Software Information

General information

TESPy Version:	0.5.1 - Exciting Exergy
Commit:	51ff17f2@dev
CoolProp version:	6.4.1
Python version:	3.8.10 (default, Nov 26 2021, 20:14:08) [GCC 9.3.0]
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Parameter highlighting

Variable component parameters:	*italic*
Specified input parameter:	**bold**
Results of simulation:	normalfont

Equations are displayed for input parameters only.

1 Connections in design mode

1.1 Connection specifications and results

Table 1: Connection specifications and results

label	m in kg/s	p in bar (1)	h in kJ/kg	T in °C (2)	s in kJ/kgK
0	1,177.781	250.0000	1,094.69	600.0	2.7674
1	857.314	**75.0000**	397.67	**35.0**	1.6468
2	857.314	**258.4000**	450.33	123.2	1.6668
3	1,177.781	**257.0000**	885.84	433.7	2.4966
4	1,177.781	**250.0000**	1,094.69	**600.0**	2.7674
5	1,177.781	**77.9500**	934.37	457.1	2.7920
6	857.314	**75.1500**	558.65	128.2	2.1153
10	320.467	75.1500	558.65	128.2	2.1153
11	320.467	**257.5100**	670.11	264.1	2.1468
12	857.314	257.5100	670.11	264.1	2.1468
13	1,177.781	257.5100	670.11	264.1	2.1468
14	1,177.781	**76.9400**	718.63	269.1	2.4533
15	1,177.781	75.1500	558.65	128.2	2.1153

1.2 Equations applied

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

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

1.3 Specified fluids

Table 2: Specified fluids

label	CO2 (3)
1	**1.000**

1.4 Equations applied

$$0 = x_{\text{CO2}} - x_{\text{CO2,spec}} \tag{3}$$

1.5 Referenced temperature

Table 3: Specified reference values for temperature

label	reference	factor in -	delta in °C
0	12	1	0

1.6 Equation applied

$$0 = \text{value} - \text{value}_{\text{ref}} \cdot \text{factor} + \text{delta} \tag{4}$$

2 Components in design mode

2.1 Components of type HeatExchangerSimple

2.1.1 Mandatory constraints

$$0 = \dot{m}_{\mathrm{in},i} - \dot{m}_{\mathrm{out},i}\ \forall i \in [1] \tag{5}$$

$$0 = x_{fl,\mathrm{in},i} - x_{fl,\mathrm{out},i}\ \forall fl \in \text{network fluids},\ \forall i \in [1] \tag{6}$$

2.1.2 Specifications and results

Table 4: Parameters of components of type HeatExchangerSimple

label	Q	pr	zeta
Heater	245,974,293.29	0.97	101.53
Water cooler	-138,014,256.36	1.00	4.06

2.2 Components of type CycleCloser

2.2.1 Mandatory constraints

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

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

2.2.2 Specifications and results

Table 5: Parameters of components of type CycleCloser

label	mass_deviation	fluid_deviation
Cycle closer	0.00	0.00

2.3 Components of type Compressor

2.3.1 Mandatory constraints

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

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

2.3.2 Specifications and results

Table 6: Parameters of components of type Compressor

label	P	eta_s (11)	pr
Compressor 1	45,145,931.33	**0.85**	3.45
Compressor 2	35,720,359.99	**0.85**	3.43

2.3.3 Equations applied

$$0 = -\left(h_{\mathrm{out}} - h_{\mathrm{in}}\right) \cdot \eta_{\mathrm{s}} + \left(h_{\mathrm{out,s}} - h_{\mathrm{in}}\right) \tag{11}$$

2.4 Components of type HeatExchanger

2.4.1 Mandatory constraints

$$0 = \dot{m}_{\mathrm{in},i} - \dot{m}_{\mathrm{out},i} \; \forall i \in [1, 2] \tag{12}$$

$$0 = x_{fl,\mathrm{in},i} - x_{fl,\mathrm{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1, 2] \tag{13}$$

$$0 = \dot{m}_{\mathrm{in},1} \cdot (h_{\mathrm{out},1} - h_{\mathrm{in},1}) + \dot{m}_{\mathrm{in},2} \cdot (h_{\mathrm{out},2} - h_{\mathrm{in},2}) \tag{14}$$

2.4.2 Specifications and results

Table 7: Parameters of components of type HeatExchanger

label	Q	ttd_u	ttd_l (15)	pr1	pr2
Recuperator 1	-188,427,545.84	5.00	**5.00**	0.98	1.00
Recuperator 2	-254,083,168.77	23.45	**5.00**	0.99	1.00

2.4.3 Equations applied

$$0 = ttd_{\mathrm{l}} - T_{\mathrm{out},1} + T_{\mathrm{in},2} \tag{15}$$

2.5 Components of type Turbine

2.5.1 Mandatory constraints

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

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

2.5.2 Specifications and results

Table 8: Parameters of components of type Turbine

label	P	eta_s (18)	pr
Turbine	-188,826,328.26	**0.90**	0.31

2.5.3 Equations applied

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

2.6 Components of type Splitter

2.6.1 Mandatory constraints

$$0 = \sum \dot{m}_{\mathrm{in},i} - \sum \dot{m}_{\mathrm{out},j} \; \forall i \in \text{inlets}, \forall j \in \text{outlets} \tag{19}$$

$$0 = x_{fl,\mathrm{in}} - x_{fl,\mathrm{out},j} \; \forall fl \in \text{network fluids}, \forall j \in \text{outlets} \tag{20}$$

$$0 = h_{in} - h_{\mathrm{out},j} \; \forall j \in \text{outlets} \tag{21}$$

$$\begin{split} 0 = p_{\mathrm{in},1} - p_{\mathrm{in},i} \; \forall i \in \text{inlets} \setminus \{1\} \\ 0 = p_{\mathrm{in},1} - p_{\mathrm{out},j} \; \forall j \in \text{outlets} \end{split} \tag{22}$$

2.7 Components of type Merge

2.7.1 Mandatory constraints

$$0 = \sum \dot{m}_{\mathrm{in},i} - \sum \dot{m}_{\mathrm{out},j} \; \forall i \in \text{inlets}, \forall j \in \text{outlets} \tag{23}$$

$$0 = \sum_i \dot{m}_{\mathrm{in},i} \cdot x_{fl,\mathrm{in},i} - \dot{m}_{\mathrm{out}} \cdot x_{fl,\mathrm{out}} \; \forall fl \in \text{network fluids}, \forall i \in \text{inlets} \tag{24}$$

$$0 = \sum_i \left(\dot{m}_{\mathrm{in},i} \cdot h_{\mathrm{in},i}\right) - \dot{m}_{\mathrm{out}} \cdot h_{\mathrm{out}} \; \forall i \in \text{inlets} \tag{25}$$

$$\begin{aligned} 0 &= p_{\mathrm{in},1} - p_{\mathrm{in},i} \; \forall i \in \text{inlets} \setminus \{1\} \\ 0 &= p_{\mathrm{in},1} - p_{\mathrm{out},j} \; \forall j \in \text{outlets} \end{aligned} \tag{26}$$

3 Busses in design mode

3.1 Bus “total output power”

Specified total value of energy flow: $\dot{E}_{\mathrm{bus}} = -100,000,000.00\,\mathrm{W}$

$$0 = \dot{E}_{\mathrm{bus}} - \sum_i \dot{E}_{\mathrm{bus},i} \tag{27}$$

Table 9: Results overview for bus total output power

label	$\dot{E}_{\mathrm{comp}}$	$\dot{E}_{\mathrm{comp,result}}$	$\dot{E}_{\mathrm{bus}}$	$\dot{E}_{\mathrm{bus,result}}$	η_{result}
Turbine	$\dot{m}_{\mathrm{in}} \cdot (h_{\mathrm{out}} - h_{\mathrm{in}})$	-188,826,328.26	$\dot{E}_{\mathrm{comp}} \cdot \eta$	-185,068,684.32	0.98
Compressor 1	$\dot{m}_{\mathrm{in}} \cdot (h_{\mathrm{out}} - h_{\mathrm{in}})$	45,145,931.33	$\frac{\dot{E}_{\mathrm{comp}}}{\eta}$	47,492,038.00	0.95
Compressor 2	$\dot{m}_{\mathrm{in}} \cdot (h_{\mathrm{out}} - h_{\mathrm{in}})$	35,720,359.99	$\frac{\dot{E}_{\mathrm{comp}}}{\eta}$	37,576,646.32	0.95
total	-	-107,960,036.94	-	**-100,000,000.00**	-

3.2 Bus “heat input”

This bus is used for postprocessing only.

Table 10: Results overview for bus heat input

label	$\dot{E}_{\mathrm{comp}}$	$\dot{E}_{\mathrm{comp,result}}$	$\dot{E}_{\mathrm{bus}}$	$\dot{E}_{\mathrm{bus,result}}$	η_{result}
Heater	$\dot{m}_{\mathrm{in}} \cdot (h_{\mathrm{out}} - h_{\mathrm{in}})$	245,974,293.29	$\frac{\dot{E}_{\mathrm{comp}}}{\eta}$	245,974,293.29	1.00
total	-	245,974,293.29	-	245,974,293.29	-