Additional Test Cases for case F

HOCLOOP project - Task 2.2

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1 Case-F - Baseline

In the table below the main parameter used in the definition of case F. **Notice that the inlet pressure has been increased to 13bar** due to some numerical issue in reaching a solution considering the original 10bar inlet pressure.

Table 1: **Main Parameters for Case F**

Parameter	**Value**	**Units**
WELL GEOMETRY		
Vertical Depth	3000	m
Horizontal Length	3500	m
DIAMETERS		
Tubing Internal ($d_{tub_{in}}$)	0.1000	m
Tubing External ($d_{tub_{out}}$)	0.1300	m
Casing Internal ($d_{cas_{in}}$)	0.1617	m
Casing External ($d_{cas_{out}}$)	0.1778	m
GEOLOGICAL DATA		
Surface Temperature	11	°C
Geothermal Gradient	0.0325	°C/m
Rock Thermal Conductivity (k_{rock})	2.4230	W/(m K)
Rock Heat Capacity (c_{rock})	0.90267	kJ/(kg K)
Rock Density (ρ_{rock})	2600	kg/m^3
FLUID INLET CONDITION		
Inlet Pressure	13	bar
Inlet Temperature	45	°C
Flow Rate	8.80149	kg/s

Under these conditions the *BHEModel2.0* developed by UNIFI is able to reach a solution but, due to the high friction losses in the pipeline (especially in the annulus), a negative outlet pressure is predicted. For these reason other cases have been tested.

2 Case-F - Other cases

The other cases have been generated from case F by modifying three parameters: the **flow rate** $\dot{m}$, the **annulus outlet diameter** $d_{cas_{in}}$ and the **inlet pressure** p_{in}.

The parameters have been modified as follows:

$$\dot{m}_{F.x} = \alpha_{\%}\ \dot{m}_F \tag{1}$$

$$d_{cas_{in}\,F.x} = \beta_{\%}\ d_{cas_{in}\,F} \tag{2}$$

where $\alpha_{\%}$ and $\beta_{\%}$ are two modifiers that has been set according to the table below:

Table 2: **Modifier considered for different test cases**

Test Case	$\alpha_{\%}$	$\beta_{\%}$	p_{in}
Case F (baseline)	1.00	1.00	13bar
Case F.1	0.50	1.00	13bar
Case F.2	0.25	1.00	13bar
Case F.3	1.00	1.10	13bar
Case F.4	1.00	1.25	13bar
Case F.5	1.00	1.00	40bar

the outer diameter of the casing has been modified as well:

$$d_{cas_{out}\,F.x} = d_{cas_{in}\,F.x} + 0.015m \tag{3}$$