UniSim® Plate-Fin Exchanger Modeler

(referred to as UniSim® PFE)

Getting Started Guide

Honeywell

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The information in this help file is subject to change over time. Honeywell may make changes to the requirements described. Future revisions will incorporate changes, including corrections of typographical errors and technical inaccuracies.

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Table of Contents

Introduction

This Getting Started Guide forms part of the documentation supplied with each UniSim Heat Exchanger program:

- UniSim® Heat Exchangers User Guide
- Getting Started
- Program Reference Guide.

The UniSim® Heat Exchangers User Guide is supplied as a pdf document with the installation media. The Documentation media contains the UniSim® Heat Exchangers User Guide and all the other documents. The UniSim® Heat Exchangers User Guide is generic to all UniSim Heat Exchanger programs. The Getting Started and Reference Guide are specific to each UniSim Heat Exchanger program.

The Getting Started Guide assumes you have access to an installed copy of the UniSim Heat Exchanger program, and takes you through some example cases provided with the program, so you can get a feel for it capabilities. It also describes how you can run a set of QA sample cases, and compare the output files with sample results, to confirm that the operation of the program is as it should be.

More detailed examples, showing how you can use the program to solve typical problems, are provided in Appendices to the program Reference Guide.

Technical Support

Technical support is available by phone (1-403-509-1379 or 1-866-392-8748 toll free in North America), fax (1-403-216-2801).

E-mail support for customers with a current support contract for their product is available.

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Global	unisim.support@honeywell.com
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Asia Pacific	unisim.support.ap@honeywell.com

On-line support can be accessed via http://www.honeywell.com/ps.

When contacting us via email or phone, please include in your message:

Your full name, company, phone and fax numbers.

The software version you are using (shown in the Help menu, About UniSim…).

A detailed description of the problem (attach a simulation case if possible).

1 Getting Started

Included with your **UniSim® Plate-Fin Exchanger Modeler** (*referred to as **UniSim® PFE***) software are a number of example input files that can acquaint you with the program. These cases are fully defined and ready to run. You can simply open the cases and run UniSim® PFE to see the type of output that can be generated. This **Getting Started** will step you through one of these example cases, as a brief introduction to the UniSim® PFE architecture, input options and available output information.

A complete set of results for the sample input files is provided **Chapter 2 - QA Examples** in a separate location for Quality Assurance purposes. See **Chapter 2 - QA Examples** for details.

Chapter 7 - Examples, of the UniSim® PFE Reference Guide consists of a set of tutorials that you can follow to build different types of UniSim® PFE examples. By working through these examples you will familiarise yourself with the software data entry methods and the various input and output views.

Before looking at and running the sample input files, it is important for you to know that UniSim® PFE can perform several main types of calculations. When you begin modelling your own exchangers you will have to make the choice as to which calculation type you require. The examples in the UniSim® PFE Reference Guide provide greater detail on the calculation mode options, but for the purposes of this **Getting**

Started, they are briefly described below:

Calculation Types	
Design Engine	For designing a heat exchanger to meet a heat load duty and pressure drop limits, which you specify.
Simulation Engine	Determines the heat load, pressure changes and stream outlet conditions that will occur with a specified exchanger, with given stream inlet conditions.
Simulation Engine - Thermosyphon Mode	Determines the flowrate and duty of a specified exchanger, operating as a thermosyphon. You specify the head of liquid during flow through the exchanger.
Layer by Layer Engine	This is like **Simulation**, but is performed for every layer in the exchanger, rather than for every stream.
Crossflow Engine	Simulation of crossflow exchangers, with one or more passes.
Crossflow Engine - Thermosyphon Mode	Same as for the Simulation engine - thermosyphon mode but with at least one crossflow stream.

There are four "Engines" within UniSim PFE - Design, Simulation, Layer-by Layer and Crossflow. These mostly use the same common input data and output formats, with engine-specific data where required.

1.1 Example 1

In this first example you will take a brief look at how an existing dataset can be reviewed, run and the outputs accessed.

1. Start UniSim® PFE. This can be done several ways and will depend on how you set up your desktop. However, the two main ways are:
   - Clicking on the **Start** menu then **Programs**, **Honeywell**, **UniSim Heat Exchangers Rxxx**, and **UniSim PFE**.
   - Selecting PFE from within **Windows Explorer.**

Once the splash screen has cleared you will see the main UniSim® PFE window and over the top of this is the **Welcome** dialog screen see

Figure 1.1

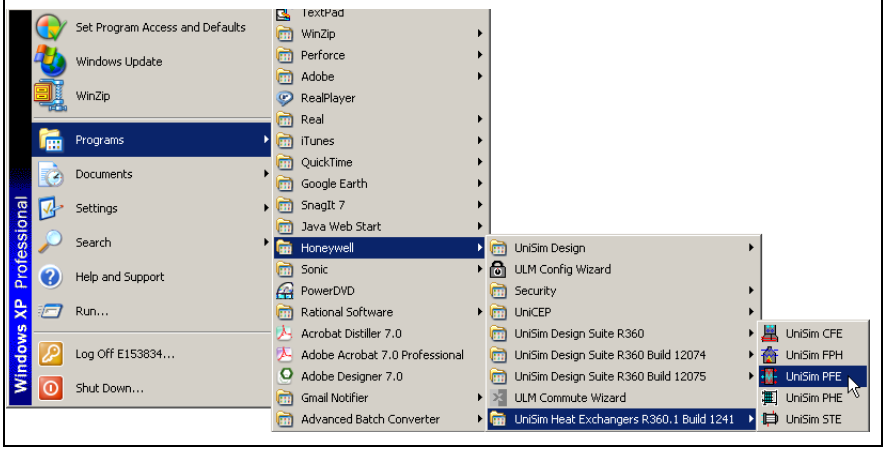
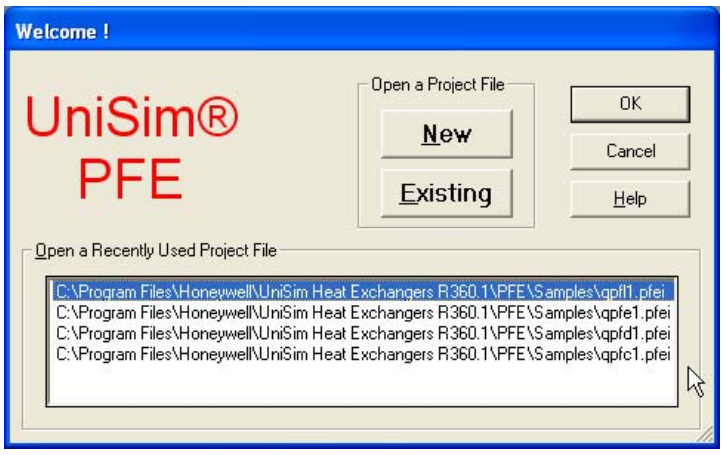


Figure 1.2. From this screen you can select to create a **New** file or open an **Existing** file. If you have used UniSim® PFE previously, the project file you have worked with will appear in the **Recently Used Project File** list, making it easy to get back to files you were recently working on.

Figure 1.2

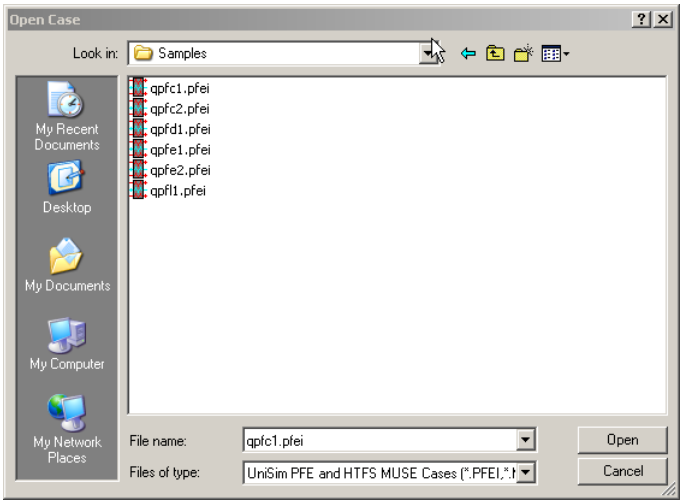


2. Select an **Existing** file; press the ***Existing*** button.
3. You are presented with an **Open File** screen. To open the file for this Getting Started, go to the

C:\PROGRAM FILES\Honeywell\UniSim Heat Exchangers Rxxx\UniSim PFE\Samples directory.

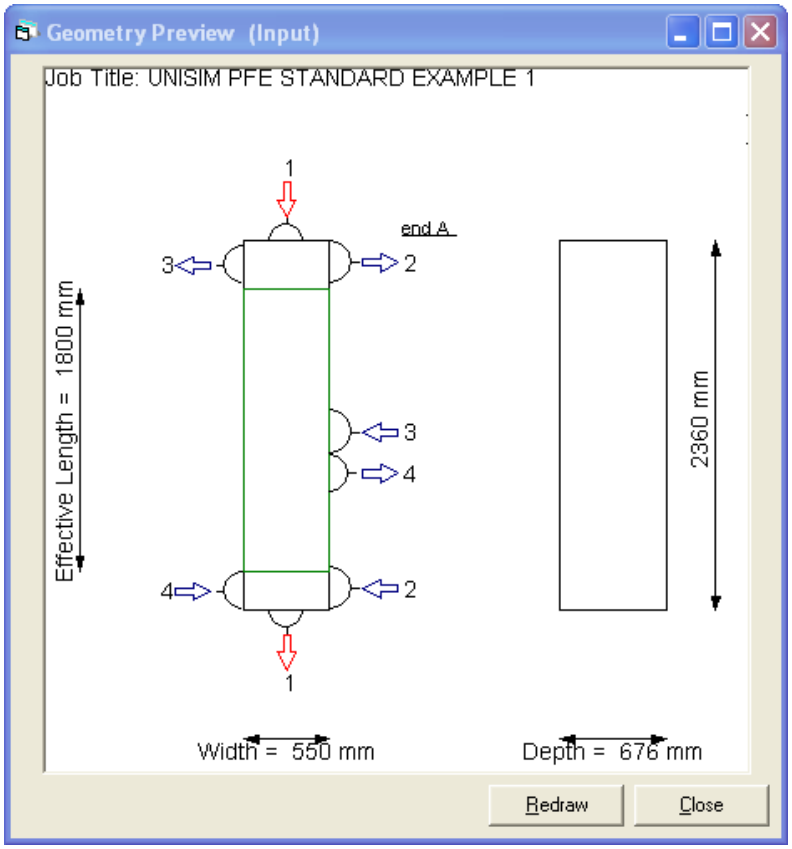
(This is the default directory, the exact location may be different if you changed the UniSim® PFE destination directory during installation.) See **Figure 1.3** for the **Open File** view.

Figure 1.3



4. For this example, select the file **QPFE1.PFEI**. You will know when the file has been loaded because the **Exchanger Diagram** will appear within the **UniSim® PFE** window. .

Figure 1.4



If you cannot remember where a file is located, there is a Find File utility to help you. Select Find File from the File menu or use the keyboard shortcut by pressing <CTRL> + <F>.

Once UniSim® PFE has started you can open other files by selecting **Open** from the **File** menu. To use the **Welcome** screen again, select **Start Project** from the **View** menu.

Open Icon

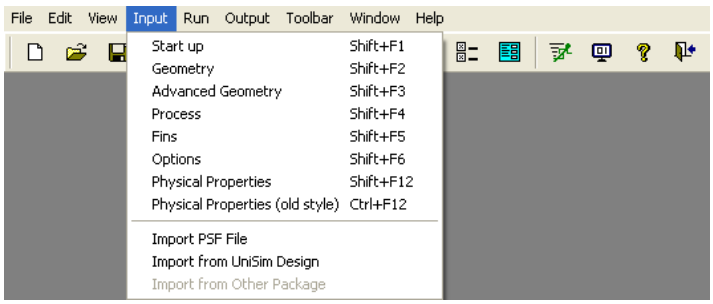
However, in either case you can only have one project active at any one time. For most common activities there are short-cuts. To open a file you can either click on the ***Open*** icon or use the keyboard shortcut by pressing <**CTRL**>+<**O**>.

Now look a bit closer at the project file you have opened:

1. Click on **Input** in the menu bar.

The **Input** menu shown below gives access to all of the input data. The menu itself is divided into the different types of data you need to describe the heat exchanger and the conditions under which it will operate. These include different aspects of geometry, process conditions and physical properties.

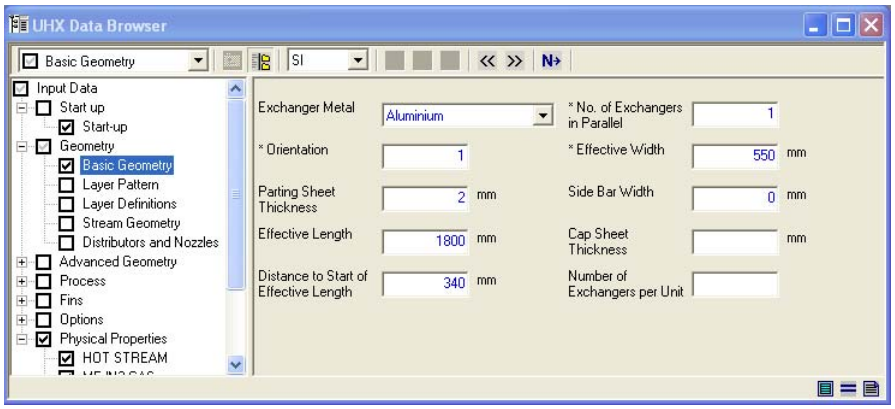
Figure 1.5



You may see minor differences in the screens in your version of UniSim® PFE, compared with the figures in this manual.

2. Select the **Geometry** input form (see **Figure 1.6**) and you should see inputs which give the exchanger metal, number of exchangers in parallel, orientation and so on. This screen is typical of most screens in that the data is entered either in a text box or via a drop- down menu. The drop-down menu shows a list of possible inputs where you simply select the appropriate item.

Figure 1.6



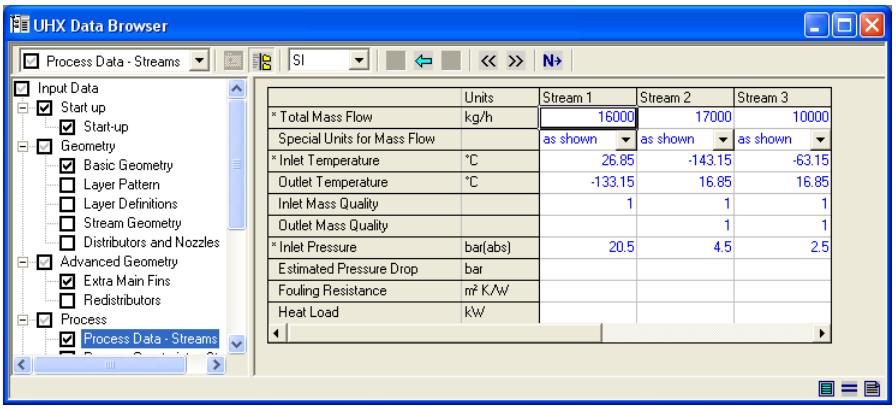
If at any point you are not sure what input you want or something is not clear, you can press <F1> and get context sensitive help. If you select the Exchanger Metal entry and press <F1> you can see a list of all the metals supported.

3. Now look at process data by selecting **Process** from the **Input** menu or by clicking on the ***Process*** icon.

Process Icon

Figure 1.7 shows another form of input screen where the input items are arranged in a spreadsheet format. If the data do not fit on the screen, a scrollbar allows you to access the other input items. The spreadsheet view is used when data are required several times, in this case for each of the streams in the exchanger.

Figure 1.7



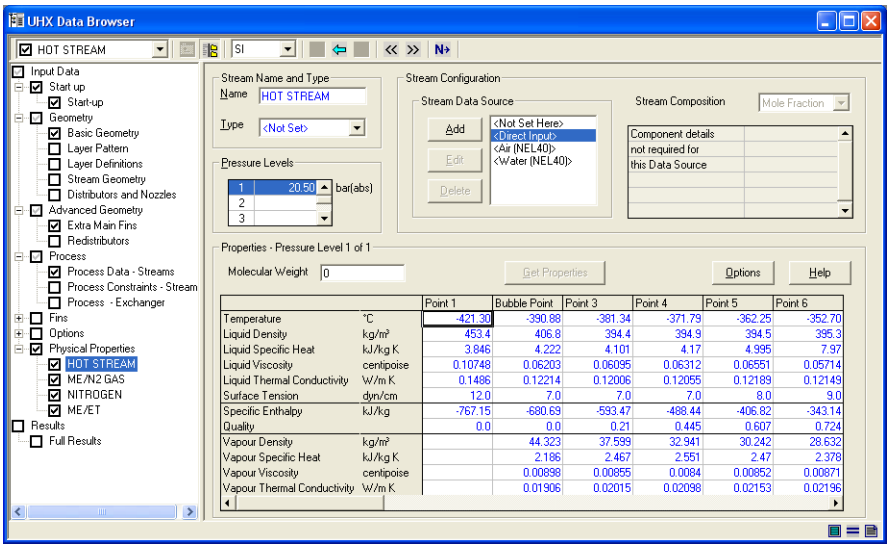
4. Finally, you will look briefly at the physical properties input by selecting **Physical Properties** from the **Input** menu or by clicking on the ***Physical Properties*** icon.

Physical Properties Icon

The initial screen, **Figure 1.8**, shows the top level information about each stream.

Depending on the type of physical property data you are working with, you can either enter the property data for the stream directly or enter data for components and allow UniSim® PFE to perform vapour liquid equilibrium and mixture calculations. All of the physical property data, are managed through this screen.

Figure 1.8



Since this is an existing case all the necessary data have already been entered.

5. Run UniSim® PFE by doing **one** of the following:

Run Icon

- Click on the ***Run*** icon in the Toolbar;
- Select the **Run** menu and then **Calculate All**;
- Press **<F4>**.

UniSim® PFE now displays a status window that reports progress of the run.

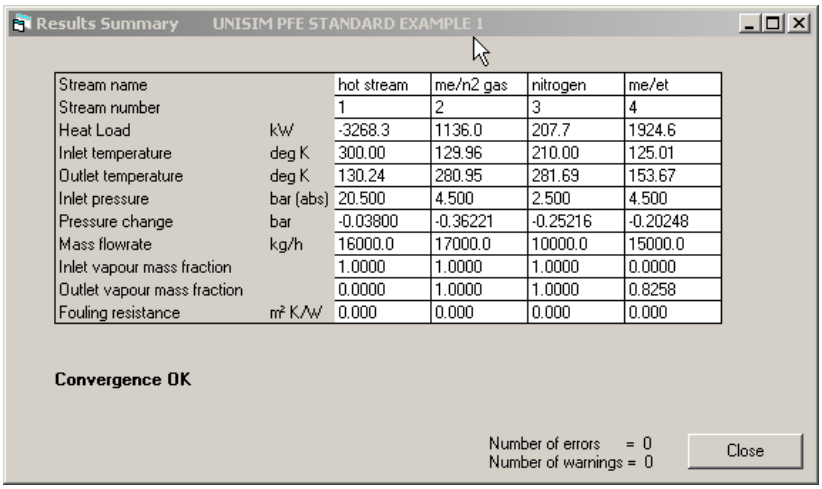
When the run completes there are three possible outcomes and corresponding outputs will be displayed.

- Successful run with no fatal errors and no warnings - a screen showing the **Results Summary** is displayed;
- Successful run with no fatal errors but with one or more warnings - the **Results Summary** is displayed together with a list of the warnings associated with the run;
- Failed run due to fatal errors - the **Error Log** is shown with a description of the errors that have occurred.

In this case you should see the **Results Summary** which shows the given stream inlet conditions, and the calculated stream

outlet conditions. See **Figure 1.9**.

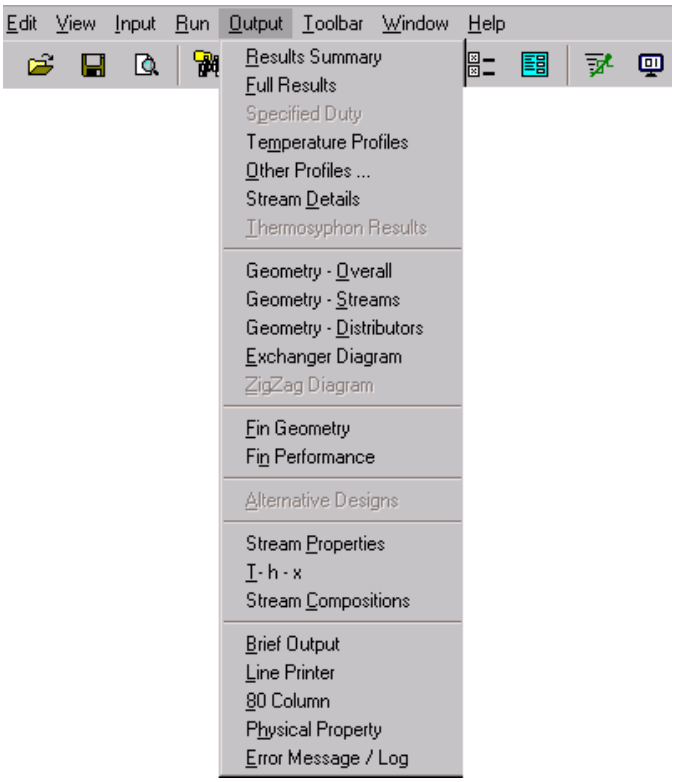
Figure 1.9



Stream name		hot stream	me/n2 gas	nitrogen	me/et
Stream number		1	2	3	4
Heat Load	kW	-3268.3	1136.0	207.7	1924.6
Inlet temperature	deg K	300.00	129.96	210.00	125.01
Outlet temperature	deg K	130.24	280.95	281.69	153.67
Inlet pressure	bar (abs)	20.500	4.500	2.500	4.500
Pressure change	bar	-0.03800	-0.36221	-0.25216	-0.20248
Mass flowrate	kg/h	16000.0	17000.0	10000.0	15000.0
Inlet vapour mass fraction		1.0000	1.0000	1.0000	0.0000
Outlet vapour mass fraction		0.0000	1.0000	1.0000	0.8258
Fouling resistance	m² K/W	0.000	0.000	0.000	0.000

There are many different outputs that can be viewed from the **Output** menu, as shown in **Figure 1.10**.

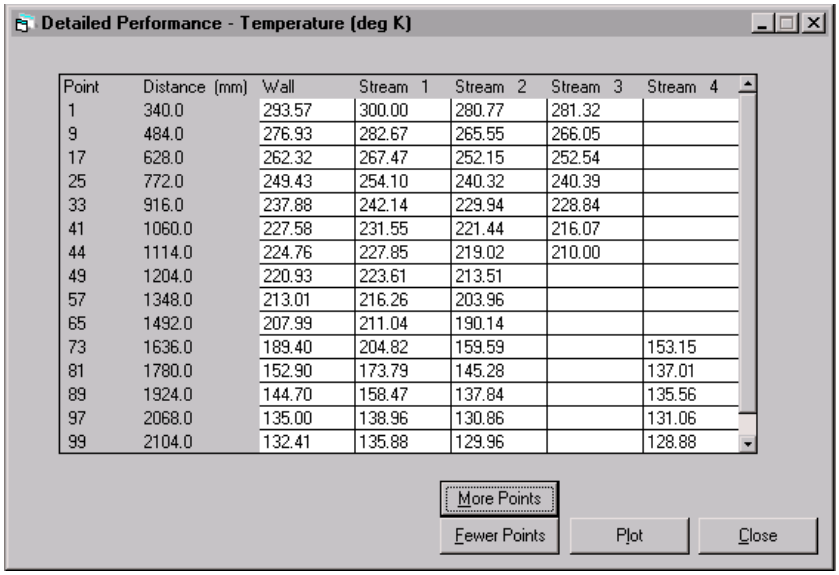
Figure 1.10



Notice from this menu the different types of output available. The first group of outputs are all special '**Windows**' outputs, that is to say they are special views of the data typically in the form of graphs or tables.

6. Select **Temperature Profiles** from the **Output** menu to see a table of the stream temperature (**Figure 1.11**). This could alert you to any unusual behaviour.

Figure 1.11



Point	Distance (mm)	Wall	Stream 1	Stream 2	Stream 3	Stream 4
1	340.0	293.57	300.00	280.77	281.32	
9	484.0	276.93	282.67	265.55	266.05	
17	628.0	262.32	267.47	252.15	252.54	
25	772.0	249.43	254.10	240.32	240.39	
33	916.0	237.88	242.14	229.94	228.84	
41	1060.0	227.58	231.55	221.44	216.07	
44	1114.0	224.76	227.85	219.02	210.00	
49	1204.0	220.93	223.61	213.51		
57	1348.0	213.01	216.26	203.96		
65	1492.0	207.99	211.04	190.14		
73	1636.0	189.40	204.82	159.59		153.15
81	1780.0	152.90	173.79	145.28		137.01
89	1924.0	144.70	158.47	137.84		135.56
97	2068.0	135.00	138.96	130.86		131.06
99	2104.0	132.41	135.88	129.96		128.88

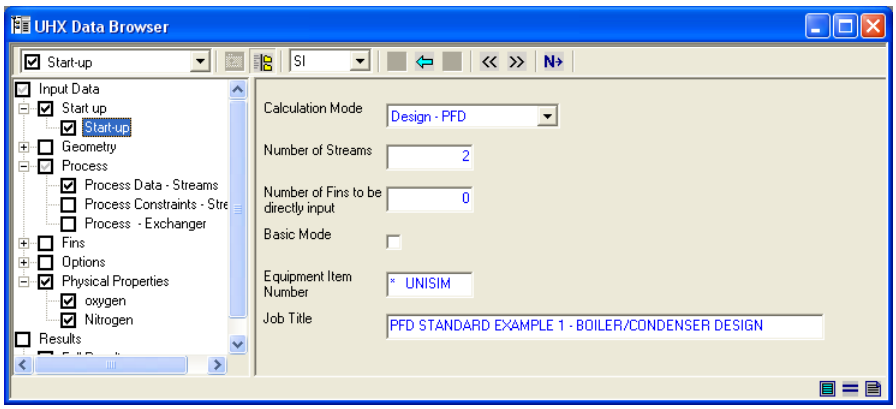
You will see there are other sets of outputs under the **Output** menu. The final group of outputs are files generated directly by the calculation engine. They are all text files and contain different aspects of results generated. Of these, the one that you are most likely to use is the **Lineprinter Output,** which contains all of the important information, should you want to retain output.

1.2 Example 2

In **Example 1** you will have seen that there is a lot of data that can be entered when simulating an exchanger. To design an exchanger requires much less data. For all calculation types you can reduce the amount of input you must consider by using **Basic Input Mode**.

1. Select **Open** from the **File** menu and select example **QPFD1.PFE1**. As this is a design case you will initially be shown the **Process** input (as shown in **Figure 1.7** for the previous example).
2. Open the **Start up** screen by selecting **Start up** from the **Input** menu.

Figure 1.12



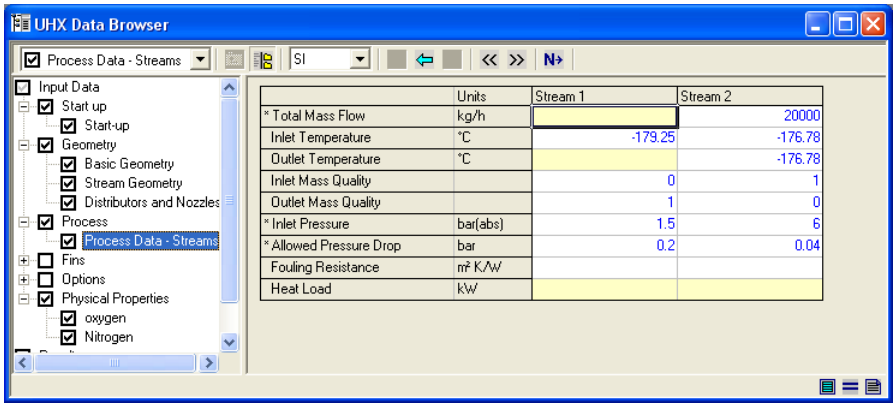
The **Start up** screen is also shown whenever you create a new file. It is here where you must specify the type of calculation that UniSim® PFE will perform. Notice that this is a **Design** case.

All the main input screens have keyboard short-cuts. For instance the Start up screen is <SHIFT>+<F1>; Physical Properties Data is <SHIFT>+<F12>.

3. Check the **Basic Mode** check-box. Then, select ***OK***.

You will now see the **Process Geometry** form again as shown in **Figure 1.13**. Notice that the amount of information displayed on the form has reduced, and that the view now has only one tab instead of three. This reduction of input fields is applied throughout the main input forms.

Figure 1.13

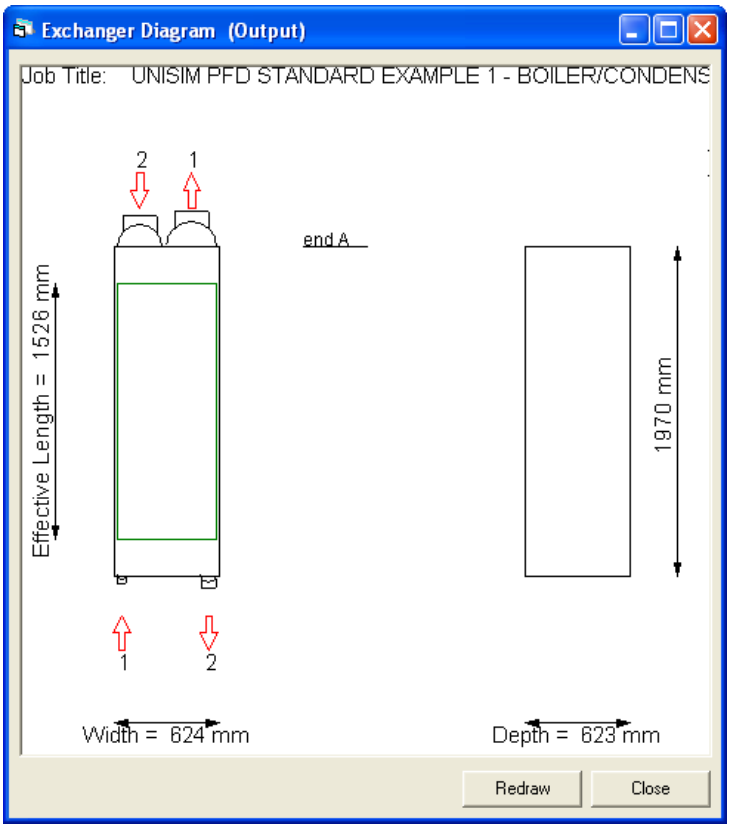


4. Look for **Geometry** under the **Input** menu. You will find it is greyed out. This is because in **Design** mode there is no need to specify any **Geometry** input.
5. If you go back to **Start up** under the **Input** menu, switch off **Basic** mode, and press **OK**, you will find you can access the **Geometry** input. Note that nearly all the items are blank.

If you **Run** this case, then look at the **Output** menu, you will see that the **Exchanger Diagram** can be requested. See **Figure 1.14**. This diagram is based on the results of the calculation, whereas the diagram shown when the previous example (UniSim® PFE Simulation) was started reflected the

input data initally supplied.

Figure 1.14



This concludes the **UniSim® PFE Getting Started** section. Continue examining UniSim® PFE **Input** and **Output** options on your own, or examine any of the other sample cases. Once you have completed your UniSim® PFE session, simply select the ***Exit*** icon or **Exit** from the **File** menu to close UniSim® PFE.

Exit Icon

2 QA Examples

A set of seven sample UniSim® PFE cases, including both input and output files are provided with UniSim® PFE for Quality Assurance (**QA**) purposes. As a check that you have installed UniSim® PFE correctly, you should run the input files and compare your results files with those provided.

UniSim® PFE files have a file extension **.PFEx** (where **x** is an indicator of the type of file (input or one of the various outputs). A full listing is given in the **Help Text**.

On installation, the QA files are stored in a subdirectory **QADATA** of the directory containing the main UniSim® PFE folder. The sample cases have file names **QPFE1, QPFE2 and QPFD1**, and file extensions **.QAx** instead of **.PFEx**. The different extensions are used to ensure that you cannot accidentally overwrite the QA files when running UniSim® PFE.

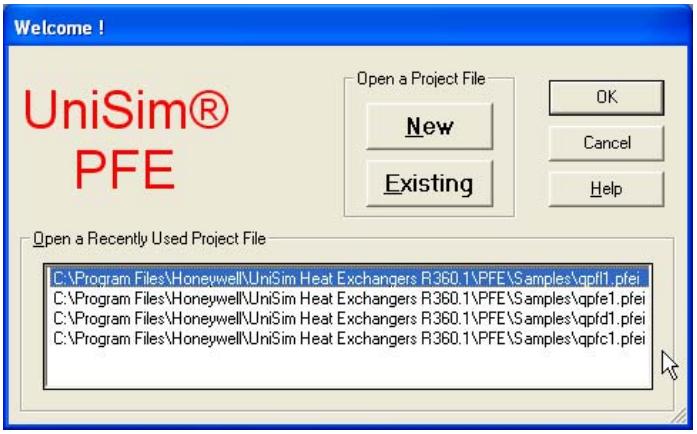
Copies of the QA input files, with the standard input file extension **.PFE** are also put in the **\UniSim Heat Exchangers Rxxx\UniSim PFE\Samples** directory by the installation procedure.

2.1 Creating Output for Comparison

Using the **QPFE1** example, a typical check on UniSim® PFE installation would be as follows:

1. Copy the **QPFE1.QAI** file from the **\UniSim Heat Exchangers Rxxx\UniSim PFE\QADATA** directory to some other directory, for example **\My Documents\My Heat Exchanger Cases**.
2. Rename the file, and give it the extension **.PFE** for example **MYTEST1.PFE**.
3. Start UniSim® PFE, you will see the opening screen, click on ***Existing*** and select **\My Documents\My Heat Exchanger Cases\MYTEST1.PFE**.
4. Run UniSim® PFE with this case.
5. Compare the results files from your run with the results files supplied with UniSim® PFE.
6. Checks may be repeated with the other QA files supplied.

Figure 2.1



2.2 Comparing Outputs

Your calculated results are files named **MYTEST1.PFEx**, in directory **\My Documents\My Heat Exchanger Cases** and these need to be compared with the supplied results files **QPFE1.QAx** in directory **\UniSim Heat Exchangers Rxxx\UniSim PFE\QADATA**.

Remember, the **QADATA** files supplied with UniSim® PFE have the extension .QAx.

The most important comparisons are the **.PFEV** and **.PFEL** files but other files can be compared as well. The **.PFEV** file is the **Brief Output** and is a relatively short file. You can do the comparison using a file difference utility, or by printing off the two files and looking for differences.

If the files are identical, (except for the run time and input file name recorded in the output), the QA check is successful. If the files differ slightly, but only in the fourth or fifth significant figure of one or two variables, the QA check on this example is also successful. If there are more significant differences, consult Honeywell.