Software Information

- Please check, whether your inputs, the equations applied and the charactersitics are displayed correctly.
- You are welcome to send your feedback via `https://github.com/oemof/tespy/issues`.
- LaTeXpackages required are:
  - graphicx
  - float
  - hyperref
  - booktabs
  - amsmath
  - units
  - cleveref
- To supress these messages, call the model documentation with the keyword draft=False.

TESPy Version:	0.4.0 - dev
Commit:	d918f10d@feature/self_documenting_models
CoolProp version:	6.4.0
Python version:	3.8.0 (default, Oct 28 2019, 16:14:01) [GCC 8.3.0]

1 Connections in design mode

1.1 Specified connection parameters

label	p in bar (1)	T in °C (2)
consumer cycle closer:out1_district heating pump:in1	10.000	60.000
condenser:out2_consumer:in1	-	90.000
ambient air:out1_pump:in1	2.000	12.000
evaporator:out1_sink ambient 1:in1	2.000	9.000
intercooler:out2_sink ambient 2:in1	-	30.000

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 cycle closer: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

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

2 Components in design mode

2.1 Components of type CycleCloser

2.1.1 Mandatory constraints

$$0 = p_{\mathrm{in},i} - p_{\mathrm{out},i} \; \forall i \in [1] \tag{7}$$

$$0 = h_{\mathrm{in},i} - h_{\mathrm{out},i} \; \forall i \in [1] \tag{8}$$

2.2 Components of type Condenser

2.2.1 Mandatory constraints

$$0 = \dot{m}_{\mathrm{in},i} - \dot{m}_{\mathrm{out},i} \; \forall i \in [1,2] \tag{9}$$

$$0 = x_{fl,\mathrm{in},i} - x_{fl,\mathrm{out},i} \; \forall fl \in \text{network fluids}, \, \forall i \in [1,2] \tag{10}$$

$$0 = \dot{m}_{\mathrm{in},1} \cdot \left(h_{\mathrm{out},1} - h_{\mathrm{in},1}\right) + \dot{m}_{\mathrm{in},2} \cdot \left(h_{\mathrm{out},2} - h_{\mathrm{in},2}\right) \tag{11}$$

2.2.2 Inputs specified

label	ttd_u (12)	pr1 (13)	pr2 (14)	subcooling (15)
condenser	5.000	0.990	0.990	True

Table 4: Parameters of components of type Condenser

2.2.3 Equations applied

$$0 = ttd_{\mathrm{u}} - T_{\mathrm{sat}}\left(p_{\mathrm{in},1}\right) + T_{\mathrm{out},2} \tag{12}$$

$$0 = p_{\mathrm{in},1} \cdot pr1 - p_{\mathrm{out},1} \tag{13}$$

$$0 = p_{\mathrm{in},2} \cdot pr2 - p_{\mathrm{out},2} \tag{14}$$

$$0 = h_{\mathrm{out},1} - h\left(p_{\mathrm{out},1}, x = 0\right) \tag{15}$$

2.3 Components of type Pump

2.3.1 Mandatory constraints

$$0 = \dot{m}_{\mathrm{in},i} - \dot{m}_{\mathrm{out},i} \; \forall i \in [1] \tag{16}$$

$$0 = x_{fl,\mathrm{in},i} - x_{fl,\mathrm{out},i} \; \forall fl \in \text{network fluids}, \, \forall i \in [1] \tag{17}$$

2.3.2 Inputs specified

label	eta_s (18)
district heating pump	0.800
evaporator reciculation pump	0.800
pump	0.750

Table 5: Parameters of components of type Pump

2.3.3 Equations applied

$$0 = -\left(h_{\mathrm{out}} - h_{\mathrm{in}}\right) \cdot \eta_{\mathrm{s}} + \left(h_{\mathrm{out,s}} - h_{\mathrm{in}}\right) \tag{18}$$

2.4 Components of type HeatExchangerSimple

2.4.1 Mandatory constraints

$$0 = \dot{m}_{\mathrm{in},i} - \dot{m}_{\mathrm{out},i} \; \forall i \in [1] \tag{19}$$

$$0 = x_{fl,\mathrm{in},i} - x_{fl,\mathrm{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1] \tag{20}$$

2.4.2 Inputs specified

label	Q (21)	pr (22)
consumer	-200000.000	0.990

Table 6: Parameters of components of type HeatExchangerSimple

2.4.3 Equations applied

$$0 = \dot{m}_{\mathrm{in}} \cdot \left(h_{\mathrm{out}} - h_{\mathrm{in}}\right) - \dot{Q} \tag{21}$$

$$0 = p_{\mathrm{in},1} \cdot pr - p_{\mathrm{out},1} \tag{22}$$

2.5 Components of type Valve

2.5.1 Mandatory constraints

$$0 = \dot{m}_{\mathrm{in},i} - \dot{m}_{\mathrm{out},i} \; \forall i \in [1] \tag{23}$$

$$0 = x_{fl,\mathrm{in},i} - x_{fl,\mathrm{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1] \tag{24}$$

$$0 = h_{\mathrm{in},i} - h_{\mathrm{out},i} \; \forall i \in [1] \tag{25}$$

2.6 Components of type Drum

2.6.1 Mandatory constraints

$$0 = \sum \dot{m}_{\mathrm{in},i} - \sum \dot{m}_{\mathrm{out},j} \; \forall i \in \text{inlets}, \forall j \in \text{outlets} \tag{26}$$

$$0 = x_{fl,\mathrm{in},1} - x_{fl,\mathrm{out},j} \; \forall fl \in \text{network fluids}, \forall j \in \text{outlets} \tag{27}$$

$$0 = \sum_i \left(\dot{m}_{\text{in},i} \cdot h_{\text{in},i}\right) - \sum_j \left(\dot{m}_{\text{out},j} \cdot h_{\text{out},j}\right) \;\; \forall i \in \text{inlets} \; \forall j \in \text{outlets} \tag{28}$$

$$\begin{split} 0 = p_{\text{in},1} - p_{\text{in},i} \; \forall i \in \text{inlets} \setminus \{1\} \\ 0 = p_{\text{in},1} - p_{\text{out},j} \; \forall j \in \text{outlets} \end{split} \tag{29}$$

$$\begin{split} 0 =& h_{\text{out},1} - h\left(p_{\text{out},1}, x = 0\right) \\ 0 =& h_{\text{out},2} - h\left(p_{\text{out},2}, x = 1\right) \end{split} \tag{30}$$

2.7 Components of type HeatExchanger

2.7.1 Mandatory constraints

$$0 = \dot{m}_{\text{in},i} - \dot{m}_{\text{out},i} \; \forall i \in [1, 2] \tag{31}$$

$$0 = x_{fl,\text{in},i} - x_{fl,\text{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1, 2] \tag{32}$$

$$0 = \dot{m}_{\text{in},1} \cdot \left(h_{\text{out},1} - h_{\text{in},1}\right) + \dot{m}_{\text{in},2} \cdot \left(h_{\text{out},2} - h_{\text{in},2}\right) \tag{33}$$

2.7.2 Inputs specified

label	ttd_u (34)	ttd_l (35)	pr1 (36)	pr2 (37)
evaporator	-	5.000	0.980	0.990
superheater	2.000	-	0.980	0.990
intercooler	-	-	0.990	0.980

Table 7: Parameters of components of type HeatExchanger

2.7.3 Equations applied

$$0 = ttd_{\text{u}} - T_{\text{in},1} + T_{\text{out},2} \tag{34}$$

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

$$0 = p_{\text{in},1} \cdot pr1 - p_{\text{out},1} \tag{36}$$

$$0 = p_{\text{in},2} \cdot pr2 - p_{\text{out},2} \tag{37}$$

2.8 Components of type Splitter

2.8.1 Mandatory constraints

$$0 = \sum \dot{m}_{\text{in},i} - \sum \dot{m}_{\text{out},j} \; \forall i \in \text{inlets}, \forall j \in \text{outlets} \tag{38}$$

$$0 = x_{fl,\text{in}} - x_{fl,\text{out},j} \; \forall fl \in \text{network fluids}, \forall j \in \text{outlets} \tag{39}$$

$$0 = h_{in} - h_{\text{out},j} \; \forall j \in \text{outlets} \tag{40}$$

$$\begin{split} 0 = p_{\text{in},1} - p_{\text{in},i} \; \forall i \in \text{inlets} \setminus \{1\} \\ 0 = p_{\text{in},1} - p_{\text{out},j} \; \forall j \in \text{outlets} \end{split} \tag{41}$$

2.9 Components of type Compressor

2.9.1 Mandatory constraints

$$0 = \dot{m}_{\mathrm{in},i} - \dot{m}_{\mathrm{out},i} \; \forall i \in [1] \tag{42}$$

$$0 = x_{fl,\mathrm{in},i} - x_{fl,\mathrm{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1] \tag{43}$$

2.9.2 Inputs specified

label	eta_s (44)	pr (45)
compressor 1	0.850	-
compressor 2	0.900	3.000

Table 8: Parameters of components of type Compressor

2.9.3 Equations applied

$$0 = -\left(h_{\mathrm{out}} - h_{\mathrm{in}}\right) \cdot \eta_{\mathrm{s}} + \left(h_{\mathrm{out,s}} - h_{\mathrm{in}}\right) \tag{44}$$

$$0 = p_{\mathrm{in},1} \cdot pr - p_{\mathrm{out},1} \tag{45}$$