

## Using CTHE

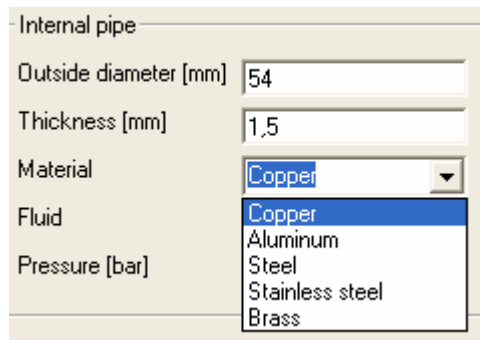
CTHE is a simple but powerful tool for the design of a concentric tube heat exchanger (tube in tube heat exchanger) or a coaxial heat exchanger. It can estimate the capacity of the exchanger and it can evaluate the required surface. It can also help for giving a reference model for more advanced heat exchangers.

CTHE allows the use of several common liquids and refrigerants, plus user defined fluid.

CTHE is dedicated to the single-phase thermal exchange (liquid or gas/vapor).

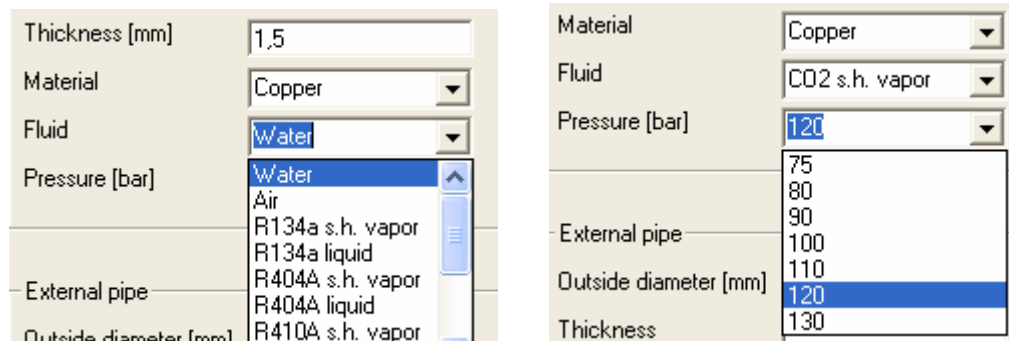
### Description

#### 1- Internal tube



Here you can enter the diameter, the thickness of the internal tube of the concentric heat exchanger. You can also select the material of the internal tube.

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Then you can select the fluid, and the absolute pressure. For liquids, only pressure of 1 bar is available. For refrigerants, *s.h.* means superheated vapor. No condensation or evaporation is admitted. For vapors and gases, enter the actual absolute pressure.

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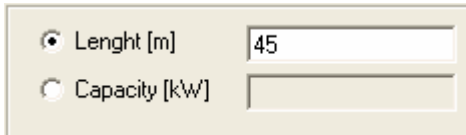


Here you enter inlet temperature of internal medium, and you have the option to select outlet temperature or mass flow.

## 2- External tube (annulus)

The menu for external pipe is the same as internal one, but it is not required to specify the material of the tube (the calculation assumes adiabatic conditions).

## 3- Length / Capacity

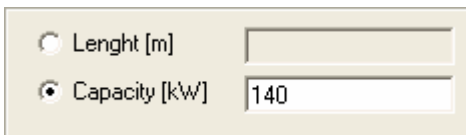


☒ Length [m] 45

☐ Capacity [kW]

If length option is selected, the program verifies the effective capacity that can be exchanged with this length of tube and the respective surface.

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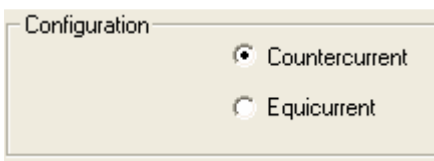


☐ Length [m]

☒ Capacity [kW] 140

If capacity option is selected, the program computes the necessary length for exchanging the required capacity.

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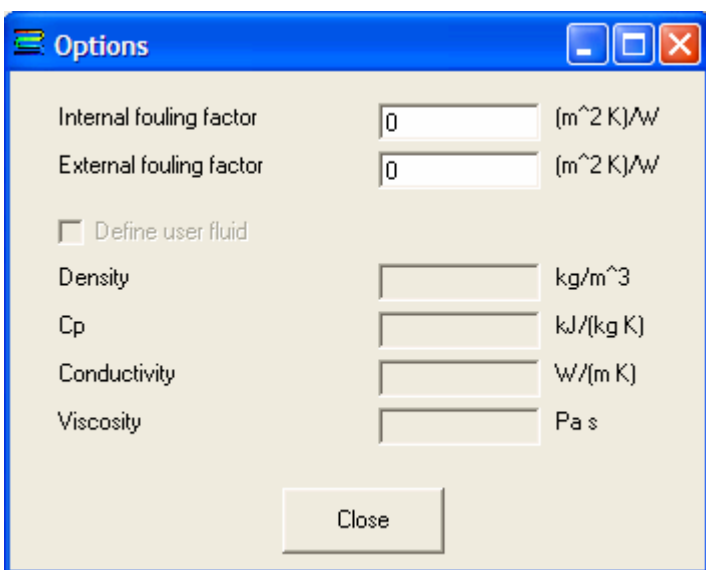
Configuration

☒ Countercurrent

☐ Equicurrent

Here countercurrent or equicurrent flow can be selected.

## 4- Options



**Options**

Internal fouling factor 0 (m<sup>2</sup> K)/W

External fouling factor 0 (m<sup>2</sup> K)/W

☐ Define user fluid

Density kg/m<sup>3</sup>

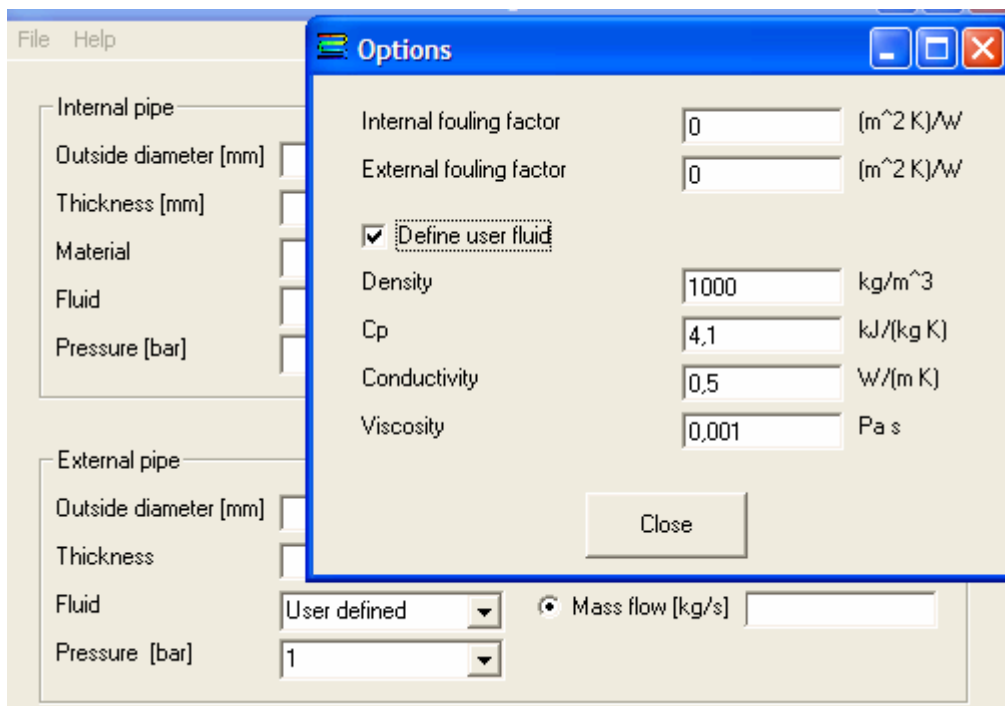
Cp kJ/(kg K)

Conductivity W/(m K)

Viscosity Pa s

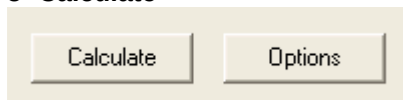
Close

Pushing *Options* button, this window appears, where fouling factors can be entered. If the selected fluid is *User defined*, the following area will be enabled:



Clicking *Define user fluid* will let you enter the properties of a new fluid. Only liquid or gas properties can be entered (no vapors). Clicking *Close* the fluid's data will be saved, also for further use.

## 5- Calculate



Eventually, pushing *Calculate* button, the program computes the balance of energy and the heat transfer coefficient, and the results are showed in the following window:

|                           |                      | INTERNAL PIPE  | EXTERNAL PIPE |
|---------------------------|----------------------|----------------|---------------|
| Outside diameter          | mm                   | 48,3           | 88,9          |
| Thickness                 | mm                   | 4,1            | 5,45          |
| Material                  |                      | Steel          |               |
| Fluid                     |                      | Methanol 40%   | Acetone       |
| Pressure                  | bar                  | 1              | 1             |
| Temp in                   | °C                   | 65,6           | 10            |
| Temp out                  | °C                   | 26,7           | 34,554        |
| Mass flow                 | kg/s                 | 1,258          | 3,15          |
| Velocity                  | m/s                  | 1,101          | 1,34          |
| Pressure drop             | kPa                  | 23,153         | 38,934        |
| Fouling factor            | (m <sup>2</sup> K)/W | 0,0003522      | 0             |
| Reynolds number           |                      | 38163          | 92536         |
| Capacity                  | kW                   | <b>178,322</b> |               |
| Surface                   | m <sup>2</sup>       | 10,045         |               |
| Lenght                    | m                    | 66,2           |               |
| Heat transfer coefficient | W/(m <sup>2</sup> K) | 767            |               |
| Configuration             |                      | Contercurrent  |               |
| <div>Close</div>          |                      |                |               |

*Pressure drop* considers only losses in the pipes and not in the discontinuities (local pressure drops).

## **6- Printing / Saving / Opening a file**

The calculation can be printed selecting in the menu *File > Print* and saved in a file *\*.cth* selecting *File > Save*.

Once saved, the calculation can be opened with the command *File > Open*.

In order to initialize the input data, the command *File > New* can be used.