Software Information

TESPy Version:	0.4.3 - dev
Commit:	b8e11e11@dev
CoolProp version:	6.4.0
Python version:	3.7.6 (default, Jan 8 2020, 20:23:39) [MSC v.1916 64 bit (AMD64)]
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1 Connections in design mode

1.1 Specified connection parameters

label	p in bar (1)	T in °C (2)
consumer back flow:out1_district heating pump:in1	10.000	50.000
condenser:out2_consumer:in1	-	90.000
ambient air:out1_pump:in1	1.000	8.000
evaporator:out1_sink ambient 1:in1	1.000	4.000
intercooler:out2_sink ambient 2:in1	-	10.000

Table 1: Specified connection parameters

1.2 Equations applied

$$0 = p - p_{\mathrm{spec}} \tag{1}$$

$$0 = T\left(p, h\right) - T_{\mathrm{spec}} \tag{2}$$

1.3 Specified fluids

label	NH3 (3)	air (4)	water (5)
coolant cycle closer:out1_condenser:in1	1.000	0.000	0.000
consumer back flow:out1_district heating pump:in1	0.000	0.000	1.000
ambient air:out1_pump:in1	0.000	0.000	1.000

Table 2: Specified fluids

1.4 Equations applied

$$0 = x_{\mathrm{NH3}} - x_{\mathrm{NH3,spec}} \tag{3}$$

$$0 = x_{\mathrm{air}} - x_{\mathrm{air,spec}} \tag{4}$$

$$0 = x_{\mathrm{water}} - x_{\mathrm{water,spec}} \tag{5}$$

1.5 Referenced values for mass flow

label	reference	factor in -	delta in $^{\mathrm{kg}}/_{\mathrm{s}}$
evaporator reciculation pump:out1_evaporator:in2	valve:out1_drum:in1	1.250	0

Table 3: Referenced values for mass flow

1.6 Equation applied

$$0 = \mathrm{value} - \mathrm{value}_{\mathrm{ref}} \cdot \mathrm{factor} + \mathrm{delta} \tag{6}$$

1.7 Referenced values for pressure

label	reference	factor in -	delta in bar
consumer:out1_consumer feed flow:in1	consumer back flow:out1_district heating pump:in1	1	0

Table 4: Referenced values for pressure

1.8 Equation applied

$$0 = \text{value} - \text{value}_\text{ref} \cdot \text{factor} + \text{delta} \tag{7}$$

1.9 Referenced values for enthalpy

label	reference	factor in -	delta in $^\text{kJ}/_\text{kg}$
consumer:out1_consumer feed flow:in1	consumer back flow:out1_district heating pump:in1	1	0

Table 5: Referenced values for enthalpy

1.10 Equation applied

$$0 = \text{value} - \text{value}_\text{ref} \cdot \text{factor} + \text{delta} \tag{8}$$

2 User defined equations in design mode

3 Components in design mode

3.1 Components of type CycleCloser

3.1.1 Mandatory constraints

$$0 = p_{\text{in},i} - p_{\text{out},i} \; \forall i \in [1] \tag{9}$$

$$0 = h_{\text{in},i} - h_{\text{out},i} \; \forall i \in [1] \tag{10}$$

3.2 Components of type Condenser

3.2.1 Mandatory constraints

$$0 = \dot{m}_{\text{in},i} - \dot{m}_{\text{out},i} \; \forall i \in [1, 2] \tag{11}$$

$$0 = x_{fl,\text{in},i} - x_{fl,\text{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1, 2] \tag{12}$$

$$0 = \dot{m}_{\text{in},1} \cdot (h_{\text{out},1} - h_{\text{in},1}) + \dot{m}_{\text{in},2} \cdot (h_{\text{out},2} - h_{\text{in},2}) \tag{13}$$

3.2.2 Inputs specified

label	ttd_u (14)	pr1 (15)	pr2 (16)	subcooling (17)
condenser	5.000	0.990	0.990	True

Table 6: Parameters of components of type Condenser

3.2.3 Equations applied

$$0 = ttd_\mathrm{u} - T_\mathrm{sat}\left(p_\mathrm{in,1}\right) + T_\mathrm{out,2} \tag{14}$$

$$0 = p_\mathrm{in,1} \cdot pr1 - p_\mathrm{out,1} \tag{15}$$

$$0 = p_\mathrm{in,2} \cdot pr2 - p_\mathrm{out,2} \tag{16}$$

$$0 = h_\mathrm{out,1} - h\left(p_\mathrm{out,1}, x = 0\right) \tag{17}$$

3.3 Components of type Pump

3.3.1 Mandatory constraints

$$0 = \dot{m}_{\mathrm{in},i} - \dot{m}_{\mathrm{out},i} \; \forall i \in [1] \tag{18}$$

$$0 = x_{fl,\mathrm{in},i} - x_{fl,\mathrm{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1] \tag{19}$$

3.3.2 Inputs specified

label	eta_s (20)
district heating pump	0.800
evaporator reciculation pump	0.800
pump	0.750

Table 7: Parameters of components of type Pump

3.3.3 Equations applied

$$0 = -\left(h_\mathrm{out} - h_\mathrm{in}\right) \cdot \eta_\mathrm{s} + \left(h_\mathrm{out,s} - h_\mathrm{in}\right) \tag{20}$$

3.4 Components of type HeatExchangerSimple

3.4.1 Mandatory constraints

$$0 = \dot{m}_{\mathrm{in},i} - \dot{m}_{\mathrm{out},i} \; \forall i \in [1] \tag{21}$$

$$0 = x_{fl,\mathrm{in},i} - x_{fl,\mathrm{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1] \tag{22}$$

3.4.2 Inputs specified

label	pr (23)
consumer	0.990

Table 8: Parameters of components of type HeatExchangerSimple

3.4.3 Equations applied

$$0 = p_{\mathrm{in},1} \cdot pr - p_{\mathrm{out},1} \tag{23}$$

3.5 Components of type Valve

3.5.1 Mandatory constraints

$$0 = \dot{m}_{\mathrm{in},i} - \dot{m}_{\mathrm{out},i} \; \forall i \in [1] \tag{24}$$

$$0 = x_{fl,\mathrm{in},i} - x_{fl,\mathrm{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1] \tag{25}$$

$$0 = h_{\mathrm{in},i} - h_{\mathrm{out},i} \; \forall i \in [1] \tag{26}$$

3.6 Components of type Drum

3.6.1 Mandatory constraints

$$0 = \sum \dot{m}_{\mathrm{in},i} - \sum \dot{m}_{\mathrm{out},j} \; \forall i \in \mathrm{inlets}, \forall j \in \mathrm{outlets} \tag{27}$$

$$0 = x_{fl,\mathrm{in},1} - x_{fl,\mathrm{out},j} \; \forall fl \in \text{network fluids}, \forall j \in \text{outlets} \tag{28}$$

$$0 = \sum_i \left(\dot{m}_{\mathrm{in},i} \cdot h_{\mathrm{in},i}\right) - \sum_j \left(\dot{m}_{\mathrm{out},j} \cdot h_{\mathrm{out},j}\right) \; \forall i \in \mathrm{inlets} \; \forall j \in \mathrm{outlets} \tag{29}$$

$$\begin{split} 0 = p_{\mathrm{in},1} - p_{\mathrm{in},i} \; \forall i \in \mathrm{inlets} \setminus \{1\} \\ 0 = p_{\mathrm{in},1} - p_{\mathrm{out},j} \; \forall j \in \mathrm{outlets} \end{split} \tag{30}$$

$$\begin{split} 0 =& h_{\mathrm{out},1} - h\left(p_{\mathrm{out},1}, x = 0\right) \\ 0 =& h_{\mathrm{out},2} - h\left(p_{\mathrm{out},2}, x = 1\right) \end{split} \tag{31}$$

3.7 Components of type HeatExchanger

3.7.1 Mandatory constraints

$$0 = \dot{m}_{\mathrm{in},i} - \dot{m}_{\mathrm{out},i} \; \forall i \in [1, 2] \tag{32}$$

$$0 = x_{fl,\mathrm{in},i} - x_{fl,\mathrm{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1, 2] \tag{33}$$

$$0 = \dot{m}_{\mathrm{in},1} \cdot \left(h_{\mathrm{out},1} - h_{\mathrm{in},1}\right) + \dot{m}_{\mathrm{in},2} \cdot \left(h_{\mathrm{out},2} - h_{\mathrm{in},2}\right) \tag{34}$$

3.7.2 Inputs specified

label	ttd_u (35)	ttd_l (36)	pr1 (37)	pr2 (38)
evaporator	-	5.000	0.980	0.990
superheater	2.000	-	0.980	0.990
intercooler	-	-	0.990	0.980

Table 9: Parameters of components of type HeatExchanger

3.7.3 Equations applied

$$0 = ttd_{\mathrm{u}} - T_{\mathrm{in},1} + T_{\mathrm{out},2} \tag{35}$$

$$0 = ttd_{\mathrm{l}} - T_{\mathrm{out},1} + T_{\mathrm{in},2} \tag{36}$$

$$0 = p_{\mathrm{in},1} \cdot pr1 - p_{\mathrm{out},1} \tag{37}$$

$$0 = p_{\mathrm{in},2} \cdot pr2 - p_{\mathrm{out},2} \tag{38}$$

3.8 Components of type Splitter

3.8.1 Mandatory constraints

$$0 = \sum \dot{m}_{\mathrm{in},i} - \sum \dot{m}_{\mathrm{out},j} \; \forall i \in \mathrm{inlets}, \forall j \in \mathrm{outlets} \tag{39}$$

$$0 = x_{fl,\mathrm{in}} - x_{fl,\mathrm{out},j} \; \forall fl \in \text{network fluids}, \forall j \in \mathrm{outlets} \tag{40}$$

$$0 = h_{in} - h_{\mathrm{out},j} \; \forall j \in \mathrm{outlets} \tag{41}$$

$$\begin{split} 0 = p_{\mathrm{in},1} - p_{\mathrm{in},i} \; \forall i \in \mathrm{inlets} \setminus \{1\} \\ 0 = p_{\mathrm{in},1} - p_{\mathrm{out},j} \; \forall j \in \mathrm{outlets} \end{split} \tag{42}$$

3.9 Components of type Compressor

3.9.1 Mandatory constraints

$$0 = \dot{m}_{\mathrm{in},i} - \dot{m}_{\mathrm{out},i} \; \forall i \in [1] \tag{43}$$

$$0 = x_{fl,\mathrm{in},i} - x_{fl,\mathrm{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1] \tag{44}$$

3.9.2 Inputs specified

label	eta_s (45)	pr (46)
compressor 1	0.900	-
compressor 2	0.900	3.000

Table 10: Parameters of components of type Compressor

3.9.3 Equations applied

$$0 = -\left(h_{\mathrm{out}} - h_{\mathrm{in}}\right) \cdot \eta_{\mathrm{s}} + \left(h_{\mathrm{out,s}} - h_{\mathrm{in}}\right) \tag{45}$$

$$0 = p_{\mathrm{in},1} \cdot pr - p_{\mathrm{out},1} \tag{46}$$

4 Busses in design mode

4.1 Bus "total compressor power"

This bus is used for postprocessing only.

label	$\dot{E}_\mathrm{comp}$	$\dot{E}_\mathrm{bus}$	η
compressor 1	$\dot{m}_\mathrm{in} \cdot (h_\mathrm{out} - h_\mathrm{in})$	$\dot{E}_\mathrm{comp} \cdot \eta$	$f\left(X\right)$ (1)
compressor 2	$\dot{m}_\mathrm{in} \cdot (h_\mathrm{out} - h_\mathrm{in})$	$\dot{E}_\mathrm{comp} \cdot \eta$	$f\left(X\right)$ (2)
pump	$\dot{m}_\mathrm{in} \cdot (h_\mathrm{out} - h_\mathrm{in})$	$\dot{E}_\mathrm{comp} \cdot \eta$	$f\left(X\right)$ (3)
district heating pump	$\dot{m}_\mathrm{in} \cdot (h_\mathrm{out} - h_\mathrm{in})$	$\dot{E}_\mathrm{comp} \cdot \eta$	$f\left(X\right)$ (4)
evaporator reciculation pump	$\dot{m}_\mathrm{in} \cdot (h_\mathrm{out} - h_\mathrm{in})$	$\dot{E}_\mathrm{comp} \cdot \eta$	$f\left(X\right)$ (5)

Table 11: total compressor power

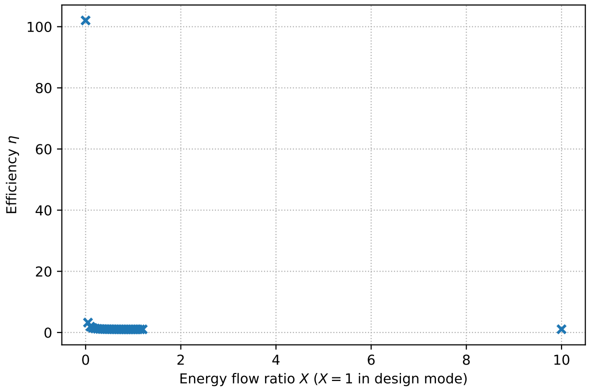

Figure 1: Bus efficiency characteristic

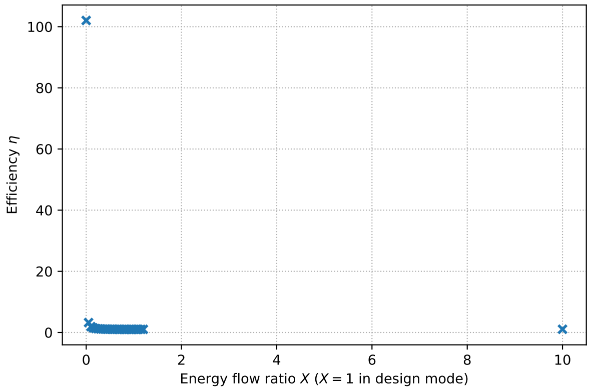

Figure 2: Bus efficiency characteristic

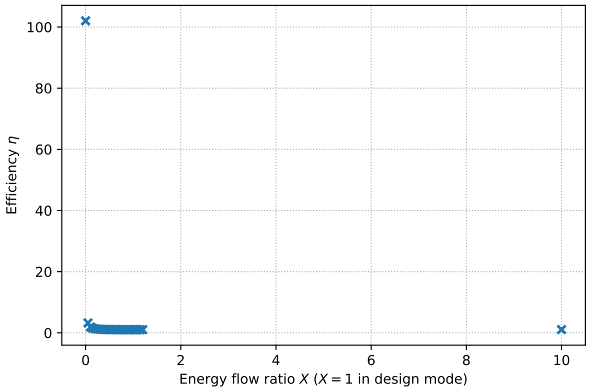

Figure 3: Bus efficiency characteristic

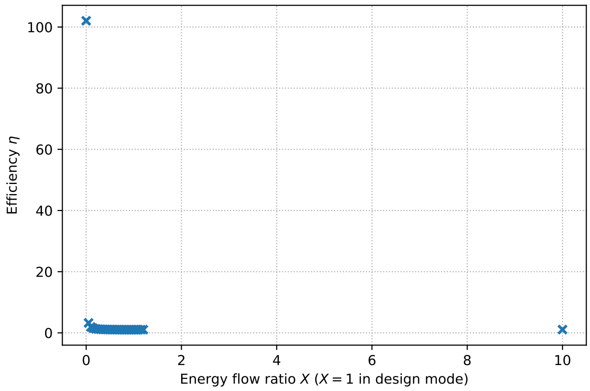

Figure 4: Bus efficiency characteristic

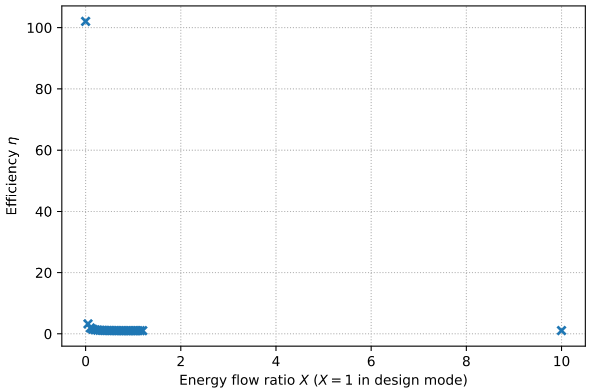

Figure 5: Bus efficiency characteristic

4.2 Bus "total delivered heat"

Specified total value of energy flow: $\dot{E}_{\mathrm{bus}} = -2240000.000\,\mathrm{W}$

$$0 = \dot{E}_{\mathrm{bus}} - \sum_i \dot{E}_{\mathrm{bus},i} \tag{47}$$

label	$\dot{E}_{\mathrm{comp}}$	$\dot{E}_{\mathrm{bus}}$	η
condenser	$\dot{m}_{\mathrm{in},1} \cdot (h_{\mathrm{out},1} - h_{\mathrm{in},1})$	$\dot{E}_{\mathrm{comp}} \cdot \eta$	1.000

Table 12: total delivered heat