## 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 | T in °C (1) | p in bar (2) |
|---|---|---|
| fuel:out1_combustion chamber:in2 | 25.000 | - |
| ambient:out1_combustion chamber:in1 | 20.000 | 1.000 |

Table 1: Specified connection parameters

## 1.2 Equations applied

$$0 = T\left(p, h\right) - T_{\text{spec}} \tag{1}$$

$$0 = p - p_{\text{spec}} \tag{2}$$

## 1.3 Specified fluids

| label | Ar (3) | CH4 (4) | CO2 (5) | H2O (6) | N2 (7) | O2 (8) |
|---|---|---|---|---|---|---|
| fuel:out1_combustion chamber:in2 | 0.000 | 0.960 | 0.040 | 0.000 | 0.000 | 0.000 |
| ambient:out1_combustion chamber:in1 | 0.013 | 0.000 | 0.000 | 0.000 | 0.755 | 0.231 |

Table 2: Specified fluids

## 1.4 Equations applied

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

$$0 = x_{\text{CH4}} - x_{\text{CH4,spec}} \tag{4}$$

$$0 = x_{\text{CO2}} - x_{\text{CO2,spec}} \tag{5}$$

$$0 = x_{\text{H2O}} - x_{\text{H2O,spec}} \tag{6}$$

$$0 = x_{\text{N2}} - x_{\text{N2,spec}} \tag{7}$$

$$0 = x_{\text{O2}} - x_{\text{O2,spec}} \tag{8}$$

# 2 Components in design mode

## 2.1 Components of type CombustionChamber

### 2.1.1 Mandatory constraints

$$0 = \dot{m}_{\text{in,1}} + \dot{m}_{\text{in,2}} - \dot{m}_{\text{out,1}} \tag{9}$$

$$\begin{aligned} 0 =& p_{\text{in,1}} - p_{\text{out,1}} \\ 0 =& p_{\text{in,1}} - p_{\text{in,2}} \end{aligned} \tag{10}$$

$$
\begin{aligned}
\Delta\dot{m}_{\text{fluid}} &= \dot{m}_{\text{in},1} \cdot x_{\text{fluid,in},1} + \dot{m}_{\text{in},2} \cdot x_{\text{fluid,in},2} - \dot{m}_{\text{out},1} \cdot x_{\text{fluid,out},1} \\
\dot{m}_{\text{fluid,m}} &= \frac{\dot{m}_{\text{in},1} \cdot x_{\text{fluid,in},1} + \dot{m}_{\text{in},2} \cdot x_{\text{fluid,in},2}}{M_{\text{fluid}}} \\
\dot{m}_{\text{H,m}} &= \dot{m}_{\text{CH4,m}} \cdot 4 \\
\dot{m}_{\text{C,m}} &= \dot{m}_{\text{CH4,m}} \cdot 1 \\
\dot{m}_{\text{O2,m,stoich}} &= \frac{\dot{m}_{\text{H,m}}}{4} + \dot{m}_{\text{C,m}}
\end{aligned}
\tag{11}
$$

$$
0 = \Delta\dot{m}_{\text{Ar}} \tag{12}
$$

$$
0 = \Delta\dot{m}_{\text{CH4}} - \dot{m}_{\text{CH4,m}} \cdot M_{\text{CH4}} \tag{13}
$$

$$
0 = \Delta\dot{m}_{\text{CO2}} + \dot{m}_{\text{C,m}} \cdot M_{\text{CO2}} \tag{14}
$$

$$
0 = \Delta\dot{m}_{\text{H2O}} + \frac{\dot{m}_{\text{H,m}}}{2} \cdot M_{\text{H2O}} \tag{15}
$$

$$
0 = \Delta\dot{m}_{\text{N2}} \tag{16}
$$

$$
0 = \Delta\dot{m}_{\text{O2}} - \dot{m}_{\text{O2,m,stoich}} \cdot M_{\text{O2}} \tag{17}
$$

$$
\begin{aligned}
0 =& \sum_i \dot{m}_{\text{in},i} \cdot (h_{\text{in},i} - h_{\text{in},i,\text{ref}}) - \dot{m}_{\text{out},1} \cdot (h_{\text{out},1} - h_{\text{out},1,\text{ref}}) \\
&+ LHV_{fuel} \cdot \left( \sum_i \dot{m}_{\text{in},i} \cdot x_{fuel,\text{in},i} - \dot{m}_{\text{out},1} \cdot x_{fuel,\text{out},1} \right) \\
&\forall i \in \text{inlets} \\
&T_{\text{ref}} = 298.15\,\text{K}\ p_{\text{ref}} = 10^5\,\text{Pa}
\end{aligned}
\tag{18}
$$

### 2.1.2 Inputs specified

| label | lamb (19) | ti (20) |
|---|---|---|
| combustion chamber | 3.000 | 2000000.000 |

Table 3: Parameters of components of type CombustionChamber

### 2.1.3 Equations applied

$$
\begin{aligned}
0 &= \frac{\dot{m}_{\text{fuel,m}}}{\dot{m}_{\text{O}_2\text{,m}} \cdot (n_{\text{C,fuel}} + 0.25 \cdot n_{\text{H,fuel}})} - \lambda \\
\dot{m}_{\text{fluid,m}} &= \frac{x_{\text{fluid}} \cdot \dot{m}}{M_{\text{fluid}}}
\end{aligned}
\tag{19}
$$

$$
\begin{aligned}
0 =& ti - LHV_{\text{fuel}} \cdot \left[ \sum_i (\dot{m}_{\text{in},i} \cdot x_{\text{fuel,in},i}) - \dot{m}_{\text{out},1} \cdot x_{\text{fuel,out},1} \right] \\
&\forall i \in \text{combustion inlets}
\end{aligned}
\tag{20}
$$