Operating Instructions

STHE

Control Philosopy

The main function of the control program written in LabVIEW is to record the correct data that is collected during an experiment in the correct order and format.
However, in contrast to the control philosophy of the Plate and Frame Heat Exchanger test rig, in the case of the STHE rig, the temperature of the water in the Hot Utility Supply tank is controlled by the computer. As a consequence, in the case of the STHE rig, the heater in the Hot Utility Supply tank is only activated if the process is running whereas in the case of the PFHE rig the temperature control of the Hot Utility Supply tank can be switched on independently of the computer that is used to collect the relevant process data.

Furthermore, as a result of this difference, the most convenient way to have hot water in the Hot Utility Supply tank of the STHE rig is to firstly drain all the water from the tank and to then fill the tanks with hot water from the University supply. In the case of the PFHE the most convenient way to have hot water in the Hot Utility Supply tank is to simply switch the heater/temperature controller of the tank on about an half an hour prior to doing commence experiments.

Pre-Start Actions

Drain all the water from the Hot Utility Supply tank and then fill the tank with hot water from the University supply. After filling the tank, close the valves in the hot water supply line.
Check that the water levels in the hot and cold utility reservoirs. It must be close to the overflow levels.
Open an adequate water flow to the cold utility reservoir in order to keep it cold as heat is exchanged with the hot utility flow.
Check that the correct valves in the system are open or close to direct the utility flows as desired.
Open valves in the recycle lines to the reservoirs to ensure that there will be flow through the pumps when they are switched on.
Push on-switches of the pumps in. In contrast to the pumps of the PFHE rig, the pumps will only switch on when the LabVIEW control program is started. The control program will also switch the pumps off if the flow rate becomes less than about 2 lit/min.

Computer Actions

Start LabVIEW by clicking the pf_main button on the screen, not the button on the bottom bar

Open existing projects: C:\Users\user\Desktop\pf_main.vi. The interface screen view will open.
Set hot supply temperature to a value < 50
Click run arrow on top bar,

Set Group No.
Name experiment description
Select heat exchanger configuration. This has to agree with the physical flow configuration of the system. If it does not agree with the physical configuration, the wrong thermocouple readings are recorded by the control program.
Set cold water temperature – it is in actual fact not controlled since the refrigeration system has been removed but the control program requires that a value be set. The temperature of the Cold Utility Supply tank will eventually settle to a steady state value which is a function of the amount of heat being exchanged in the heat exchanger and the municipal water fed to the tank.
Set hot water temperature $30 < t_{Hot} < 50$.
Set cold water flow rate. This is the value that will be recorded, but actual control of the flow rates is done manually.
Set hot water flow rate and control it manually. As with the cold utility, this is the value that will be recorded, but actual control of the flow rates is done manually.
For fine control of the flows, adjusted the bypass valves between the pumps and the reservoirs and for course control, one of the ball valves to the heat exchanger can be adjusted.
Click record button
The file name on which the data will be stored is created automatically and stored in: C:\users\user\Documents\Labview Data\group

Operating Instructions

PFHE

Control Philosopy

The only function of the LabVIEW control program of the PFHE rig is to record the correct data that is collected during an experiment in the correct order and format. None of the process parameters such as temperatures or flow rates are controlled by the program.

The temperature of the water in the Hot Utility Supply tank is controlled by an independent Dixcell temperature controller, the temperature of the Cold Utility Supply tank settles to a steady state value depending on the heat being exchanged between the hot and cold utility streams and the amount of fresh water fed to the tank and the flow rates are controlled manually be adjusting appropriate valves in the system.

Pre-Start Actions

Check that the water levels in the hot and cold utility reservoirs. It must be close to the overflow levels.

Switch the Dixell temperature controller on about 30 minutes before experiments have to begin.

The temperature setting can be adjusted by pushing and holding the “SET” button depressed for 2 seconds. Once the degrees light begins to flash, adjust the set point up or down. Press the “SET” button again or wait ten seconds. A set point of 30°C is adequate and a set point of 35°C is more than adequate.

Open an adequate flow of fresh water to the cold utility reservoir in order to keep it cold as heat is exchanged with the hot utility flow.

Check that the correct valves in the system are open or close to direct the utility flows as desired.

Open valves in the recycle lines to the reservoirs to ensure that there will be flow through the pumps when they are switched on.

Push on-switches of the pumps in. In contrast to the pumps in the PFHE rig, the pumps will start to work even if the LabVIEW control program is not running.

Computer Actions

Start LabVIEW by clicking the pf_main button on the screen, not the button on the bottom bar

Open existing projects: C:\Users\user\Desktop\pf_main.vi. The interface screen view will open.

Set hot supply temperature to a value < 50

Click run arrow on top bar,

⇨

Set Group No.

Name experiment description

Select heat exchanger configuration. This has to agree with the physical flow configuration of the system. If it does not agree with the physical configuration, the wrong thermocouple readings are recorded by the control program.

Set cold water temperature – it is in actual fact not controlled since the refrigeration system has been removed but the control program requires that a value be set. The temperature of the Cold Utility Supply tank will eventually settle to a steady state value which is a function of the amount of heat being exchanged in the heat exchanger and the municipal water fed to the tank.

Set hot water temperature $30 < t_{Hot} < 50$. This has no actual function since the temperature of the water in the Hot Utility Supply tank is controlled by the Dixcell controller.

Set cold water flow rate. This is the value that will be recorded, but actual control of the flow rates is done manually.

Set hot water flow rate and control it manually. As with the cold utility, this is the value that will be recorded, but actual control of the flow rates is done manually.

For fine control of the flows, adjusted the bypass valves between the pumps and the reservoirs and for course control, one of the ball valves to the heat exchanger can be adjusted.

Click record button

The file name on which the data will be stored is created automatically and stored in: C:\users\user\Documents\Labview Data\group