

# Software Information

## General information

TESPy Version:	0.4.3-005 - Grassmann's Graph
Commit:	84386adc@dev
CoolProp version:	6.4.0
Python version:	3.8.0 (default, Oct 28 2019, 16:14:01) [GCC 8.3.0]
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## Parameter highlighting

Variable component parameters:	<i>italic</i>
Specified input parameter:	<b>bold</b>
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	<b>75.0000</b>	397.67	<b>35.0</b>	1.6468
2	857.314	<b>258.4000</b>	450.33	123.2	1.6668
3	1,177.781	<b>257.0000</b>	885.84	433.7	2.4966
4	1,177.781	<b>250.0000</b>	1,094.69	<b>600.0</b>	2.7674
5	1,177.781	<b>77.9500</b>	934.37	457.1	2.7920
6	857.314	<b>75.1500</b>	558.65	128.2	2.1153
10	320.467	75.1500	558.65	128.2	2.1153
11	320.467	<b>257.5100</b>	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	<b>76.9400</b>	718.63	269.1	2.4533
15	1,177.781	75.1500	558.65	128.2	2.1153

## 1.2 Equations applied

$$0 = p - p_{\text{spec}} \quad (1)$$

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

## 1.3 Specified fluids

Table 2: Specified fluids

CO2 (3)	
label	
1	<b>1.000</b>

## 1.4 Equations applied

$$0 = x_{\text{CO2}} - x_{\text{CO2,spec}} \quad (3)$$

## 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

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

## 2 Components in design mode

### 2.1 Components of type HeatExchangerSimple

#### 2.1.1 Mandatory constraints

$$0 = \dot{m}_{\text{in},i} - \dot{m}_{\text{out},i} \quad \forall i \in [1] \quad (5)$$

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

#### 2.1.2 Specifications and results

Table 4: Parameters of components of type HeatExchangerSimple

	Q	pr	zeta
label			
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

$$0 = p_{\text{in},i} - p_{\text{out},i} \quad \forall i \in [1] \quad (7)$$

$$0 = h_{\text{in},i} - h_{\text{out},i} \quad \forall i \in [1] \quad (8)$$

### 2.3 Components of type Compressor

#### 2.3.1 Mandatory constraints

$$0 = \dot{m}_{\text{in},i} - \dot{m}_{\text{out},i} \quad \forall i \in [1] \quad (9)$$

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

#### 2.3.2 Specifications and results

Table 5: Parameters of components of type Compressor

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

#### 2.3.3 Equations applied

$$0 = -(h_{\text{out}} - h_{\text{in}}) \cdot \eta_s + (h_{\text{out},s} - h_{\text{in}}) \quad (11)$$

### 2.4 Components of type HeatExchanger

#### 2.4.1 Mandatory constraints

$$0 = \dot{m}_{\text{in},i} - \dot{m}_{\text{out},i} \quad \forall i \in [1, 2] \quad (12)$$

$$0 = x_{fl,\text{in},i} - x_{fl,\text{out},i} \quad \forall fl \in \text{network fluids}, \forall i \in [1, 2] \quad (13)$$

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

## 2.4.2 Specifications and results

Table 6: Parameters of components of type HeatExchanger

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

## 2.4.3 Equations applied

$$0 = ttd_l - T_{out,1} + T_{in,2} \quad (15)$$

## 2.5 Components of type Turbine

### 2.5.1 Mandatory constraints

$$0 = \dot{m}_{in,i} - \dot{m}_{out,i} \quad \forall i \in [1] \quad (16)$$

$$0 = x_{fl,in,i} - x_{fl,out,i} \quad \forall fl \in \text{network fluids}, \forall i \in [1] \quad (17)$$

### 2.5.2 Specifications and results

Table 7: Parameters of components of type Turbine

	P	eta_s (18)	pr
label			
Turbine	-188,826,328.26	<b>0.90</b>	0.31

## 2.5.3 Equations applied

$$0 = -(h_{out} - h_{in}) + (h_{out,s} - h_{in}) \cdot \eta_s \quad (18)$$

## 2.6 Components of type Splitter

### 2.6.1 Mandatory constraints

$$0 = \sum \dot{m}_{in,i} - \sum \dot{m}_{out,j} \quad \forall i \in \text{inlets}, \forall j \in \text{outlets} \quad (19)$$

$$0 = x_{fl,in} - x_{fl,out,j} \quad \forall fl \in \text{network fluids}, \forall j \in \text{outlets} \quad (20)$$

$$0 = h_{in} - h_{out,j} \quad \forall j \in \text{outlets} \quad (21)$$

$$\begin{aligned} 0 &= p_{in,1} - p_{in,i} \quad \forall i \in \text{inlets} \setminus \{1\} \\ 0 &= p_{in,1} - p_{out,j} \quad \forall j \in \text{outlets} \end{aligned} \quad (22)$$

## 2.7 Components of type Merge

### 2.7.1 Mandatory constraints

$$0 = \sum \dot{m}_{\text{in},i} - \sum \dot{m}_{\text{out},j} \quad \forall i \in \text{inlets}, \forall j \in \text{outlets} \quad (23)$$

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

$$0 = \sum_i (\dot{m}_{\text{in},i} \cdot h_{\text{in},i}) - \dot{m}_{\text{out}} \cdot h_{\text{out}} \quad \forall i \in \text{inlets} \quad (25)$$

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

## 3 Busses in design mode

### 3.1 Bus “total output power”

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

$$0 = \dot{E}_{\text{bus}} - \sum_i \dot{E}_{\text{bus},i} \quad (27)$$

Table 8: Results overview for bus total output power

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

### 3.2 Bus “heat input”

This bus is used for postprocessing only.

Table 9: Results overview for bus heat input

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