modes

When switching the fired heater to dynamic mode, any fuel streams and the air stream in steady state will be combined into one stream. When switching from dynamic to steady state, a yellow warning message states that only the radiant zone is considered in the steady state heat balance. The combined fuel/air stream in Dynamics is split into two streams for the fuel and the air.

## 4.3.1 Fired Heater Theory

### Combustion Reaction

The combustion reaction in the burner model of the Fired Heater performs pure hydrocarbon ( $C_xH_y$ ) combustion calculations only. The extent of the combustion depends on the availability of oxygen which is usually governed by the air to fuel ratio.

Air to fuel ratio ( $AF$ ) is defined as follows:

$$AF = \frac{\left( \frac{\text{Mass of flow } O_2}{\sum \text{Mass flow of fuel}} \right)}{\text{Mass Ratio of } O_2 \text{ in Air}} \quad (4.19)$$

You can set the combustion boundaries, such as the maximum  $AF$  and the minimum  $AF$ , to control the burner flame. The flame cannot light if the calculated air to fuel ratio falls below the specified minimum air to fuel ratio. The minimum air to fuel ratio and the maximum air to fuel ratio can be found on the Parameters page of the Design tab.

The heat released by the combustion process is the product of molar flowrate, and the heat of formation of the products minus the heat of formation of the reactants at combustion temperature and pressure. In the Fired Heater unit operation, a traditional reaction set for the combustion reactions is not required. You can choose the fuels components (the hydrocarbons and hydrogen) to be considered in the combustion reaction. You can see the mixing efficiency of each fuel component on the Parameter page of the Design tab.

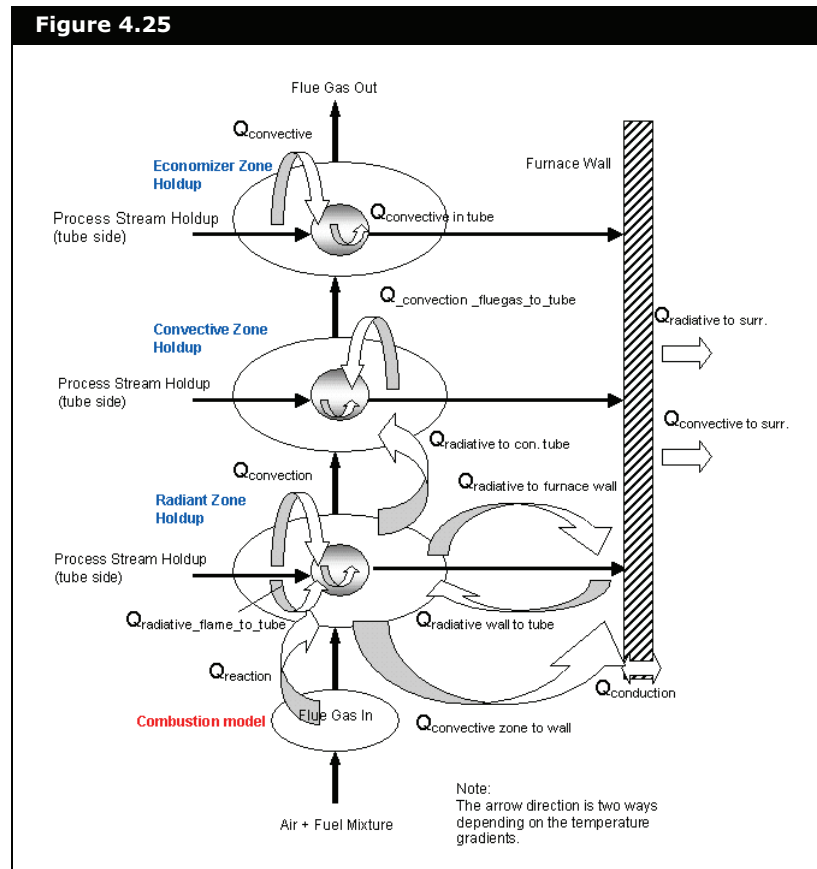
## Heat Transfer

The Fired Heater heat transfer calculations are based on energy balances for each zone. The shell side of the Fired Heater contains five holdups:

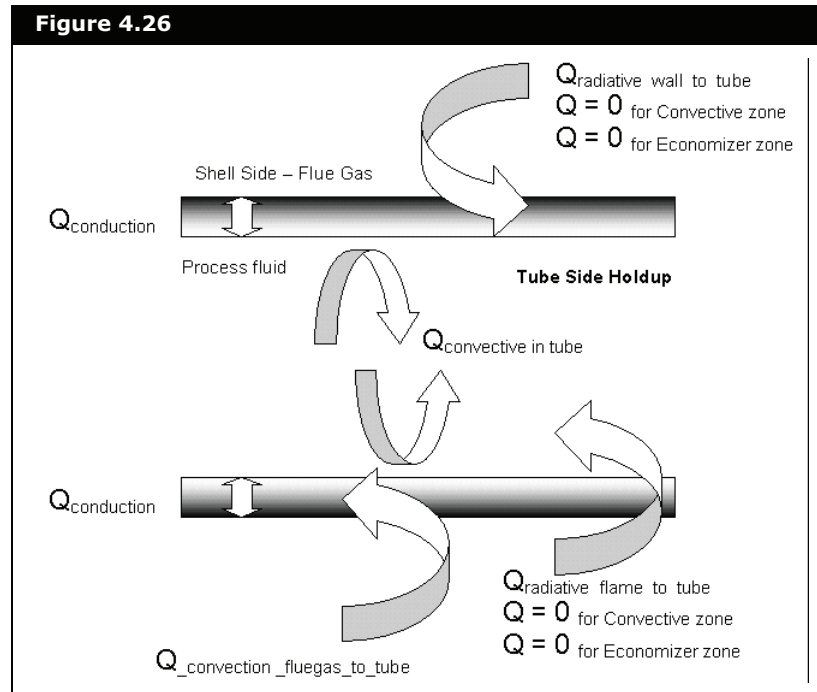
- three in the radiant zone
- a convective zone
- an economizer zone holdup as outlined previously in [Figure 4.24](#).

For the tube side, each individual stream passing through the respective zones is considered as a single holdup.

Major heat terms underlying the Fired Heater model are illustrated in the figure below.



The heat terms related to the tubeside are illustrated in the figure below.



Taking Radiant zone as an envelope, the following energy balance equation applies:

$$\begin{aligned}
 & \frac{d(M_{\text{rad}}H_{\text{rad}})}{dt} + \frac{d(M_{\text{RPFTube}}H_{\text{RPFTube}})}{dt} \\
 & = (M_{\text{RPF}}H_{\text{RPF}})_{\text{IN}} - (M_{\text{RPF}}H_{\text{RPF}})_{\text{OUT}} + (M_{\text{FG}}H_{\text{FG}})_{\text{IN}} \\
 & - (M_{\text{FG}}H_{\text{FG}})_{\text{OUT}} - Q_{\text{RadToCTube}} - Q_{\text{rad wall sur}} - Q_{\text{con wall sur}} \\
 & + Q_{\text{rad wall to tube}} - Q_{\text{con to wall}} + Q_{\text{reaction}}
 \end{aligned} \tag{4.20}$$

where:

$$\frac{d(M_{\text{rad}}H_{\text{rad}})}{dt} = \text{energy accumulation in radiant zone holdup shell side}$$

$$\frac{d(M_{RPFTube}H_{RPFTube})}{dt} = \text{energy accumulation in radiant zone}$$

*process fluid holdup (tube side)*

$$(M_{RPFH_{RPF}})_{IN} = \text{total heat flow of process fluid entering radiant zone tube}$$

$$(M_{RPFH_{RPF}})_{OUT} = \text{total heat flow of process fluid exiting radiant zone tube}$$

$$(M_{FGH_{FG}})_{IN} = \text{total heat flow of fuel gas entering radiant zone}$$

$$(M_{FGH_{FG}})_{OUT} = \text{total heat flow of fuel gas exiting radiant zone}$$

$$Q_{RadToCTube} = \text{radiant heat of radiant zone to convective zone's tube bank}$$

$$Q_{rad\_wall\_sur} = \text{radiant heat loss of Fired Heater wall in radiant zone to surrounding}$$

$$Q_{con\_wall\_sur} = \text{convective heat loss of Fired Heater wall in radiant zone to surrounding}$$

$$Q_{rad\_wall\_to\_tube} = \text{radiant heat from inner Fired Heater wall to radiant zone's tube bank}$$

$$Q_{rad\_flame\_wall} = \text{radiant heat from flue gas flame to inner Fired Heater wall}$$

$$Q_{con\_to\_wall} = \text{convective heat from flue gas to Fired Heater inner wall}$$

$$Q_{reaction} = \text{heat of combustion of the flue gas}$$

## Radiant Heat Transfer

For a hot object in a large room, the radiant energy emitted is given as:

$$Q_{radiative} = \delta A \varepsilon (T_1^4 - T_2^4) \quad (4.21)$$

where:

$$\delta = \text{Stefan-Boltzmann constant, } 5.669 \times 10^{-8} \text{ W/m}^2\text{K}^4$$

$$\varepsilon = \text{emissivity, (0-1), dimensionless}$$

$$A = \text{area exposed to radiant heat transfer, m}^2$$

$T_1$  = temperature of hot surface 1, K

$T_2$  = temperature of hot surface 2, K

## Convective Heat Transfer

The convective heat transfer taking part between a fluid and a metal is given in the following:

$$Q_{convective} = UA(T_1 - T_2) \quad (4.22)$$

where:

$U$  = overall heat transfer coefficient,  $W/m^2K$

$A$  = area exposed to convective heat transfer,  $m^2$

$T_1$  = temperature of hot surface 1, K

$T_2$  = temperature of surface 2, K

The  $U$  actually varies with flow according to the following *flow-U* relationship if this Flow Scaled method is used:

$$U_{used} = U_{specified} \left( \frac{\text{Mass flow at time } t}{\text{Reference Mass flow}} \right)^{0.8} \quad (4.23)$$

where:

$U_{specified}$  =  $U$  value at steady state design conditions.

The ratio of mass flow at time t to reference mass flow is also known as flow scaled factor. The minimum flow scaled factor is the lowest value, which the ratio is anticipated at low flow region. For the Fired Heater operation, the minimum flow scaled factor can be expressed only as a positive value.



For example, if the minimum flow scaled factor is +0.001 (0.1%), when this mass flow ratio is achieved, the  $U_{used}$  stays as a constant value. Therefore,

$$U_{used} = U_{specified}(0.001)^{0.8} \quad (4.24)$$

## Conductive Heat Transfer

Conductive heat transfer in a solid surface is given as:

$$Q_{conductive} = -kA \frac{(T_1 - T_2)}{\Delta t} \quad (4.25)$$

where:

$k$  = thermal conductivity of the solid material, W/mK

$\Delta t$  = thickness of the solid material, m

$A$  = area exposed to conductive heat transfer, m<sup>2</sup>

$T_1$  = temperature of inner solid surface 1, K

$T_2$  = temperature of outer solid surface 2, K

## Pressure Drop

The pressure drop across any pass in the Fired Heater unit operation can be determined in one of two ways:

- Specify the pressure drop - delta P.
- Define a pressure flow relation for each pass by specifying a k-value

If the pressure flow option is chosen for pressure drop determination in the Fired Heater pass, a  $k$  value is used to relate the frictional pressure drop and molar flow,  $F$  through the Fired Heater. This relation is similar to the general valve equation:

$$F = k \sqrt{\rho(P_1 - P_2)} \quad (4.26)$$

This general flow equation uses the pressure drop across the Fired Heater pass without any static head contribution. The quantity,  $(P_1 - P_2)$  is defined as the frictional pressure loss which is used to "size" the flow.

The  $k$  value is calculated based on two criteria:

- If the flow of the system is larger than the value at  $k_{ref}$  ( $k$  reference flow), the  $k$  value remain unchanged. It is recommended that the  $k$  reference flow is taken as 40% of steady state design flow for better pressure flow stability at low flow range.
- If the flow of the system is smaller than the  $k_{ref}$ , the  $k$  value is given by:

$$k_{used} = k_{user\ specified} \times Factor \quad (4.27)$$

where:

*Factor = value is determined by HYSYS internally to take into consideration the flow and pressure drop relationship for low flow regions.*

The effect of  $k_{ref}$  is to increase the stability by modeling a more linear relationship between flow and pressure. This is also more realistic at low flows.

## Minimum Specifications

The following is a list of the minimum specifications required for the Fired Heater operation to solve:

Dynamic Specifications	Description
<b>Connections</b>	At least one radiant zone inlet stream and the respective outlet zone, one burner fuel/air feed stream and one combustion product stream must be defined. There is a minimum of one inlet stream and one outlet stream required per zone. Complete the connections group for each zone of the Design tab.
<b>(Zone) Sizing</b>	The dimensions of the tube and shell in each zone in the Fired Heater must be specified. All information in the Sizing page of the Rating tab must be completed.

Dynamic Specifications	Description
<b>Heat Transfer</b>	For each zone, almost all parameters in the Radiant Zone Properties group and Radiant/Convective/Economizer Tube Properties groups are required except the Inner/Outer Scaled HX Coefficient.
<b>Nozzle</b>	Nozzle elevation is defaulted to 0. Elevation input is required when static head contribution option in Integrator property view is selected.
<b>Pressure Drop</b>	Either specify an overall delta P or an overall K value for the Fired Heater. Specify the pressure drop calculation method on the Tube Side PF page and Flue Gas PF page of the Dynamics tab.

## 4.3.2 Fired Heater Property View

There are two ways that you can add a Fired Heater to your simulation:

1. Select **Flowsheet | Add Operation** command from the menu bar. The UnitOps property view appears.  
You can also access the UnitOps property view by pressing **F12**.
2. Click the **Heat Transfer Equipment** radio button.
3. From the list of available unit operations, select **Fired Heater**.
4. Click the **Add** button.

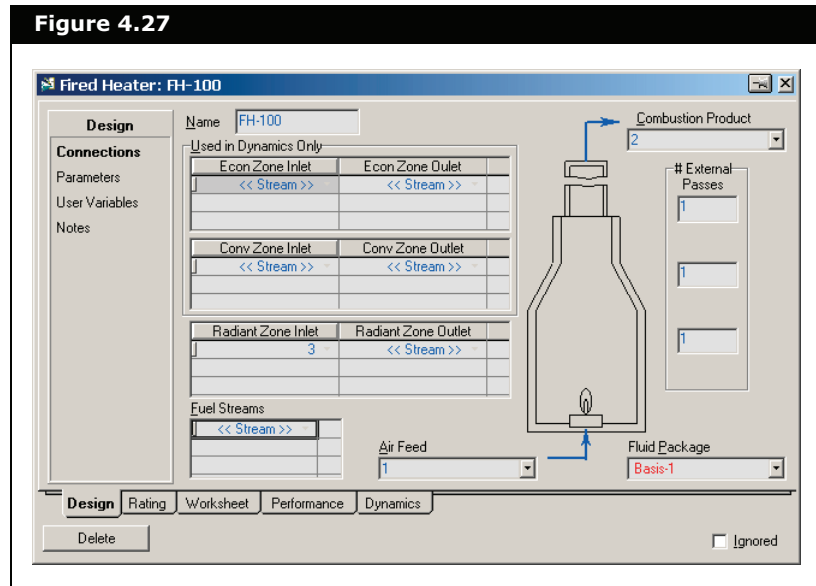
OR

1. Select **Flowsheet | Palette** command from the menu bar. The Object Palette appears.  
You can also open the Object Palette by pressing **F4**.
2. Double-click the **Fired Heater** icon.



Fired Heater icon

The Fired Heater property view appears.



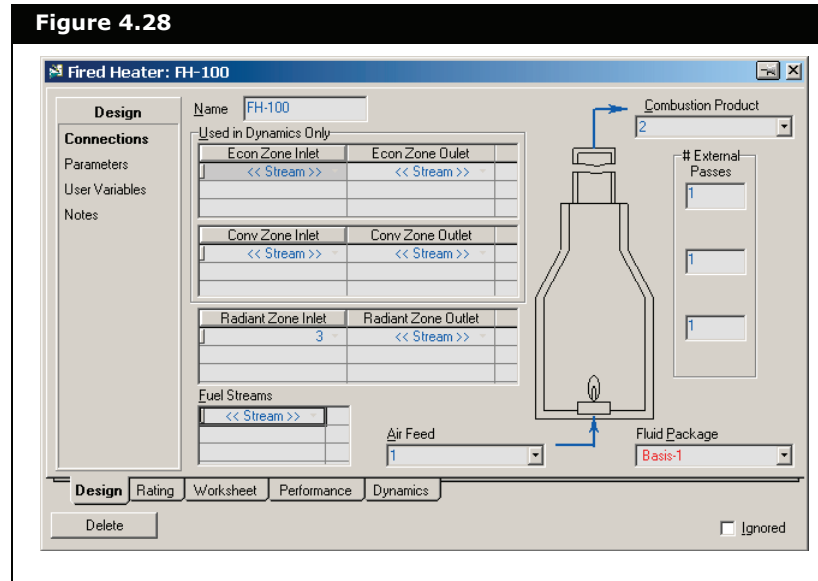
### 4.3.3 Design Tab

The Design tab contains the following pages:

- Connections
- Parameters
- User Variables
- Notes

## Connections Page

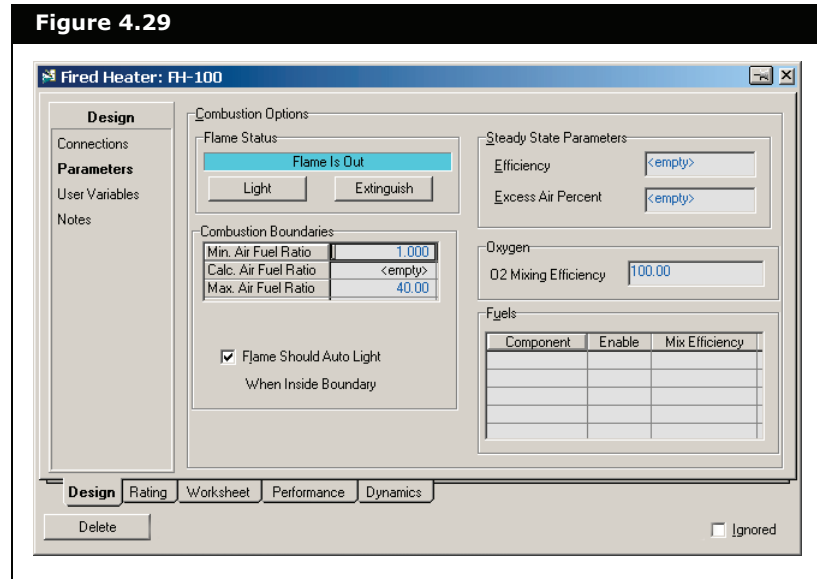
On the Connections page, you can specify the name of the operation, and inlet and outlet streams.



Object	Description
<b>Econ Zone Inlet/Outlet</b>	You can specify multiple inlet and outlet streams for the Economizer zone. (Dynamics only.) To add stream connections to Econ zone and Conv zone, enter the desired number in the corresponding <b>External Passes</b> field and then attach the streams.
<b>Conv Zone Inlet/Outlet</b>	You can specify multiple inlet and outlet streams for the Convective zone. (Dynamics only.)
<b>Radiant Zone Inlet/Outlet</b>	You can specify multiple inlet and outlet streams for the Radiant zone.
<b>Fuel Streams</b>	Specifies the stream or streams to be used for the burner fuel.
<b>Air Feed</b>	Source for the burner air. Note: If you switch to dynamics mode, all fuel streams and air will be combined in one stream named <b>"Air/Fuel Mix"</b> .
<b>Combustion Product</b>	The stream that contains the products from the combustion.
<b># External Passes</b>	Defines the number of zones required by the Fired Heater
<b>Fluid Package</b>	The associated fluid package

## Parameters Page

The Parameters page is used to specify the Fired Heater combustion options.



This page is divided into parameter groups.

Object	Description
<b>Flame Status</b>	Toggles between a lit flame and an extinguished flame.
<b>Combustion Boundaries</b>	Sets the combustion boundary based on a range of air fuel ratios.
<b>Efficiency</b>	Sets a steady state efficiency percentage. The heater will heat all the radiant zone streams equally using energy from the combustion. If the efficiency is 0, then all the energy from the combustion will go into heating the flue gas. If the efficiency is 100%, then all the energy will go to heating the radiant zone process streams and the flue gas stream will not be heated.
<b>Excess Air Percent</b>	HYSYS calculates the required Air flow using a percentage value.
<b>Oxygen</b>	Specifies the oxygen mixing efficiency.
<b>Fuels</b>	Selects the components present in your fuel as well as set their mixing efficiencies.

## User Variables Page

The User Variables page enables you to create and implement your own user variables for the current operation.

## Notes Page

The Notes page provides a text editor that allows you to record any comments or information regarding the specific unit operation, or the simulation case in general.

## 4.3.4 Rating Tab

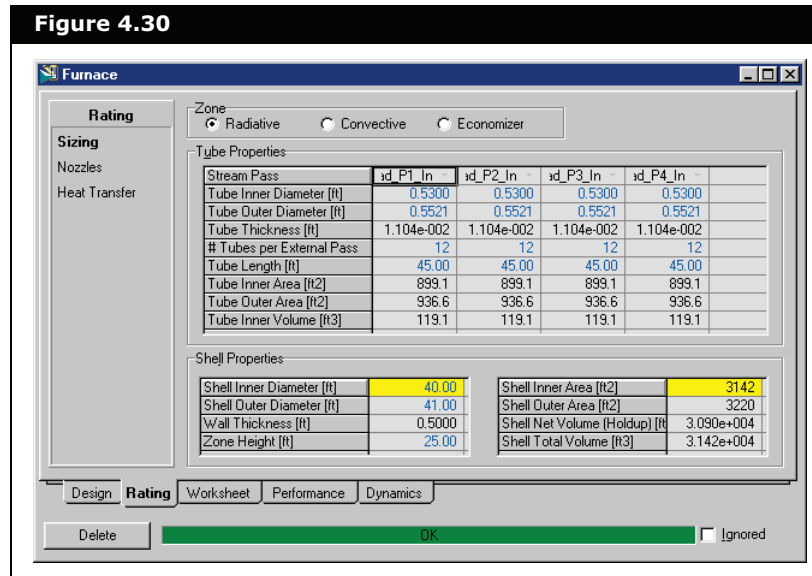
The Rating tab contains the following pages:

- Sizing
- Nozzles
- Heat Transfer

Each page is discussed in the following sections.

### Sizing Page

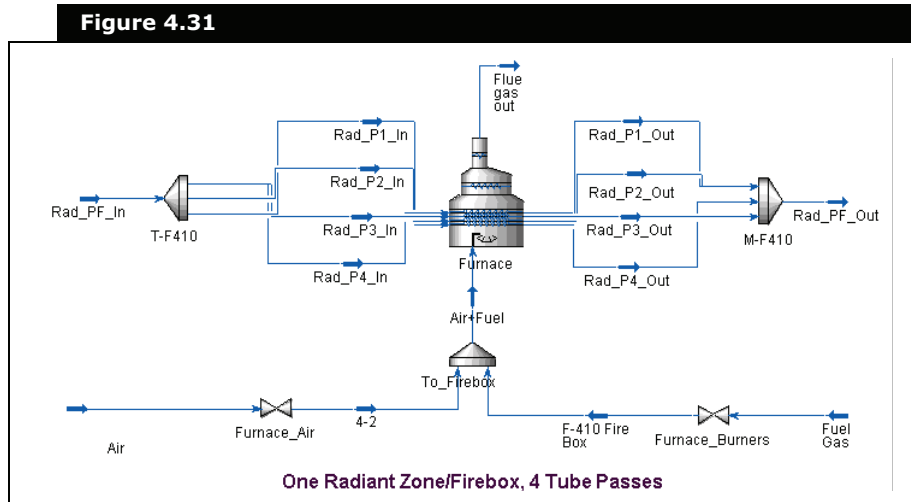
On the Sizing page, you can specify the geometry of the radiant, convective, and economizer zones in the Fired Heater.



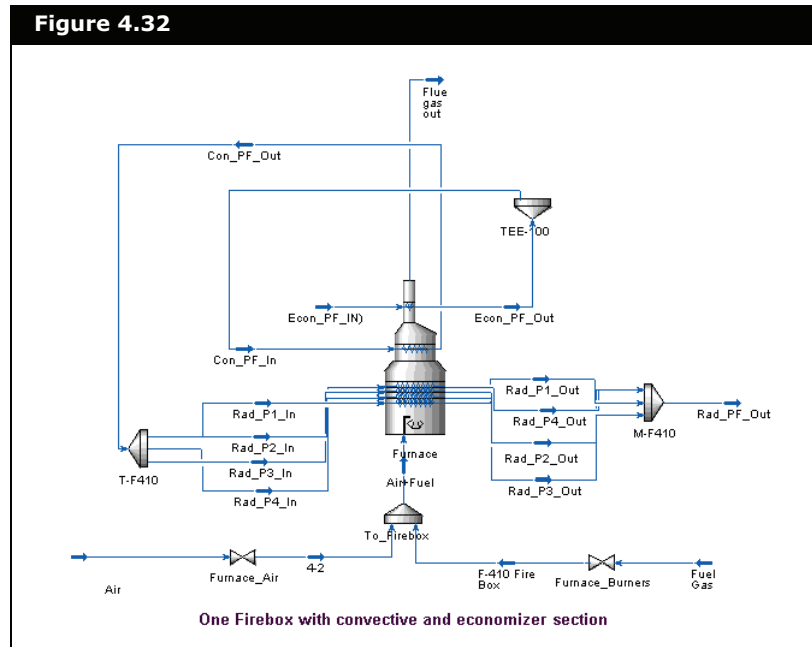
From the Zone group on the Sizing page, you can choose between Radiative, Convective, and Economizer zone property views by selecting the appropriate radio button. These property views contain information regarding the tube and shell properties. To edit or enter parameters within these property views, click the individual cell and make the necessary changes.



The figure below shows an example of the Fired Heater setup with one radiant zone/firebox only with four tube passes. This is the simplest type.



The figure below shows an example of the Fired Heater setup with a radiant, convective and economizer section.



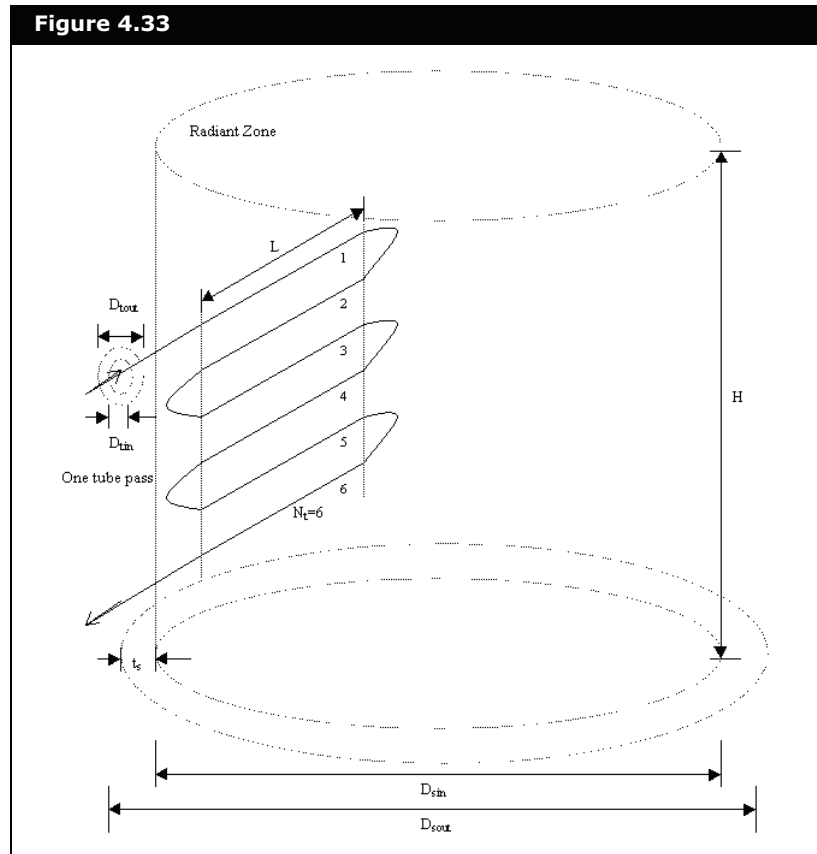
## Tube Properties Group

The Tube Properties group displays the following information regarding the dimension of the tube:

- stream pass
- tube inner diameter,  $D_{in}$
- tube outer diameter,  $D_{out}$
- tube thickness
- # tubes per external pass
- tube length,  $L$
- tube inner area
- tube outer area
- tube inner volume

A pass in the Fired Heater is defined as a path where the process fluid flows through a distinctive inlet nozzle and outlet nozzle.

The figure below illustrates the various dimensions of the tube and shell.



## Shell Properties Group

The Shell Properties group displays the following information regarding the dimension of the shell:

- shell inner diameter,  $D_{sin}$
- shell outer diameter,  $D_{sout}$
- wall thickness,  $t_s$
- zone height,  $H$
- shell inner area
- shell outer area
- shell net volume

- shell total volume

## Nozzles Page

**Figure 4.34**

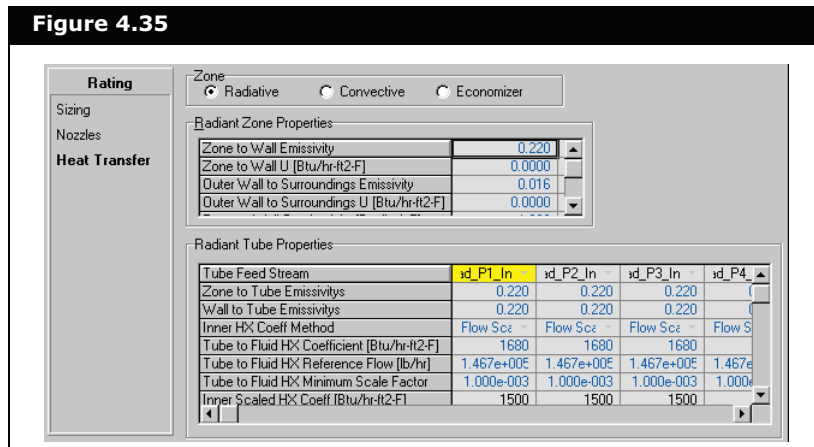


The information provided in the Nozzles page is applicable only in Dynamic mode. You can define the base elevation to ground level of the Fired Heater in the Nozzles page.

## Heat Transfer Page

The information provided in the Heat Loss page is applicable only in Dynamic mode. This page displays the radiant heat transfer properties, heat transfer coefficients of the Fired Heater wall and tube, and shell area, tube area, and volume in each individual zone.

**Figure 4.35**



HYSYS accounts for the convective, conduction, and radiative heat transfer in the radiant zone. For the convective heat transfer calculation, you have two options:

- **User Specified.** You can specify the heat transfer coefficient of the inner tube and the outer tube.

- **Flow Scaled.** The heat transfer coefficient is scaled based on a specified flow.

The scaled heat transfer coefficient is defined by **Equation (4.23)**.

The same equation applies to the outer tube heat transfer coefficient calculation. Currently, the heat transfer coefficient  $U$  must be user specified. HYSYS calculates the heat transfer coefficient from the geometry/configuration of the Fired Heater. The radiant box or the fire box is assumed cylindrical in geometry.

## Radiant Zone Properties Group

The following table describes each parameter listed in the Radiant Zone group.

Radiant Zone Parameter	Description
<b>Zone to Wall Emissivity</b>	Emissivity of flue gas. HYSYS uses a constant value.
<b>Zone to Wall U</b>	Convective heat transfer coefficient of the radiative zone to the Fired Heater inner wall.
<b>Outer Wall to Surrounding Emissivity</b>	Emissivity of the Fired Heater outer wall.
<b>Outer Wall to Surroundings U</b>	Convective heat transfer coefficient of the Fired Heater outer wall to ambient.
<b>Furnace Wall Conductivity/ Specific Heat/Wall Density</b>	These are user specified properties of a single layer of Fired Heater wall.

The Radiant, Convective, and Economizer Tube Properties groups all contain similar parameters, which are described in the following table.

Tube Properties	Description
<b>Zone to Tube Emissivity</b>	Emissivity of flue gas at radiant/convective zone to the tube in radiant/convective zone respectively.
<b>Wall to Tube Emissivity</b>	Radiant zone Fired Heater wall emissivity to the radiant zone tubes.

Tube Properties	Description
<b>Inner HX Coeff Method</b>	There are two options to calculate the Heat transfer coefficient in the tube: User Specified or Flow Scaled. Flow Scaled provides a more realistic HX calculation where: $U_{used} = U_{specified} \left( \frac{mass}{mass_{ref}} \right)^{0.8}$
<b>Tube to Fluid HX Coefficient</b>	Heat transfer coefficient of the tube to the process fluid.
<b>Tube to Fluid HX Reference Flow</b>	Mass flow at which the tube to fluid HX coefficient is based on. Usually the ideal steady state flow is recommended as input.
<b>Tube to Fluid HX Minimum Scale Factor</b>	The ratio of mass flow of the process fluid to the reference mass flow in the tube. The value ranges from a value of zero to one. If the process flow in the tube becomes less than the scale factor, the heat transfer coefficient used is smaller than U specified.
<b>Inner Scaled HX Coefficient</b>	The HX coefficient obtained if the Flow Scaled ( $U_{used}$ ) method is applied to perform the calculation.
<b>Tube <math>C_p</math>, Density, Conductivity</b>	Metal properties of the tube in their respective zones.
<b>Outer HX Coefficient Method</b>	Method used to calculate the shell side HX coefficient. Two options available: User Specified or Flow Scaled.
<b>Zone to Tube HX Coefficient</b>	HX coefficient in the radiative/convective/ economizer or flue gas zones to the respective tubes.
<b>Zone to Tube HX Reference Flow</b>	Mass flow of the flue gas at which the outer HX coefficient is based upon. This is usually designed using the ideal steady state flow of the flue gas.
<b>Zone to Tube HX Minimum Scale Factor</b>	Mass ratio of flue gas flow to the flue gas reference mass flow. This value ranges from zero to one. If the process flow in the tubes is less than this value, the HX coefficient used is set to zero.
<b>Outer Scaled U</b>	The actual HX coefficient used in the calculation if the Flow Scaled option is selected.

In general the Tube to Fluid HX Coefficient is always shown in a common Fired Heater flowsheet, however, the Zone to Wall U and Outer Wall to Surroundings U are usually unknown. The Outer wall to Surroundings U can be easily estimated from the Fired Heater convective heat loss calculation, **Equation (4.22)** if the total heat loss via Fired Heater wall is known. The total heat loss is normally expressed as a percentage of total Fired Heater duty. A 3-5% heat loss is an acceptable estimate.

Estimating Zone to Wall U requires trial and error techniques. Enter a value of U then observe the temperature profile of the flue gas exiting the radiant zone.

## 4.3.5 Worksheet Tab

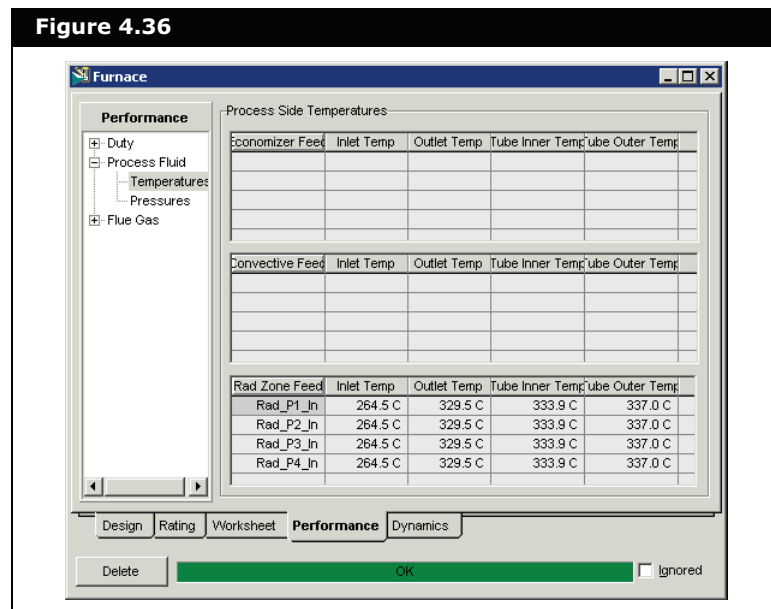
The Worksheet tab contains a summary of the information contained in the stream property view for all the streams attached to the heat exchanger unit operation.

To view the stream parameters broken down per stream phase, open the Worksheet tab of the stream property view.

**The PF Specs page is relevant to dynamics cases only.**

## 4.3.6 Performance Tab

The performance tab contains tables which highlight the calculated temperature, duty, and pressure of the Fired Heater operation.

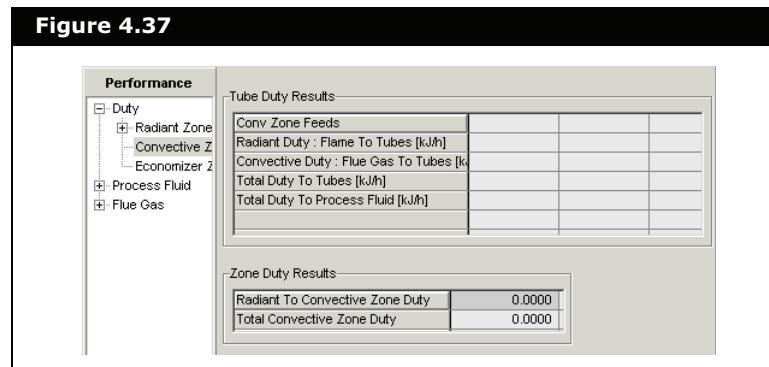


## Duty Page

The Duty page displays the results of the Fired Heater energy balance calculation. The Duty page contains three levels/branches: Radiant Zone, Convective Zone, and Economizer Zone.

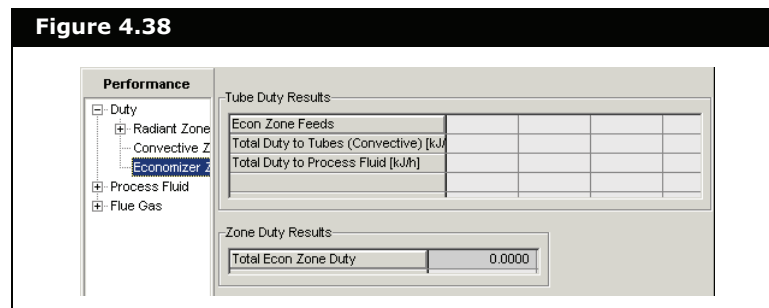
- If you select **Radiant Zone** from the tree browser, the following four levels/branches containing information regarding the Tube Duty results and Zone Duty results appear:
  - Overall
  - Holdup
  - Tubes
  - Wall
- If you select the **Convective Zone** from the tree browser, the following parameters from the Tube Duty Results group and the Zone Duty Results group appear:

**Figure 4.37**



- If you select the **Economizer Zone** from the tree browser, the following parameters from the Tube Duty results group and Zone Duty results group appear:

**Figure 4.38**





## Process Fluid Page

The Process Fluid page contains two sub-pages:

- Temperatures
- Pressures

In the Temperatures sub-page, the following parameters appear:

- Inlet Temp, Inlet stream process fluid temperature
- Outlet Temp, Outlet stream process fluid temperature
- Tube Inner Temp, Tube inner wall temperature

In the Pressures sub-page, the following parameters appear:

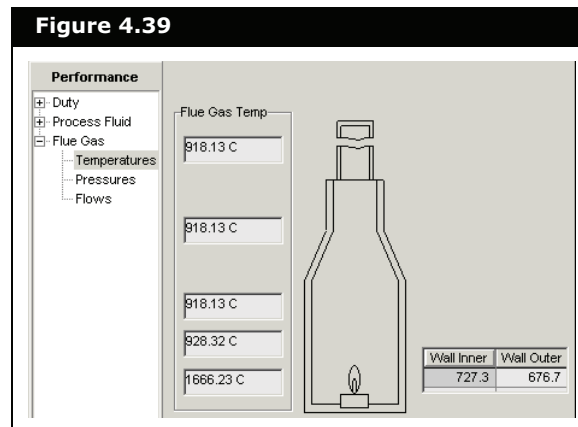
- Inlet pressure, inlet stream pressure
- Friction Delta P, friction pressure drop across the tube
- Static Head Delta P, static pressure of the stream
- Outlet Pressure, outlet stream pressure

## Flue Gas Page

The Flue Gas page contains the following sub-pages:

- Temperatures
- Pressures
- Flows

On the Temperatures sub-page, you can view your flue gas temperature and Fired Heater inner/outer wall temperatures.



Similarly, the Pressures sub-page displays the flue gas pressures, frictional delta P, and static head delta P. The Flow sub-page displays the flue gas molar/mass flow.

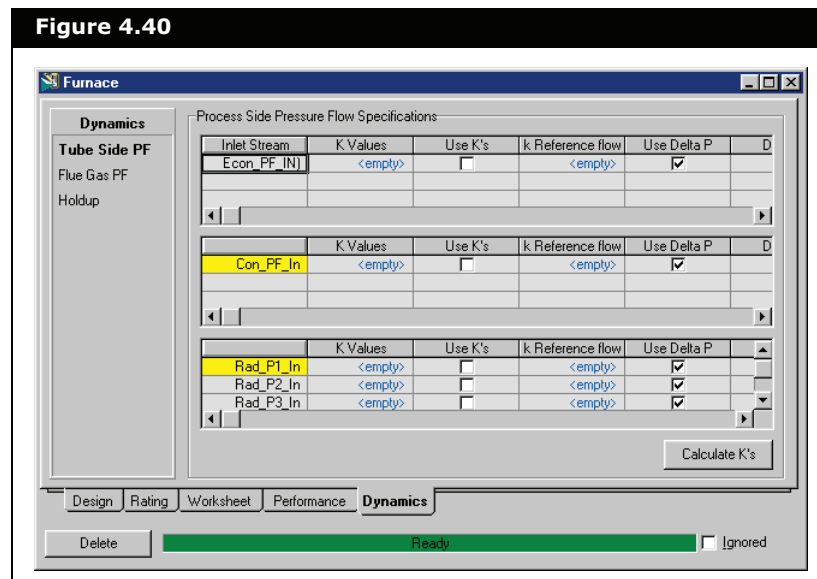
## 4.3.7 Dynamics Tab

The Dynamics tab contains information pertaining to pressure specifications for the dynamic calculations. The information is sorted into the following pages:

- Tube Side PF
- Flue Gas PF
- Holdup

### Tube Side PF Page

The Tube Side PF page allows you to specify how the pressure drop in each pass is calculated.

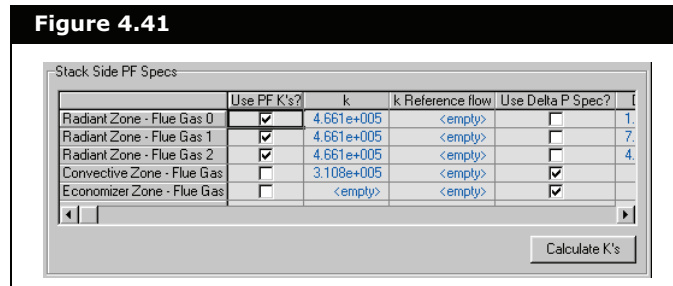


The following table outlines the tube side PF options available on this page.

Option	Description
<b>Use K's?</b>	If this checkbox is selected, the K method is used to calculate Delta P across the pass.
<b>Use Delta P Spec?</b>	If this checkbox is selected, the pressure drop is fixed at this specified value.
<b>Calculate K's</b>	If this button is clicked, HYSYS calculates the K required to maintain a specified Delta P across a defined flow condition.

## Flue Gas PF Page

On the Flue Gas PF page, you can specify how the pressure drop in each pass is calculated.



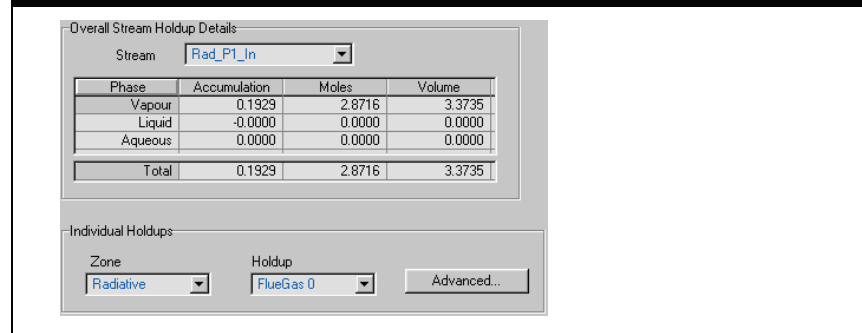
The following table outlines the tube side PF options available on this page.

Option	Description
<b>Use PF K's</b>	If this checkbox is selected, the K method is used to calculate Delta P across the pass.
<b>Use Delta P</b>	If this checkbox is selected, the pressure drop is fixed at this specified value.
<b>Calculate K's</b>	If this button is clicked, HYSYS calculates the K required to maintain a specified Delta P across a defined flow condition.

## Holdup Page

The Holdup page contains information regarding each stream's holdup properties and composition. The Individual Holdups group contains two drop-down lists (Zone and Holdup) that enable you to select and view information on individual zone and holdup section.

**Figure 4.42**



## 4.4 Heat Exchanger

The Heat Exchanger performs two-sided energy and material balance calculations. The Heat Exchanger is very flexible, and can solve for temperatures, pressures, heat flows (including heat loss and heat leak), material stream flows, or UA.

**Additional Heat Exchanger models, such as TASC and STX, are also available. Contact your local AspenTech representative for details.**

In HYSYS, you can choose the Heat Exchanger Model for your analysis. Your choices include an End Point analysis design model, an ideal ( $F_t=1$ ) counter-current Weighted design model, a steady state rating method, and a dynamic rating method for use in dynamic simulations. The dynamic rating method is available as either a Basic or Detailed model, and can also be used in Steady State mode for Heat Exchanger rating. The unit operation also allows the use of third party Heat Exchanger design methods via OLE Extensibility.