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Production GPK3 GPK4 15.01.2007

HEX-B correction

Technical Note

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1. Aims

The purpose of this technical note is to calculate productivity index from a production test realised in well GPK3 and GPK4 on the week of 15.01.2007

2. Well model used for Hex-B calculations

Table 1 and Table 2 show properties of the well GPK3 and GPK4 models used.

Table 1: Borehole/rock model in HEX-B for GPK3 production well

Bore hole parameters						Rock mass parameters	
Depth section MD [m] Nr	from:	to:	Inner radius [m]	Flow rate [% of injection rate]	Average wall roughness [mm]	Thermal conductivity [W/m K]	Specific heat capacity [J/m^{3}K]
1	0	1700.	0.110	100	0.15	3.0	2.2 10^6
2	1700	2200	0.110	100	0.15	15.00	2.2 10^6
3	2200	3800	0.110	100	0.15	3.00	2.2 10^6
4	3800	4556	0.110	100	0.15	4.00	2.2 10^6
5	4556	4768	0.108	100	0.15	4.00	2.2 10^6

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

Bore hole parameters						Rock mass parameters	
Depth section MD [m] Nr	from:	to:	Inner radius [m]	Flow rate [% of injection rate]	Average wall roughness [mm]	Thermal conductivity [W/m K]	Specific heat capacity [J/m^{3}K]
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

3. Datas overview

Before the tests, the wells were killed and filled up with fresh water.
The following figures show measured flowrates, wellhead pressures and production temperatures during production test.
The density of produced fluids is assumed to be constant during production test and is set to 1050 kg.m^{-3} for both production tests. This is equivalent to a molality of 1.6 mol/kg.
The Figure 1 and Figure 2 show flowrate in separator. Flowrates used for the calculation of the downhole overpressure were lightly different; they are multiplied by a coefficient 1.04 in order to take in account the phase change of the production fluid.

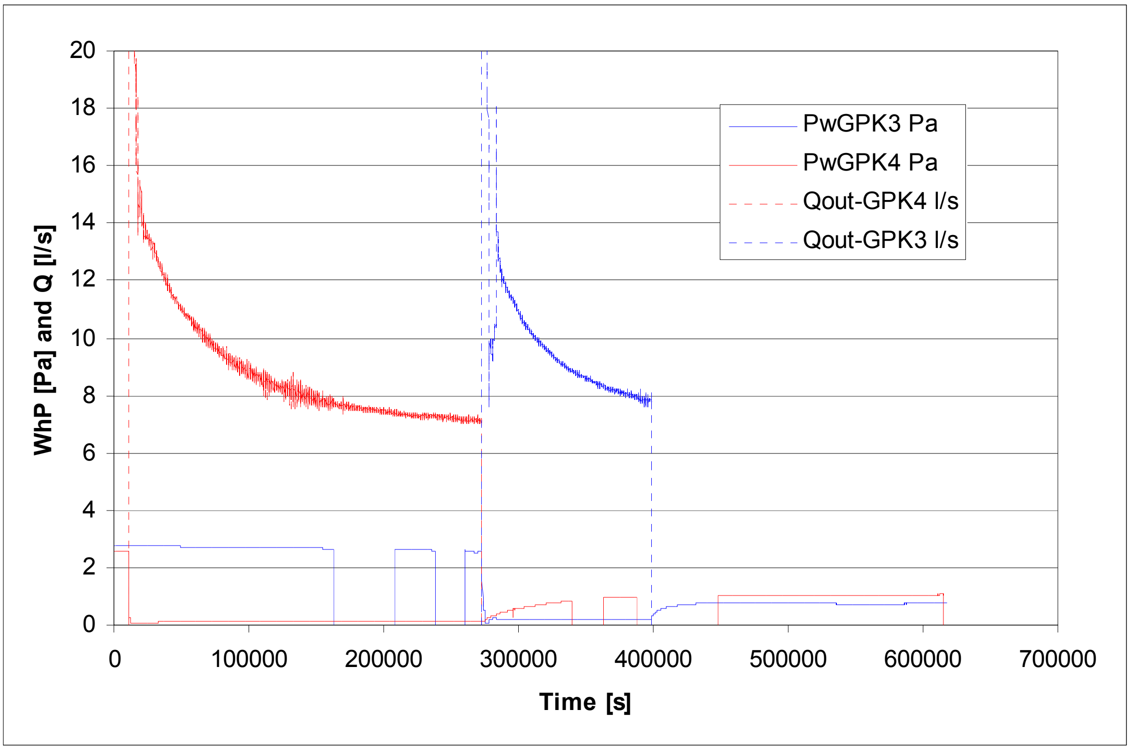

Figure 1: Production flowrates and imposed Wellhead pressures. Time origin is set on 20.01.2007 at 05:19:33.

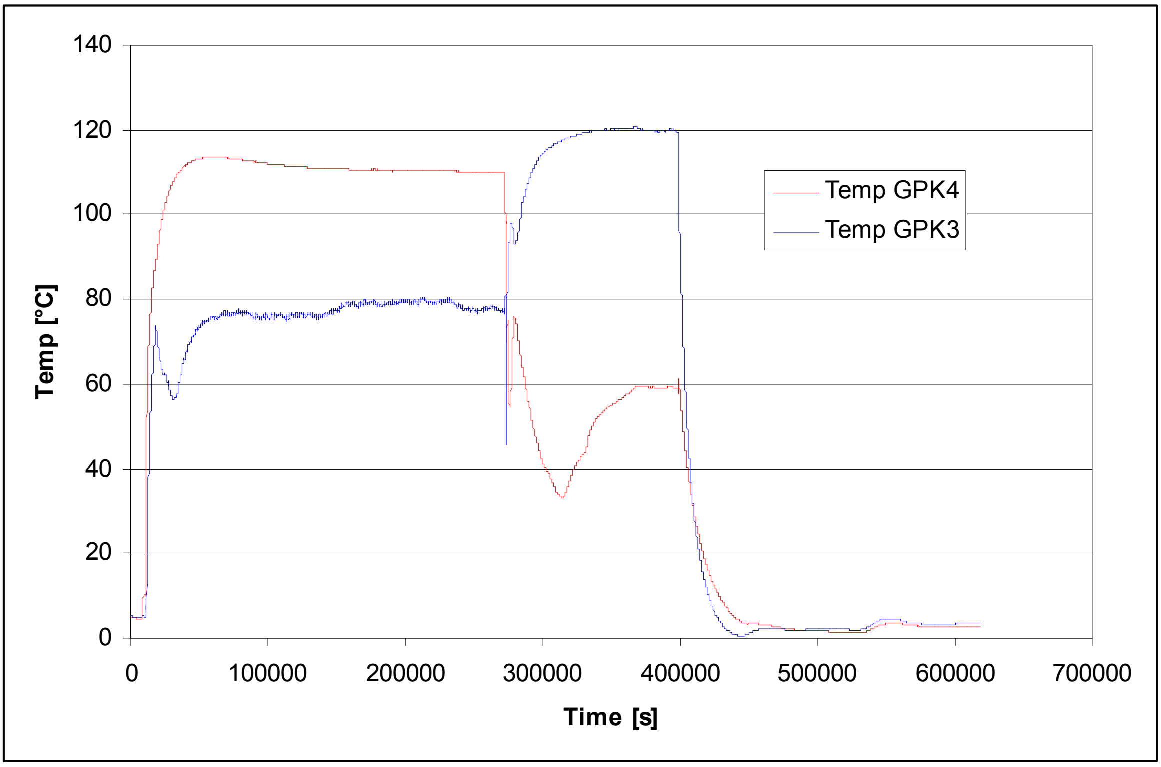

Figure 2: Production temperatures. Time origin is set on 20.01.2007 at 05:19:33.

4. GPK4 production

The GPK4 correction was run with HEX-B-83. One unique producing entry is considered at a depth of 4769 m MD and a temperature of 160°C in order to fit the measured temperature of produced fluid. Thus, for initial state, temperature profile in the wellbore is assumed about 10 °C to 15 °C colder as in an equilibrium state. Still for the initial state, the molality in the wellbore follows a square distribution, with conditions m=0 mol.kg^{-1} at the top and m=1.6 mol.kg^{-1} at the bottom of the tubing (see Figure 3).

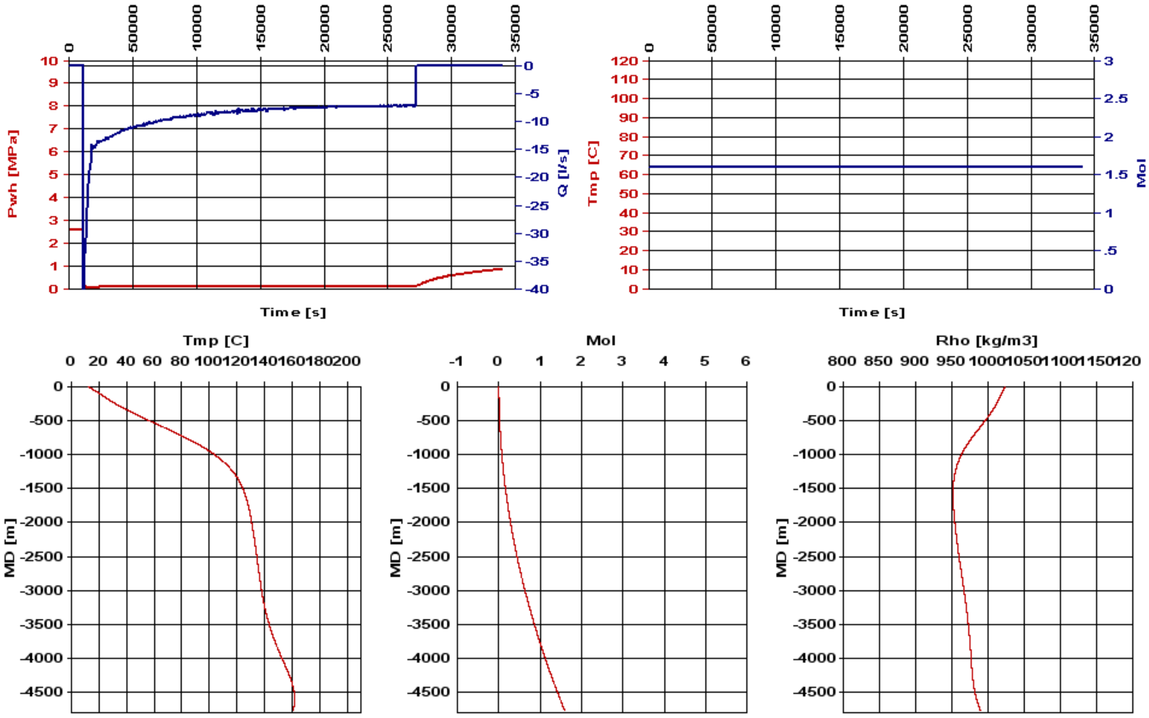

Figure 3: Input and initial parameters of Hex-b, GPK4 production test correction

These assumptions allow a reasonably good fit of the calculated temperature with the measured temperature and result in an initial downhole pressure of well GPK4 at the bottom of the casing of 45.4MPa, which is generally the accepted value.

Figure 4 shows results obtained by Hex-B calculations.

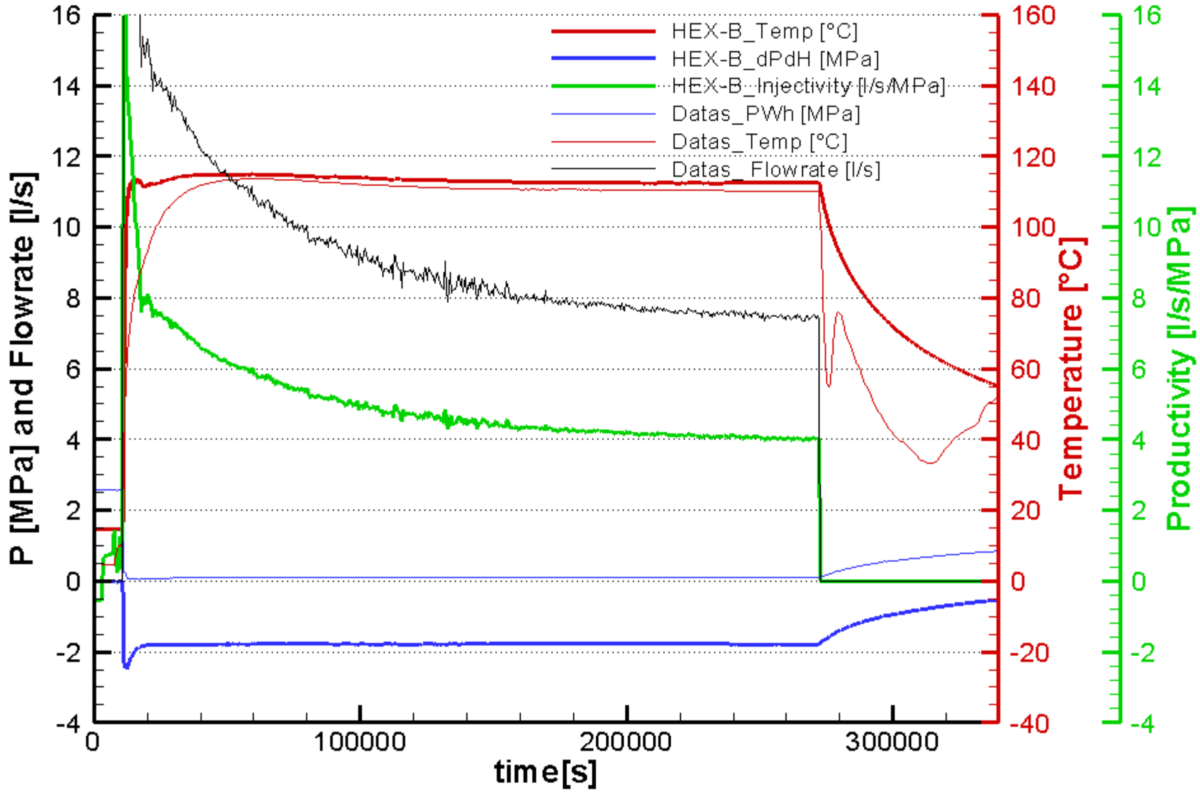

Figure 4: Results of HEX-B calculations for well GPK4. Time origin is set on 20.01.2007 at 05:19:33.

5. GPK3 Production

The GPK3 correction was run with HEX-B-81.The unique producing entry is at 4768 m MD and at a temperature of 170°C. The same molality than for well GPK4 is defined in that case, and the temperature distribution in the well remains unchanged (see Figure 5). These boundary conditions result in a 45.4 MPa initial pressure at the end of the casing.

Figure 6 shows results of HEX-B calculations.

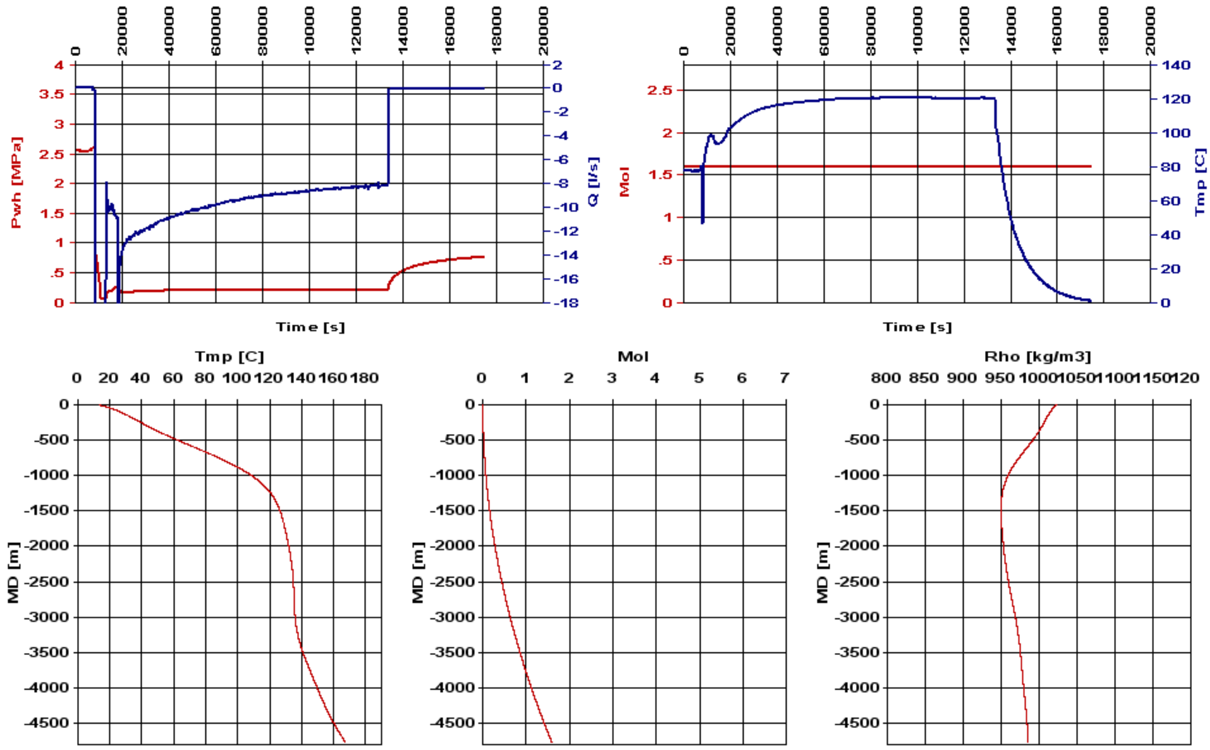

Figure 5: Input and initial parameters of Hex-b, GPK3 production test correction

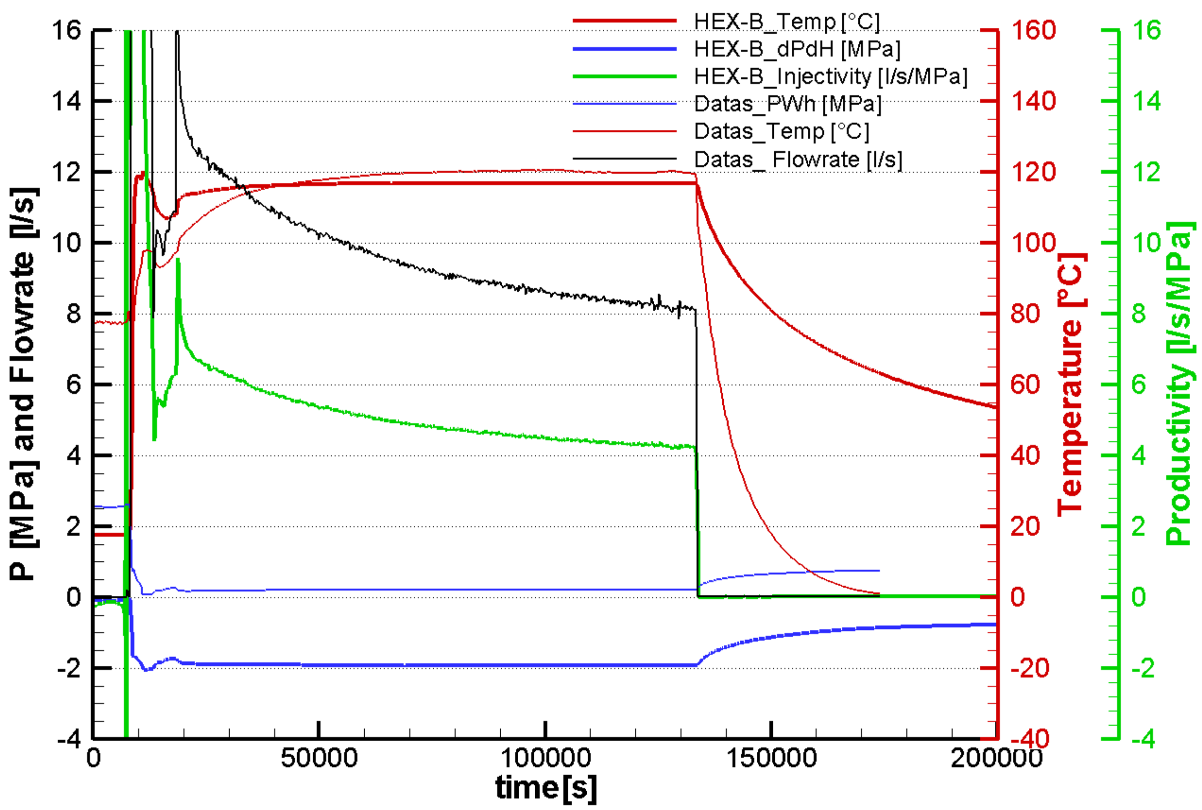

Figure 6: Results of HEX-B calculations for well GPK3. Time origin is set on 25.01.2007 at 06:55:58.

6. Conclusion

The Table 3 shows Injectivity index calculated for this production test.

Well	GPK3	GPK4
Flowrate [l/s]	-8.1	-7.5
Pdh [MPa]	-1.95	-1.85
Productivity [l/s/MPa]	4.15	4.05

Table 3: Flowrates, downhole over pressure and Productivity index for production tests of January 2007

One can compare these obtained productivity results with previous production tests made in the wells.

Calculated productivity of well GPK4 is comparable to what has been calculated for production test of 24.10.2006. An enhancement of the productivity of GPK4 is even perceptible, as final productivity of the well is higher than 4 l/s/MPa, and is stable.

Productivity of well GPK3 seems in this test lower than previously calculated, during the production test of October 6th, 2006. The productivity of the well had at that moment been evaluated to be around 6 l/s/MPa.
These differences may be explained by density differences of produced fluid in both test; during test of October 2006, the density was slowly rising up to a value of 1030 kg/m^3, whereas in this test, evaluated produced fluid density reaches very quickly a stable value of 1050kg/m^3.
As suggested by these values, it is possible that the production test of well GPK3 in October 2006 had been lightly influenced by a previous injection test.