HEAT EXCHANGER TEMPERATURE PREDICATION SPREADSHEET

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INTRODUCTION

It is frequently necessary to determine the performance of a particular heat exchanger under conditions of other than that for which it was designed. This spreadsheet permits the user to alter inlet conditions (temperature, flows) and determine new heat exchanger capacity (Btu/hr) and outlet temperatures. The equations used are based on Direct Calculation of Exchanger Exit Temperatures by J. T. Petrosky (Chemical Engineering, undated).

INPUT

1. Overall "U" (Btu/hr ft^2 ^oF). Overall heat transfer coefficient for the heat exchanger under design conditions.

2. Area (ft^2). Heat transfer area of the heat exchanger under consideration.

3. Entering temperature hot (^oF). Entering fluid temperature on the "hot" side of the heat exchanger.

4. Entering temperature cold (^oF). Entering fluid temperature on the "cold" side of the heat exchanger.

5. Flow rate cold (gpm). Fluid flow rate on the "hot" side of the heat exchanger. This value must not be exactly the same as the value in Input #6. If equal flows are to be analyzed, input a value which is slightly (.0001) larger or smaller than Input #6.

6. Flow rate cold (gpm). Fluid flow rate on the "cold" side of the heat exchanger. This value must not be exactly the same as the value in Input #5. If equal flows are to be analyzed, input a value which is slightly (.0001) larger or smaller than Input #5.

7. Specific gravity hot. Specific gravity of the "hot" side fluid. Evaluate at the average of the entering and leaving temperatures.

8. Specific gravity cold. Specific gravity of the "cold" side fluid. Evaluate at the average of the entering and leaving temperatures.

9. Specific heat hot (Btu/lb ^oF). Specific heat of the "hot" side fluid. Evaluate at the average of entering and leaving temperatures.

10. Specific heat cold (Btu/lb ^oF). Specific heat of the "cold" side fluid. Evaluate at the average of entering and leaving temperatures.

OUTPUT

1. Hot side entering and leaving temperatures (°F).

2. Cold side entering and leaving temperatures (°F).

3. Heat exchanger capacity (Btu/hr).

This spreadsheet can be used to alter any individual input parameters to examine its impact upon heat exchanger performance. It is important to bear in mind that the calculations assume that all other values remain unchanged. In reality, if temperature or flows are altered, this would have an impact upon overall U. To assure this issue, the spreadsheet including a secondary calculation in which the exchanger original design flow rate can be entered along with a new (revised) flow. The spreadsheet then calculates the resulting drop in overall U for the exchanger. This value must be manually entered at Input #1 if the user wishes to use it in a simulation. It is important to note that all exchanger respond differently to reduced flow. The calculation assumes average response for a plate-type exchanger.

Examples

Assume a system redesign makes 150° supply hot water available to a heat exchanger which previously operated on 135°. What would be the impact upon leaving cold water temperature and capacity?

Before

INPUT

1.	Overall "U"	800.00	Btu/hr sq ft F
2.	Area	8.90	sq ft
3.	Entering temp hot	135.00	F
4.	Entering temp cold	110.00	F
5.	Flow rate hot	8.00	gpm
6.	Flow rate cold	10.30	gpm
7.	Specific gravity hot	1.00	
8.	Specific gravity cold	1.00	
9.	Specific heat hot	1.00	Btu/lb F
10.	Specific heat cold	1.00	

OUTPUT	In	Out
Hot side	135.00	117.83
Cold side	110.00	123.32

Capacity - 68,428 Btu/hr

After

INPUT

1.	Overall "U"	800.00 Btu/hr sq ft F
2.	Area	8.90 sq ft
3.	Entering temp hot	150.00 F
4.	Entering temp cold	110.00 F
5.	Flow rate hot	8.00 gpm
6.	Flow rate cold	10.30 gpm
7.	Specific gravity hot	1.00
8.	Specific gravity cold	1.00
9.	Specific heat hot	1.00 Btu/lb F
10.	Specific heat cold	1.00 Btu/lb F

OUTPUT	In	Out
Hot side	150.00	122.54
Cold side	110.00	131.31

Capacity - 109,485 Btu/hr

Assume that the available hot flow rate of the heat exchanger is reduced to 50% of its original ("before" case above). How would this impact capacity and leaving cold side temperature?

After

INPUT

1.	Overall "U"	645.00 Btu/hr sq ft F
2.	Area	8.90 sq ft
3.	Entering temp hot	135.00 F
4.	Entering temp cold	110.00 F
5.	Flow rate hot	4.00 gpm
6.	Flow rate cold	10.30 gpm
7.	Specific gravity hot	1.00
8.	Specific gravity cold	1.00
9.	Specific heat hot	1.00 Btu/lb F
10.	Specific heat cold	1.00 Btu/lb F

OUTPUT	In	Out
Hot side	135.00	112.82
Cold side	110.00	118.6

Capacity - 44,203 Btu/hr

REFERENCE

Petrosky, J. T., undated. "Direct Calculation of Exchanger Exit Temperatures Calculation and Shortcut Deskbook," McGraw-Hill, Inc., New York.