

GEIE
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Production temperature tests GPK2 / GPK4

HEX-B predictions 3

Flowrates 20-50 l/s

Technical Note

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S W I S S
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1. Aims

The purpose of this technical note is to calculate production temperatures of wells GPK2 and GPK4 at various production flowrate in order to allow dimensioning of an ORC conversion unit.

Various production flowrates are tested for each well :

- GPK2: flowrates = 20 l/s, 25 l/s, 30 l/s, 40 l/s and 50 l/s
- GPK2 with fluid entry at 3900m = 20 l/s, 30 l/s, 40 l/s and 50 l/s
- GPK4: flowrates = 10 l/s, 20 l/s, 30 l/s, 40 l/s and 50 l/s

2. Well models used for Hex-B calculations

The well models used in this technical note are the same one used for interpretation of the circulation test of summer 2005. Table 1 and Table 2 show properties of the wells models used.

Table 1: Borehole/rock model in HEX-B for GPK2 production well

Bore hole parameters					Rock mass parameters		
Nr	Depth section MD [m]		Inner radius [m]	Flow rate [% of injection rate]	Average wall roughness [mm]	Thermal conductivity [W/m K]	Specific heat capacity [J/m ³ K]
	from:	to:					
1	0	1500.	0.08	100	0.15	2.4	2.2 10 ⁶
2	1500	3800	0.08	100	0.15	3.2	2.2 10 ⁶
3	3800	4800	0.08	100	0.15	2.4	2.2 10 ⁶

Table 2: Borehole/rock model in HEX-B for GPK4 production well

Bore hole parameters					Rock mass parameters		
Nr	Depth section MD [m]		Inner radius [m]	Flow rate [% of injection rate]	Average wall roughness [mm]	Thermal conductivity [W/m K]	Specific heat capacity [J/m ³ K]
	from:	to:					
1	0	1500.	0.11	100	0.15	2.0	2.2 10 ⁶
2	1500	3800	0.11	100	0.15	3.0	2.2 10 ⁶
3	3800	4800	0.11	100	0.15	2.0	2.2 10 ⁶

For both wells, wellhead overpressure is assumed to be equal to 10 bars.

3. Results

The simulations were run during a time of $4.0 \cdot 10^6$ seconds (corresponding to 46 days) in order to reach a quasi steady state temperature regime in the entire well, as observed during 2005 long term circulation test (see technical note 017-16). This simulation time of $4.0 \cdot 10^6$ seconds allows quite short computation time.

3.1. Results for GPK2 production

Figure 1 shows GPK2 wellhead temperature for different production flowrates

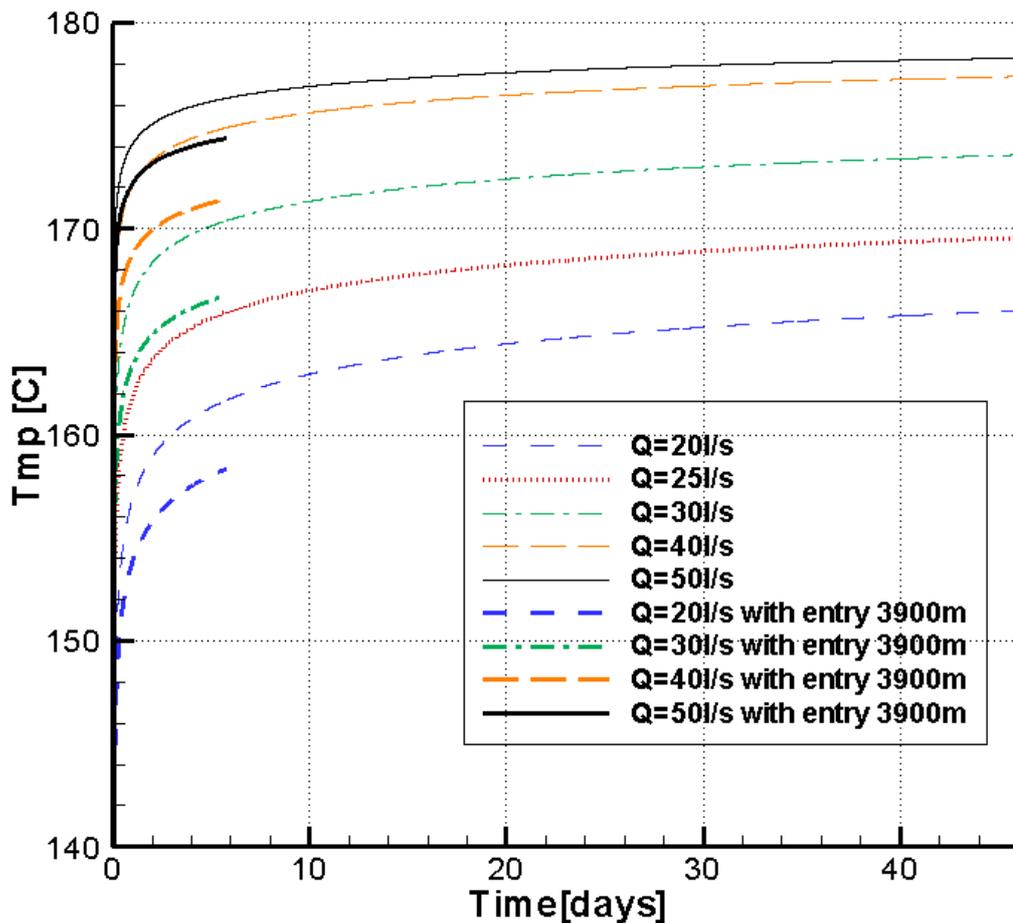


Figure 1 : GPK2 temperature evolution for different production flowrates

The thin lines on the figure show results for a 46 days simulation of production with GPK2. In this case, a single fluid production entry is assumed at 4800m TVD, at a temperature of 192 °C.

In order to take in account the fluid inflow at a depth of 3900m, a new version of Hex-B was developed in order to allow multiple inflow depths of fluid. The thick lines on the figure 1 show results for a 6 days simulation of production with two fluids entries: The first one is located at a depth of 3900m (temp. 170°C), represents 25% of

produced fluid and the second one is located in the open section of the well, at a depth of 4800m TVD (temp. 192°C). Unfortunately, the new HEX-B version did not allow calculation of more than 6 days, because of a time step limitation. Thus, this calculation is useful to give an idea of the temperature drop at wellhead during production because of this parasite entry at 3900 m.

3.2. Results for GPK4 production

Figure 2 shows GPK4 wellhead temperature for different production flowrates

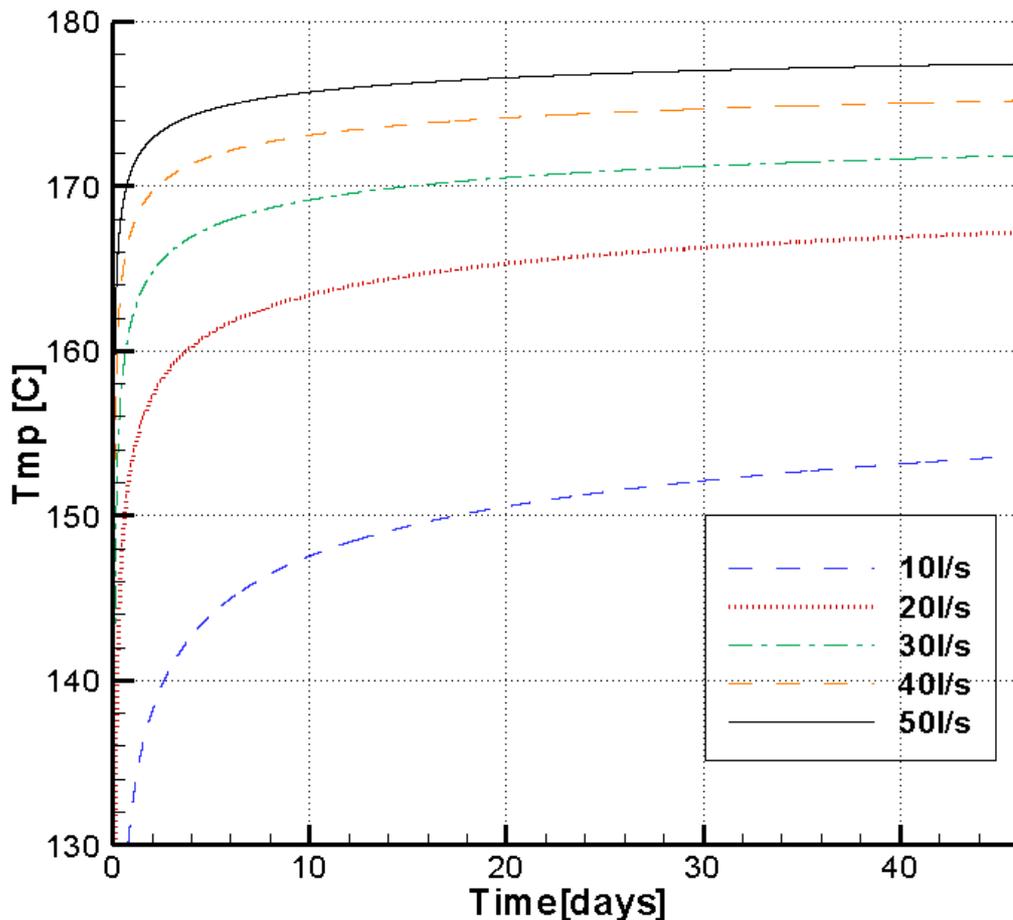


Figure 2 : GPK4 temperature evolution for different production flowrates

Important note: this calculation assumes that produced fluid comes from a depth of 4620m TVD (4890m MD) and at a temperature of 187 °C (unique fluid entry)

4. Conclusion

Table 3 shows the different production temperatures for each well at calculated flowrates. Temperature indicated in this table take in account the fact that the steady state regime is not totally reached after a simulation time of 46 days. Production temperatures for the model of GPK2 with the parasite entry are estimated from figure 1.

Table 3 : Wellhead production temperatures

Production flowrate [l/s]	10	20	25	30	40	50
GPK2 wellhead temp[°C]		168	172	175	178	179
GPK2 wellhead temp[°C] with parasite entry at 3900m, 25% of flow, 170 °C		164		171	175	177
GPK4 wellhead temp[°C]	160	168		173	176	178