

## Model of the absorber

The only model parameter is the temperature of the absorber

The input data of the model are as follows (provided by other system components):

- The pressure of the absorber
- The flow-rate of incoming processes (the refrigerant and the weak solution)
- The concentration of the weak solution
- The temperature of the weak solution

The outputs are:

- The thermal load of the absorber
- The concentration of the rich solution
- The flow-rate of the rich solution

## Graphical interface of the absorber

A graphical interface for the absorber can be deduced (Figure 1). It allows you to build the lower left of the screen, the rest being defined as a Thermoptim standard.

The input data is provided by the other components of the global model: the flow of refrigerant, set by the upstream process "refrigerant" here is 0.93 kg / s, the pressure of the absorber (point "refrigerant") is equal to 0.00872 bar, corresponding to an evaporation temperature of 5 ° C, and the flow and concentration of the weak solution (11.06 kg / s and 0.354).

node: absorber      type: external mixer

main process: rich solution      display      m global: 11.99      h global: 110.28271305      T global: 40.7

☐ iso-pressure

process name	m abs	T (°C)	H
refrigerant	0.93	5	2,510.78
weak solution	11.06	61	181.03

Absorber      absorber

absorber temperature (°C): 40.700

Poor solution fraction: 0.354

absorber load: -3014.893

Rich solution fraction: 0.414

Buttons: Duplicate, Suppress, Save, Close, links, Calculate, add a branch, delete a branch

Figure 1: GUI of the absorber

## Thermodynamic model

The model equations are obtained as follows, the thermodynamic fluid being defined by its own model.

The weak solution is sprayed into rain and washes the refrigerant vapor at low pressure, which is absorbed, releasing its heat of condensation and heat of dilution.

This heat  $Q_{abs}$  is extracted, cooling water which then cools the condenser.

With the assumption that the absorber is at constant temperature  $T_{abs}$  and the rich solution is saturated, the equations of the absorber are:

The equation for saturation vapor pressure of the solution  $P_{abs} = P(x_{sr}, T_{abs})$  provides the concentration of the rich saturated solution and therefore its enthalpy  $h_{srD} = h(x_{sr}, T_{abs})$ .

The conservation of mass  $m_{sr} = m_r + m_{sp}$  provides  $m_{sr}$ .

Conservation of enthalpy gives  $Q_{abs}$ :

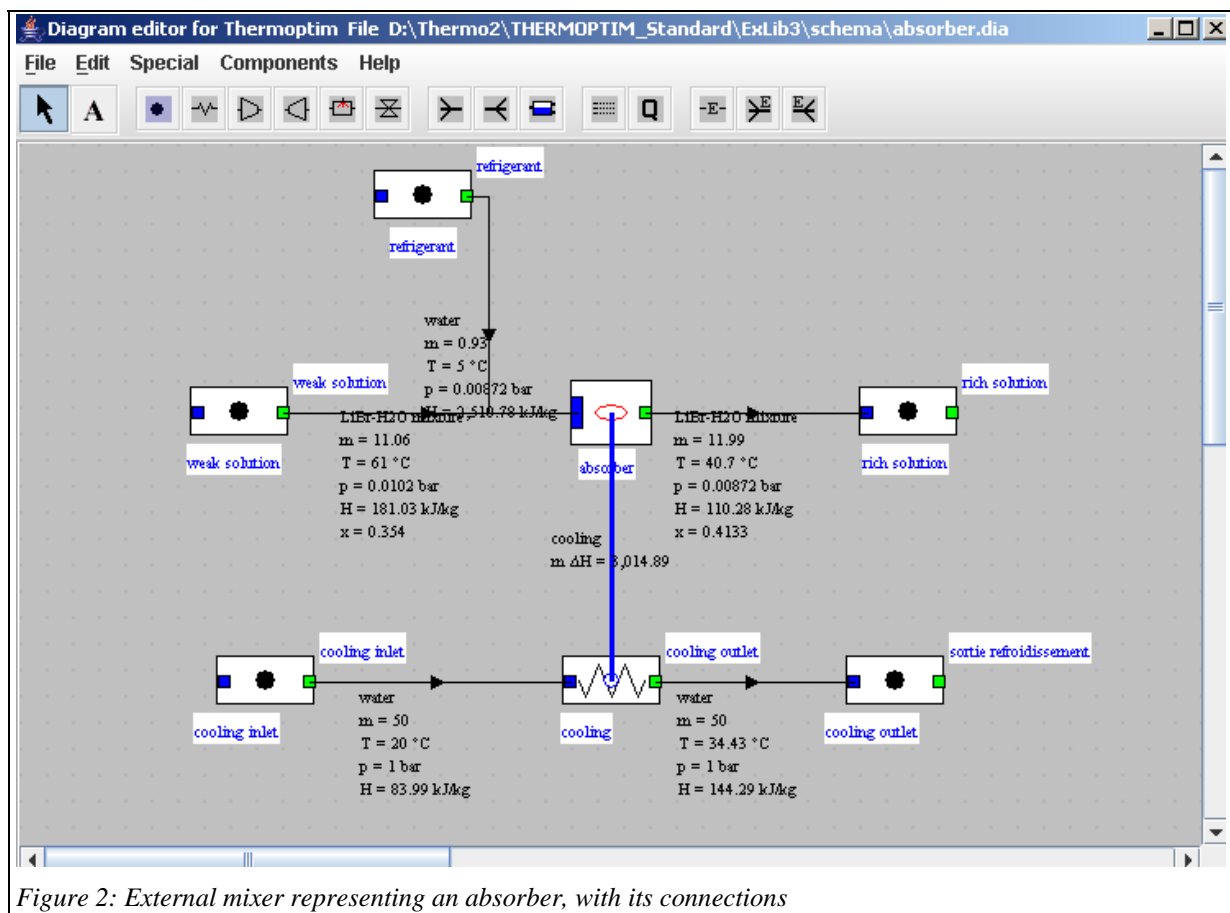
$$m_r h_{r1} + m_{sp} h_{spE} = m_{sr} h_{srD} + Q_{abs}$$


Figure 2: External mixer representing an absorber, with its connections

**Sequence of calculations**

In practice, the sequence of calculations is as follows:

- 1) consistency checking and updating of the node before calculation
- 2) reading of  $T_{\text{abs}}$  on the screen of the external node
- 3) Reverse  $P_{\text{abs}} = P(x_{\text{sr}}, T_{\text{abs}})$  to get  $x_{\text{sr}}$
- 4) flow-rate calculation
- 5) calculation of the heat load  $Q_{\text{abs}}$
- 6) updating of processes connected to the external node
- 7) update and calculation of the associated thermocoupler