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Oskarshamn site investigation

Hydraulic injection tests in borehole KLX02, 2003

Sub-area Laxemar

Nils Rahm, Golder Associates AB

Cristian Enachescu, Golder Associates GmbH

December 2004

Svensk Kärnbränslehantering AB
Swedish Nuclear Fuel
and Waste Management Co
Box 5864
SE-102 40 Stockholm Sweden
Tel 08-459 84 00
+46 8 459 84 00
Fax 08-661 57 19
+46 8 661 57 19

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Keywords: Site/project, hydrogeology, Hydraulic tests, Injection test, Hydraulic parameters, Transmissivity.

Abstract

Hydraulic injection tests have been performed in Borehole KLX02 at the Laxemar area, Oskarshamn. The tests are part of the general program for site investigations and specifically for the Simpevarp sub-area. The hydraulic testing programme has the aim to characterise the rock with respect to its hydraulic properties of the fractured zones and rock mass between them. Data is subsequently delivered for the site descriptive model.

This report describes the results and primary data evaluation of the hydraulic injection tests in borehole KLX02 performed between 8th July and 1st of August 2003.

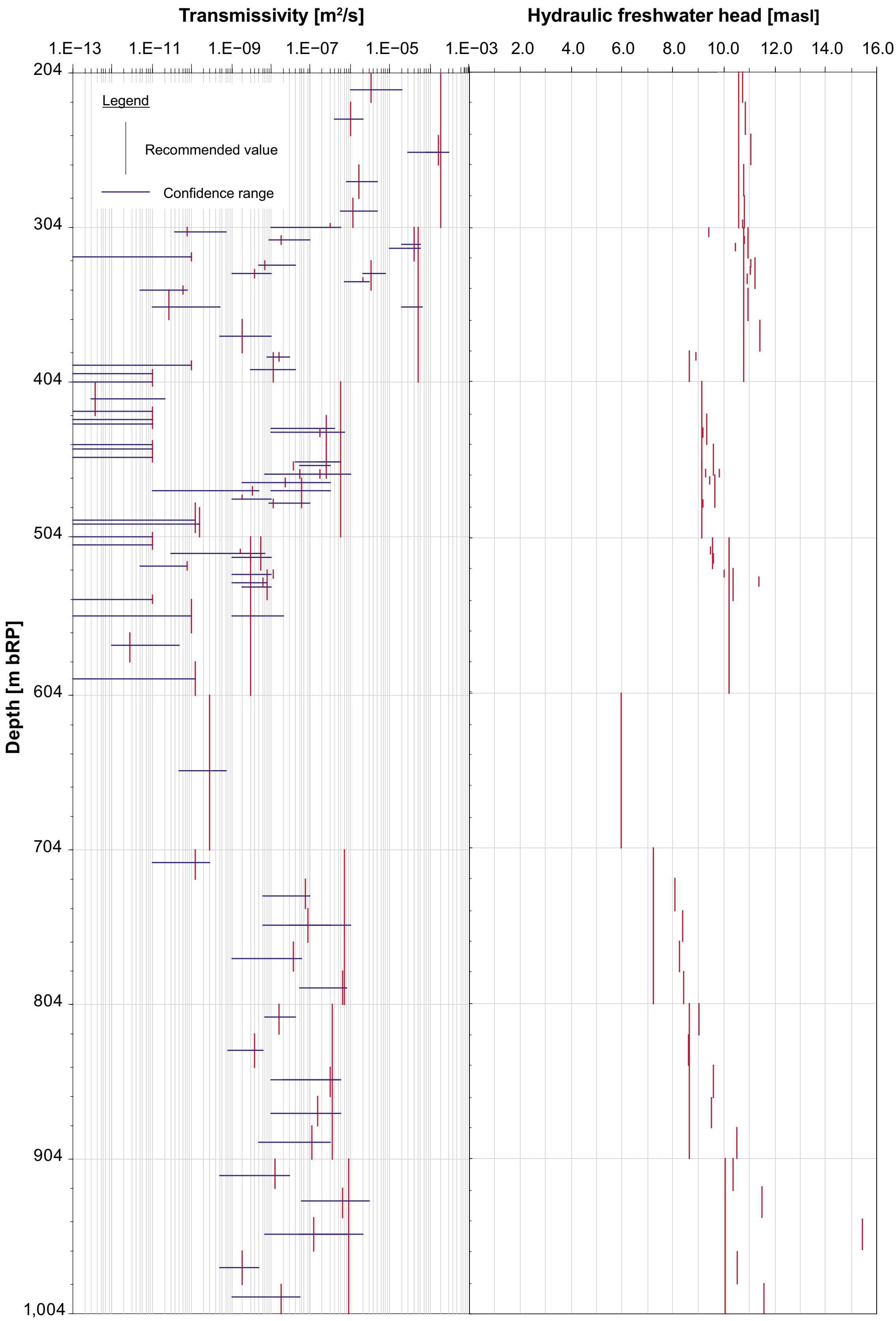
The objective of the hydrotests was to describe the rock around the borehole with respect of hydraulic parameters, mainly transmissivity (T) and hydraulic conductivity (K) at different measurement scales of 100 m 20 m and 5 m sections. Transient evaluation during flow and recovery period provided additional information such as flow regimes, hydraulic boundaries and cross-over flows. Constant pressure injection tests were conducted between 204–1,004 m below ToC. The results of the test interpretation are presented as transmissivity and hydraulic freshwater head

Summary

Injektionstester har utförts i borrhål KLX02 i delområde Laxemar området, Oskarshamn. Testerna är en del av SKB:s platsundersökningar. Hydraultestprogrammet där injektions-testerna ingår har som mål att karakterisera berget med avseende på dess hydrauliska egenskaper av sprickzoner och mellanliggande bergmassa. Data från testerna används vid den platsbeskrivande modelleringen av området.

Denna rapport redovisar resultaten och utvärderingar av primärdata från de hydrauliska injektionstesterna i borrhål KLX02. Testerna utfördes mellan den 8 juli till den 1 augusti 2003.

Syftet med hydrotesterna var framförallt att beskriva bergets hydrauliska egenskaper runt borrhålet med avseende på hydrauliska parametrar, i huvudsak transmissivitet (T), hydraulisk konduktivitet vid olika mätskalor av 100 m, 20 m, och 5 m sektioner. Transient utvärdering under injektions- och återhämtningsfasen gav ytterligare information avseende flödesgeometri, hydrauliska gränser och sprickläckage. Injektionstester utfördes mellan 204–1 004 m borrhålslängd. Resultaten av test utvärderingen presenteras som transmissivitet, hydraulisk konduktivitet och grundvattennivå uttryckt i ekvivalent nivå sötvattenpelare (fresh-water head).



Borehole KLX02 – Summary of results.

Contents

1 Introduction

A general program for site investigations presenting survey methods has been prepared /SKB, 2001a/, as well as a site-specific program for the investigations in the Simpevarp area /SKB, 2001b/. The hydraulic injection tests form part of the site characterization program under item 1.1.5.8 in the work breakdown structure of the execution programme, /SKB, 2002/.

Measurements were carried out according in borehole KSH01A during 8th July to 1st August 2003 following the methodology described in SKB MD 323.001 and in the activity plan AP PS 400-03-063 (SKB internal controlling documents). Data and results were delivered to the SKB site characterization database SICADA with field note number Simpevarp 138.

Borehole KLX02 is situated in the Laxemar area 2.5 km northwest from the nuclear power plant at Simpevarp, Figure 1-1. The borehole was drilled 1992 at 1,700 m depth with an inner diameter of 76 mm. The upper 200 m is cased with large diameter telescopic casing ranging from diameter 340–92 mm.

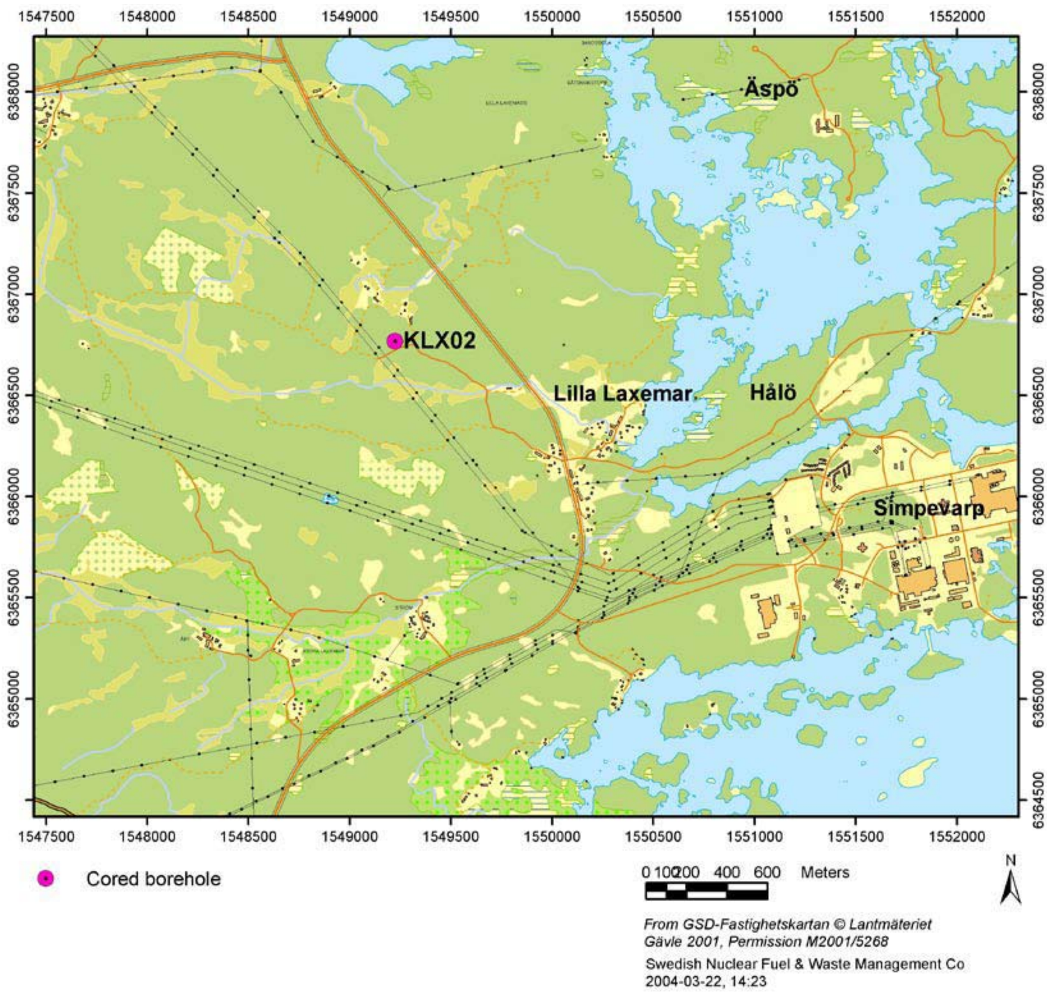


Figure 1-1. *The investigation area Laxemar, Oskarshamn with location of borehole KLX02.*

The aim at the time for drilling was to test drilling technique and enable investigation beyond 1,000 m depth. Two extensive borehole investigation programmes were performed during a five year period. Hydrotesting has previously been done in the borehole and done with 300 m test sections and showed that the uppermost 207–505 m were of highest conductivity and the section 505–803 of lowest hydraulic conductivity. Later hydrotesting concluded that one existing highly conductive zone was present at 250 m below ToC. An account of previous activities and results in KLX02 is found in /SKB, 2001c/.

2 Objective

The objective of the hydrotests in borehole KLX02 is to describe the rock around the borehole with respect to hydraulic parameters, mainly transmissivity (T) and hydraulic conductivity (K). This is done at different measurement scales of 100 m, 20 m and 5 m sections. Among these parameters transient evaluation during the flow and recovery period provides additional information such as flow regimes, hydraulic boundaries and cross-over flows.

3 Scope of work

The scope of work consisted of preparation of the PSS2 tool which included calibration and functional checks, injection tests of 100 m, 20 m and 5 m test sections, analysis and reporting.

Preparation for testing was done according to the Quality plan. This step mainly consists of functions checks of the equipment to be used, the PSS2 tool. Calibration checks and function checks were documented in the daily log and/or relevant documents.

The following test programme was performed.

Table 3-1. Performed test programme at borehole KLX02.

No of injection tests	Interval	Positions	Time/test	Total test time
8	100 m	204–1,004 m	125 min	16.7 hrs
35	20 m	204–1,004 m	90 min	54 hrs
36	5 m	300–700 m	90 min	52.5 hrs
			Total:	123.2 hrs

3.1 Boreholes

The borehole is telescope drilled with specifications on its construction according to Table 3-2. The reference point in the boreholes is the centre of top of casing (ToC), given as Elevation in table below. The Swedish National coordinate system (RT90) is used in the x-y direction and RHB70 in the z-direction. Northing and Easting refer to the top of the boreholes at the ground surface. The borehole diameter in Table 3-2 refers to the final diameter of the drill bit after drilling to full depth.

Table 3-2. Information about KLX02 (from SICADA 2003-05-23 10:11:11).

Title	Value				
Borehole length (m)	1,700.500				
Drilling period(s)	From date	To date	Secup (m)	Seclow (m)	Drilling type
	1992-08-15	1992-09-05	0.000	202.950	Core drilling
	1992-10-15	1992-11-29	202.950	1,700.500	Core drilling
Starting point coordinate	Length (m)	Northing (m)	Easting (m)	Elevation (masl)	Coord system
(centerpoint of TOC)	0.000	6366768.985	1549224.090	18.400	RT90-RHB70
Angles	Length (m)	Bearing Inclination	(– = down)		
	0.000	9.119		–85.000	

Title	Value			
Borehole diameter	Secup (m)	Seclow (m)	Hole diam (m)	
	0.400	3.000	0.340	
	3.000	200.800	0.215	
	200.800	201.000	0.165	
	201.000	202.950	0.092	
	202.950	1,700.500	0.076	
Casing diameter	Secup (m)	Seclow (m)	Case in (m)	Case out (m)
	0.000	3.000	0.250	
	3.000	200.800	0.183	0.194
	200.800	202.950	0.077	0.084
Grove milling	Length (m)	Trace detecTable		
	220.000	YES		
	300.000	YES		
	400.000	YES		
	500.000	YES		
	600.000	YES		
	700.000	YES		
	803.000	YES		
	901.000	NO		
	951.000	YES		
	1,001.000	YES		
	1,051.000	YES		
	1,101.000	YES		
	1,201.000	YES		
	1,301.000	YES		
	1,401.000	YES		
	1,501.000	YES		
	1,601.000	YES		

3.2 Tests

Injection tests were conducted according to the Activity Plan AP PS 400-03-034 and the method description for hydraulic injection tests, SKB MD 323.001 (SKB internal documents). Tests were done in 100 m, 20 m test sections between 204–1,004 m below ToC and in 5 m test sections between 300–700 m below ToC. The criteria for performing injection tests in 20 m and 5 m test sections was as follows (see Figure 3-1):

- for the 20 m sections a measurable flow of > 0,001 L/min in the previously performed tests at 100 m test scale,
- for the 5 m sections a measurable flow of > 0,001 L/min in the previously performed tests in at 20 m test scale.

The measurements were performed with SKB's custom made equipment for hydraulic testing called PSS2, SKB MD 345.100 (SKB internal document).

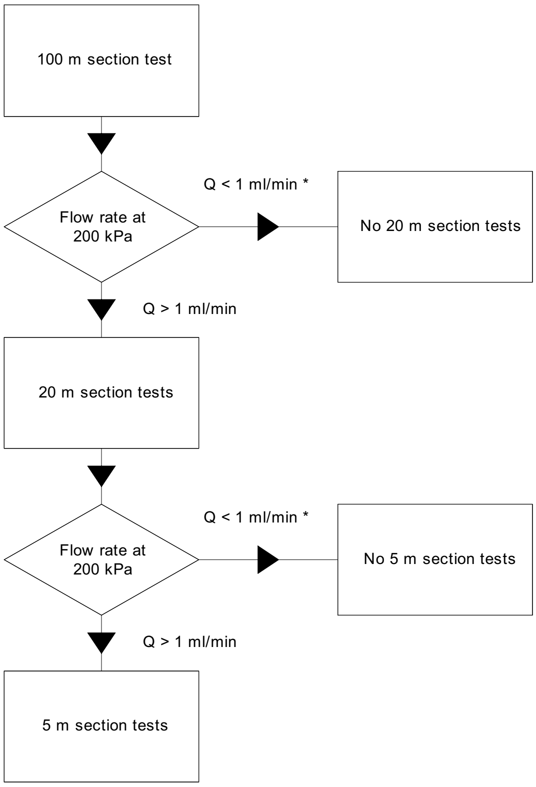


Figure 3-1. *Flow chart for test sections.*

Table 3-3. Tests performed.

Bh ID	Test section (m)	Test type[1]	Test no	Test start Date, time (yyyy-mm-dd hh:mm:ss)	Test stop Date, time (yyyy-mm-dd hh:mm:ss)
KLX02	204–304	3	1	2003-07-10 08:23:00	2003-07-10 11:15:42
KLX02	304–404	3	2	2003-07-10 13:06:06	2003-07-10 15:49:57
KLX02	404–504	3	1	2003-07-10 17:17:27	2003-07-10 19:35:55
KLX02	504–604	3	4	2003-07-11 10:05:06	2003-07-11 17:25:07
KLX02	604–704	3	1	2003-07-11 18:46:23	2003-07-12 08:04:23
KLX02	704–804	3	1	2003-07-12 09:31:43	2003-07-12 12:01:13
KLX02	804–904	3	1	2003-07-12 14:29:13	2003-07-12 16:20:58
KLX02	904–1004	3	1	2003-07-12 17:51:11	2003-07-12 19:41:44
KLX02	204–224	3	2	2003-07-14 12:16:05	2003-07-14 14:27:45

Bh ID	Test section (m)	Test type[1]	Test no	Test start Date, time (yyyy-mm-dd hh:mm:ss)	Test stop Date, time (yyyy-mm-dd hh:mm:ss)
KLX02	224–244	3	1	2003-07-14 15:32:56	2003-07-14 17:15:35
KLX02	244–264	3	1	2003-07-14 17:50:43	2003-07-14 19:11:14
KLX02	264–284	3	1	2003-07-15 08:27:56	2003-07-15 09:54:58
KLX02	284–304	3	1	2003-07-15 10:46:41	2003-07-15 12:09:00
KLX02	304–324	3	1	2003-07-15 12:56:28	2003-07-15 14:44:09
KLX02	324–344	3	1	2003-07-15 15:33:57	2003-07-15 16:57:59
KLX02	344–364	7	1	2003-07-15 17:31:20	2003-07-16 07:57:23
KLX02	364–384	7	1	2003-07-16 08:35:17	2003-07-16 09:39:47
KLX02	384–404	3	1	2003-07-16 10:20:41	2003-07-16 13:45:14
KLX02	404–424	7	1	2003-07-16 14:23:23	2003-07-16 15:29:01
KLX02	424–444	3	1	2003-07-16 16:07:33	2003-07-16 17:31:20
KLX02	444–464	3	1	2003-07-16 18:03:49	2003-07-16 19:59:09
KLX02	464–484	3	1	2003-07-17 08:08:16	2003-07-17 10:13:06
KLX02	481–501	3	1	2003-07-17 10:48:27	2003-07-17 12:52:40
KLX02	484–504	3	1	2003-07-17 13:21:26	2003-07-17 15:06:32
KLX02	504–524	3	1	2003-07-17 15:40:43	2003-07-17 18:46:30
KLX02	524–544	3	1	2003-07-17 19:25:26	2003-07-17 21:32:36
KLX02	544–564	3	1	2003-07-18 11:21:00	2003-07-18 13:41:58
KLX02	564–584	7	1	2003-07-18 14:16:16	2003-07-18 16:30:51
KLX02	584–604	3	1	2003-07-18 17:12:14	2003-07-18 18:41:14
KLX02	704–724	7	1	2003-07-19 09:18:04	2003-07-19 10:48:39
KLX02	724–744	3	1	2003-07-19 11:23:16	2003-07-19 15:45:40

Bh ID	Test section (m)	Test type[1]	Test no	Test start Date, time (yyyy-mm-dd hh:mm:ss)	Test stop Date, time (yyyy-mm-dd hh:mm:ss)
KLX02	744–764	3	1	2003-07-19 16:21:59	2003-07-19 18:03:27
KLX02	764–784	3	1	2003-07-19 18:46:26	2003-07-19 22:07:40
KLX02	784–804	3	1	2003-07-20 08:30:05	2003-07-20 09:51:18
KLX02	804–824	3	1	2003-07-20 10:36:25	2003-07-20 13:06:43
KLX02	824–844	3	1	2003-07-20 13:39:13	2003-07-20 16:02:14
KLX02	844–864	3	1	2003-07-20 16:42:46	2003-07-20 19:17:46
KLX02	864–884	3	1	2003-07-21 08:11:54	2003-07-21 10:07:05
KLX02	884–904	3	1	2003-07-21 10:45:16	2003-07-21 12:38:38
KLX02	904–924	3	1	2003-07-21 13:11:12	2003-07-21 16:10:35
KLX02	922–942	3	1	2003-07-21 16:48:25	2003-07-21 18:34:37
KLX02	943–963	3	1	2003-07-22 08:27:35	2003-07-22 10:10:55
KLX02	964–984	3	1	2003-07-22 10:53:15	2003-07-22 12:59:46
KLX02	984–1,004	3	1	2003-07-22 13:39:39	2003-07-22 15:33:16
KLX02	300–305	3	1	2003-07-24 10:32:54	2003-07-24 12:36:23
KLX02	305–310	3	1	2003-07-24 13:01:43	2003-07-24 16:09:26
KLX02	310–315	3	1	2003-07-24 16:35:19	2003-07-24 18:33:22
KLX02	315–320	3	1	2003-07-25 08:25:57	2003-07-25 09:47:53
KLX02	320–325	3	1	2003-07-25 10:12:02	2003-07-25 12:46:06
KLX02	325–330	3	1	2003-07-25 13:18:15	2003-07-25 15:11:54
KLX02	330–335	3	1	2003-07-25 15:37:19	2003-07-25 17:42:08
KLX02	335–340	3	1	2003-07-25 18:05:23	2003-07-25 19:34:39
KLX02	341–346	7	1	2003-07-26 08:19:56	2003-07-26 10:41:54

T_T	Transient evaluation (log-log or lin-log). Judged best evaluation of T_{Sf}, T_{Lf}, T_{Ss}, T_{Ls}	$[L^2/T]$	m^2/s
T_{NLR}	Evaluation based on non-linear regression.	$[L^2/T]$	m^2/s
S	Storage coefficient, (Storativity)	[-]	-
S*	Assumed storage coefficient	[-]	-
S_f	Fracture storage coefficient	[-]	-
S_m	Matrix storage coefficient	[-]	-
S_{NLR}	Storage coefficient, evaluation based on non-linear regression	[-]	-
S_s	Specific storage coefficient; confined storage.	[1/L]	1/m
S_s*	Assumed specific storage coefficient; confined storage.	[1/L]	1/m
ξ	Skin factor	[-]	-
ξ*	Assumed skin factor	[-]	-
C	Wellbore storage coefficient	$[(LT^2)\cdot M^2]$	m^3/Pa
C_D	$C_D = C\cdot\rho_w g /(2\pi\cdot S\cdot r_w^2)$, Dimensionless wellbore storage coefficient	[-]	-
ω	$\omega= S_f /(S_f + S_m)$, storage ratio (Storativity ratio); the ratio of storage coefficient between that of the fracture and total storage.	[-]	-
λ	$\lambda= \alpha\cdot (K_m / K_f) \cdot r_w^2$ interporosity flow coefficient.	[-]	-
T_{GRF}	Transmissivity interpreted using the GRF method	$[L^2/T]$	m^2/s
S_{GRF}	Storage coefficient interpreted using the GRF method	[1/L]	1/m
D_{GRF}	Flow dimension interpreted using the GRF method	[-]	-
c_w	Water compressibility; corresponding to β in hydrogeological literature.	$[(LT^2)/M]$	1/Pa
c_r	Pore-volume compressibility, (rock compressibility); Corresponding to α/n in hydrogeological literature.	$[(LT^2)/M]$	1/Pa
c_t	$c_t = c_r + c_w$, total compressibility; compressibility per volumetric unit of rock obtained through multiplying by the total porosity, n. (Presence of gas or other fluids can be included in c_t if the degree of saturation (volume of respective fluid divided by n) of the pore system of respective fluid is also included)	$[(LT^2)/M]$	1/Pa
n	Total porosity	-	-
ρ	Density	$[M/L^3]$	$kg/(m^3)$
ρ_w	Fluid density in measurement section during pumping/injection	$[M/L^3]$	$kg/(m^3)$
μ	Dynamic viscosity	[M/LT]	Pa s
μ_w	Dynamic viscosity (Fluid density in measurement section during pumping/injection)	[M/LT]	Pa s

Bh ID	Test section (m)	Test type[1]	Test no	Test start Date, time (yyyy-mm-dd hh:mm:ss)	Test stop Date, time (yyyy-mm-dd hh:mm:ss)
KLX02	385–390	3	1	2003-07-26 11:20:36	2003-07-26 13:46:54
KLX02	390–395	3	1	2003-07-26 14:12:41	2003-07-26 16:06:07
KLX02	395–400	3	1	2003-07-26 16:35:40	2003-07-27 08:11:01
KLX02	400–405	3	1	2003-07-27 08:38:04	2003-07-27 09:24:22
KLX02	420–425	3	1	2003-07-27 09:55:46	2003-07-27 10:56:17
KLX02	425–430	3	1	2003-07-27 11:23:43	2003-07-27 12:09:03
KLX02	429–434	3	1	2003-07-27 13:20:34	2003-07-27 14:21:18
KLX02	434–439	3	1	2003-07-27 14:48:52	2003-07-27 16:31:48
KLX02	440–445	3	1	2003-07-27 16:58:13	2003-07-27 17:58:57
KLX02	445–450	3	1	2003-07-28 08:13:41	2003-07-28 09:13:23
KLX02	450–455	3	1	2003-07-28 09:38:48	2003-07-28 10:38:26
KLX02	455–460	3	1	2003-07-28 11:02:06	2003-07-28 13:29:31
KLX02	460–465	3	1	2003-07-28 13:53:46	2003-07-28 15:33:06
KLX02	460–465	3	2	2003-08-01 11:51:55	2003-08-01 15:49:18
KLX02	465–470	3	1	2003-07-28 15:56:11	2003-07-28 17:44:44
KLX02	470–475	7	1	2003-07-28 18:07:32	2003-07-29 08:23:13
KLX02	475–480	7	2	2003-08-01 09:44:33	2003-08-01 11:22:57
KLX02	480–485	3	1	2003-07-29 10:54:04	2003-07-29 13:28:33
KLX02	500–505	3	1	2003-07-29 14:00:46	2003-07-29 14:59:49
KLX02	505–510	3	1	2003-07-29 15:29:13	2003-07-29 16:29:02
KLX02	510–515	3	1	2003-07-29 16:54:05	2003-07-29 20:42:34
KLX02	510–515	7	2	2003-07-31 18:16:37	2003-07-31 23:56:00

Bh ID	Test section (m)	Test type[1]	Test no	Test start Date, time (yyyy-mm-dd hh:mm:ss)	Test stop Date, time (yyyy-mm-dd hh:mm:ss)
KLX02	515–520	3	2	2003-07-31 14:49:10	2003-07-31 17:50:05
KLX02	520–525	7	1	2003-07-30 13:23:25	2003-07-30 15:12:17
KLX02	525–530	3	1	2003-07-30 15:36:31	2003-07-30 16:58:56
KLX02	530–535	3	2	2003-07-31 11:06:21	2003-07-31 14:18:09
KLX02	535–540	3	1	2003-07-31 08:09:25	2003-07-31 09:08:37
KLX02	540–545	3	1	2003-07-31 09:44:18	2003-07-31 10:42:00

1: 3: Injection test, 7: Pulse injection test.

No other additional measurements except the actual hydraulic tests and related measurements of packer position and water level in annulus of borehole KLX02 were conducted.

3.3 Control of equipment

Control of equipment was mainly performed according to the Quality plan. The basis for equipment handling is described in the "Mätssystembeskrivning" SKB MD 345.101–123 which is composed of two parts 1) management description, 2) drawings and technical documents of the modified PSS2 tool.

Function checks were performed before and during the tests. Among these pressure sensors were checked at ground level and while running in the hole calculated to the static head. Temperature was checked at ground level and while running in. Leakage at joints in the pipe string was done at least every 100 m of running in.

Any malfunction was recorded, and measures were taken accordingly for proper operation. Approval was made according to SKB site manager, or Quality plan and the Mätssystembeskrivning.

4 Equipment

4.1 Description of equipment

The equipment called PSS2 (Pipe String System 2) is a highly integrated tool for testing boreholes at great depth (see conceptual drawing in the next Figure). The system is built inside a container suitable for testing at any weather. Briefly, the components consists of a hydraulic rig, down-hole equipment including packers, pressure gauges, shut-in tool and level indicator, racks for pump, gauge carriers, breakpins, etc. shelfs and drawers for tools and spare parts.

There are three spools for a multi-signal cable, a test valve hose and a packer inflation hose. There is a water tank for injection purposes, pressure vessels for injection of packers, to open test valve and for low flow injection. The PSS2 has been upgraded with a computerized flow regulation system. The office part of the container consists of a computer, regulation valves for the nitrogen system, a 24 V back-up system in case of power shut-offs and a flow regulation board.

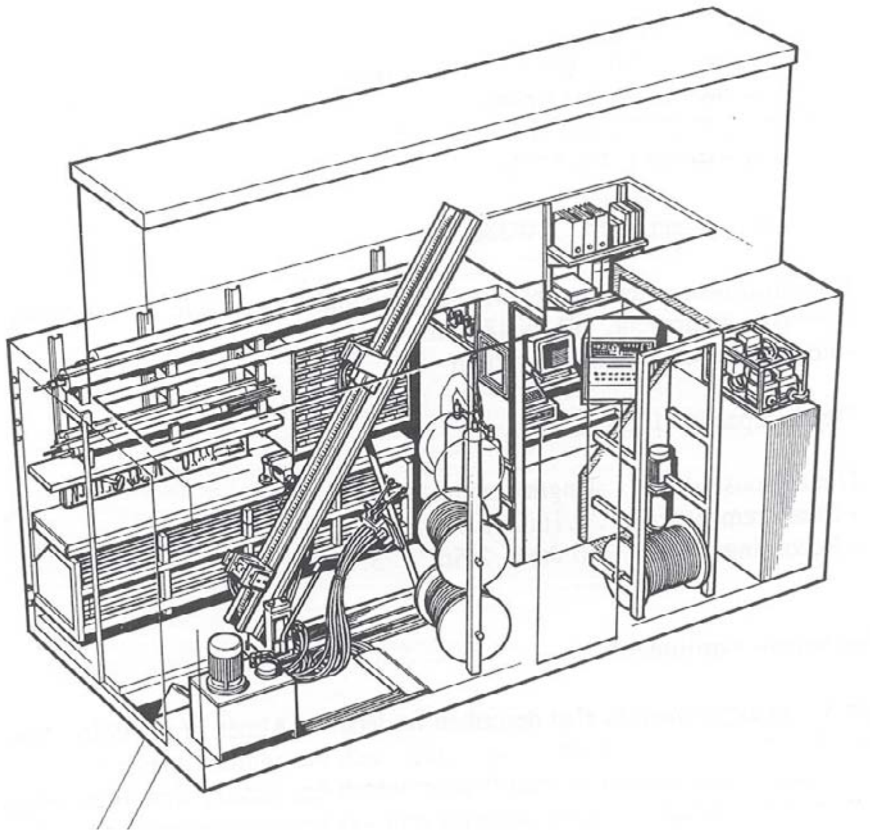


Figure 4-1. *A view of the layout and equipment of PSS2.*

PSS2 is documented in photographs 1–6.

Photo 1. *Hydraulic rig.*

Photo 2. *Rack for pump, down-hole equipment, workbench and drawers for tools.*

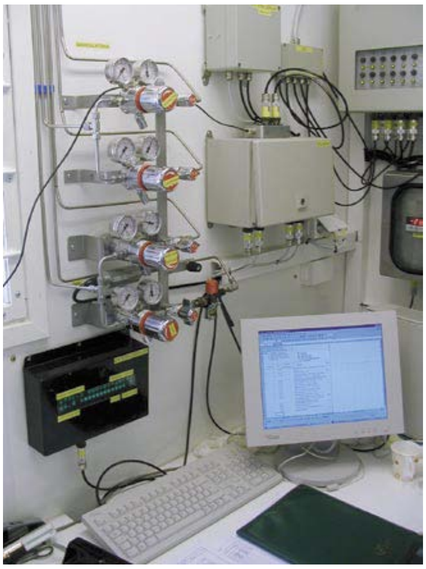


Photo 3. *Computer room, displays and gas regulators.*

Photo 4. *Pressure vessels for test valve, packers and injection.*

Photo 5. *Positioner, bottom end of down-in-hole string.*

Photo 6. *Packer and gauge carrier.*

The down-hole equipment consists from bottom to top of the following equipment:

- Level indicator – SS 630 mm pipe with OD 73 mm with 3 plastic wheels connected to a Hallswitch.
- Gauge carrier – SS 1.5 m carrying bottom section pressure transducer and connections from positioner.
- Lower packer – SS and PUR 1.5 m with OD 72 mm, stiff ends, tightening length 1.0 m, maximum pressure 6.5 MPa, working pressure 1.6 MPa.
- Contact carrier – SS 1,0 m carrying connections for sensors below.
- Pop joint – SS 1.0 or 0.5 m with OD 33 mm and ID 21 mm, double O-ring fittings, trapezoid thread, friction loss of 3 kPa/m at 50 L/min.
- Pipe string – SS 3.0 m with OD 33 mm and ID 21 mm, double O-ring fittings, trapezoid thread, friction loss of 3 kPa/m at 50 L/min.
- Gauge carrier with breakpin – SS 2.0 m carrying test section pressure transducer, temperature sensor and connections for sensors below. Breakpin with maximum load of 47.3 (± 1.0) kN.
- Upper packer – SS and PUR 1.5 m with OD 72 mm, fixed ends, seal length 1.0 m, maximum pressure 6.5 MPa, working pressure 1.6 MPa.
- Breakpin – SS 250 mm with OD 33.7 mm. Maximum load of 47.3 (± 1.0) kN.
- Pipe gauge carrier – SS 2.0 m carrying top section pressure transducer, connections from sensors below. Flow pipe is double bent at both ends to give room for sensor equipment.
- Shut-in tool (test valve) – SS 1.0 m with a OD of 48 mm, Teflon coated valve piston, friction loss of 11 kPa at 10 L/min (260 kPa–50 L/min). Working pressure 2.8–4.0 MPa.

The tool scheme is presented in Figure 4-2.

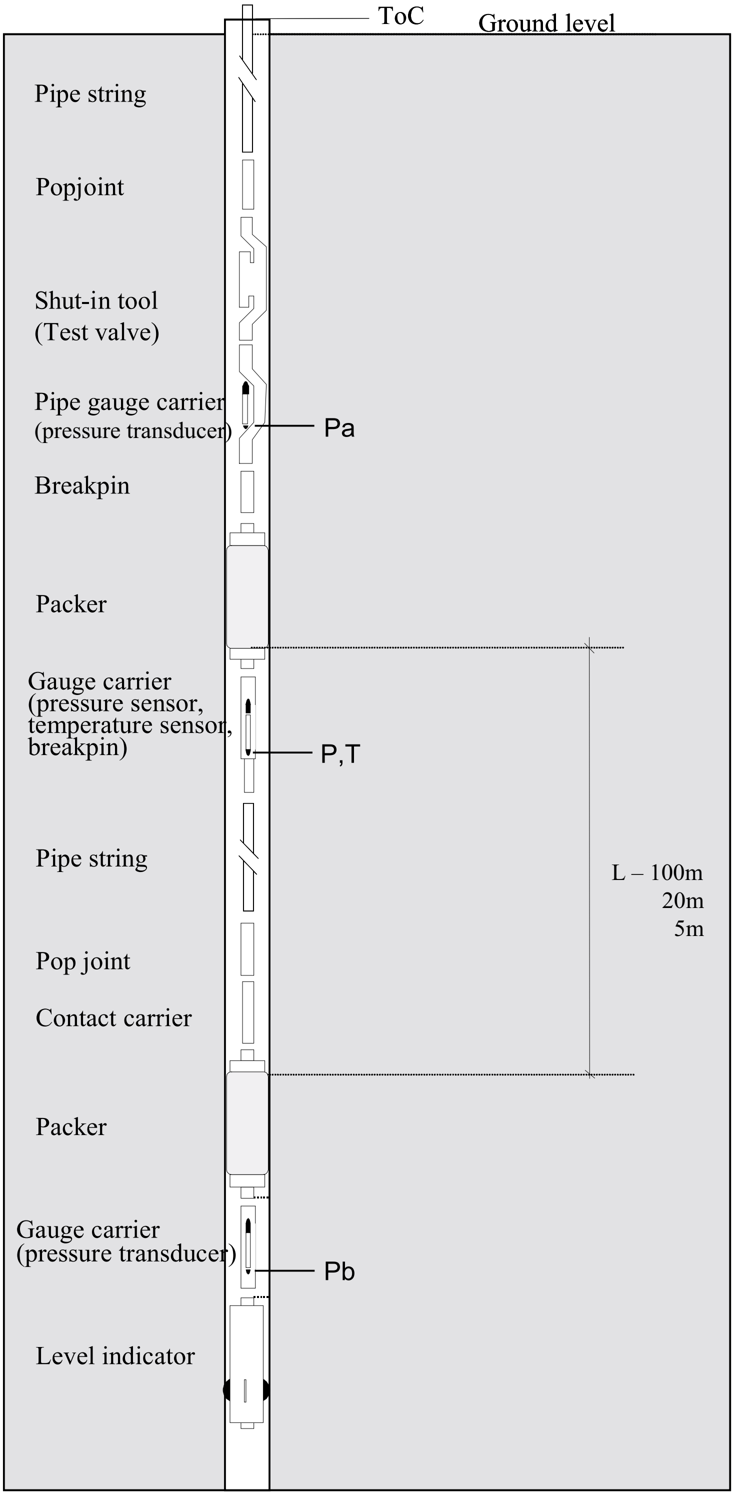


Figure 4-2. *Schematic drawing of the down-hole equipment in the PSS2 system.*

4.2 Sensors

Table 4-1. Technical specifications of sensors.

Keyword	Sensor	Name	Unit	Value/Range	Comments
$p_{sec,a,b}$	Pressure	Druck PTX 162-1464abs	9–30 4–20 0–13.5 Resolution accuracy	VDC mA MPa % of FS	
$T_{sec,surf,air}$	Temperature	BGI	18–24 4–20 0–32 0.1	VDC mA °C °C	
Q_{big}	Flow	Micro motion Elite sensor	0–100 ± 0.1	kg/min %	Massflow
Q_{small}	Flow	Micro motion Elite sensor	0–1.8 ± 0.1	kg/min %	Massflow
p_{air}	Pressure	Druck PTX 630	9–30 4–20 0–120 ± 0.1	VDC mA KPa % of FS	
p_{pack}	Pressure	Druck PTX 630	9–30 4–20 0–4 ± 0.1	VDC mA MPa % of FS	
$p_{in,out}$	Pressure	Druck PTX 1400	9–28 4–20 0–2.5	VDC mA MPa	

Table 4-2. Sensor positions and wellbore storage (WBS) controlling factors.

Borehole information			Sensors		Equipment affecting WBS coefficient		
ID	Test section (m)	Test no	Type	Position (m fr ToC)	Position	Function	Outer diameter (mm)
KLX02	204–304	1	p_a p T p_b	201.5 205.25 205.5 306	Test section	Signal cable Pump string Packer line	9.1 33 6
KLX02	204–224	1	p_a p T p_b	201.5 205.25 205.5 226	Test section	Signal cable Pump string Packer line	9.1 33 6
KLX02	300–305	1	p_a p T p_b	297.5 301.25 301.5 307	Test section	Signal cable Pump string Packer line	9.1 33 6

4.3 Data acquisition system

The data acquisition system in the PSS2 container contains a stationary PC with the software Orchestrator, pump- and injection tests parameters such as pressure, temperature and flow are monitored and sensor data collected. A second laptop PC is connected to the stationary PC through a network containing evaluation software, Flowdim. While testing, data from previously tested section is converted with IPPlot and entered Flowdim for evaluation.

The data acquisition system starts and stops the test automatically or can be disengaged for manual operation of magnetic and regulation valves within the injection/pumping system. The flow regulation board is used for differential pressure and valve settings prior testing and for monitoring valves during actual test. An outline of the data acquisition system is outlined in Figure 4-3.

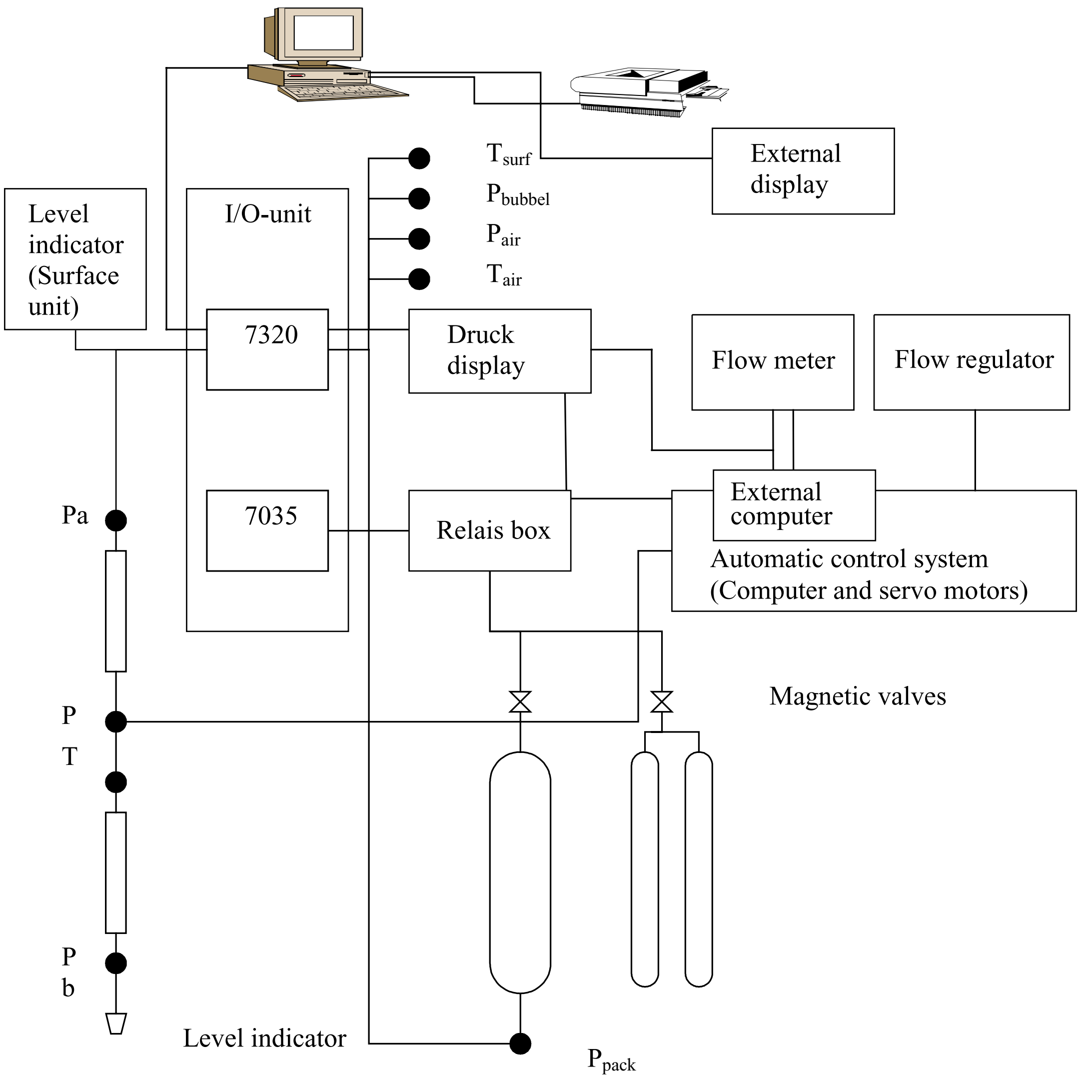


Figure 4-3. *Schematic drawing of the data acquisition system and the flow regulation control system in PSS2.*

5 Execution

5.1 Preparations

The Site Acceptance Test (SAT) between 26th May and 6th June were forming part of previous work. Due to the work done in the frame of the SAT task on borehole KLX02, the test container was already installed, the packer inflation and test valve hoses were filled with water and the rig was mounted at arrival of the test team.

Following additional preparation work and functional checks were conducted prior to starting test activities:

- Function check of shut-in tool both ends, overpressure by 1 MPa, leak detected on lower side close to valve. Discarded. Replace shut-in tool. Check new shut-in tool (OK).
- Synchronize clocks on all computers (OK).
- Check pressure gauges against atmospheric pressure and than on test depth against column of water OK).
- Check functionality of level indicator – works well with 77 mm ring.
- Translate all protocols into English (OK).
- Filling injection tank with 2"pump (OK).
- Filling pressure vessels with clean water (OK).
- Filling buffer tank with water (OK).
- Filling packers with water and de-air (OK).
- Measure and assemble test tool (OK).

5.2 Execution of tests/measurements

5.2.1 Test principle

The tests were conducted as constant pressure injection (CHi phase) followed by a shut-in pressure recovery (CHir phase). In some cases, when the test section transmissivity was too low (typically lower than 1E–9 m^2/s) no measurable flow could be registered during the CHi phase. In some of these cases the CHir phase was conducted as a pulse injection test as a trial (PI phase). In other cases, also due to the very low test section transmissivity, the packer compliance period lasted very long (typically several hours). As agreed with SKB, a test was skipped when there was no indication for a pressure stabilisation within 45 min (for 100 m sections) or within 30 min (for 20 m and 5 m sections, see Figure 5-1). In such cases there was no active test conducted, the behaviour of the compliance period being taken as a proof of very low interval transmissivity (lower than 1E–11 m^2/s). Between test no 42 (922–942 m) and no 43 (943–963 m) as well as between test no 52 (335–340 m) and no 53 (341–346 m) are no overlaps of the sections. The positions of the packers had to be shifted to avoid cross-flow and damage of the packers due to major fractured zones. Basics for selection of performing tests in 20 m and 5 m section see chapter 3.2.

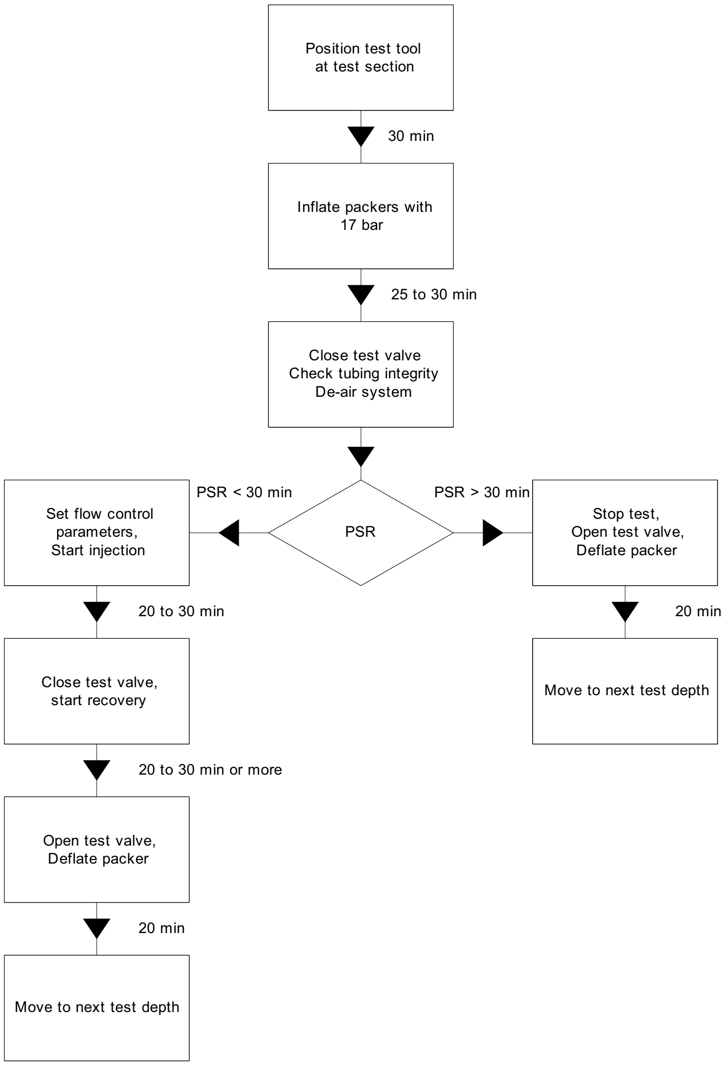


Figure 5-1. *Flow chart for test performance.*

5.2.2 Test procedure

A test cycle includes the following phases: 1) Transfer of down-hole equipment to the next section. 2) Packer inflation. 3) Pressure stabilisation. 4) Constant head injection. 5) Pressure recovery. 6) Packer deflation. The injection tests in KLX02 has been carried out by applying a constant injection pressure of c 200 kPa (20 m water column) above the static formation pressure in the test section. Before start of the injection tests, approximately stable pressure conditions prevailed in the test section. After the injection period, the pressure recovery in the section was measured.

The duration for each phase is presented in Table 3-3.

In some cases injection and recovery phases were prolonged. This was due to testing zones of high interest for example high flow zones, low flow zones or when performing pulse tests.

Table 5-1. Durations for packer inflation, pressure stabilisation, injection and recovery phase and packer deflation in KLX02.

Position test tool to new test section (correct position using the borehole markers)	Approx. 30 min
Inflate packers with 17 bar	25 min
Close test valve	10 min
Check tubing integrity with 6 bar	2 min
De-air system	2 min
Set automatic flow control parameters	5 min
Start injection	20 to 45 min
Close test valve, start recovery	20 min or more
Open test valve	10 min
Deflate packers	25 min
Move to next test depth	…

5.3 Data handling

The data handling followed several stages. The data acquisition software (Orchestrator) produced an ASCII raw data file (*.ht2) which contains the data in voltage and milliampere format plus calibration coefficients. The *.ht2 files were processed to *.dat files using the SKB program called IPPlot. These files contain the time, pressure, flow rate and temperature data. The *.dat files were synthesised in Excel to a *.xls file for plotting purposes. Finally, the test data to be delivered to SKB were exported from Excel in csv format. These files were also used for the subsequent test analysis.

5.4 Analyses and interpretation

5.4.1 Analysis software

The tests were analysed using a type curve matching method. The analysis was performed using Golder's test analysis program FlowDim. FlowDim is an interactive analysis environment allowing the user to interpret constant pressure, constant rate and slug/pulse tests in source as well as observation boreholes. The program allows the calculation of type-curves for homogeneous, dual porosity and composite flow models in variable flow geometries from linear to spherical.

5.4.2 Analysis approach

Constant pressure tests are analysed using a rate inverse approach. The method initially known as the /Jacob and Lohman, 1952/ method was further improved for the use of type curve derivatives and for different flow models.

Constant rate and pressure recovery tests are analysed using the method described by /Gringarten, 1986/ and /Bourdet et al. 1989/ by using type curve derivatives calculated for different flow models.

5.4.3 Pulse injection tests

A test is always initiated as a constant pressure injection. However, if after a few seconds of injection the rate quickly drops to zero, this indicates a very tight section. It is then decided to close the test valve and measure the pressure recovery. The pressure recovery is analysed as a pulse injection phase (PI).

During the brief injection phase a small volume is injected (derived from the flowmeter measurements). This injected volume produces the pressure increase of dp. Using a dV/dp approach, the wellbore storage coefficient relevant for the subsequent pressure recovery can be calculated. It should be noted though that there is large uncertainty connected with the determination of the wellbore storage coefficient (probably one order of magnitude), which will implicitly translate into uncertainty in the derived transmissivity.

Figure 5-2 below show an example of a typical pressure versus time evolution for such a tight section.

The analysis was then done according to:

- Calculation of initial estimates of the model parameters by using the Ramey Plot /Ramey et al. 1975/. This plot is typically not presented in the appendix.
- Flow model identification and type curve analysis in the deconvolution Peres Plot /Peres et al. 1989; Chakrabarty and Enachescu, 1997/. A non-linear regression algorithm is used to provide optimized model parameters in the latter stages. An example of the type curves is presented in Figure 5-3.

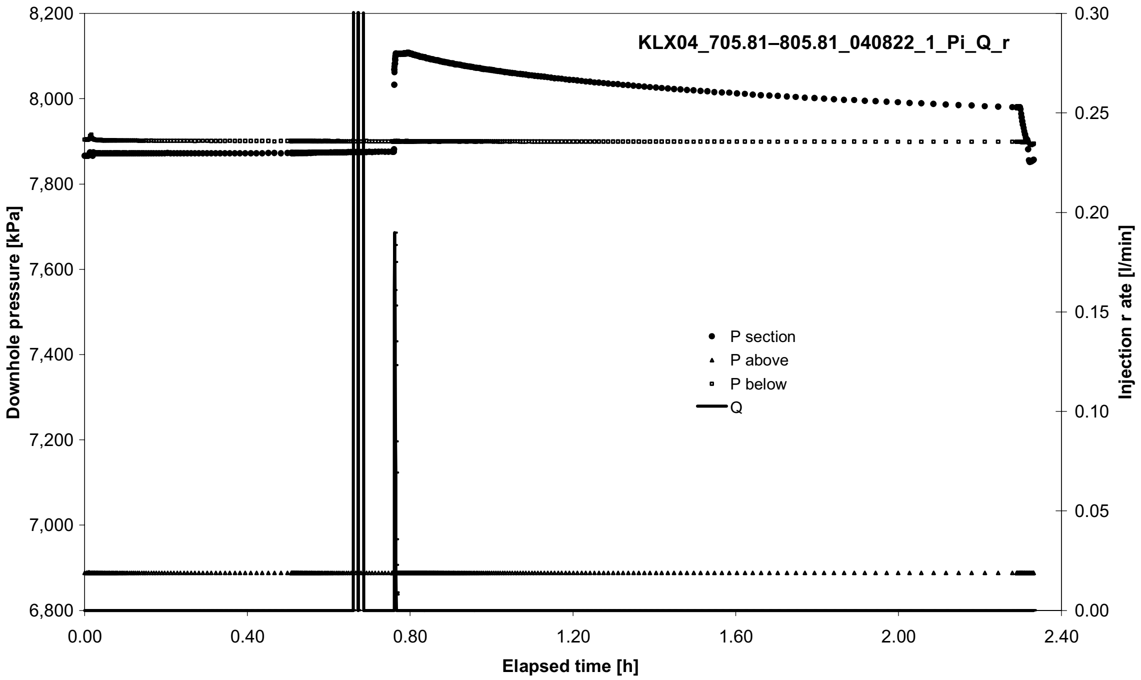


__Figure 5-2.__ Typical pressure versus time plot of a Pulse injection test.

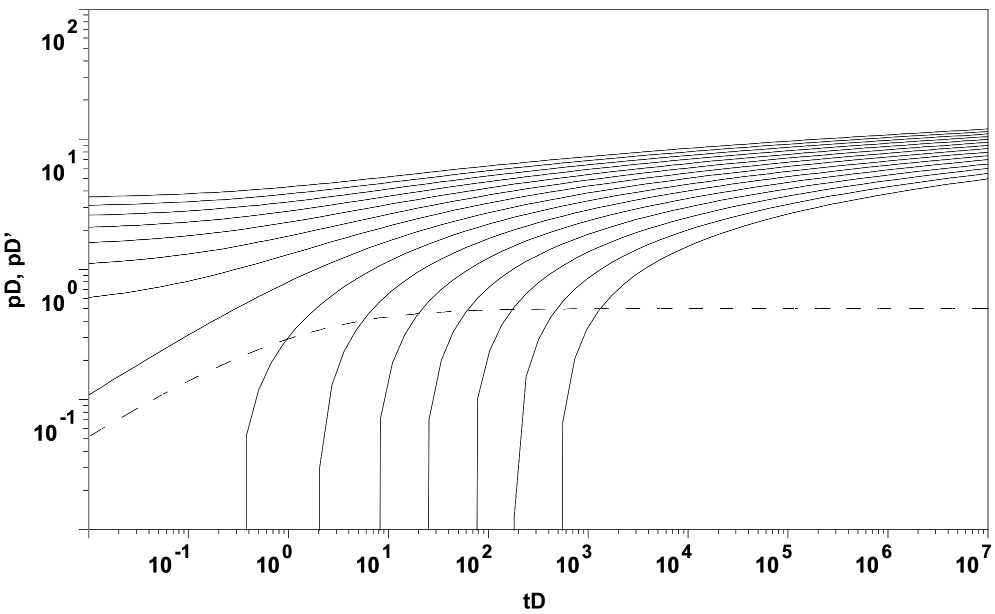


Figure 5-3. *Deconvolution type curve set for pulse test analysis.*

5.4.4 Analysis methodology

Each of the relevant test phases is subsequently analyzed using the following steps:

- Identification of the flow model by evaluation of the derivative on the log-log diagnostic plot. Initial estimates of the model parameters are obtained by conventional straight-line analysis.
- Superposition type curve matching in log-log coordinates. A non-linear regression algorithm is used to provide optimized model parameters in the latter stages.
- Non-linear regression in semi-log coordinates /superposition HORNER plot; Horner, 1951/. In this stage of the analysis, the static formation pressure is selected for regression.

The test analysis methodology is best explained in /Horne, 1990/.

5.4.5 Steady state analysis

In addition to the type curve analysis, an interpretation based on the assumption of stationary conditions was performed as described by /Moye, 1967/.

5.4.6 Flow models used for analysis

The flow models used in analysis were derived from the shape of the pressure derivative calculated with respect to log time and plotted in log-log coordinates.

In several cases the pressure derivative suggests a change of transmissivity with the distance from the borehole. In such cases a composite flow model was used in the analysis.

In other cases, the use of a homogeneous flow model led to very large skin factors (e.g. 20). In these cases, in addition to the homogeneous flow model analysis an analysis using a composite flow model was conducted. In these cases the skin was represented explicitly as inner composite zone.

The flow dimension displayed by the test can be diagnosed from the slope of the pressure derivative. A slope of 0.5 indicates linear flow, a slope of 0 (horizontal derivative) indicates radial flow and a slope of –0.5 indicates spherical flow. The flow dimension diagnosis was commented for each of the tests. However, in all cases it was possible to achieve to acceptable analysis results (good match quality) by using radial flow geometry (flow dimension of 2).

5.4.7 Calculation of the static formation pressure an equivalent freshwater head

The static pressure measured at transducer depth, was derived from the pressure recovery (CHir) following the constant pressure injection phase by using straight line or type curve extrapolation in the Horner plot.

The equivalent freshwater head (expressed in meters above sea level) was calculated from the static formation pressure, corrected for atmospheric pressure measured by the surface gauge, by assuming a water density of 1,000 kg/m^3 (freshwater). The equivalent freshwater head is the static water level an individual test interval would show if isolated and connected to the surface by tubing full of freshwater. Figure 5-4 shows the methodology schematically.

The freshwater head in meters above sea level is calculated as following:

$$h = \frac{(p_i - p_{atm})}{\rho \cdot g}$$

which is the p_i value expressed in a water column of freshwater.

With consideration of the elevation of the reference point (RP) and the gauge depth (Gd), the freshwater head is

$$head = RP_{elev} - Gd + \frac{(p_i - p_{atm})}{\rho \cdot g}.$$

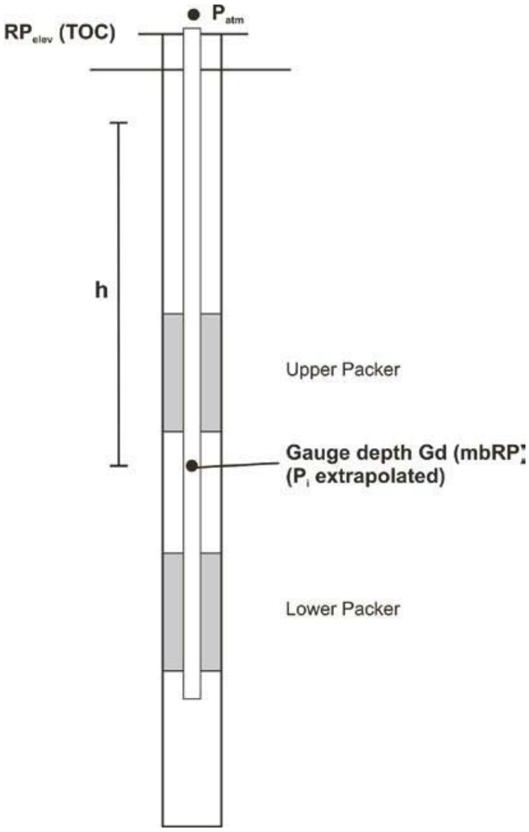


Figure 5-4. *Schematic methodologies for calculation of the freshwater head.*

5.4.8 Derivation of the recommended transmissivity and the confidence range

In most of the cases more than one analysis was conducted on a specific test. Typically both test phases were analysed (CHi and CHir) and in some cases the CHir phase was analysed using two different flow models. The parameter sets (i.e. transmissivities) derived from the individual analyses of a specific test usually differ. In the case when the differences are small (which is typically the case) the recommended transmissivity value is chosen from the test phase that shows the best data and derivative quality, which is most of the cases at the CHir phase. In cases when a composite flow model was deemed to be most representative for the hydraulic behaviour of the specific test section, than the outer zone transmissivity was selected as recommended value, because it is regarded as most representative for the large scale undisturbed formation properties.

The confidence range of the transmissivity was derived using expert judgement. Factors considered were the range of transmissivities derived from the individual analyses of the test as well as additional sources of uncertainty such as noise in the flow rate measurement, numeric effects in the calculation of the derivative or possible errors in the measurement of the wellbore storage coefficient. No statistical calculations were performed to derive the confidence range of transmissivity.

In some cases the tests were not analysable due to the fact that the flow rates during the CHi phase were below the range of the flowmeter (< 0.5 mL/min) or because the compliance phase following packer inflation was too long, thus indicating a very low interval transmissivity. In such cases the interval transmissivity was recommended to a value of 1.0E–11 m^2/s which was in the same time regarded as the upper boundary of the confidence range. This value is consistent with the observations made during the analysis of the other tests in the borehole (i.e. the transmissivity must be lower than in the cases when the test was analysable).

5.4.9 Normalized derivative plot analysis

In addition to the type curve analysis described above, a normalized derivative plot analysis was performed. The advantage of this analysis is that it allows displaying the derivatives of several tests and test phases in a normalized fashion, such that the radial flow transmissivity can be directly read from the y-axis of the plot. A normalized plot synthesis of all tests conducted is presented in Appendix 5. In the following, the theory of normalized plots is briefly presented:

In cases when the difference in results of the individual analyses was large (more than half order of magnitude) the test phases were compared in a normalized plot and the phase showing the best derivative quality was selected.

The synthesis of hydraulic packer tests as well as long term monitoring data can be conducted using normalized derivative plotting techniques. This technique unifies the analysis of tests conducted under different inner boundary conditions (i.e. constant rate, constant pressure and slug/pulse), allowing a direct comparison between such measurements in terms of flow model and transmissivity.

Table 5-2. Data processing and transmissivity transformation equations used in the derivative normalization analysis.

Test type	Data processing	Transmissivity transformation equation
Slug/Pulse tests	$p_{PR}(t)=\frac{\int_0^t (p_i - p_w(t))}{(p_w(t)-p_0)}\left[\frac{1}{s}\right]$	$p_{PR}(t)=\frac{C\,\rho\,g\,p_D(t_D)}{2\pi\,T}$
Constant rate tests	$p(t)=p_w(t)-p_0[Pa]$	$\Delta p(t)=\frac{q\,\rho\,g\,p_D(t_D)}{2\pi\,T}$
Constant pressure tests	$q_{inv}(t)=\frac{1}{q_w(t)}\left[\frac{s}{m^3}\right]$	$q_{inv}(t)=\frac{\Delta p\,\rho\,g}{2\pi\,T\,Q_D(t_D)}$

The table presents the data processing methodology used in the derivative normalization analysis. The method is based on the fact that in the case of infinite acting radial flow, the semilog derivative of the flow model ($p_D(t_D)$ or $Q_D(t_D)$) converges to the constant value of 0.5 at middle and late times:

$$\frac{dp_D(t_D)}{d\log t_D}=0.5$$
$$\frac{dQ_D(t_D)}{d\log t_D}=0.5 \qquad (1)$$

for t_D > 1E+02 (constant rate) and t_D > 1E+01 (constant pressure and slug/pulse).

The transformation equations in the table can be rewritten for the semilog derivative:

$$\frac{dp_{PR}(t)}{d\log t} = \frac{C\,\rho\,g\,\dfrac{dp_D(t_D)}{d\log t_D}}{2\pi\,T} \qquad \text{for slug/pulse tests} \qquad (2)$$

$$\frac{d\Delta p(t)}{d\log t} = \frac{q\,\rho\,g\,\dfrac{dp_D(t_D)}{d\log t_D}}{2\pi\,T} \qquad \text{for constant rate tests} \qquad (3)$$

$$\frac{dq_{inv}(t)}{d\log t} = \frac{\Delta p\,\rho\,g}{2\pi\,T\,\dfrac{dQ_D(t_D)}{d\log t_D}} \qquad \text{for constant pressure tests} \qquad (4)$$

If replacing the infinite acting radial flow assumption stated in equation 1 into equations 2, 3 and 4, these can be solved for transmissivity, as presented for the example of a constant rate test, in equation 5.

$$T_{IARF} = \frac{d\log t}{d\Delta p(t)}\frac{q\,\rho\,g}{4\pi} \qquad (5)$$

Using equations of the type of equation 5, one can normalize the derivative of any test phase and express it in terms of transmissivity units. In this way, for any point on the derivative curve that fulfils the infinite acting radial flow (IARF) assumption (flat shape of the derivative), the formation transmissivity is equal to the Y-coordinate of this point in a T_{IARF} vs. time plot.

This method allows plotting the derivative of a given test phase in terms of transmissivity units, this fact enabling the user to directly compare and synthesize the behaviour of different tests on a single normalized multi-derivative plot.

6 Results

In the following, results of all tests are presented and analysed. Chapter 6.1 presents the 100 m tests, 6.2 the 20 m tests, 6.3 the 5 m tests and 6.4 the pulse injection tests. The results are given as general comments to test pereformance, the identified flow regimes and calculated parameters and finally the parameters which are considered as most representative are chosen and justification is given. All results are also summarised in Table 7-1 and 7-2 of the Synthesis chapter.

6.1 100 m single-hole injection tests

In the following, the 100 m section tests conducted in borehole KLX02 are presented and analysed.

6.1.1 Section 204 –304 m, test no 1, injection

Comments to test

The test was conducted as a constant pressure injection (CHi) with a pressure difference of 201 kPa, followed by a pressure recovery (CHir). The test data indicates a hydraulic connection between the test interval and the section below. The injection rate decreased from 52.5 L/min at start of the CHi to 47.5 L/min at the end, indicating a relatively high interval transmissivity. The early times of the CHi (first 3 minutes) are not analysable due to the time needed by the system to regulate constant pressure. The CHir shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow regime is interpreted from the shape of the semi-log derivative plotted in log-log coordinates. In case of the present test both test phases show a flat derivative at late times, which is indicative of a flow dimension of 2 (radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-1. The table below presents relevant parameters with respect to the selected model.

Table 6-1. Analyses results; section 204–304 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	3.86E–5	NA	NA
T_M [m^2/s]	5.03E–05	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	NA	NA	4.5E–5
T_2 [m^2/s]	5.6E–5	1.8E–4	1.5E–4
r_1 [m]	NA	NA	19
S [–] (ass. approx. 1E–6)	1.3E–6	1.0E–6	2.8E–6
ξ [–]	0	17.8	0
C [m^3/Pa]	NA	3.0E–8	2.6E–8

Selected representative parameters

The recommended transmissivity of 1.8E–4 m^2/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the interval transmissivity is estimated to be 3E–5 to 3E–4 m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,028.6 kPa.

The analysis of the CHi and CHir phases shows some inconsistency that should be resolved in case further analysis of the test is planned. In this case we recommend conducting a full superposition transient analysis in order to account for pressure history effects and changing flow rates during the CHi phase.

6.1.2 Section 304–404 m, test no 2, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 200 kPa, followed by a pressure recovery phase. No hydraulic connection between test interval and the adjacent zones was observed. The injection rate decreased from 14.22 L/min at start of the CHi phase to 13.19 L/min at the end, indicating a relatively high interval transmissivity. The early times of the CHi phase (first 20 seconds) are not analysable due to the time needed by the system to regulate constant pressure. However, the middle and late times of the CHi phase are of good quality and can be analysed quantitatively. The recovery phase (CHir) shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test both test phases (CHi and CHir) show a flat derivative at late times, which is indicative of a flow dimension of 2 (radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis is presented in Appendix 2-2. The table below presents relevant parameters with respect to the selected model.

Table 6-2. Analyses results; section 304–404 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.08E–5	NA	NA
T_M [m^2/s]	1.41E–5	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	4.6E–6	NA	4.9E–6
T_2 [m^2/s]	4.6E–5	4.9E–5	4.9E–5
r_1 [m]	0.38	NA	0.38
S [–] (ass. approx. 1E–6)	1.4E–6	1.0E–6	7.69E–7
ξ [–]	0	18.5	0
C [m^3/Pa]	NA	8.3E–9	7.11E–9

Selected representative parameters

The recommended transmissivity of 4.9E–5 m^2/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the interval transmissivity is estimated to be 2.0E–5 to 6.5E–5 m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,007.6 kPa.

The analysis of the CHi and CHir phases shows very good consistency. No further analysis is recommended.

6.1.3 Section 404–504 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 199 kPa, followed by a pressure recovery phase. No hydraulic connection between test interval and the adjacent zones was observed. The injection rate decreased from 0.185 L/min at start of the CHi phase to 0.163 L/min at the end, indicating a low interval transmissivity. The early times of the CHi phase (first 1 minute seconds) are not analysable due to the time needed by the system to regulate constant pressure. However, the middle and late times of the CHi phase are of good quality and can be analysed quantitatively. The recovery phase (CHir) shows no problems and is amenable for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test both test phases (CHi and CHir) show a flat derivative at late times, which is indicative of a flow dimension of 2 (radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-3. The table below presents relevant parameters with respect to the selected model.

Table 6-3. Analyses results; section 404–504 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.31E–7	NA	NA
T_M [m^2/s]	1.71E–7	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	6.5E–8	NA	5.3E–8
T_2 [m^2/s]	2.4E–7	5.9E–7	5.3E–7
r_1 [m]	0.38	NA	0.38
S [–] (ass. approx. 1E–6)	3.8E–6	1.0E–6	2.8E–6
ξ [–]	0	20.1	0
C [m^3/Pa]	NA	3.0E–10	2.6E–10

Selected representative parameters

The recommended transmissivity of 5.9E–7 m^2/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the interval transmissivity is estimated to be 1.5E–7 to 6.0E–7 m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,967.9 kPa.

The analysis of the CHi and CHir phases shows very good consistency. No further analysis is recommended.

6.1.4 Section 504–604 m, test no 4, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 200 kPa, followed by a pressure recovery phase. No hydraulic connection between test interval and the adjacent zones was observed. The rate regulation during the constant pressure injection phase was poor because dominated by strong oscillations. The average injection rate during this phase was 1.8E–2 L/min, indicating a low interval transmissivity. The CHi data is not analysable due to the problems mentioned above. The recovery phase (CHir) shows no problems and is amenable for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase shows a flat derivative at middle and late times, which is indicative of a flow dimension of 2 (radial flow). An infinite acting radial composite flow model was used in the analysis. The analysis plots are presented in Appendix 2-4. The table below presents relevant parameters with respect to the selected model.

Table 6-4. Analyses results; section 504–604 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.31E–8	NA	NA
T_M [m^2/s]	1.70E–8	NA	NA
Flow model	NA	NA	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	NA	NA	1.5E–8
T_2 [m^2/s]	NA	NA	3.0E–9
r_1 [m]	NA	NA	2.4
S [–] (ass. approx. 1E–6)	NA	NA	
ξ [–]	NA	NA	0
C [m^3/Pa]	NA	NA	2.5E–10

Selected representative parameters

The recommended transmissivity of 3.0E–9 m^2/s was derived from the outer zone transmissivity derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the interval transmissivity is estimated to be 1.0E–9 to 2.0E–8 m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,953.6 kPa.

No further analysis is recommended.

6.1.5 Section 604–704 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 196 kPa, followed by a pressure recovery phase. No hydraulic connection between test interval and the adjacent zones was observed. The rate regulation during the constant pressure injection phase was poor because dominated by strong oscillations. The average injection rate during this phase was 2E–3 L/min, indicating a very low interval transmissivity. This rate was also used in the analysis of the pressure recovery phase (CHir). The CHi data is not analysable due to the problems mentioned above. The recovery phase (CHir) shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase is mainly dominated by wellbore storage and composite transition, such that a flow dimension of 2 (radial flow) had to be assumed. An infinite acting radial composite flow model was used in the analysis. The analysis plots are presented in Appendix 2-5. The table below presents relevant parameters with respect to the selected model.

Table 6-5. Analyses results; section 604–704 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.25E–9	NA	NA
T_M [m^2/s]	1.63E–9	NA	NA
Flow model	NA	NA	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	NA	NA	3.0E–10
T_2 [m^2/s]	NA	NA	1.1E–10
r_1 [m]	NA	NA	1.2
S [–] (ass. approx. 1E–6)	NA	NA	2.8E–6
ξ [–]	NA	NA	0
C [m^3/Pa]	NA	NA	1.4E–10

Selected representative parameters

The recommended transmissivity of 3.0E–10 m^2/s was derived from the outer zone transmissivity derived from the analysis of the CHir phase. The confidence range for the interval transmissivity is estimated to be 5.0E–11 to 7.0E–10 m^2/s. The flow was assumed to be 2 (test response strongly masked by wellbore storage). The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,886.5 kPa.

No further analysis is recommended.

6.1.6 Section 704–804 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 200 kPa, followed by a pressure recovery phase. No hydraulic connection between test interval and the adjacent zones was observed. The injection rate was nearly constant 0.2 L/min during the CHi phase, indicating a relatively low interval transmissivity. The early times of the CHi phase (first 1.8 minutes) are not analysable due to the time needed by the system to regulate constant pressure. However, the middle and late times of the CHi phase are of good quality and can be analysed quantitatively. The recovery phase (CHir) shows no problems and is amenable for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test both test phases (CHi and CHir) show a flat derivative at late times, which is indicative of a flow dimension of 2 (radial flow). The downward slope of the derivative at late times of the CHir phase (slope = –1) indicates a radial composite transition to a shell of higher transmissivity. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-6. The table below presents relevant parameters with respect to the selected model.

Table 6-6. Analyses results; section 704–804 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.63E–7	NA	NA
T_M [m^2/s]	2.12E–7	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	1.3E–7	NA	1.2E–7
T_2 [m^2/s]	8.7E–7	6.9E–7	7.0E–7
r_1 [m]	6.5	NA	2.9
S [–] (ass. approx. 1E–6)	1.0E–6	1.0E–6	3.2E–6
ξ [–]	0	19.4	0
C [m^3/Pa]	NA	1.3E–9	1.1E–9

Selected representative parameters

The recommended transmissivity of 6.9E–7 m^2/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the interval transmissivity is estimated to be 3.0E–8 to 1.0E–6 m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 6,873.4 kPa.

The analysis of the CHi and CHir phases shows very good consistency. No further analysis is recommended.

6.1.7 Section 804–904 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 199 kPa, followed by a pressure recovery phase. No hydraulic connection between test interval and the adjacent zones was observed. The injection rate was nearly constant varying between 0.105 L/min at start of the CHi phase and 0.095 L/min at its end, indicating a relatively low interval transmissivity. The early times of the CHi phase (first 2.4 minutes) are not analysable due to the time needed by the system to regulate constant pressure. The middle and late times of the CHi phase are of better quality, they are however distorted at late times by noise in the measured flow rate. The analysis results of the CHi phase should be regarded as order of magnitude only. The recovery phase (CHir) shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test both test phases (CHi and CHir) show a flat derivative at late times, which is indicative of a flow dimension of 2 (radial flow). The downward slope of the derivative at late times of the CHir phase (slope = –1) indicates a radial composite transition to a shell of higher transmissivity. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-7. The table below presents relevant parameters with respect to the selected model.

Table 6-7. Analyses results; section 804–904 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	7.81E–8	NA	NA
T_M [m^2/s]	1.02E–7	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	5.9E–8	NA	6.9E–8
T_2 [m^2/s]	3.0E–7	3.5E–7	3.4E–7
r_1 [m]	3.8	NA	5.3
S [–] (ass. approx. 1E–6)	6.9E–7	1.0E–6	2.9E–7
ξ [–]	0	20.0	0
C [m^3/Pa]	NA	4.2E–10	3.9E–10

Selected representative parameters

The recommended transmissivity of 3.5E–7 m^2/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the interval transmissivity is estimated to be 2.0E–8 to 5.0E–7 m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 7,861.1 kPa.

The analysis of the CHi and CHir phases shows very good consistency. No further analysis is recommended.

6.1.8 Section 904–1,004 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 198 kPa, followed by a pressure recovery phase. No hydraulic connection between test interval and the adjacent zones was observed. The injection rate was nearly constant varying between 0.183 L/min at start of the CHi phase and 0.172 L/min at its end, indicating a relatively low interval transmissivity. The early times of the CHi phase (first 2.8 minutes) are not analysable due to the time needed by the system to regulate constant pressure. The middle and late times of the CHi phase are of better quality, they are however distorted at late times by noise in the measured flow rate. The analysis results of the CHi phase should be regarded as order of magnitude only. The recovery phase (CHir) shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test both test phases (CHi and CHir) show a flat derivative at late times, which is indicative of a flow dimension of 2 (radial flow). The downward slope of the derivative at late times of the CHir phase (slope = –1) indicates a radial composite transition to a shell of higher transmissivity. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-8. The table below presents relevant parameters with respect to the selected model.

Table 6-8. Analyses results; section 904–1,004 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.42E–7	NA	NA
T_M [m^2/s]	1.85E–7	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	1.1E–7	NA	9.1E–8
T_2 [m^2/s]	1.3E–6	9.1E–7	1.5E–6
r_1 [m]	4.6	NA	1.9
S [–] (ass. approx. 1E–6)	3.3E–6	1.0E–6	2.3E–6
ξ [–]	0	32.6	0
C [m^3/Pa]	NA	1.6E–9	1.6E–9

Selected representative parameters

The recommended transmissivity of 9.1E–7 m^2/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the interval transmissivity is estimated to be 5.0E–8 to 2.0E–6 m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 8,848.6 kPa.

The analysis of the CHi and CHir phases shows very good consistency. No further analysis is recommended.

6.2 20 m single-hole injection tests

In the following, the 20 m section tests conducted in borehole KLX02 are presented and analysed.

6.2.1 Section 204–224 m, test no 2, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 200 kPa, followed by a pressure recovery phase. The test data indicates a good packer seal. No hydraulic connection between the test section and the adjacent zones was observed. The injection rate decreased from 4.25 L/min at start of the CHi phase to 3.16 L/min at the end, indicating a relatively high interval transmissivity. The early times of the CHi phase (first 0.7 minutes) are not analysable due to the time needed by the system to regulate constant pressure. Only the late times of the CHi phase can be analysed quantitatively. The recovery phase (CHir) shows early times problems as well, which were caused by the test valve. Therefore, only the middle and late times can be analysed quantitatively.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the data quality does not allow for a specific determination of the flow dimension. The analysis was conducted assuming a flow dimension of 2 (radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. The CHir phase was analysed using a radial composite flow model. The analysis plots are presented in Appendix 2-9. The table below presents relevant parameters with respect to the selected model.

Table 6-9. Analyses results; section 204–224 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	2.62E–6	NA	NA
T_M [m^2/s]	2.74E–6	NA	NA
Flow model	Homogeneous Infinite acting	NA	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	3.2E–6	NA	1.9E–6
T_2 [m^2/s]	NA	NA	1.6E–4 (acting as a cst. P boundary)
r_1 [m]	NA	NA	1.4
S [–] (ass. approx. 1E–6)	1.4E–6	NA	2.6E–6
ξ [–]	0	NA	0
C [m^3/Pa]	NA	NA	1.7E–10

Selected representative parameters

The recommended transmissivity of 3.2E–6 m²/s was derived from the analysis of the CHi phase, which shows the best data and derivative quality. The confidence range for the transmissivity of the inner composite zone (borehole vicinity) is estimated to be 1E–6 to 2E–5 m²/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,030.3 kPa.

The analysis of the CHi and CHir phases shows some inconsistency that should be resolved in case further analysis of the test is planned. In this case we recommend conducting a full superposition transient analysis in order to account for pressure history effects and changing flow rates during the CHi phase.

6.2.2 Section 224–244 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 200 kPa, followed by a pressure recovery phase. The test data indicates a good packer seal; no hydraulic connection between the test section and the adjacent zones was observed. The injection rate decreased from 1.68 L/min at start of the CHi phase to 1.34 L/min at the end, indicating a moderate interval transmissivity. The CHi phase was conducted without problems. The automated system managed to regulate the rate very quickly (14 seconds) such that the entire phase is amenable for quantitative analysis. The CHir phase recovered to static conditions very quickly, such that the analysis should be regarded with caution.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension was derived from the CHi phase, which shows a flat derivative (dimension 2 – radial flow) at late times. An infinite acting radial composite flow model was used in the analysis. The analysis plots are presented in Appendix 2-10. The table below presents relevant parameters with respect to the selected model.

Table 6-10. Analyses results; section 224–244 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.18E–6	NA	NA
T_M [m^2/s]	1.23E–6	NA	NA
Flow model	Radial 2 shell composite Infinite acting	NA	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	9.7E–7	NA	4.7E–7
T_2 [m^2/s]	4.8E–6	NA	6.9E–4 (acting as a cst. P boundary)
r_1 [m]	3.8	NA	0.4
S [–] (ass. approx. 1E–6)	1.0E–6	NA	1.7E–6
ξ [–]	0	NA	0
C [m^3/Pa]	NA	NA	1.9E–10

Selected representative parameters

The recommended transmissivity of 9.7E–7 m^2/s was derived from the analysis of the CHi phase, which shows the best data and derivative quality. The confidence range for the transmissivity of the inner composite zone (borehole vicinity) is estimated to be 4E–7 to 2E–6 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,226.6 kPa.

The analysis of the CHi and CHir phases shows some inconsistency that should be resolved in case further analysis of the test is planned. In this case we recommend conducting a full superposition transient analysis in order to account for pressure history effects and changing flow rates during the CHi phase.

6.2.3 Section 244–264 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 199 kPa, followed by a pressure recovery phase. The test data indicates a hydraulic connection of the test interval to both adjacent sections (above and below test interval). The injection rate decreased from 49.5 L/min at start of the CHi phase to 43.4 L/min at the end, indicating a relatively high interval transmissivity. The CHi phase was conducted without problems. The automated system managed to regulate the rate very quickly (less than 1 minute) such that the entire phase is amenable for quantitative analysis. The CHir phase was distorted at early times by a malfunction of the test valve. The phase shows however, good data quality and is amenable for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension can be derived from both test phases, which show a flat derivative (dimension 2 – radial flow) at late times. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-11. The table below presents relevant parameters with respect to the selected model.

Table 6-11. Analyses results; section 244–264 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	3.60E–5	NA	NA
T_M [m^2/s]	3.77E–5	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	3.2E–5 (only estimated)	NA	3.4E–5
T_2 [m^2/s]	1.6E–4	1.7E–4	1.7E–4
r_1 [m]	3.8 (upper limit)	NA	3.8
S [–] (ass. approx. 1E–6)	9.2E–7	1.0E–6	2.9E–6
ξ [–]	0	18.0	0
C [m^3/Pa]	NA	2.1E–8	2.7E–8 (large value due to malfunction of the test valve)

Selected representative parameters

The recommended transmissivity of 1.7E–4 m^2/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the transmissivity of the outer composite zone is estimated to be 8E–5 to 2E–4 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,424.2 kPa.

The analysis of the CHi and CHir phases shows good consistency. It is unclear whether the inner or outer composite zone parameters should be regarded as representative for the formation behaviour. If further analysis is intended, this uncertainty should be resolved using full superposition analysis.

6.2.4 Section 264–284 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 201 kPa, followed by a pressure recovery phase. The test interval was well isolated, no hydraulic connection between test section and adjacent zones was observed. The injection rate decreased from 2.47 L/min at start of the CHi phase to 1.59 L/min at the end, indicating a relatively high interval transmissivity. The CHi phase was conducted without problems. The automated system managed to regulate the rate very quickly (less than 1 minute) such that the entire phase is amenable for quantitative analysis. The CHir phase shows very fast recovery, such that the analysis does not provide reliable results. The results should be regarded as order of magnitude only.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension can be derived from the CHi phase, which shows a flat derivative (dimension 2 – radial flow) at late times. However, a regression line drawn through the entire middle and late times of the CHi phase derivative yields a flow dimension of 1.3. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-12. The table below presents relevant parameters with respect to the selected model.

Table 6-12. Analyses results; section 264–284 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.31E–6	NA	NA
T_M [m^2/s]	1.37E–6	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	1.7E–6	NA	1.1E–6
T_2 [m^2/s]	1.1E–6	6.2E–6	5.7E–6 (results less reliable due to very fast recovery)
r_1 [m]	32.3	NA	3.8
S [–] (ass. approx. 1E–6)	7.8E–7	1.0E–6	1.6E–6
ξ [–]	0	20.3	0
C [m^3/Pa]	NA	2.4E–10	1.38E–10

Selected representative parameters

The recommended transmissivity of 1.7E–6 m^2/s was derived from the analysis of the CHi phase (inner composite zone), which shows the best data and derivative quality. The confidence range for the transmissivity of the inner composite zone is estimated to be 8E–7 to 5E–6 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,616.7 kPa.

The analysis of the CHi and CHir phases shows some inconsistency. The quick pressure recovery during the CHir phase renders this phase as less useful for the analysis. To improve analysis consistency and if further analysis is intended, a full superposition analysis should be conducted. Further, as commented above, there is room for interpretation as far as the flow dimension is concerned. This additional uncertainty could be further explored using GRF analysis.

6.2.5 Section 284–304 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 199 kPa, followed by a pressure recovery phase. The test interval was well isolated, no hydraulic connection between test section and adjacent zones was observed. The injection rate decreased from 1.35 L/min at start of the CHi phase to 1.05 L/min at the end, indicating a relatively high interval transmissivity. The CHi phase was conducted without problems. The automated system managed to regulate the rate very quickly (1.6 minutes) such that the entire phase is amenable for quantitative analysis. The CHir phase shows very fast recovery, such that the analysis does not provide reliable results. The results should be regarded as order of magnitude only.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension can be derived from the CHi phase, which shows a flat derivative (dimension 2 – radial flow) at late times. However, a regression line drawn through the entire middle and late times of the CHi phase derivative yields a flow dimension of 1.7. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-13. The table below presents relevant parameters with respect to the selected model.

Table 6-13. Analyses results; section 284–304 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	8.63E–7	NA	NA
T_M [m^2/s]	9.02E–7	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	1.1E–6	NA	6.9E–7
T_2 [m^2/s]	NA	6.9E–6	8.7E–6 (results less reliable due to very fast recovery)
r_1 [m]	NA	NA	2.9
S [–] (ass. approx. 1E–6)	9.9E–7	1.0E–6	7.5E–7
ξ [–]	0	38.3	0
C [m^3/Pa]	NA	1.4E–10	6.9E–11

Selected representative parameters

The recommended transmissivity of 1.1E–6 m^2/s was derived from the analysis of the CHi phase, which shows the best data and derivative quality. The confidence range for the transmissivity is estimated to be 6E–7 to 5E–6 m^2/s (the outer zone transmissivity derived from the CHir phase is not considered reliable due to the very quick recovery). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,812.6 kPa.

The analysis of the CHi and CHir phases shows some inconsistency. The quick pressure recovery during the CHir phase renders this phase as less useful for the analysis. To improve analysis consistency and if further analysis is intended, a full superposition analysis should be conducted. Further, as commented above, there is room for interpretation as far as the flow dimension is concerned. This additional uncertainty could be further explored using GRF analysis.

6.2.6 Section 304–324 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 199 kPa, followed by a pressure recovery phase. The test shows hydraulic communication between the test interval and the adjacent zones. The injection rate decreased from 12.03 L/min at start of the CHi phase to 11.39 L/min at the end, indicating a relatively high interval transmissivity. The CHi phase was conducted without problems. The automated system managed to regulate the rate very quickly (36 seconds) such that the entire phase is amenable for quantitative analysis. The CHir phase shows relatively fast recovery, however, the data is of good quality and as such, amenable for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension can be derived from both test phases which show a flat derivative (dimension 2 – radial flow) at late times. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-14. The table below presents relevant parameters with respect to the selected model.

Table 6-14. Analyses results; section 304–324 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	9.36E–6	NA	NA
T_M [m^2/s]	9.80E–6	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	1.1E–5	NA	8.3E–6
T_2 [m^2/s]	4.2E–5	4.2E–5	4.1E–5
r_1 [m]	41.8	NA	3.8
S [–] (ass. approx. 1E–6)	1.0E–6	1.0E–6	5.9E–7
ξ [–]	0	18.6	0
C [m^3/Pa]	NA	6.5E–9	5.5E–9

Selected representative parameters

The recommended transmissivity of 4.2E–5 m^2/s was derived from the analysis of the CHi phase, which shows the best data and derivative quality. The confidence range for the transmissivity is estimated to be 2E–5 to 6E–5 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,009.3 kPa.

The analysis of the CHi and CHir phases shows inconsistency as far as the extent of the inner composite zone is concerned. To improve analysis consistency and if further analysis is intended, a full superposition analysis should be conducted.

6.2.7 Section 324–344 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 200 kPa, followed by a pressure recovery phase. The test shows hydraulic communication between the test interval and the adjacent zones. The injection rate decreased from 2.73 L/min at start of the CHi phase to 2.27 L/min at the end, indicating a moderately high interval transmissivity. The CHi phase was conducted without problems. The automated system managed to regulate the rate very quickly (32 seconds) such that the entire phase is amenable for quantitative analysis. The CHir phase shows very fast recovery. Therefore, the analysis results should be regarded as order of magnitude only.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension can be best derived from the late time CHi data which shows a flat derivative (dimension 2 – radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-15. The table below presents relevant parameters with respect to the selected model.

Table 6-15. Analyses results; section 324–344 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.86E–6	NA	NA
T_M [m^2/s]	1.95E–6	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	1.8E–6	NA	1.6E–6
T_2 [m^2/s]	3.2E–6	8.7E–6	7.8E–6
r_1 [m]	2.28	NA	3.8
S [–] (ass. approx. 1E–6)	8.7E–7	1.0E–6	2.9E–6
ξ [–]	0	20.1	0
C [m^3/Pa]	NA	3.5E–10	2.7E–10

Selected representative parameters

The recommended transmissivity of 3.2E–6 m^2/s was derived from the analysis of the CHi phase (outer zone), which shows the best data and derivative quality. The confidence range for the transmissivity is estimated to be 2E–6 to 8E–6 m^2/s (the outer zone transmissivity is considered as most representative). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,207.4 kPa.

The analysis of the CHi and CHir phases shows good consistency. No further analysis is recommended.

6.2.8 Section 384–404 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 249 kPa, followed by a pressure recovery phase. The test interval was well isolated, no hydraulic connection between test section and adjacent zones was observed. The rate regulation during the constant pressure injection (CHi) did not perform properly, the pressure in the interval showing oscillations till the late times of the phase. Because of this reason the analysis of the CHi phase is only qualitative. The flow rate oscillated between 4 and 14 mL/min, indicating a low interval transmissivity. The CHir phase was conducted without problems and shows good data quality. The CHir phase is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase derivative shows a downward trend at late times indicating either an increase of transmissivity at some distance from the borehole or a flow dimension above 2. It was decided to use a flow dimension of 2 (radial flow) in the analysis. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-18. The table below presents relevant parameters with respect to the selected model.

Table 6-16. Analyses results; section 384–404 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	2.74E–9	NA	NA
T_M [m^2/s]	2.87E–9	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	2.0E–9	NA	7.6E–10
T_2 [m^2/s]	NA	1.1E–8	2.2E–08
r_1 [m]	NA	NA	0.2
S [–] (ass. approx. 1E–6)	2.5E–6	1.0E–6	3.8E–6
ξ [–]	0	21.1	0
C [m^3/Pa]	NA	4.3E–11	3.5E–11

Selected representative parameters

The recommended transmissivity of 1.1E–8 m^2/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the transmissivity is estimated to be 2E–9 to 4E–8 m^2/s (the inner zone transmissivity derived from the CHir phase is considered to be caused by a local skin effect). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,768.0 kPa.

The analysis of the CHi and CHir phases shows some inconsistency, which is mainly caused by the poor CHi data. To improve analysis consistency and if further analysis is intended, a full superposition analysis should be conducted. Further, as commented above, there is room for interpretation as far as the flow dimension is concerned. This additional uncertainty could be further explored using GRF analysis.

6.2.9 Section 424–444 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 199 kPa, followed by a pressure recovery phase. The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate control during the CHi phase was not very good. In addition, due to the very small injection rates (very low transmissivity) the rate measurements are relatively noisy. Because of this reason the results of the CHi analysis should be regarded as order of magnitude only. The flow rate varied between 0.048 L/min and 0.054 L/min. The CHir phase is of good quality and is amenable for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension can be best derived from the late time CHir data which shows a flat derivative (dimension 2 – radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-20. The table below presents relevant parameters with respect to the selected model.

Table 6-17. Analyses results; section 424–444 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	4.05E–8	NA	NA
T_M [m^2/s]	4.24E–8	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	2.6E–8	NA	1.8E–8
T_2 [m^2/s]	8.6E–8	2.4E–7	2.6E–7
r_1 [m]	2.85	NA	0.50
S [–] (ass. approx. 1E–6)	1.0E–6	1.0E–6	1.0E–6
ξ [–]	0	32.2	0
C [m^3/Pa]	NA	8.8E–11	9.4E–11

Selected representative parameters

The recommended transmissivity of 2.4E–7 m^2/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the transmissivity is estimated to be 1E–8 to 4E–7 m^2/s (including both inner and outer composite zone). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,164.9 kPa.

If further analysis is planned, it should be clarified which of the composite zones can be seen as representative. This could be done by using a full superposition analysis.

6.2.10 Section 444–464 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 199 kPa, followed by a pressure recovery phase. The test shows hydraulic communication between the test interval and the bottom hole zone. The injection rate decreased from 0.15 L/min at start of the CHi phase to 0.088 L/min at the end, indicating a relatively low interval transmissivity. The CHi phase was conducted without problems. The automated system managed to regulate the rate very quickly (1.7 minutes) such that the late time data of the CHi phase is amenable for quantitative analysis. The CHir phase shows relatively fast recovery, however, the data is of good quality and as such, amenable for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be uniquely determined. The analysis was conducted using the radial flow assumption (flow dimension = 2), the downward derivative slope at late times of the CHir phase was interpreted as a transition to a higher transmissivity zone. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-21. The table below presents relevant parameters with respect to the selected model.

Table 6-18. Analyses results; section 444–464 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	7.26E–8	NA	NA
T_M [m^2/s]	7.60E–8	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	5.2E–8	NA	4.0E–8
T_2 [m^2/s]	2.6E–7	3.1E–7	3.2E–7
r_1 [m]	2.85	NA	0.76
S [–] (ass. approx. 1E–6)	1.6E–6	1.0E–6	5.7E–7
ξ [–]	0	21.0	0
C [m^3/Pa]	NA	5.6E–11	5.3E–11

Selected representative parameters

The recommended transmissivity of 2.6E–7 m^2/s was derived from the analysis of the CHi phase (outer zone). The confidence range for the transmissivity is estimated to be 4E–8 to 5E–7 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,362.5 kPa.

To improve analysis consistency and if further analysis is intended, a full superposition analysis should be conducted.

6.2.11 Section 464–484 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 197 kPa, followed by a pressure recovery phase. The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate was very noisy and decreased from approx. 0.03 L/min at start of the CHi phase to 0.01 L/min at the end, indicating a relatively low interval transmissivity. The automated system managed to regulate the rate relatively quickly (2.8 minutes), however, due to the low injection rates the data set is very noisy. Therefore the results of the analysis of the CHi phase should be regarded as order of magnitude only. The CHir phase shows relatively fast recovery, however, the data is of good quality and as such, amenable for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be uniquely determined. The analysis was conducted using the radial flow assumption (flow dimension = 2), the downward derivative slope at late times of the CHir phase was interpreted as a transition to a higher transmissivity zone. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-22. The table below presents relevant parameters with respect to the selected model.

Table 6-19. Analyses results; section 464–484 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	8.78E–9	NA	NA
T_M [m^2/s]	9.19E–9	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	6.5E–9	NA	3.9E–9
T_2 [m^2/s]	NA	5.7E–8	1.3E–7
r_1 [m]	NA	NA	0.47
S [–] (ass. approx. 1E–6)	1.8E–6	1.0E–6	4.8E–7
ξ [–]	0	32.6	0
C [m^3/Pa]	NA	4.4E–11	4.4E–11

Selected representative parameters

The recommended transmissivity of 5.7E–8 m^2/s was derived from the analysis of the CHir phase. The confidence range for the transmissivity is estimated to be 1E–8 to 3E–7 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,558 kPa.

To improve analysis consistency and if further analysis is intended, a full superposition analysis should be conducted.

6.2.12 Section 481–501 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 199 kPa, followed by a pressure recovery phase. The test shows no hydraulic communication between the test interval and the adjacent zones. Because conducted at an erroneous depth (481–501 m bToC) the test was terminated prematurely and repeated at the correct depth. The formation shows very low transmissivity, the injection rate was for the largest period of the test lower than 0.5 mL/min and most of the time not measurable. Therefore the CHi phase is not analysable. The CHir phase was analysed, however due to the fact that the flow rate was below the measurement range of the flowmeter, the analysis was conducted assuming a maximum value for the flow rate of 0.5 mL/min. Therefore, the derived transmissivity should be regarded as a maximum value as well.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be uniquely determined. The analysis was conducted using the radial flow assumption (flow dimension = 2). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. The analysis plots are presented in Appendix 2-23. The table below presents relevant parameters with respect to the selected model.

Table 6-20. Analyses results; section 481–501 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.64E–10	NA	NA
T_M [m^2/s]	1.72E–10	NA	NA
Flow model	NA	WBS and skin Homogeneous Infinite acting	NA
T_1 [m^2/s]	NA	1.3E–10 (or lower)	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	1.9E–6	NA
ξ [–]	NA	0	NA
C [m^3/Pa]	NA	1.7E–11	NA

Selected representative parameters

The recommended transmissivity is 1.3E–10 m^2/s which should be seen as an upper boundary of the formation transmissivity at this depth. The analysis was conducted using a flow dimension of 2.

No further analysis is recommended.

6.2.13 Section 484–504 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 199 kPa, followed by a pressure recovery phase. The test shows no hydraulic communication between the test interval and the adjacent zones. The formation shows very low transmissivity, the injection rate was for the largest period of the test lower than 0.5 mL/min and most of the time not measurable. Therefore the CHi phase is not analysable. The CHir phase was analysed, however due to the fact that the flow rate was below the measurement range of the flowmeter, the analysis was conducted assuming a maximum value for the flow rate of 0.5 mL/min. Therefore, the derived transmissivity should be regarded as a maximum value as well.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be uniquely determined. The analysis was conducted using the radial flow assumption (flow dimension = 2). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-24. The table below presents relevant parameters with respect to the selected model.

Table 6-21. Analyses results; section 484–504 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	4.08E–10	NA	NA
T_M [m^2/s]	4.27E–10	NA	NA
Flow model	NA	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	NA	NA	1.6E–10 (or lower)
T_2 [m^2/s]	NA	1.6E–10	3.3E–10
r_1 [m]	NA	NA	0.56
S [–] (ass. approx. 1E–6)	NA	1.0E–6	9.9E–7
ξ [–]	NA	0.04	0
C [m^3/Pa]	NA	1.2E–11	1.3E–11

Selected representative parameters

The recommended transmissivity is 1.6E–10 m^2/s and was derived from the inner composite zone. Due to the fact that the derivative does not reach infinite acting regime at late times, the derived transmissivity could be higher than calculated (estimated up to one order of magnitude). The analysis was conducted using a flow dimension of 2.

No further analysis is recommended.

6.2.14 Section 504–524 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase (CHi) with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The pressure regulation of the CHi phase was poor and the injection flow rate was unsTable. The injection rate decreased from 0.018 L/min at start of the CHi phase to 0.008 L/min at the end, indicating a low interval transmissivity. Due to the poor data quality, the analysis of the CHi phase can only deliver an order of magnitude for transmissivity. The CHir phase is of good quality and can be analysed quantitatively.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be uniquely determined. The analysis could be consistently conducted using the radial flow assumption (flow dimension = 2). However, the derivative of the CHir phase shows at late times a slope of 0.5 which may indicate linear flow (flow dimension = 1). An infinite acting radial composite flow model was used in the analysis. The analysis plots are presented in Appendix 2-25. The table below presents relevant parameters with respect to the selected model.

Table 6-22. Analyses results; section 504–524 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	6.36E–9	NA	NA
T_M [m^2/s]	6.66E–9	NA	NA
Flow model	Homogeneous Infinite acting	NA	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	5.4E–9	NA	5.4E–9
T_2 [m^2/s]	NA	NA	1.9E–9
r_1 [m]	NA	NA	1.83
S [–] (ass. approx. 1E–6)	1.2E–6	NA	1.0E–6
ξ [–]	0	NA	0
C [m^3/Pa]	NA	NA	3.9E–11

Selected representative parameters

The recommended transmissivity of 5.4E–9 m^2/s was derived from the analysis of the CHir phase (inner zone). The confidence range for the transmissivity is estimated to be 1E–9 to 7E–9 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a range between 4,944 kPa and 4,950 kPa.

To improve analysis consistency and resolve the uncertainty concerning the flow dimension, a full superposition analysis coupled with a generalized radial flow analysis is recommended.

6.2.15 Section 524–544 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase (CHi) with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The CHi phase was well controlled except for the late times when the system started to oscillate, thus producing noisy flow rates. The injection rate decreased from 0.028 L/min at start of the CHi phase to 0.007 L/min at the end, indicating a low interval transmissivity. Due to the poor data quality, the analysis of the CHi phase can only deliver an order of magnitude for transmissivity. The CHir phase is of good quality and can be analysed quantitatively.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be uniquely determined. The analysis could be consistently conducted using the radial flow assumption (flow dimension = 2). However, the derivative of the CHir phase shows at late times a slope of 0.08 which may indicate a flow dimension of 1.8. An infinite acting radial composite flow model was used in the analysis. The analysis plots are presented in Appendix 2-26. The table below presents relevant parameters with respect to the selected model.

Table 6-23. Analyses results; section 524–544 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	5.78E–9	NA	NA
T_M [m^2/s]	6.05E–9	NA	NA
Flow model	Homogeneous Infinite acting	NA	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	6.4E–9	NA	8.2E–9
T_2 [m^2/s]	NA	NA	5.5E–9
r_1 [m]	NA	NA	1.92
S [–] (ass. approx. 1E–6)	1.0E–6	NA	1.6E–6
ξ [–]	0	NA	0
C [m^3/Pa]	NA	NA	6.3E–11

Selected representative parameters

The recommended transmissivity of 8.2E–9 m^2/s was derived from the analysis of the CHir phase (inner zone). The confidence range for the transmissivity is estimated to be 2E–9 to 1E–8 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,149.9 kPa.

To improve analysis consistency and resolve the uncertainty concerning the flow dimension, a full superposition analysis coupled with a generalized radial flow analysis is recommended.

6.2.16 Section 544–564 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate dropped below the measurement range of the flowmeter ($q < 0.5$ mL/min) almost instantaneously, indicating the very low transmissivity of the interval. None of the test phases is analysable, but the low injection rates show that the interval transmissivity must be lower than 1E–10 m^2/s.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be determined. No flow model identification was possible. The measured pressures, flow rates and temperatures are presented in Appendix 2-27. The table below presents relevant parameters with respect to the selected model.

Table 6-24. Analyses results; section 544–564 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–10	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the very low injection rates (below measurement range of flowmeter), the interval transmissivity is lower than 1E–10 m^2/s.

No further analysis recommended.

6.2.17 Section 584–604 m, test no 1, injection

Comments to test

The test was conducted as constant pressure injection (CHi) with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The formation shows very low transmissivity, the injection rate was for the largest period of the test lower than 0.5 mL/min and most of the time not measurable. Therefore the CHi phase is not analysable. The CHir phase was analysed, however due to the fact that the flow rate was below the measurement range of the flowmeter, the analysis was conducted assuming a maximum value for the flow rate of 0.5 mL/min. Therefore, the derived transmissivity should be regarded as a maximum value as well.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be uniquely determined. The analysis was conducted using the radial flow assumption (flow dimension = 2). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. The analysis plots are presented in Appendix 2-29. The table below presents relevant parameters with respect to the selected model.

Table 6-25. Analyses results; section 584–604 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	4.17E–10 (or lower)	NA	NA
T_M [m^2/s]	4.36E–10 (or lower)	NA	NA
Flow model	NA	WBS and skin Homogeneous Infinite acting	NA
T_1 [m^2/s]	NA	1.2E–10 (or lower)	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	3.5E–6	NA
ξ [–]	NA	0	NA
C [m^3/Pa]	NA	3.4E–11	NA

Selected representative parameters

The recommended transmissivity is 1.2E–10 m^2/s. Regarding the fact that the transmissivity is very low and the injection rate was below the measurement range of the flowmeter the derived transmissivity could be up to one order of magnitude lower than derived from the analysis. The analysis was conducted using a flow dimension of 2.

No further analysis is recommended.

6.2.18 Section 724–744 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase (CHi) with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The CHi phase was well controlled the target pressure difference being achieved after 2.4 minutes. The injection rate decreased from 0.070 L/min at start of the CHi phase to 0.038 L/min at the end, indicating a low interval transmissivity. The CHi test phase was analysed quantitatively. The CHir phase is of good quality and was analysed quantitatively.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be uniquely determined. The analysis could be consistently conducted using the radial flow assumption (flow dimension = 2). However, the late time derivative of both test phases (CHi and CHir) is sloping downwards, which may indicate a flow dimension above 2. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-31. The table below presents relevant parameters with respect to the selected model.

Table 6-26. Analyses results; section 724–744 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	3.11E–8	NA	NA
T_M [m^2/s]	3.25E–8	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	2.4E–8	NA	2.8E–8
T_2 [m^2/s]	8.0E–8	7.6E–8	9.2E–8
r_1 [m]	3.80	NA	4.86
S [–] (ass. approx. 1E–6)	1.1E–6	1.0E–06	1.1E–6
ξ [–]	0	7.9	0
C [m^3/Pa]	NA	1.0E–9	8.6E–10

Selected representative parameters

The recommended transmissivity of 7.6E–8 m^2/s was derived from the analysis of the CHir phase. The confidence range for the transmissivity is estimated to be 6E–9 to 1E–7 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using type curve extrapolation in the Horner plot to a value of 7,076.1 kPa.

To improve analysis consistency and resolve the uncertainty concerning the flow dimension, a full superposition analysis coupled with a generalized radial flow analysis is recommended.

6.2.19 Section 744–764 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase (CHi) with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The CHi phase was well controlled the target pressure difference being achieved after 2.7 minutes. The injection rate decreased from 0.045 L/min at start of the CHi phase to 0.015 L/min at the end, indicating a low interval transmissivity. The CHi test phase was analysed quantitatively. The CHir phase is of good quality and was analysed quantitatively.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be uniquely determined. The analysis could be consistently conducted using the radial flow assumption (flow dimension = 2). However, the late time derivative of the CHi phase is sloping downwards, which may indicate a flow dimension above 2. In the analysis, this was interpreted as a transition to a higher transmissivity region. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-32. The table below presents relevant parameters with respect to the selected model.

Table 6-27. Analyses results; section 744–764 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.37E–8	NA	NA
T_M [m^2/s]	1.43E–8	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	9.9E–9	NA	8.2E–9
T_2 [m^2/s]	NA	8.5E–8	1.5E–7
r_1 [m]	NA	NA	1.36
S [–] (ass. approx. 1E–6)	1.1E–6	1.0E–6	1.1E–6
ξ [–]	0	32.3	0
C [m^3/Pa]	NA	8.9E–11	6.9E–11

Selected representative parameters

The recommended transmissivity of 8.5E–8 m^2/s was derived from the analysis of the CHir phase. The confidence range for the transmissivity is estimated to be 6E–9 to 3E–7 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 7,274.1 kPa.

To improve analysis consistency and resolve the uncertainty concerning the flow dimension, a full superposition analysis coupled with a generalized radial flow analysis is recommended.

6.2.20 Section 764–784 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase (CHi) with a pressure difference of about 200 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The CHi phase was poorly controlled, the rate sequence is very noisy. The injection rate decreased from approx. 0.02 L/min at start of the CHi phase to 0.01 L/min at the end, indicating a low interval transmissivity. The CHi data quality is inadequate for quantitative analysis. Only a qualitative type curve match was conducted. The results should be regarded as order of magnitude only. The CHir phase is of good quality and was analysed quantitatively.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the horizontal derivative at late times of the CHir phase indicates a flow dimension of 2. The analysis was conducted using the radial flow assumption (flow dimension = 2). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-33. The table below presents relevant parameters with respect to the selected model.

Table 6-28. Analyses results; section 764–784 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	8.19E–9	NA	NA
T_M [m^2/s]	8.57E–9	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	5.6E–9	NA	3.8E–9
T_2 [m^2/s]	7.2E–9	3.7E–8	3.8E–8
r_1 [m]	0.57	NA	0.57
S [–] (ass. approx. 1E–6)	2.8E–6	1.0E–6	1.0E–6
ξ [–]	0	22.5	0
C [m^3/Pa]	NA	4.6E–11	4.0E–11

Selected representative parameters

The recommended transmissivity of 3.7E–8 m^2/s was derived from the analysis of the CHir phase. The confidence range for the transmissivity is estimated to be 1E–9 to 6E–8 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 7,467.8 kPa.

No further analysis is recommended.

6.2.21 Section 784–804 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) conducted with a pressure difference of 200 kPa, followed by a pressure recovery phase. No hydraulic connection between test interval and the adjacent zones was observed. The injection rate decreased from 0.241 L/min at start of the CHi phase to 0.135 L/min at the end, indicating a low interval transmissivity. The early times of the CHi phase (first 1 minute) are not analysable due to the time needed by the system to regulate constant pressure. However, the middle and late times of the CHi phase are of good quality and adequate for quantitative analysis. The recovery phase (CHir) shows no problems and is amenable for quantitative analysis as well.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test both test phases (CHi and CHir) show a flat derivative at late times, which is indicative of a flow dimension of 2 (radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-34. The table below presents relevant parameters with respect to the selected model.

Table 6-29. Analyses results; section 784–804 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m²/s]	1.10E–7	NA	NA
T_M [m²/s]	1.15E–7	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m²/s]	7.8E–8	NA	6.9E–8
T_2 [m²/s]	7.8E–7	6.6E–7	5.8E–7
r_1 [m]	2.66	NA	1.52
S [–] (ass. approx. 1E–6)	2.0E–6	1.0E–6	2.3E–6
ξ [–]	0	32.0	0
C [m³/Pa]	NA	2.4E–10	2.1E–10

Selected representative parameters

The recommended transmissivity of 6.6E–7 m²/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the interval transmissivity is estimated to be 5E–8 to 8E–7 m²/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 7,664.1 kPa.

The analysis of the CHi and CHir phases shows very good consistency. No further analysis is recommended.

6.2.22 Section 804–824 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) conducted with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test interval was well isolated, no hydraulic connection between test section and adjacent zones was observed. The rate regulation during the constant pressure injection (CHi) did not perform properly, the pressure in the interval showing oscillations till the late times of the phase. Because of this reason the analysis of the CHi phase is only qualitative. The flow rate decreased from 0.007 L/min at start of the CHi phase to 0.003 L/min at its end, indicating a low interval transmissivity. The CHir phase was conducted without problems and shows good data quality. The CHir phase is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase derivative shows a downward trend at late times indicating either an increase of transmissivity at some distance from the borehole or a flow dimension above 2. It was decided to use a flow dimension of 2 (radial flow) in the analysis and model the downward sloping derivative using a composite system with increasing transmissivity away from the borehole. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-35. The table below presents relevant parameters with respect to the selected model.

Table 6-30. Analyses results; section 804–824 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m²/s]	2.45E–9	NA	NA
T_M [m²/s]	2.57E–9	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m²/s]	1.6E–9	NA	8.0E–10
T_2 [m²/s]	NA	1.6E–8	2.7E–08
r_1 [m]	NA	NA	0.24
S [–] (ass. approx. 1E–6)	1.5E–6	1.0E–6	1.5E–6
ξ [–]	0	32.6	0
C [m³/Pa]	NA	3.8E–11	3.8E–11

Selected representative parameters

The recommended transmissivity of 1.6E–8 m²/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the transmissivity is estimated to be 7E–9 to 4E–8 m²/s (the inner zone transmissivity derived from the CHir phase is considered to be caused by a local skin effect). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 7,865 kPa.

The analysis of the CHi and CHir phases shows some inconsistency, which is mainly caused by the poor CHi data. To improve analysis consistency and if further analysis is intended, a full superposition analysis should be conducted. Further, as commented above, there is room for interpretation as far as the flow dimension is concerned. This additional uncertainty could be further explored using GRF analysis.

6.2.23 Section 824–844 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) conducted with a pressure difference of 250 kPa, followed by a pressure recovery phase (CHir). The test interval was well isolated, no hydraulic connection between test section and adjacent zones was observed. The rate regulation during the constant pressure injection (CHi) did not perform properly, the pressure in the interval showing oscillations till the late times of the phase. Because of this reason no analysis of the CHi phase was performed. The flow rate decreased from 0.006 L/min at start of the CHi phase to 0.002 L/min at its end, indicating a low interval transmissivity. The CHir phase was conducted without problems and shows good data quality. The CHir phase is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase derivative shows a downward trend at late times indicating either an increase of transmissivity at some distance from the borehole or a flow dimension above 2. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-36. The table below presents relevant parameters with respect to the selected model.

Table 6-31. Analyses results; section 824–844 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.62E–9	NA	NA
T_M [m^2/s]	1.70E–9	NA	NA
Flow model	NA	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	NA	NA	1.0E–9
T_2 [m^2/s]	NA	3.8E–9	3.4E–9
r_1 [m]	NA	NA	1.25
S [–] (ass. approx. 1E–6)	NA	1.0E–6	7.3E–7
ξ [–]	NA	9.25	0
C [m^3/Pa]	NA	7.5E–11	6.4E–11

Selected representative parameters

The recommended transmissivity of 3.8E–9 m^2/s was derived from the analysis of the CHir phase. The confidence range for the transmissivity is estimated to be 8E–10 to 6E–9 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using type curve extrapolation in the Horner plot to a value of 8,055.6 kPa.

As commented above, there is room for interpretation as far as the flow dimension is concerned. This uncertainty could be further explored using GRF analysis.

6.2.24 Section 844–864 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate control during the CHi phase was good. The flow data is adequate for quantitative analysis; the flow rate varied between 0.16 L/min and 0.06 L/min indicating a moderate interval transmissivity. The CHir phase is of good quality and adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the late time derivative of the CHir phase shows a downward trend which could indicate a flow-geometry larger than radial as well as the transition to a zone of higher transmissivity. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-37. The table below presents relevant parameters with respect to the selected model.

Table 6-32. Analyses results; section 844–864 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m²/s]	4.93E–8	NA	NA
T_M [m²/s]	5.15E–8	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m²/s]	3.8E–8	NA	4.1E–8
T_2 [m²/s]	5.4E–8	3.2E–7	4.8E–7
r_1 [m]	0.76	NA	4.37
S [–] (ass. approx. 1E–6)	1.4E–6	1.0E–6	4.3E–7
ξ [–]	0	30.9	0
C [m³/Pa]	NA	1.1E–10	8.4E–11

Selected representative parameters

The recommended transmissivity of 3.2E–7 m²/s was derived from the analysis of the CHir phase which appears to be the most conservative choice in this case. The confidence range for the transmissivity is estimated to be 1E–8 to 6E–7 m²/s (including both inner and outer composite zone). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 8,259.9 kPa.

If further analysis is planned, it should be clarified which of the composite zones can be seen as representative. This could be done by using a full superposition analysis.

6.2.25 Section 864–884 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate control during the CHi phase was good. The flow data is adequate for quantitative analysis although the flow rate was oscillating at late times in a bandwidth of approx. 3 mL/min; the flow rate varied between 0.041 L/min and 0.028 L/min indicating a moderate interval transmissivity. The CHir phase is of good quality and adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the late time derivative of the CHir phase shows a downward trend which could indicate a flow-geometry larger than radial as well as the transition to a zone of higher transmissivity. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-38. The table below presents relevant parameters with respect to the selected model.

Table 6-33. Analyses results; section 864–884 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m²/s]	2.28E–8	NA	NA
T_M [m²/s]	2.38E–8	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m²/s]	1.7E–8	NA	1.5E–8
T_2 [m²/s]	1.1E–7	1.5E–7	3.6E–7
r_1 [m]	2.36	NA	1.47
S [–] (ass. approx. 1E–6)	1.3E–6	1.0E–6	1.2E–6
ξ [–]	0	32.5	0
C [m³/Pa]	NA	7.1E–11	5.5E–11

Selected representative parameters

The recommended transmissivity of 1.5E–7 m²/s was derived from the analysis of the CHir phase which appears to be the most conservative choice in this case. The confidence range for the transmissivity is estimated to be 1E–8 to 6E–7 m²/s (including both inner and outer composite zone). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 8,453.9 kPa.

If further analysis is planned, it should be clarified which of the composite zones can be seen as representative. This could be done by using a full superposition analysis.

6.2.26 Section 884–904 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate control during the CHi phase was good. The flow data is adequate for quantitative analysis; the flow rate varied between 0.055 L/min and 0.021 L/min indicating a moderate interval transmissivity. The CHir phase is of good quality and adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the late time derivative of the CHir phase shows a downward trend which could indicate a flow-geometry larger than radial as well as the transition to a zone of higher transmissivity. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-39. The table below presents relevant parameters with respect to the selected model.

Table 6-34. Analyses results; section 884–904 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m²/s]	1.72E–8	NA	NA
T_M [m²/s]	1.80E–8	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m²/s]	1.1E–8	NA	7.0E–9
T_2 [m²/s]	7.5E–8	1.1E–7	1.3E–7
r_1 [m]	2.47	NA	0.40
S [–] (ass. approx. 1E–6)	1.0E–6	1.0E–6	1.1E–6
ξ [–]	0	32.2	0
C [m³/Pa]	NA	1.1E–10	1.1E–10

Selected representative parameters

The recommended transmissivity of 1.1E–7 m²/s was derived from the analysis of the CHir phase. The confidence range for the transmissivity is estimated to be 5E–9 to 3E–7 m²/s (including both inner and outer composite zone). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 8,658.4 kPa.

If further analysis is planned, it should be clarified which of the composite zones can be seen as representative. This could be done by using a full superposition analysis.

6.2.27 Section 904–924 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate control during the CHi phase was poor. Due to the very small injection rate (6 to 3 mL/min) the rate sequence is very noisy, such that the CHi phase is inadequate for quantitative analysis. The results of the type curve analysis should be regarded as order of magnitude only. The low injection rates indicate a low interval transmissivity. The CHir phase is of good quality and adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be uniquely determined. The downward trend in the CHir derivative at late times can be either interpreted as a flow dimension above 2 or as a transition period to a zone of higher transmissivity. The analysis was conducted using the radial flow assumption (dimension = 2). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-40. The table below presents relevant parameters with respect to the selected model.

Table 6-35. Analyses results; section 904–924 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	2.86E–9	NA	NA
T_M [m^2/s]	2.99E–9	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	1.9E–9	NA	1.1E–9
T_2 [m^2/s]	NA	1.3E–8	1.5E–8
r_1 [m]	NA	NA	3.20
S [–] (ass. approx. 1E–6)	1.3E–6	1.0E–6	1.2E–6
ξ [–]	0	21.1	0
C [m^3/Pa]	NA	4.1E–11	3.8E–11

Selected representative parameters

The recommended transmissivity of 1.3E–8 m^2/s was derived from the analysis of the CHir phase. the confidence range for the transmissivity is estimated to be 5E–10 to 3E–8 m^2/s (including both inner and outer composite zone). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 8,851.6 kPa.

If further analysis is planned, it should be clarified which of the composite zones can be seen as representative. This could be done by using a full superposition analysis. Resolving the uncertainty concerning the flow dimension may be a further topic of interest which could be addressed with a GRF analysis.

6.2.28 Section 922–942 m, test no 1, injection

Comments to test

The test was conducted as of a constant pressure injection phase (CHi) with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). No hydraulic connection between test interval and the adjacent zones was observed. The injection rate decreased during the CHi phase from 0.59 L/min at start to 0.18 L/min at the end of the CHi phase, indicating a relatively low interval transmissivity. The early times of the CHi phase (first 2.1 minutes) are not analysable due to the time needed by the system to regulate constant pressure. However, the middle and late times of the CHi phase are of good quality and can be analysed quantitatively. The recovery phase (CHir) shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test both test phases (CHi and CHir) show a downward trend at late times, which can be interpreted as a flow dimension above 2 or a transition to a zone of higher transmissivity. Both phases were analysed using radial flow models (flow dimension = 2). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-41. The table below presents relevant parameters with respect to the selected model.

Table 6-36. Analyses results; section 922–942 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.38E–7	NA	NA
T_M [m^2/s]	1.44E–7	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	1.1E–7	NA	1.0E–7
T_2 [m^2/s]	1.4E–6	6.1E–7	7.0E–7
r_1 [m]	5.51	NA	2.26
S [–] (ass. approx. 1E–6)	2.0E–6	1.0E–6	1.4E–6
ξ [–]	0	19.4	0
C [m^3/Pa]	NA	1.4E–9	1.4E–9

Selected representative parameters

The recommended transmissivity of 6.1E–7 m^2/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the interval transmissivity is estimated to be 6.0E–8 to 3.0E–6 m^2/s. The flow dimension used for analysis is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 9,038.3 kPa.

The analysis of the CHi and CHir phases shows very consistency. The uncertainty concerning the flow dimension could be addressed in a GRF analysis, in case further interpretation is planned.

6.2.29 Section 943–963 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) with a pressure difference of 201 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate control during the CHi phase was good. The flow data is adequate for quantitative analysis although the flow rate was oscillating at late times in a bandwidth of approx. 2 mL/min; the flow rate varied between 0.051 L/min and 0.02 L/min indicating a moderate interval transmissivity. The CHir phase is of good quality and adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be uniquely determined. The downward slope of the CHir derivative at late times may indicate a flow dimension above 2 or represent the transition to a zone of higher transmissivity (composite model). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-42. The table below presents relevant parameters with respect to the selected model.

Table 6-37. Analyses results; section 943–963 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.91E–8	NA	NA
T_M [m^2/s]	2.00E–8	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	1.5E–8	NA	8.8E–9
T_2 [m^2/s]	1.9E–8	1.2E–7	7.5E–7
r_1 [m]	1.14	NA	0.63
S [–] (ass. approx. 1E–6)	1.2E–6	1.0E–6	1.3E–6
ξ [–]	0	32.6	0
C [m^3/Pa]	NA	4.7E–11	3.9E–11

Selected representative parameters

The recommended transmissivity of 1.2E–7 m^2/s was derived from the analysis of the CHir phase. the confidence range for the transmissivity is estimated to be 7E–9 to 8E–7 m^2/s (including both inner and outer composite zone). The transmissivity at the high end of the range are determined by the fact that the CHir derivative slopes downwards and shows no sign of sTableilization. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 9,281.5 kPa.

If further analysis is planned, it should be clarified which of the composite zones can be seen as representative. This could be done by using a full superposition analysis. Also, the relatively high outer composite zone transmissivity should be verified.

6.2.30 Section 964–984 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) conducted with a pressure difference of about 200 kPa, followed by a pressure recovery phase (CHir). The test interval was well isolated, no hydraulic connection between test section and adjacent zones was observed. The rate regulation during the constant pressure injection (CHi) did not perform properly, the pressure in the interval showing oscillations till the late times of the phase. Because of this reason the analysis of the CHi phase has only qualitative character.

The flow rate decreased from 0.0075 L/min at start of the CHi phase to 0.0014 L/min at its end, indicating a low interval transmissivity. The CHir phase was conducted without problems and shows good data quality. The CHir phase is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase derivative shows a downward trend at late times indicating either an increase of transmissivity at some distance from the borehole or a flow dimension above 2. It was decided to use a flow dimension of 2 (radial flow) in the analysis and model the downward sloping derivative using a composite system with increasing transmissivity away from the borehole. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-43. The table below presents relevant parameters with respect to the selected model.

Table 6-38. Analyses results; section 964–984 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.13E–9	NA	NA
T_M [m^2/s]	1.18E–9	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	9.7E–10	NA	7.3E–10
T_2 [m^2/s]	NA	2.0E–9	2.4E–9
r_1 [m]	NA	NA	0.75
S [–] (ass. approx. 1E–6)	1.2E–6	1.0E–6	1.5E–6
ξ [–]	0	5.0	0
C [m^3/Pa]	NA	3.7E–11	3.0E–11

Selected representative parameters

The recommended transmissivity of 2.0E–9 m^2/s was derived from the analysis of the CHir phase. The confidence range for the transmissivity is estimated to be 5E–10 to 5E–9 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using type curve extrapolation in the Horner plot to a value ranging from 9,431 to 9,445 kPa.

As commented above, there is room for interpretation as far as the flow dimension is concerned. This uncertainty could be further explored using GRF analysis.

6.2.31 Section 984–1,004 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) with a pressure difference of 202 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate control during the CHi phase was poor. Due to the very small injection rate (18 to 5 mL/min) the rate sequence is very noisy, such that the CHi phase is inadequate for quantitative analysis. The results of the type curve analysis should be regarded as order of magnitude only. The low injection rates indicate a low interval transmissivity. The CHir phase is of good quality and adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be uniquely determined. The downward trend in the CHir derivative at late times can be either interpreted as a flow dimension above 2 or as a transition period to a zone of higher transmissivity. The analysis was conducted using the radial flow assumption (dimension = 2). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-44. The table below presents relevant parameters with respect to the selected model.

Table 6-39. Analyses results; section 984–1,004 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	4.51E–9	NA	NA
T_M [m^2/s]	4.72E–9	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	3.5E–9	NA	2.6E–9
T_2 [m^2/s]	NA	1.9E–8	3.0E–8
r_1 [m]	NA	NA	1.08
S [–] (ass. approx. 1E–6)	1.3E–6	1.0E–6	8.8E–7
ξ [–]	0	20.9	0
C [m^3/Pa]	NA	6.9E–11	5.4E–11

Selected representative parameters

The recommended transmissivity of 1.9E–8 m^2/s was derived from the analysis of the CHir phase. The confidence range for the transmissivity is estimated to be 1E–9 to 5E–8 m^2/s (including both inner and outer composite zone). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 9,642.9 kPa.

If further analysis is planned, it should be clarified which of the composite zones can be seen as representative. This could be done by using a full superposition analysis. Resolving the uncertainty concerning the flow dimension may be a further topic of interest which could be addressed with a GRF analysis.

6.3 5 m single-hole injection tests

In the following, the 5 m section tests conducted in borehole KLX02 are presented and analysed.

6.3.1 Section 300–305 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate control during the CHi phase was good. The flow data is adequate for quantitative analysis; the flow rate varied between 0.076 L/min and 0.043 L/min indicating a moderate interval transmissivity. The CHir phase is of good quality and adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test there is ambiguity concerning the flow dimension in borehole vicinity. The CHir derivative shows at middle times a slope of –0.5, which is indicative for spherical flow. At late times the derivative shows a negative unit slope (–1) which indicates a transition to a higher transmissivity zone. Generally, the derivative shows the picture of a "partially penetrating" interval, which is consistent with the small interval length (5 m). However, for consistency, the test was analysed using a radial flow model (flow dimension = 2). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-45. The table below presents relevant parameters with respect to the selected model.

Table 6-40. Analyses results; section 300–305 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	3.49E–8	NA	NA
T_M [m^2/s]	2.88E–8	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	2.2E–8	NA	1.7E–8
T_2 [m^2/s]	3.2E–7	1.4E–7	2.4E–7
r_1 [m]	1.9	NA	1.0
S [–] (ass. approx. 1E–6)	1.1E–6	1.0E–6	9.6E–7
ξ [–]	0	21.5	0
C [m^3/Pa]	NA	1.8E–11	9.9E–12

Selected representative parameters

The recommended transmissivity of 3.2E–7 m^2/s was derived from the analysis of the CHi phase. The confidence range for the transmissivity is estimated to be 1E–8 to 6E–7 m^2/s (including both inner and outer composite zone). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,968.1 kPa.

If further analysis is planned, it should be clarified which of the composite zones can be seen as representative. This could be done by using a full superposition analysis. The ambiguity concerning the near borehole flow dimension could be addressed by means of a GRF analysis.

6.3.2 Section 305–310 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 200 kPa, followed by a pressure recovery phase. The test shows no hydraulic communication between the test interval and the adjacent zones. The formation shows very low transmissivity, the injection rate was for the largest period of the test lower than 0.5 mL/min and most of the time not measurable. Therefore the CHi phase is not analysable. The CHir phase was analysed, however due to the fact that the flow rate was below the measurement range of the flowmeter, the analysis was conducted assuming an average value for the flow rate of 0.35 mL/min. Therefore, the derived transmissivity should be regarded as a maximum value as well.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be uniquely determined. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-46. The table below presents relevant parameters with respect to the selected model.

Table 6-41. Analyses results; section 305–310 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	2.45E–10	NA	NA
T_M [m^2/s]	2.02E–10	NA	NA
Flow model	NA	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	NA	NA	4.8E–11 (or lower)
T_2 [m^2/s]	NA	7.4E–11 (or higher)	8.1E–11 (or higher)
r_1 [m]	NA	NA	0.14
S [–] (ass. approx. 1E–6)	NA	1.0E–6	1.7E–6
ξ [–]	NA	26.2	0
C [m^3/Pa]	NA	1.7E–11	1.7E–11

Selected representative parameters

The recommended transmissivity is 7.4E–11 m^2/s and was derived from the analysis of the CHir phase. Due to the fact that the derivative does not reach infinite acting regime at late times, the transmissivity could be higher than calculated (estimated up to one order of magnitude). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using type curve extrapolation in the Horner plot to a value of 3,004 kPa.

No further analysis is recommended.

6.3.3 Section 310–315 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) conducted with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test interval was well isolated, no hydraulic connection between test section and adjacent zones was observed. The rate regulation during the constant pressure injection (CHi) did not perform properly, the pressure in the interval showing oscillations till the late times of the phase. Because of this reason the analysis of the CHi phase is only qualitative. The flow rate decreased from 0.008 L/min at start of the CHi phase to 0.001 L/min at its end, indicating a low interval transmissivity. The CHir phase was conducted without problems and shows good data quality. The CHir phase is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase derivative shows a downward trend at late times indicating either an increase of transmissivity at some distance from the borehole or a flow dimension above 2. It was decided to use a flow dimension of 2 (radial flow) in the analysis and model the downward sloping derivative using a composite system with increasing transmissivity away from the borehole. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-47. The table below presents relevant parameters with respect to the selected model.

Table 6-42. Analyses results; section 310–315 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.23E–9	NA	NA
T_M [m^2/s]	1.01E–9	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	1.4E–9	NA	7.2E–10
T_2 [m^2/s]	NA	1.8E–8	7.4E–08
r_1 [m]	NA	NA	0.23
S [–] (ass. approx. 1E–6)	1.6E–6	1.0E–6	1.4E–6
ξ [–]	0	39.1	0
C [m^3/Pa]	NA	1.4E–11	1.2E–11

Selected representative parameters

The recommended transmissivity of 1.8E–8 m^2/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the transmissivity is estimated to be 9E–9 to 9E–8 m^2/s (the inner zone transmissivity derived from the CHir phase is considered to be caused by a local skin effect). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,066.7 kPa.

The analysis of the CHi and CHir phases shows some inconsistency, which is mainly caused by the poor CHi data. To improve analysis consistency and if further analysis is intended, a full superposition analysis should be conducted. Further, as commented above, there is room for interpretation as far as the flow dimension is concerned. This additional uncertainty could be further explored using GRF analysis.

6.3.4 Section 315–320 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) with a pressure difference of 198 kPa, followed by a pressure recovery phase (CHir). The test shows hydraulic communication between the test interval and the adjacent zones. The injection rate decreased from 12.38 L/min at start of the CHi phase to 10.94 L/min at the end, indicating a relatively high interval transmissivity. The CHi phase was conducted without problems. The automated system managed to regulate the rate very quickly (43 seconds) such that the entire phase is adequate for quantitative analysis. The CHir phase shows relatively fast recovery, however, the data is of good quality and as such, adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension can be derived from both test phases which show a flat derivative (dimension 2 – radial flow) at late times. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-48. The table below presents relevant parameters with respect to the selected model.

Table 6-43. Analyses results; section 315–320 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	9.03E–6	NA	NA
T_M [m^2/s]	7.46E–6	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	8.6E–6	NA	8.2E–6
T_2 [m^2/s]	2.6E–5	4.2E–5	4.1E–5
r_1 [m]	3.8	NA	3.8
S [–] (ass. approx. 1E–6)	1.2E–6	1.0E–6	1.0E–6
ξ [–]	0	18.6	0
C [m^3/Pa]	NA	6.0E–9	6.4E–9

Selected representative parameters

The recommended transmissivity of 4.2E–5 m^2/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the transmissivity is estimated to be 1E–5 to 6E–5 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,111.9 kPa.

The analysis of the CHi and CHir phases shows good consistency. No further analysis is recommended.

6.3.5 Section 320–325 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate dropped below the measurement range of the flowmeter (q < 0.5 mL/min) almost instantaneously, indicating the very low transmissivity of the interval. In addition, due to hardware problems (possibly extended packer compliance) the pressure kept rising during the CHir phase. None of the test phases is analysable, but the low injection rates show that the interval transmissivity must be lower than 1E–10 m^2/s.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow model cannot be determined. No analysis was performed. The measured data is presented in Appendix 2-49.

Table 6-44. Analyses results; section 320–325 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–10	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the very low injection rates (below measurement range of flowmeter), the interval transmissivity is lower than 1E–10 m^2/s.

No further analysis recommended.

6.3.6 Section 325–330 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) with a pressure difference of about 200 kPa, followed by a pressure recovery phase (CHir). The test section was well isolated, no hydraulic connection between test section and adjacent zones was observed. The rate regulation during the constant pressure injection (CHi) did not perform properly, the pressure in the interval showing oscillations till the late times of the phase. Because of this reason no analysis of the CHi phase is possible. The flow rate oscillated between 7 mL/min and 0 mL/min below measurement range of the flowmeter), indicating a low interval transmissivity. The CHir phase was conducted without problems and shows good data quality. The CHir phase is adequate for quantitative analysis. The analysis was conducted using an average flow rate of 1.3 mL/min.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase derivative shows a downward trend at late times indicating either an increase of transmissivity at some distance from the borehole or a flow dimension above 2. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-50. The table below presents relevant parameters with respect to the selected model.

Table 6-45. Analyses results; section 325–330 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	6.51E–10	NA	NA
T_M [m^2/s]	5.37E–10	NA	NA
Flow model	NA	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	NA	NA	3.9E–10
T_2 [m^2/s]	NA	7.2E–9	1.3E–08
r_1 [m]	NA	NA	0.36
S [–] (ass. approx. 1E–6)	NA	1.0E–6	6.3E–7
ξ [–]	NA	38.0	0
C [m^3/Pa]	NA	1.4E–11	1.2E–11

Selected representative parameters

The recommended transmissivity of 7.2E–9 m^2/s was derived from the analysis of the CHir phase. The confidence range for the transmissivity is estimated to be 5E–9 to 4E–8 m^2/s (the inner zone transmissivity derived from the CHir phase is considered to be caused by a local skin effect). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,215.8 kPa.

As commented above, there is room for interpretation as far as the flow dimension is concerned. This uncertainty could be further explored using GRF analysis.

6.3.7 Section 330–335 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) with a pressure difference of about 200 kPa, followed by a pressure recovery phase (CHir). The test section was well isolated, no hydraulic connection between test section and adjacent zones was observed. The rate regulation during the constant pressure injection (CHi) did not perform properly, the pressure in the interval showing oscillations till the late times of the phase. Because of this reason no analysis of the CHi phase is possible. The flow rate oscillated between 9 mL/min and 0 mL/min (below measurement range of the flowmeter), indicating a low interval transmissivity. The CHir phase was conducted without problems and shows good data quality. The CHir phase is adequate for quantitative analysis. The analysis was conducted using an average flow rate of 0.8 mL/min.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase derivative shows a downward trend at late times indicating either an increase of transmissivity at some distance from the borehole or a flow dimension above 2. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-51. The table below presents relevant parameters with respect to the selected model.

Table 6-46. Analyses results; section 330–335 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	2.45E–10	NA	NA
T_M [m^2/s]	2.02E–10	NA	NA
Flow model	NA	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	NA	NA	8.5E–11
T_2 [m^2/s]	NA	3.9E–9	4.3E–09
r_1 [m]	NA	NA	0.08
S [–] (ass. approx. 1E–6)	NA	1.0E–6	4.4E–6
ξ [–]	NA	33.2	0
C [m^3/Pa]	NA	1.3E–11	1.2E–11

Selected representative parameters

The recommended transmissivity of 3.9E–9 m^2/s was derived from the analysis of the CHir. The confidence range for the transmissivity is estimated to be 1E–9 to 1E–8 m^2/s (the inner zone transmissivity derived from the CHir phase is considered to be caused by a local skin effect). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,264 kPa.

As commented above, there is room for interpretation as far as the flow dimension is concerned. This uncertainty could be further explored using GRF analysis.

6.3.8 Section 335–340 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 200 kPa, followed by a pressure recovery phase. The test interval was well isolated, no hydraulic connection between test section and adjacent zones was observed. The injection rate decreased from 2.739 L/min at start of the CHi phase to 1.863 L/min at the end, indicating a relatively high interval transmissivity. The CHi phase was conducted without problems. The automated system managed to regulate the rate very quickly (44 seconds) such that the entire phase is adequate for quantitative analysis. The CHir phase shows very fast recovery, such that the analysis does not provide reliable results. The results should be regarded as order of magnitude only.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension can be derived from the CHi phase, which shows a flat derivative (dimension 2 – radial flow) at late times. However, a regression line drawn through the entire middle and late times of the CHi phase derivative yields a flow dimension of 1.5. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-52. The table below presents relevant parameters with respect to the selected model.

Table 6-47. Analyses results; section 335–340 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m²/s]	1.52E–6	NA	NA
T_M [m²/s]	1.26E–6	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m²/s]	2.0E–6	NA	8.7E–7 (results less reliable due to very fast recovery)
T_2 [m²/s]	1.1E–7	1.2E–5 (results less reliable due to very fast recovery)	4.1E–5 (results less reliable due to very fast recovery)
r_1 [m]	29.26	NA	7.37
S [–] (ass. approx. 1E–6)	1.1E–6	1.0E–6	2.7E–6
ξ [–]	0	34.1	0
C [m³/Pa]	NA	2.8E–10	2.8E–10

Selected representative parameters

The recommended transmissivity of 2.0E–6 m²/s was derived from the analysis of the CHi phase, which shows the best data and derivative quality. The confidence range for the transmissivity is estimated to be 7E–7 to 3E–6 m²/s (the outer zone transmissivity derived from the CHir phase is not considered reliable due to the very quick recovery). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,311.9 kPa.

The analysis of the CHi and CHir phases shows some inconsistency. The quick pressure recovery during the CHir phase renders this phase as less useful for the analysis. To improve analysis consistency and if further analysis is intended, a full superposition analysis should be conducted. Further, as commented above, there is room for interpretation as far as the flow dimension is concerned. This additional uncertainty could be further explored using GRF analysis.

6.3.9 Section 385–390 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) conducted with a pressure difference of about 200 kPa, followed by a pressure recovery phase (CHir). The test interval was well isolated, no hydraulic connection between test section and adjacent zones was observed. The rate regulation during the constant pressure injection (CHi) did not perform properly, the pressure in the interval showing oscillations till the late times of the phase. Because of this reason no analysis of the CHi phase was possible. The flow rate decreased from oscillated between 5 mL/min and 2 mL/min during CHi, indicating a low interval transmissivity. The average flow rate was 3.5 mL/min. The CHir phase was conducted without problems and shows good data quality. The CHir phase is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase derivative shows a downward trend at late times indicating either an increase of transmissivity at some distance from the borehole or a flow dimension above 2. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-54. The table below presents relevant parameters with respect to the selected model.

Table 6-48. Analyses results; section 385–390 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m²/s]	2.44E–9	NA	NA
T_M [m²/s]	2.01E–9	NA	NA
Flow model	NA	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m²/s]	NA	NA	6.6E–10
T_2 [m²/s]	NA	1.7E–8	1.3E–08
r_1 [m]	NA	NA	0.15
S [–] (ass. approx. 1E–6)	NA	1.0E–6	1.7E–6
ξ [–]	NA	33.1	0
C [m³/Pa]	NA	1.8E–11	1.5E–11

Selected representative parameters

The recommended transmissivity of 1.7E–8 m^2/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the transmissivity is estimated to be 8E–9 to 3E–8 m^2/s (the inner zone transmissivity derived from the CHir phase is considered to be caused by a local skin effect). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,780.1 kPa.

As commented above, there is room for interpretation as far as the flow dimension is concerned. This uncertainty could be further explored using GRF analysis.

6.3.10 Section 390–395 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate dropped below the measurement range of the flowmeter ($q < 0.5$ mL/min) almost instantaneously, indicating the very low transmissivity of the interval. In addition (possibly due to hardware problems) the pressure did not show any reaction after closing the test valve (CHir phase). None of the test phases is analysable, but the low injection rates show that the interval transmissivity must be lower than 1E–10 m^2/s.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow model cannot be determined. No analysis was performed. The measured data is presented in Appendix 2-55.

Table 6-49. Analyses results; section 390–395 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–10	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the very low injection rates (below measurement range of flowmeter), the interval transmissivity is lower than 1E–10 m^2/s.

No further analysis recommended.

6.3.11 Section 395–400 m, test no 1, injection

Comments to test

The intention was to conduct the test as a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). However, after inflating the packers and closing the test valve, the pressure kept rising for 2 hours to start decreasing afterwards for 14 hours (overnight). This phenomenon is caused by prolonged packer expansion in a very tight section (T probably smaller than 1E–11 m^2/s). The test shows no hydraulic communication between the test interval and the adjacent zones. None of the test phases is analysable.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow model cannot be determined. No analysis was performed. The measured data is presented in Appendix 2-56.

Table 6-50. Analyses results; section 395–400 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–11	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than 1E–11 m^2/s.

No further analysis recommended.

6.3.12 Section 400–405 m, test no 1, injection

Comments to test

The intention was to conduct the test as a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). However, after inflating the packers and closing the test valve, the pressure kept rising with approx. 27 kPa per 15 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E–11 m^2/s. The test shows no hydraulic communication between the test interval and the adjacent zones. None of the test phases is analysable.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow model cannot be determined. No analysis was performed. The measured data is presented in Appendix 2-57.

Table 6-51. Analyses results; section 400–405 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–11	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than 1E–11 m^2/s.

No further analysis recommended.

6.3.13 Section 420–425 m, test no 1, injection

Comments to test

The intention was to conduct the test as a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). However, after inflating the packers and closing the test valve, the pressure kept rising with approx. 17 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E–11 m^2/s. The test shows no hydraulic communication between the test interval and the adjacent zones. None of the test phases is analysable.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow model cannot be determined. No analysis was performed. The measured data is presented in Appendix 2-58.

Table 6-52. Analyses results; section 420–425 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–11	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than 1E–11 m^2/s.

No further analysis recommended.

6.3.14 Section 425–430 m, test no 1, injection

Comments to test

The intention was to conduct the test as a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). However, after inflating the packers and closing the test valve, the pressure kept rising with approx. 45 kPa per 15 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E–11 m^2/s. The test shows no hydraulic communication between the test interval and the adjacent zones. None of the test phases is analysable.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow model cannot be determined. No analysis was performed. The measured data is presented in Appendix 2-59.

Table 6-53. Analyses results; section 425–430 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–11	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than 1E–11 m^2/s.

No further analysis recommended.

6.3.15 Section 429–434 m, test no 1, injection

Comments to test

The intention was to conduct the test as a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). However, after inflating the packers and closing the test valve, the pressure kept rising with approx. 25 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E–11 m^2/s. The test shows no hydraulic communication between the test interval and the adjacent zones. None of the test phases is analysable.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow model cannot be determined. No analysis was performed. The measured data is presented in Appendix 2-60.

Table 6-54. Analyses results; section 429–434 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–11	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than 1E–11 m^2/s.

No further analysis recommended.

6.3.16 Section 434–439 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 200 kPa, followed by a pressure recovery phase. The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate control during the CHi phase was good; the CHi phase is adequate for quantitative analysis. The flow rate varied between 0.07 L/min and 0.05 L/min. The CHir phase is of good quality and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension can be best derived from the late time CHir data which shows a flat derivative (dimension 2 – radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-61. The table below presents relevant parameters with respect to the selected model.

Table 6-55. Analyses results; section 434–439 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	4.10E–8	NA	NA
T_M [m^2/s]	3.38E–8	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	2.7E–8	NA	1.9E–8
T_2 [m^2/s]	1.1E–7	1.7E–7	5.9E–7
r_1 [m]	1.5	NA	0.86
S [–] (ass. approx. 1E–6)	1.2E–6	1.0E–6	1.0E–6
ξ [–]	0	22.8	0
C [m^3/Pa]	NA	6.0E–11	5.3E–11

Selected representative parameters

The recommended transmissivity of 1.7E–7 m^2/s was derived from the analysis of the CHir phase. The confidence range for the transmissivity is estimated to be 1E–8 to 7E–7 m^2/s (including both inner and outer composite zone). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,261 kPa.

If further analysis is planned, it should be clarified which of the composite zones can be seen as representative. This could be done by using a full superposition analysis.

6.3.17 Section 440–445 m, test no 1, injection

Comments to test

The intention was to conduct the test as a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). However, after inflating the packers and closing the test valve, the pressure kept rising with approx. 42 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E–11 m^2/s. The test shows no hydraulic communication between the test interval and the adjacent zones. None of the test phases is analysable.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow model cannot be determined. No analysis was performed. The measured data is presented in Appendix 2-62.

Table 6-56. Analyses results; section 440–445 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–11	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than 1E–11 m^2/s.

No further analysis recommended.

6.3.18 Section 445–450 m, test no 1, injection

Comments to test

The intention was to conduct the test as a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). However, after inflating the packers and closing the test valve, the pressure kept rising with approx. 72 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E–11 m^2/s. The test shows no hydraulic communication between the test interval and the adjacent zones. None of the test phases is analysable.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow model cannot be determined. No analysis was performed. The measured data is presented in Appendix 2-63.

Table 6-57. Analyses results; section 445–450 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–11	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than 1E–11 m^2/s.

No further analysis recommended.

6.3.19 Section 450–455 m, test no 1, injection

Comments to test

The intention was to conduct the test as a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). However, after inflating the packers and closing the test valve, the pressure kept rising with approx. 20 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E–11 m^2/s. The test shows no hydraulic communication between the test interval and the adjacent zones. None of the test phases is analysable.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow model cannot be determined. No analysis was performed. The measured data is presented in Appendix 2-64.

Table 6-58. Analyses results; section 450–455 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–11	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than 1E–11 m^2/s.

No further analysis recommended.

6.3.20 Section 455–460 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate control during the CHi phase was good, however, due to very small rates, the flow data is noisy. Only a qualitative analysis was possible. The flow rate varied between 0.017 L/min at start of the CHi phase and 0.006 L/min at its end, indicating a low interval transmissivity. The CHir phase is of good quality and adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test there is ambiguity concerning the flow dimension. The downward trend of the CHir derivative at late times can be interpreted as a flow dimension above 2 or can represent the transition to a zone of higher transmissivity. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-65. The table below presents relevant parameters with respect to the selected model.

Table 6-59. Analyses results; section 455–460 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	5.34E–9	NA	NA
T_M [m^2/s]	4.41E–9	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	3.8E–9	NA	1.2E–9
T_2 [m^2/s]	NA	3.9E–8	1.8E–7
r_1 [m]	NA	NA	0.16
S [–] (ass. approx. 1E–6)	1.2E–6	1–0E–6	1.5E–6
ξ [–]	0	39.0	0
C [m^3/Pa]	NA	1.4E–11	1.3E–11

Selected representative parameters

The recommended transmissivity of 3.9E–8 m^2/s was derived from the analysis of the CHir phase which appears to be most representative for the formation behaviour. The confidence range for the transmissivity is estimated to be 5E–8 to 3E–7 m^2/s (refers to the outer composite zone only; the inner zone is considered to be a local skin). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,465.4 kPa.

As commented above, there is room for interpretation as far as the flow dimension is concerned. This uncertainty could be further explored using GRF analysis.

6.3.21 Section 460–465 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 202 kPa, followed by a pressure recovery phase. The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate control during the CHi phase was good; the CHi phase is adequate for quantitative analysis. The flow rate varied between 0.057 L/min and 0.039 L/min. The CHir phase shows very fast recovery, such that the late time data can are only adequate for a qualitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension can be best derived from the CHi data which shows a flat derivative (dimension 2 – radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-66. The table below presents relevant parameters with respect to the selected model.

Table 6-60. Analyses results; section 460–465 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	3.23E–8	NA	NA
T_M [m^2/s]	2.67E–8	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	2.2E–8	NA	8.5E–9
T_2 [m^2/s]	1.1E–7	1.8E–7	3.0E–6 (unreliable)
r_1 [m]	1.71	NA	0.21
S [–] (ass. approx. 1E–6)	1.0E–6	1.0E–6	1.0E–6
ξ [–]	0	32.0	0
C [m^3/Pa]	NA	1.4E–11	1.3E–11

Selected representative parameters

The recommended transmissivity of 1.8E–7 m^2/s was derived from the analysis of the CHir phase. The confidence range for the transmissivity is estimated to be 7E–9 to 3E–7 m^2/s (excluding the outer composite zone transmissivity derived from the CHir analysis, which is considered not reliable). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,515.6 kPa.

If further analysis is planned, it should be clarified which of the composite zones can be seen as representative. This could be done by using a full superposition analysis.

6.3.22 Section 460–465 m, test no 2, injection

Comments to test

The test was composed of a constant pressure injection test phase with a pressure difference of 200 kPa, followed by a pressure recovery phase. The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate control during the CHi phase was good, the flow rate varied between 0.135 L/min and 0.061 L/min. The phase is adequate for quantitative analysis. The CHir phase shows very fast recovery and should be therefore be seen as less adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivatives of both flow phases are relatively noisy, such that a reliable calculation of the flow dimension is not possible. The analysis was conducted assuming a flow dimension of 2 (radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-81. The table below presents relevant parameters with respect to the selected model.

Table 6-61. Analyses results; section 460–465 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m²/s]	4.99E–8	NA	NA
T_M [m²/s]	4.12E–8	NA	NA
Flow model	Radial 2 shell composite Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m²/s]	5.4E–8	NA	2.6E–8
T_2 [m²/s]	1.1E–8	4.2E–7	8.5E–7 (less reliable due to fast recovery)
r_1 [m]	26.6	NA	0.57
S [–] (ass. approx. 1E–6)	6.1E–7	1.0E–6	1.3E–6
ξ [–]	0	39.1	0
C [m³/Pa]	NA	1.9E–11	2.1E–11

Selected representative parameters

The recommended transmissivity of 5.4E–8 m²/s was derived from the analysis of the CHi phase (inner zone). The confidence range for the transmissivity is estimated to be 1E–8 to 1E–6 m²/s (including both inner and outer composite zone). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,520.9 kPa.

If further analysis is planned, more detailed flow model identification should be conducted. This could be done by using a full superposition analysis.

6.3.23 Section 465–470 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) with a pressure difference of about 200 kPa, followed by a pressure recovery phase (CHir). The test shows no hydraulic communication between the test interval and the adjacent zones. The injection rate control during the CHi phase was good, however, due to very small rates, the flow data is noisy. Only a qualitative analysis was possible. The flow rate varied between 0.007 L/min at start of the CHi phase and 0.004 L/min at its end, indicating a low interval transmissivity. The CHir phase is of good quality and adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test there is ambiguity concerning the flow dimension. The downward trend of the CHir derivative at late times can be interpreted as a flow dimension above 2 or can represent the transition to a zone of higher transmissivity. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-67. The table below presents relevant parameters with respect to the selected model.

Table 6-62. Analyses results; section 465–470 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m²/s]	3.70E–9	NA	NA
T_M [m²/s]	3.05E–9	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m²/s]	2.8E–9	NA	1.1E–9
T_2 [m²/s]	NA	2.4E–8	1.4E–7 (unreliable)
r_1 [m]	NA	NA	0.19
S [–] (ass. approx. 1E–6)	1.0E–6	1.0E–6	1.2E–6
ξ [–]	0	33.2	0
C [m³/Pa]	NA	1.3E–11	1.2E–11

Selected representative parameters

The recommended transmissivity of 2.4E–8 m²/s was derived from the analysis of the CHir phase which appears to be most representative for the formation behaviour. The confidence range for the transmissivity is estimated to be 2E–9 to 3E–7 m²/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,565.8 kPa.

As commented above, there is room for interpretation as far as the flow dimension is concerned. This uncertainty could be further explored using GRF analysis.

6.3.24 Section 480–485 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) conducted with a pressure difference of about 200 kPa, followed by a pressure recovery phase (CHir). The test interval was well isolated, no hydraulic connection between test section and adjacent zones was observed. The rate regulation during the constant pressure injection (CHi) did not perform properly, the pressure in the interval showing oscillations till the late times of the phase. Because of this reason no analysis of the CHi phase is possible. The flow rate decreased from 0.007 L/min at start of the CHi phase to 0.001 L/min at its end, indicating a low interval transmissivity. The CHir phase was conducted without problems and shows good data quality. The CHir phase is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase derivative shows a downward trend at late times indicating either an increase of transmissivity at some distance from the borehole or a flow dimension above 2. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-70. The table below presents relevant parameters with respect to the selected model.

Table 6-63. Analyses results; section 480–485 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	1.50E–9	NA	NA
T_M [m^2/s]	1.24E–9	NA	NA
Flow model	NA	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	NA	NA	4.1E–10
T_2 [m^2/s]	NA	1.1E–8	4.1E–08
r_1 [m]	NA	NA	0.15
S [–] (ass. approx. 1E–6)	NA	1.0E–6	9.4E–7
ξ [–]	NA	33.4	0
C [m^3/Pa]	NA	6.1E–12	6.9E–12

Selected representative parameters

The recommended transmissivity of 1.1E–8 m^2/s was derived from the analysis of the CHir phase. The confidence range for the transmissivity is estimated to be 9E–9 to 9E–8 m^2/s (the inner zone transmissivity derived from the CHir phase is considered to be caused by a local skin effect). The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,709.4 kPa.

No further analysis is recommended.

6.3.25 Section 500–505 m, test no 1, injection

Comments to test

The intention was to conduct the test as a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). However, after inflating the packers and closing the test valve, the pressure kept rising with approx. 47 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E–11 m^2/s. The test shows no hydraulic communication between the test interval and the adjacent zones. None of the test phases is analysable.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow model cannot be determined. No analysis was performed. The measured data is presented in Appendix 2-71.

Table 6-64. Analyses results; section 500–505 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–11	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than 1E–11 m^2/s.

No further analysis recommended.

6.3.26 Section 505–510 m, test no 1, injection

Comments to test

The intention was to conduct the test as a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). However, after inflating the packers and closing the test valve, the pressure kept rising with approx. 106 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E–11 m^2/s. The test shows no hydraulic communication between the test interval and the adjacent zones. None of the test phases is analysable.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow model cannot be determined. No analysis was performed. The measured data is presented in Appendix 2-72.

Table 6-65. Analyses results; section 505–510 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–11	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than 1E–11 m^2/s.

No further analysis recommended.

6.3.27 Section 510–515 m, test no 1 and 2, injection and pulse injection

Comments to test

The test was composed of two parts. Part one was conducted as a constant pressure injection phase (CHi) with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test section was well isolated, no hydraulic connection between test section and adjacent zones was observed. The rate regulation during the constant pressure injection (CHi) did not perform properly, the pressure in the interval showing oscillations till the late times of the phase. Because of this reason no analysis of the CHi phase is possible. The flow rate was 0.001 L/min or lower (most of the time below measurement range of the flowmeter), indicating a low interval transmissivity. The CHir phase was conducted without problems and shows good data quality. The CHir phase is adequate for quantitative analysis. The analysis was conducted using an average flow rate of 1 mL/min. The second part of the test was conducted as pulse injection (PI). The test was analysed using a wellbore storage coefficient of 1.3E–11 m^3/Pa, which is consistent with the value obtained from the CHir analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase derivative shows a downward trend at late times indicating either an increase of transmissivity at some distance from the borehole or a flow dimension above 2. It was decided to use a flow dimension of 2 (radial flow) in the analysis and model the downward sloping derivative using a composite system with increasing transmissivity away from the borehole. The response of the CHir phase is, however, inconsistent with the PI phase response, which shows an upwards derivative trend at late times. The analysis plots are presented in Appendix 2-73. The table below presents relevant parameters with respect to the selected model.

Table 6-66. Analyses results; section 510–515 m.

Parameter	PI phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	4.8E–10	NA	2.0E–10
T_2 [m^2/s]	5.5E–11	1.7E–9	1.6E–9
r_1 [m]	0.94	NA	0.16
S [–] (ass. approx. 1E–6)	1.0E–6	1.0E–6	1.0E–6
ξ [–]	3.5	10.1	0
C [m^3/Pa]	1.3E–11	1.4E–11	1.3E–11

Selected representative parameters

The recommended transmissivity of 1.7E–9 m^2/s was derived from the analysis of the CHir phase. The confidence range for the transmissivity is estimated to be 3E–11 to 3E–9 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,004.8 kPa.

If further analysis of the data set is planned, the inconsistency between the CHir and PI responses should be clarified using full superposition analysis.

6.3.28 Section 515–520 m, test no 2, injection

Comments to test

The test was composed of a constant pressure injection test phase (CHi) with a pressure difference of 242 kPa, followed by a pressure recovery phase (CHir). No hydraulic connection between test interval and the adjacent zones was observed. The rate regulation during the constant pressure injection phase was very good, the data is adequate for quantitative analysis. The injection rate decreased from 0.26 L/min at start of the CHi phase to 0.009 L/min at its end, indicating a relatively low interval transmissivity. The recovery phase (CHir) shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase shows a flat derivative at middle and late times, which is indicative of a flow dimension of 2 (radial flow). An infinite radial composite flow model was used in the analysis. The analysis plots are presented in Appendix 2-74. The table below presents relevant parameters with respect to the selected model.

Table 6-67. Analyses results; section 515–520 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	6.05E–9	NA	NA
T_M [m^2/s]	5.00E–9	NA	NA
Flow model	Radial 2 shell composite Infinite acting	NA	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	4.7E–9	NA	9.3E–9
T_2 [m^2/s]	2.9E–9	NA	2.9E–9
r_1 [m]	2.09	NA	1.95
S [–] (ass. approx. 1E–6)	1.6E–6	NA	1.0E–6
ξ [–]	0	NA	2
C [m^3/Pa]	NA	NA	1.8E–11

Selected representative parameters

The recommended transmissivity of 2.9E–9 m^2/s was derived from the outer zone transmissivity derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the interval transmissivity is estimated to be 1.0E–9 to 1E–8 m^2/s (accounting for both composite zones). The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,054.6 kPa.

The analysis of the two test phases shows good consistency. No further analysis is recommended.

6.3.29 Section 525–530 m, test no 1, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) conducted with a pressure difference of 200 kPa, followed by a pressure recovery phase (CHir). The test interval was well isolated, no hydraulic connection between test section and adjacent zones was observed. The rate regulation during the constant pressure injection (CHi) did not perform properly, the flow rate showing oscillations till the late times of the phase. Because of this reason the analysis of the CHi phase is only qualitative. The flow rate decreased from 0.005 L/min at start of the CHi phase to 0.003 L/min at its end, indicating a low interval transmissivity. The CHir phase was conducted without problems and shows good data quality. The CHir phase is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase derivative shows a downward trend at late times indicating either an increase of transmissivity at some distance from the borehole or a flow dimension above 2. An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-76. The table below presents relevant parameters with respect to the selected model.

Table 6-68. Analyses results; section 525–530 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	3.27E–9	NA	NA
T_M [m^2/s]	2.70E–9	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	2.3E–9	NA	1.1E–9
T_2 [m^2/s]	NA	1.1E–8	9.7E–9
r_1 [m]	NA	NA	0.23
S [–] (ass. approx. 1E–6)	1.0E–6	1.0E–6	1.0E–6
ξ [–]	0	15.9	0
C [m^3/Pa]	NA	1.5E–11	1.3E–11

Selected representative parameters

The recommended transmissivity of 1.1E–8 m^2/s was derived from the analysis of the CHir phase, which shows the best data and derivative quality. The confidence range for the transmissivity is estimated to be 1E–9 to 1E–8 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,156.3 kPa.

The analysis of the CHi and CHir phases shows some inconsistency, which is mainly caused by the poor CHi data. To improve analysis consistency and if further analysis is intended, a full superposition analysis should be conducted. Further, as commented above, there is room for interpretation as far as the flow dimension is concerned. This additional uncertainty could be further explored using GRF analysis.

6.3.30 Section 530–535 m, test no 2, injection

Comments to test

The test was composed of a constant pressure injection phase (CHi) conducted with a pressure difference of about 220 kPa, followed by a pressure recovery phase (CHir). The test interval was well isolated, no hydraulic connection between test section and adjacent zones was observed. The rate regulation during the constant pressure injection (CHi) performed well, the flow rate decreased from 0.02 L/min at start of the CHi phase to 0.006 L/min at its end, indicating a low interval transmissivity. The CHir phase was conducted without problems and shows good data quality. The CHir phase is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHir phase derivative is horizontal at middle and late times indicating a flow dimension of 2 (radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. In a further step, an alternative analysis of the CHir using a radial composite flow model was performed with the aim of explicitly modelling the skin as a zone of finite thickness. The analysis plots are presented in Appendix 2-78. The table below presents relevant parameters with respect to the selected model.

Table 6-69. Analyses results; section 530–535 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	4.66E–9	NA	NA
T_M [m^2/s]	3.85E–9	NA	NA
Flow model	Homogeneous Infinite acting	WBS and skin Homogeneous Infinite acting	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	4.0E–9	NA	2.7E–9
T_2 [m^2/s]	NA	6.6E–9	6.5E–9
r_1 [m]	NA	NA	0.19
S [–] (ass. approx. 1E–6)	1.2E–6	1.0E–6	1.0E–6
ξ [–]	0	2	0
C [m^3/Pa]	NA	1.8E–11	1.8E–11

Selected representative parameters

The recommended transmissivity of 6.6E–9 m^2/s was derived from the analysis of the CHir, which shows the best data and derivative quality. The confidence range for the transmissivity is estimated to be 1E–9 to 8E–9 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,218.3 kPa.

The analysis of the CHi and CHir phases shows some inconsistency, which is mainly caused by the poor CHi data. To improve analysis consistency and if further analysis is intended, a full superposition analysis should be conducted.

6.3.31 Section 535–540 m, test no 1, injection

Comments to test

The intention was to conduct the test as a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). However, after inflating the packers and closing the test valve, the pressure kept rising with approx. 123 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E–11 m^2/s. The test shows no hydraulic communication between the test interval and the adjacent zones. None of the test phases is analysable.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow model cannot be determined. No analysis was performed. The measured data is presented in Appendix 2-79.

Table 6-70. Analyses results; section 535–540 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–11	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than 1E–11 m^2/s.

No further analysis recommended.

6.3.32 Section 540–545 m, test no 1, injection

Comments to test

The intention was to conduct the test as a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). However, after inflating the packers and closing the test valve, the pressure kept rising with approx. 30 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E–11 m2/s. The test shows no hydraulic communication between the test interval and the adjacent zones. None of the test phases is analysable.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow model cannot be determined. No analysis was performed. The measured data is presented in Appendix 2-80.

Table 6-71. Analyses results; section 540–545 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	NA
T_1 [m^2/s]	lower than 1E–11	NA	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	NA	NA
ξ [–]	NA	NA	NA
C [m^3/Pa]	NA	NA	NA

Selected representative parameters

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than 1E–11 m^2/s.

No further analysis recommended.

6.4 Single-hole pulse injection tests

In the present section the tests that were conducted as pulse injection or that were analysed as pulse injection due to lack of measurable flow during the injection flow are presented. The tests were analysed using RAMEY type curve analysis as well as deconvolution type curve analysis.

6.4.1 Section 344–364 m, test no 1, pulse injection

Comments to test

The test was initiated as a constant pressure injection. However, after a few seconds of injection the rate quickly dropped to zero, indicating a very tight section. It was therefore decided to close the test valve and measure the pressure recovery overnight. The pressure recovery was analysed as a pulse injection phase (PI). During the brief injection phase a total volume of 0.0072 l was injected (derived from the flowmeter measurements). This injected volume produced a pressure increase of 266 kPa. Using a dV/dP approach, the wellbore storage coefficient relevant for the subsequent pressure recovery can be calculated to 2.7E–11 m^3/Pa. It should be noted though that there is large uncertainty connected with the determination of the wellbore storage coefficient (probably one order of magnitude), which will implicitly translate into uncertainty in the derived transmissivity.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be determined with any degree of certainty because the shape of the deconvolved pulse data is very sensitive to the assumed p0 and pi values of the test. The analysis was conducted assuming a flow dimension of 2 – radial flow). An infinite acting composite flow model was used in the analysis. The analysis plots are presented in Appendix 2-16. The table below presents relevant parameters with respect to the selected model.

Table 6-72. Analyses results; section 344–364 m.

Parameter	CHi phase	CHir phase	CHir phase (analysed as PI)
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	Radial 2 shell composite Infinite acting
T_1 [m^2/s]	NA	NA	8.5E–11
T_2 [m^2/s]	NA	NA	2.6E–11
r_1 [m]	NA	NA	0.21
S [–] (ass. approx. 1E–6)	NA	NA	2.9E–6
ξ [–]	NA	NA	0
C [m^3/Pa]	NA	NA	2.7E–11 (derived from dV/dP)

Selected representative parameters

The recommended transmissivity of 2.6E–11 m^2/s was derived from the analysis of the CHir phase (outer zone), which shows the best data and derivative quality. The confidence range for the transmissivity is estimated to be 1E–11 to 5E–10 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was estimated from the last reading and shape of the pressure recovery to a value of 3,400.0 kPa.

The test data is poor, this being mainly caused by the very low interval transmissivity and the test design which was not optimized for this transmissivity range. No further analysis is recommended.

6.4.2 Section 364–384 m, test no 1, pulse injection

Comments to test

The test was initiated as a constant pressure injection. However, after a few seconds of injection the rate quickly dropped to zero, indicating a very tight section. It was therefore decided to close the test valve and measure the pressure recovery overnight. The pressure recovery was analysed as a pulse injection phase (PI). During the brief injection phase a total volume of 0.0164 l was injected (derived from the flowmeter measurements. This injected volume produced a pressure increase of 285.3 kPa. Using a dV/dP approach, the wellbore storage coefficient relevant for the subsequent pressure recovery can be calculated to 5.8E–11 m^3/Pa. It should be noted though that there is large uncertainty connected with the determination of the wellbore storage coefficient (probably one order of magnitude), which will implicitly translate into uncertainty in the derived transmissivity.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be determined with any degree of certainty because the shape of the deconvolved pulse data is very sensitive to the assumed p0 and pi values of the test. The analysis was conducted assuming a flow dimension of 2 – radial flow). An infinite acting radial composite flow model was used in the analysis. The analysis plots are presented in Appendix 2-17. The table below presents relevant parameters with respect to the selected model.

Table 6-73. Analyses results; section 364–384 m.

Parameter	CHi phase	CHir phase	CHir phase (analysed as PI)
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	Radial 2 shell composite Infinite acting
T_1 [m^2/s]	NA	NA	3.2E–9
T_2 [m^2/s]	NA	NA	1.8E–9
r_1 [m]	NA	NA	1.38
S [–] (ass. approx. 1E–6)	NA	NA	2.5E–7
ξ [–]	NA	NA	0
C [m^3/Pa]	NA	NA	5.8E–11 (derived from dV/dP)

Selected representative parameters

The recommended transmissivity of 1.8E–9 m^2/s was derived from the analysis of the CHir phase (outer zone), which shows the best data and derivative quality. The confidence range for the transmissivity is estimated to be 5E–10 to 1E–8 m^2/s. The analysis was conducted using a flow dimension of 2. The static pressure measured at transducer depth, was estimated from the last reading and shape of the pressure recovery to a value of 3,600.0 kPa.

The test data is poor, this being mainly caused by the very low interval transmissivity and the test design which was not optimized for this transmissivity range. No further analysis is recommended.

6.4.3 Section 404–424 m, test no 1, pulse injection

Comments to test

The test was initiated as a constant pressure injection. However, after a few seconds of injection the rate quickly dropped to zero, indicating a very tight section. It was therefore decided to close the test valve and measure the pressure recovery. The pressure recovery was analysed as a pulse injection phase (PI). During the brief injection phase a total volume of 0.048 l was injected (derived from the flowmeter measurements. This injected volume produced a pressure increase of 249 kPa. Using a dV/dP approach, the wellbore storage coefficient relevant for the subsequent pressure recovery can be calculated to 1.9E–10 m^3/Pa. It should be noted though that there is large uncertainty connected with the determination of the wellbore storage coefficient (probably one order of magnitude), which will implicitly translate into uncertainty in the derived transmissivity.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be determined with any degree of certainty because the shape of the deconvolved pulse data is very sensitive to the assumed p0 and pi values of the test. The analysis was conducted assuming a flow dimension of 2 – radial flow). An infinite acting radial composite flow model was used in the analysis. The analysis plots are presented in Appendix 2-19. The table below presents relevant parameters with respect to the selected model.

Table 6-74. Analyses results; section 404–424 m.

Parameter	CHi phase	CHir phase	CHir phase (analysed as PI)
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	Radial 2 shell composite Infinite acting
T_1 [m^2/s]	NA	NA	1.8E–11 (to be seen as skin)
T_2 [m^2/s]	NA	NA	3.6E–13
r_1 [m]	NA	NA	0.08
S [–] (ass. approx. 1E–6)	NA	NA	2.2E–6
ξ [–]	NA	NA	0
C [m^3/Pa]	NA	NA	1.9E–10 (derived from dV/dP)

Selected representative parameters

The recommended transmissivity of 3.6E–13 m^2/s was derived from the analysis of the CHir phase (outer zone). It should be noted that due to the very low interval transmissivity the results are very uncertain. The confidence range for the transmissivity is estimated to be 3E–13 to 2E–11 m^2/s (the outer zone transmissivity is considered as most representative). The analysis was conducted using a flow dimension of 2. No static pressure could be derived.

The test data is poor, this being mainly caused by the very low interval transmissivity and the test design which was not optimized for this transmissivity range. No further analysis is recommended.

6.4.4 Section 564–584 m, test no 1, pulse injection

Comments to test

The test was started as a constant pressure injection test phase (CHi) with subsequent pressure recovery phase (CHir). However, given the fact that no measurable flow was registered during the CHi phase it was decided to close the test valve and conduct the test as a pulse injection. The test shows no hydraulic communication between the test interval and the adjacent zones.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be uniquely determined because the slope of the deconvolution derivative is strongly dependent on the assumed static and initial pressure of the pulse. The analysis was conducted using the radial flow assumption (flow dimension = 2). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. The analysis plots are presented in Appendix 2-28. The table below presents relevant parameters with respect to the selected model.

Table 6-75. Analyses results; section 564–584 m.

Parameter	CHi phase	CHir phase	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	Homogeneous Infinite acting	NA
T_1 [m^2/s]	NA	2.8E–12	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	3.1E–6	NA
ξ [–]	NA	0	NA
C [m^3/Pa]	NA	5.1E–11 (assumed; value similar with other tests)	NA

Selected representative parameters

The recommended transmissivity is 2.8E–12 m^2/s. The confidence range of the transmissivity is estimated to be between 1E–12 m^2/s and 5E–11 m^2/s. The analysis was conducted using a flow dimension of 2.

No further analysis is recommended.

6.4.5 Section 704–724 m, test no 1, pulse injection

Comments to test

The test was initiated as a constant pressure injection. However, after a few seconds of injection the rate quickly dropped to zero, indicating a very tight section. It was therefore decided to close the test valve and measure the pressure recovery. The pressure recovery was analysed as a pulse injection phase (PI). During the brief injection phase a total volume of 0.035 l was injected (derived from the flowmeter measurements. This injected volume produced a pressure increase of 203.3 kPa. Using a dV/dP approach, the wellbore storage coefficient relevant for the subsequent pressure recovery can be calculated to 1.7E–10 m^3/Pa. It should be noted though that there is large uncertainty connected with the determination of the wellbore storage coefficient (probably one order of magnitude), which will implicitly translate into uncertainty in the derived transmissivity.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be determined with any degree of certainty because the shape of the deconvolved pulse data is very sensitive to the assumed p0 and pi values of the test. The analysis was conducted assuming a flow dimension of 2 – radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. The analysis plots are presented in Appendix 2-30. The table below presents relevant parameters with respect to the selected model.

Table 6-76. Analyses results; section 704–724 m.

Parameter	CHi phase	CHir phase (analysed as PI)	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	WBS and skin Homogeneous Infinite acting	NA
T_1 [m^2/s]	NA	1.2E–10	NA
T_2 [m^2/s]	NA	NA	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	1.1E–6	NA
ξ [–]	NA	2 (from deconvolution analysis)	NA
C [m^3/Pa]	NA	1.7E–10 (derived from dV/dP)	NA

Selected representative parameters

The recommended transmissivity of 1.2E–10 m^2/s was derived from the analysis of the CHir phase. It should be noted that due to the very low interval transmissivity the results are very uncertain the confidence range for the transmissivity is estimated to be 1E–11 to 3E–10 m^2/s . The analysis was conducted using a flow dimension of 2. No static pressure could be derived.

The test data is poor, this being mainly caused by the very low interval transmissivity and the test design which was not optimized for this transmissivity range. No further analysis is recommended.

6.4.6 Section 341–346 m, test no 1, pulse injection

Comments to test

The test was initiated as a constant pressure injection. However, after a few seconds of injection the rate quickly dropped to zero, indicating a very tight section. It was therefore decided to close the test valve and measure the pressure recovery. The pressure recovery was analysed as a pulse injection phase (PI). During the brief injection phase a total volume of 0.022 l was injected (derived from the flowmeter measurements. This injected volume produced a pressure increase of 201.6 kPa. Using a dV/dP approach, the wellbore storage coefficient relevant for the subsequent pressure recovery can be calculated to 1.1E–10 m^3/Pa. It should be noted though that there is large uncertainty connected with the determination of the wellbore storage coefficient (probably one order of magnitude), which will implicitly translate into uncertainty in the derived transmissivity.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be determined with any degree of certainty because the shape of the deconvolved pulse data is very sensitive to the assumed p0 and pi values of the test. The analysis was conducted assuming a flow dimension of 2 – radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. The analysis plots are presented in Appendix 2-53. The table below presents relevant parameters with respect to the selected model.

Table 6-77. Analyses results; section 341–346 m.

Parameter	CHi phase	CHir phase (analysed as PI)	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	NA	WBS and skin Radial 2 shell composite Infinite acting
T_1 [m^2/s]	NA	NA	1.8E–11 (to be seen as skin)
T_2 [m^2/s]	NA	NA	6.1E–11
r_1 [m]	NA	NA	0.15
S [–] (ass. approx. 1E–6)	NA	NA	1.0E–6
ξ [–]	NA	NA	0
C [m^3/Pa]	NA	NA	1.1E–10 (derived from dV/dP)

Selected representative parameters

The recommended transmissivity of 6.1E–11 m^2/s was derived from the analysis of the CHir phase (outer zone). It should be noted that due to the very low interval transmissivity the results are very uncertain. The confidence range for the transmissivity is estimated to be

5E–11 to 8E–11 m^2/s (the outer zone transmissivity is considered as most representative). The analysis was conducted using a flow dimension of 2. No static pressure could be derived.

The test data is poor, this being mainly caused by the very low interval transmissivity and the test design which was not optimized for this transmissivity range. No further analysis is recommended.

6.4.7 Section 470–475 m, test no 1, pulse injection

Comments to test

The test was started with a long lasting pressure recovery. After rising for approx. 1 hour, the pressure rolled over and started dropping, this response indicating a very tight test section as well as the relatively long time needed by the packers to inflate completely. The test was continued as a constant pressure injection. However, after a few seconds of injection the rate quickly dropped to zero, confirming that the section is very tight. It was therefore decided to close the test valve and measure the pressure recovery. The pressure recovery was analysed as a pulse injection phase (PI). During the brief injection phase a total volume of approx 3 ml was injected (derived from the flowmeter measurements. This injected volume produced a pressure increase of 204 kPa. Using a dV/dP approach, the wellbore storage coefficient relevant for the subsequent pressure recovery can be calculated to 1.3E–11 m^3/Pa. It should be noted though that there is large uncertainty connected with the determination of the wellbore storage coefficient (probably one order of magnitude), which will implicitly translate into uncertainty in the derived transmissivity.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be determined with any degree of certainty because the shape of the deconvolved pulse data is very sensitive to the assumed p0 and pi values of the test. The analysis was conducted assuming a flow dimension of 2 – radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. The analysis plots are presented in Appendix 2-68. The table below presents relevant parameters with respect to the selected model.

Table 6-78. Analyses results; section 470–475 m.

Parameter	CHi phase	CHir phase (analysed as PI)	CHir phase
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	WBS and skin Homogeneous Infinite acting	NA
T_1 [m^2/s]	NA	NA (transmissivity near the wellbore much lower, expressed by the high skin)	NA
T_2 [m^2/s]	NA	3.4E–9 (matched to late time data)	NA
r_1 [m]	NA	NA	NA
S [–] (ass. approx. 1E–6)	NA	1.7E–6	NA
ξ [–]	NA	10	NA
C [m^3/Pa]	NA	1.3E–13 (derived from dV/dP)	NA

Selected representative parameters

The recommended transmissivity of 3.4E–9 m^2/s was derived from the analysis of the CHir phase. It should be noted that due to the very low interval transmissivity the results are very uncertain. The confidence range for the transmissivity is estimated to be 1E–11 to 5E–9 m^2/s. The analysis was conducted using a flow dimension of 2. No static pressure could be derived.

The test data is poor, this being mainly caused by the very low interval transmissivity and the test design which was not optimized for this transmissivity range. No further analysis is recommended.

6.4.8 Section 475–480 m, test no 2, pulse injection

Comments to test

The test was started with pressure recovery of 0.4 hours during which the pressure rose by 13 kPa. The test was continued as a pulse injection. During the brief injection phase a total volume of approx 6 ml was injected (derived from water level in tubing). This injected volume produced a pressure increase of 293 kPa. Using a dV/dP approach, the wellbore storage coefficient relevant for the subsequent pressure recovery can be calculated to 1.8E–11 m3/Pa. It should be noted though that there is large uncertainty connected with the determination of the wellbore storage coefficient (probably one order of magnitude), which will implicitly translate into uncertainty in the derived transmissivity.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be determined with any degree of certainty because the shape of the deconvolved pulse data is very sensitive to the assumed p0 and pi values of the test. The analysis was conducted assuming a flow dimension of 2 – radial flow). An infinite acting homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. The analysis plots are presented in Appendix 2-69. The table below presents relevant parameters with respect to the selected model.

Table 6-79. Analyses results; section 475–480 m.

Parameter	NA	PI phase	NA
Q/s [m^2/s]	NA	NA	NA
T_M [m^2/s]	NA	NA	NA
Flow model	NA	WBS and skin Radial 2 shell composite Infinite acting	NA
T_1 [m^2/s]	NA	1.9E–9	NA
T_2 [m^2/s]	NA	6.9E–9	NA
r_1 [m]	NA	1.9	NA
S [–] (ass. approx. 1E–6)	NA	1.1E–6	NA
ξ [–]	NA	10	NA
C [m^3/Pa]	NA	1.8E–13 (derived from dV/dP)	NA

Selected representative parameters

The recommended transmissivity of 1.9E–9 m^2/s was derived from the analysis of the PI phase (inner composite zone). It should be noted that due to the very low interval transmissivity the results are very uncertain. The confidence range for the transmissivity is estimated to be 1E–9 to 1E–8 m^2/s.The analysis was conducted using a flow dimension of 2. No static pressure could be derived.

No further analysis is recommended.

6.4.9 Section 520–525 m, test no 1, pulse injection

Comments to test

The test was initiated as a constant pressure injection. However, after a few seconds of injection the rate quickly dropped to zero, indicating a very tight section. It was therefore decided to close the test valve and measure the pressure recovery. The pressure recovery was analysed as a pulse injection phase (PI). During the brief injection phase a total volume of 0.163 l was injected (derived from the flowmeter measurements). This injected volume produced a pressure increase of 209 kPa. Using a dV/dP approach, the wellbore storage coefficient relevant for the subsequent pressure recovery can be calculated to 1.3E–10 m^3/Pa. It should be noted though that there is large uncertainty connected with the determination of the wellbore storage coefficient (probably one order of magnitude), which will implicitly translate into uncertainty in the derived transmissivity.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the flow dimension cannot be determined with any degree of certainty because the shape of the deconvolved pulse data is very sensitive to the assumed p0 and pi values of the test. An infinite acting radial composite flow model was used in the analysis. The analysis plots are presented in Appendix 2-75. The table below presents relevant parameters with respect to the selected model.

Table 6-80. Analyses results; section 520–525 m.

Parameter	CHi phase	CHir phase	CHir phase (analysed as PI)
Q/s [m^2/s]	NA	NA	NA
TM [m^2/s]	NA	NA	NA
Flow model	NA	NA	WBS and skin Radial 2 shell composite Infinite acting
T1 [m^2/s]	NA	NA	9.1E–12
T2 [m^2/s]	NA	NA	7.3E–11
r1 [m]	NA	NA	0.07
S [–] (ass. approx. 1E–6)	NA	NA	1.0E–6
ξ [–]	NA	NA	0.4
C [m^3/Pa]	NA	NA	1.3E–10 (derived from dV/dP)

Selected representative parameters

The recommended transmissivity of 7.3E–11 m^2/s was derived from the analysis of the CHir phase (outer zone). It should be noted that due to the very low interval transmissivity the results are very uncertain. The confidence range for the transmissivity is estimated to be 5E–12 to 8E–11 m^2/s. The analysis was conducted using a flow dimension of 2. No static pressure could be derived.

The test data is poor, this being mainly caused by the very low interval transmissivity and the test design which was not optimized for this transmissivity range. No further analysis is recommended.

7 Synthesis

The synthesis chapter summarizes the basic test parameters and analysis results. In addition, the correlation between steady state and transient transmissivities as well as between the matched and the theoretical wellbore storage (WBS) coefficient are presented and discussed. An additional synthesis based on normalized plots as well as transmissivity and equivalent freshwater head profiles are presented in Appendix 5.

7.1 Summary of results

Table 7-1. General test data from constant head injection tests and pulse tests in KLX02. (bml = below measurement limit).

Borehole secup (m)	Borehole seclow (m)	Date and time for test, start YYYYMMDD hh:mm	Date and time for test, stop YYYYMMDD hh:mm	Q_p (m^3/s)	Q_m (m^3/s)	tp (s)	t_F (s)	p_0 (kPa)	p_i (kPa)	p_p (kPa)	p_F (kPa)	Te_w (°C)	Test phases measured *Analysed test phases marked bold*	
204.00	304.00	20030710 08:23	20030710 11:15	7.92E–04	8.34E–04	2160	2040	2021.0	2026.0	2227.0	2030.0	10.0	**CHi**	**CHir**
304.00	404.00	20030710 13:46	20030710 15:49	2.20E–04	2.26E–04	1980	1800	3012.0	3011.0	3210.0	3010.0	11.5	**CHi**	**CHir**
404.00	504.00	20030710 17:17	20030710 19:35	2.67E–06	2.83E–06	1980	1920	3994.0	3968.0	4167.0	3969.0	–	**CHi**	**CHir**
504.00	604.00	20030711 10:05	20030711 17:29	2.67E–07	3.01E–07	1800	8340	4968.0	4987.0	5187.0	4975.0	14.5	CHi	**CHir**
604.00	704.00	20030711 18:46	20030712 08:04	2.50E–08	3.33E–08	1800	42300	5963.0	5953.0	6149.0	5897.0	15.7	CHi	**CHir**
704.00	804.00	20030712 09:31	20030712 12:01	3.32E–06	3.33E–06	3600	1800	6939.0	6874.0	7074.0	6876.0	17.3	**CHi**	**CHir**
804.00	904.00	20030712 14:29	20030712 16:20	1.58E–06	1.69E–06	1800	1980	7926.0	7864.0	8063.0	7862.0	18.8	**CHi**	**CHir**
904.00	1,004.00	20030712 17:51	20030712 19:41	2.87E–06	2.88E–06	1800	1800	8909.0	8850.0	9048.0	8850.0	20.5	**CHi**	**CHir**
204.00	224.00	20030714 12:16	20030714 14:27	5.34E–05	5.95E–05	1200	1200	2029.0	2030.0	2230.0	2030.0	10.0	**CHi**	**CHir**
224.00	244.00	20030714 15:32	20030714 17:15	2.40E–05	2.53E–05	1500	1200	2228.0	2227.0	2427.0	2227.0	10.0	**CHi**	**CHir**
244.00	264.00	20030714 17:50	20030714 19:11	7.31E–04	7.54E–04	1200	1500	2423.0	2423.0	2622.0	2427.0	10.5	**CHi**	**CHir**
264.00	284.00	20030715 08:25	20030715 10:01	2.67E–05	3.01E–05	1200	1200	2616.0	2616.0	2817.0	2617.0	10.7	**CHi**	**CHir**
284.00	304.00	20030715 10:46	20030715 12:09	1.75E–05	1.94E–05	1200	1200	2813.0	2813.0	3012.0	2813.0	11.0	**CHi**	**CHir**
304.00	324.00	20030715 12:56	20030715 14:44	1.90E–04	1.94E–04	1200	1200	3010.0	3011.0	3210.0	3011.0	11.2	**CHi**	**CHir**
324.00	344.00	20030715 15:33	20030715 16:57	3.97E–05	4.12E–05	1200	1200	3207.0	3207.0	3407.0	3407.0	11.5	**CHi**	**CHir**
344.00	364.00	20030715 17:31	20030716 07:57	–	–	300	49440	3404.0	3432.0	3666.0	3403.0	12.0	**Pi**	
364.00	384.00	20030716 08:35	20030716 09:39	–	-	120	1320	3598.0	3600.0	3810.0	3604.0	12.2	**Pi**	
384.00	404.00	20030716 10:20	20030716 13:45	6.96E–08	6.96E–08	1200	1200	3795.0	3773.0	4022.0	3776.0	12.5	**CHi**	**CHir**
404.00	424.00	20030716 14:23	20030716 15:29	–	–	180	1200	3994.0	4010.0	4247.0	4246.0	12.8	**Pi**	
424.00	444.00	20030716 16:07	20030716 17:31	8.22E–07	8.39E–07	1200	1200	4191.0	4165.0	4364.0	4165.0	13.1	**CHi**	**CHir**
444.00	464.00	20030716 18:03	20030716 19:59	1.47E–06	1.51E–06	1200	1800	4387.0	4363.0	4562.0	4363.0	13.4	**CHi**	**CHir**
464.00	484.00	20030717 08:08	20030717 10:13	1.76E–07	1.92E–07	1800	1200	4585.0	4558.0	4755.0	4558.0	13.6	**CHi**	**CHir**
481.00	501.00	20030717 10:48	20030717 12:52	3.33E–09(bml)	8.33E–09	1800	1800	4749.0	4744.0	4943.0	4759.0	14.0	CHi	**CHir**

Borehole secup (m)	Borehole seclow (m)	Date and time for test, start YYYYMMDD hh:mm	Date and time for test, stop YYYYMMDD hh:mm	Q_p (m^3/s)	Q_m (m^3/s)	tp (s)	t_F (s)	p_0 (kPa)	p_i (kPa)	p_p (kPa)	p_F (kPa)	Te_w (°C)	Test phases measured *Analysed test phases marked bold*	
484.00	504.00	20030717 13:21	20030717 15:06	8.28E–09(bml)	8.33E–09	1800	2400	4781.0	477.6	4975.0	4774.0	14.0	CHi	**CHir**
504.00	524.00	20030717 15:40	20030717 18:46	1.30E–07	1.48E–07	1800	2700	4978.0	4983.0	5183.0	4980.0	14.2	**CHi**	**CHir**
524.00	544.00	20030717 19:25	20030717 21:32	1.17E–07	1.97E–07	3600	1800	5173.0	5165.0	5363.0	5184.0	14.5	**CHi**	**CHir**
544.00	564.00	20030718 11:21	20030718 13:41	–	–	480	5400	5371.0	5365.0	5555.0	5426.0	14.9		
564.0	584.0	20030718 14:16	20030718 16:30	–	–	180	3840	5568.0	5614.0	5817.0	5794.0	15.2	**Pi**	
584.00	604.00	20030718 17:12	20030718 18:41	8.33E–09(bml)	8.33E–09	1200	1800	5765.0	5767.0	5963.0	5820.0	15.5	CHi	**CHir**
704.00	724.00	20030719 09:18	20030719 10:48	–	–	1200	1800	6941.0	6950.0	7147.0	7117.0	17.3	**PI**	
724.00	744.00	20030719 11:23	20030719 15:45	6.33E–07	7.34E07	1200	1800	7139.0	7081.0	7281.0	7081.0	17.6	**CHi**	**CHir**
744.0	764.0	20030719 16:21	20030719 18:03	2.79E–07	2.88E–07	1800	1200	7337.0	7275.0	7475.0	7275.0	18.0	**CHi**	**CHir**
764.00	784.00	20030719 18:46	20030719 22:07	1.65E–07	1.69E–07	7200	1800	7532.0	7474.0	7672.0	7474.0	18.2	**CHi**	**CHir**
784.00	804.00	20030720 08:30	20030720 09:51	2.24E–06	2.30E–06	1200	1200	7726.0	7664.0	7884.0	7665.0	18.6	**CHi**	**CHir**
804.00	824.00	20030720 10:36	20030720 13:06	5.00E–08	5.49E–08	2400	1800	7924.0	7866.0	8066.0	7865.0	18.9	**CHi**	**CHir**
824.00	844.00	20030720 13:39	20030720 16.02	4.14E–08	4.76E–08	1800	2400	8122.0	8069.0	8319.0	8066.0	19.2	**CHi**	**CHir**
844.00	864.00	20030720 16:42	20030720 19:17	1.00E–06	1.07E–06	3600	1800	8320.0	8261.0	8461.0	8261.0	20.1	**CHi**	**CHir**
864.00	884.00	20030721 08:11	20030721 10:07	4.65E–07	5.01E–07	1200	1200	8511.0	8454.0	8654.0	8455.0	19.9	**CHi**	**CHir**
884.00	904.00	20030721 10:45	20030721 12:38	3.50E–07	3.65E–07	1800	1800	8711.0	8658.0	8858.0	8659.0	20.2	**CHi**	**CHir**
904.00	924.00	20030721 13:11	20030721 16:10	5.83E–08	6.47E–08	1200	1200	8911.0	8855.0	9055.0	8855.0	20.6	**CHi**	**CHir**
922.00	942.00	20030721 16:48	20030721 18:34	2.81E–06	3.03E–06	1200	1800	9087.0	9040.0	9240.0	9039.0	20.9	**CHi**	**CHir**
943.00	963.00	20030722 08:27	20030722 10:10	3.91E–07	4.01E–07	1800	1200	9289.0	9285.0	9486.0	9282.0	21.1	**CHi**	**CHir**
964.00	984.00	20030722 10:53	20030722 12:59	2.23E–08	3.04E–08	2400	1800	9497.0	9450.0	9653.0	9453.0	21.5	**CHi**	**CHir**
984.00	1,004.00	20030722 13:39	20030722 15:33	9.29E–08	9.91E–08	2400	1800	9692.0	9648.0	9850.0	9647.0	21.8	**CHi**	**CHir**
300.00	305.00	20030724 10:32	20030724 12:36	7.11E–07	7.14E–07	1800	1800	2967.0	2968.0	3168.0	2968.0	11.4	**CHi**	**CHir**
305.00	310.00	20030724 13:01	20030724 16:09	5.00E–09(bml)	5.83E–09	1200	7200	3018.0	3021.0	3221.0	3019.0	11.3	**CHi**	**CHir**
310.00	315.00	20030724 16:35	20030724 18:33	2.50E–08	5.12E–08	1800	1800	3067.0	3067.0	3267.0	3067.0	11.5	**CHi**	**CHir**
315.00	320.00	20030725 08:25	20030724 09:47	1.82E–04	1.92E–04	1200	1200	3112.0	3112.0	3310.0	3114.0	11.5	**CHi**	**CHir**
320.00	325.00	20030725 10:12	20030725 12:46	–	–	300	420	3161.0	3359.0	3491.0	3732.0	11.6		

Borehole secup (m)	Borehole seclow (m)	Date and time for test, start YYYYMMDD hh:mm	Date and time for test, stop YYYYMMDD hh:mm	Q_p (m^3/s)	Q_m (m^3/s)	tp (s)	t_F (s)	p_0 (kPa)	p_i (kPa)	p_p (kPa)	p_F (kPa)	Te_w (°C)	Test phases measured *Analysed test phases marked bold*	
325.00	330.00	20030725 13:18	20030725 15:11	1.33E–08(bml	2.17E–08	1800	1800	3211.0	3214.0	3415.0	3216.0	11.7	CHi	**CHir**
330.00	335.00	20030725 15:37	20030725 17:42	5.00E–09(bml	1.33E–08	1800	2700	3262.0	3264.0	3464.0	3265.0	11.8	CHi	**CHir**
335.00	340.00	20030725 18:05	20030725 19:34	3.11E–05	3.61E–05	1200	1200	3311.0	3312.0	3512.0	3312.0	11.7	**CHi**	**CHir**
341.00	346.00	20030726 08:19	20030726 10:41	–	–	1200	1800	3367.0	3490.0	3688.0	3666.0	11.9	CHi	**CHir**
385.00	390.00	20030726 11:20	20030726 13:46	5.00E–08	5.86E–08	1200	5160	3802.0	3783.0	3984.0	3780.0	12.4	CHi	**CHir**
390.00	395.00	20030726 14:12	20030726 16:06	–	–	1200	300	3851.0	3975.0	4183.0	4183.0	12.6		
395.00	400.00	20030726 16:35	20030727 08:11	–	–	–	–	3897.0	–	–	–	12.7		
400.00	405.00	20030727 08:38	20030727 09:24	–	–	–	–	3937.0	–	–	–	12.8		
420.00	425.00	20030727 09:55	20030727 10:56	–	–	–	–	4140.0	–	–	–	13.0		
425.00	430.00	20030727 11:23	20030727 12:09	–	–	–	–	4188.0	–	–	–	13.1		
429.00	434.00	20030727 13:20	20030727 14:21	–	–	–	–	4229.0	–	–	–	13.2		
434.00	439.00	20030727 14:48	20030727 16:31	8.35E–07	8.55E–07	1800	1200	4283.0	4261.0	4461.0	4261.0	13.3	**CHi**	**CHir**
440.00	445.00	20030727 16:58	20030727 17:58	–	–	–	–	4338.0	–	–	–	13.4		
445.00	450.00	20030728 08:13	20030728 09:13	–	–	–	–	4381.0	–	–	–	13.5		
450.00	455.00	20030728 09:38	20030728 10:38	–	–	–	–	4436.0	–	–	–	13.5		
455.00	460.00	20030728 11:02	20030728 13:29	1.09E–07	1.16E–07	3600	1200	4478.0	4466.0	4666.0	4466.0	13.6	**CHi**	**CHir**
460.00	465.00	20030728 13:53	20030728 15:33	6.66E–07	&.98E–07	1800	1200	4537.0	4515.0	4717.0	4515.0	13.6	**CHi**	**CHir**
460.00	465.00	20030801 11:51	20030801 15:49	1.01E–06	1.16E–06	7560	1200	4537.0	4520.0	4719.0	4521.0	13.7	**CHi**	**CHir**
465.00	470.00	20030728 15:56	20030728 17:44	7.57E–08	8.43E–08	1800	1200	4581.0	4565.0	4766.0	4566.0	13.8	**CHi**	**CHir**
470.00	475.00	20030728 18:07	20030729 08:23	–	–	240	1200	4620.0	4617.0	4810.0	4612.0	13.8	**Pi**	
475.00	480.00	20030801 09:44	20030801 11:22	–	–	0	2700	4659.0	4671.0	4948.0	4670.0	13.9	**Pi**	
480.00	485.00	20030729 10:54	20030729 13.28	3.04E–08	3.90E–08	1800	4860	4709.0	4712.0	4910.0	4709.0	14.0	CHi	**CHir**
500.00	505.00	20030729 14:00	20030729 14:59	–	–	–	–	4910.0	–	–	–	14.2		
505.00	510.00	20030729 15:29	20030729 16:29	–	–	–	–	4957.0	–	–	–	14.3		
510.00	515.00	20030729 16:54	20030729 20:42	8.33E–09(bml)	1.67E–08	1200	9600	5009.0	5010.0	5210.0	5005.0	14.4	**CHir**	**Pi**
515.00	520.00	20030731 14:49	20030731 17:50	1.49E–07	1.94E–07	1200	5400	5057.0	5067.0	5309.0	5067.0	14.5	**CHi**	**CHir**

Borehole secup (m)	Borehole seclow (m)	Date and time for test, start YYYYMMDD hh:mm	Date and time for test, stop YYYYMMDD hh:mm	Q_p (m^3/s)	Q_m (m^3/s)	tp (s)	t_F (s)	p_0 (kPa)	p_i (kPa)	p_p (kPa)	p_F (kPa)	Te_w (°C)	Test phases measured *Analysed test phases marked bold*	
520.00	525.00	20030730 13:23	20030730 15:12	–	–	1800	1200	5103.0	5116.0	5314.0	5239.0	14.5	**Pi**	
525.00	530.00	20030730 15:36	20030730 16:36	6.67E–08	6.96E–08	1200	1200	5172.0	5159.0	5359.0	5160.0	14.6	**CHi**	**CHir**
530.00	535.00	20030731 11:06	20030731 14:18	1.06E–07	1.46E–07	1200	7980	5224.0	5221.0	5445.0	5221.0	14.7	**CHi**	**CHir**
535.00	540.00	20030731 08:09	20030731 09:08	–	–	–	–	5273.0	–	–	–	14.8		
540.00	545.00	20030731 09:44	20030731 10:42	–	–	–	–	5322.0	–	–	–	14.8		

#NV: Not analysed.
CHi: Constant head injection phase.
CHir: Recovery phase following the constant head injection phase.
Pi: Pulse Injection.

Table 7-2. Results from analysis of constant head tests and pulse tests in KLX02.

Interval position		Steady state analysis				Transient analysis: Wellbore effects			Transient analysis: Formation parameters							Static conditions		Observations	
up m bToC	low m bToC	Q/s m²/s	T_M m²/s	K_M m/s	Flow model	C_M m³/Pa	C_T m³/Pa	ξ_t –	T_1 m²/s	T_2 m²/s	T_T m²/s	T_{MIN} m²/s	T_{MAX} m²/s	r_1 m	S* –	p* kPa	h_{wif} masl	CUZ	CLZ
204	304	3.86E–05	5.03E–05	5.03E–07	WBS2	3.00E–08	1.01E–10	17.8	#NV	1.80E–04	1.80E–04	3.00E–05	3.00E–04	#NV	1.00E–06	2029	10.58	–	x
304	404	1.08E–05	1.41E–05	1.41E–07	WBS2	8.30E–09	1.01E–10	18.5	#NV	4.90E–05	4.90E–05	2.00E–05	6.50E–05	#NV	1.00E–06	3008	10.77	–	–
404	504	1.31E–07	1.71E–07	1.71E–09	WBS2	3.00E–10	1.01E–10	20.1	#NV	5.90E–07	5.90E–07	1.50E–07	6.00E–07	#NV	1.00E–06	3968	9.14	–	–
504	604	1.31E–08	1.70E–08	1.70E–10	WBS22	2.50E–10	1.01E–10	0	1.50E–08	3.00E–09	3.00E–09	1.00E–09	2.00E–08	2.4	1.00E–06	4954	10.21	–	–
604	704	1.25E–09	1.63E–09	1.63E–11	WBS22	1.40E–10	1.01E–10	0	3.00E–10	1.10E–10	3.00E–10	5.00E–11	7.00E–10	1.2	1.00E–06	5887	5.97	–	–
704	804	1.63E–07	2.12E–07	2.12E–09	WBS2	1.30E–09	1.01E–10	19.4	#NV	6.90E–07	6.90E–07	3.00E–08	1.00E–06	#NV	1.00E–06	6873	7.26	–	–
804	904	7.80E–08	1.02E–07	1.02E–09	WBS2	4.20E–10	1.01E–10	20	#NV	3.50E–07	3.50E–07	2.00E–08	5.00E–07	#NV	1.00E–06	7861	8.64	–	–
904	1,004	1.42E–07	1.85E–07	1.85E–09	WBS2	1.60E–09	1.01E–10	32.6	#NV	9.10E–07	9.10E–07	5.00E–08	2.00E–06	#NV	1.00E–06	8849	10.03	–	–
204	224	2.62E–06	2.74E–06	1.37E–07	WBS2	1.70E–10	2.02E–11	0	3.20E–06	#NV	3.20E–06	1.00E–06	2.00E–05	#NV	1.00E–06	2030	10.75	–	–
224	244	1.18E–06	1.23E–06	6.15E–08	WBS22	1.90E–10	2.02E–11	0	9.70E–07	4.80E–06	9.70E–07	4.00E–07	2.00E–06	3.8	1.00E–06	2227	10.84	–	–
244	264	3.60E–05	3.77E–05	1.89E–06	WBS2	2.10E–08	2.02E–11	18	#NV	1.70E–04	1.70E–04	8.00E–05	2.00E–04	#NV	1.00E–06	2424	11.06	x	x
264	284	1.31E–06	1.37E–06	6.85E–08	WBS22	2.40E–10	2.02E–11	20.3	1.70E–06	1.10E–06	1.70E–06	8.00E–07	5.00E–06	32	1.00E–06	2617	10.77	–	–
284	304	8.63E–07	9.02E–07	4.51E–08	WBS2	1.40E–10	2.02E–11	38.3	1.10E–06	#NV	1.10E–06	6.00E–07	5.00E–06	#NV	1.00E–06	2813	10.82	–	–
304	324	9.36E–06	9.80E–06	4.90E–07	WBS22	6.50E–09	2.02E–11	18.6	1.10E–05	4.20E–05	4.20E–05	2.00E–05	6.00E–05	42	1.00E–06	3009	10.95	x	x
324	344	1.86E–06	1.95E–06	9.75E–08	WBS22	3.50E–10	2.02E–11	20.1	1.80E–06	3.20E–06	3.20E–06	2.00E–06	8.00E–06	2.3	1.00E–06	3207	11.22	x	x
344	364	#NV	#NV	#NV	WBS22	2.70E–11	2.02E–11	0	8.50E–11	2.60E–11	2.60E–11	1.00E–11	5.00E–10	0.2	1.00E–06	3400	10.94	–	–
364	384	#NV	#NV	#NV	WBS22	5.80E–11	2.02E–11	0	3.20E–09	1.80E–09	1.80E–09	5.00E–10	1.00E–08	1.4	1.00E–06	3600	11.42	–	–
384	404	2.74E–09	2.87E–09	1.44E–10	WBS2	4.30E–11	2.02E–11	21.1	#NV	1.10E–08	1.10E–08	2.90E–09	4.00E–08	#NV	1.00E–06	3768	8.65	–	–
404	424	#NV	#NV	#NV	WBS22	1.90E–10	2.02E–11	0	1.80E–11	3.60E–13	3.60E–13	3.00E–13	2.00E–11	0.1	1.00E–06	#NV	#NV	–	–
424	444	4.05E–08	4.24E–08	2.12E–09	WBS2	8.80E–11	2.02E–11	32.2	#NV	2.40E–07	2.40E–07	1.00E–08	4.00E–07	#NV	1.00E–06	4165	9.33	–	–
444	464	7.26E–08	7.60E–08	3.80E–09	WBS22	5.60E–11	2.02E–11	21	5.20E–08	2.60E–07	2.60E–07	4.00E–08	5.00E–07	2.9	1.00E–06	4363	9.59	–	x
464	484	8.78E–09	9.19E–09	4.60E–10	WBS2	4.40E–11	2.02E–11	32.6	#NV	5.70E–08	5.70E–08	1.00E–08	3.00E–07	#NV	1.00E–06	4558	9.64	–	–
481	501	1.64E–10	1.72E–10	8.60E–12	WBS2	1.70E–11	2.02E–11	0	#NV	#NV	1.30E–10	1.00E–13	1.30E–10	#NV	1.00E–06	#NV	#NV	–	–

Interval position		Steady state analysis				Transient analysis Wellbore effects			Formation parameters							Static conditions		Observations	
up m bToC	low m bToC	Q/s m^2/s	T_M m^2/s	K_M m/s	Flow model	C_M m^3/Pa	C_T m^3/Pa	ξ_t –	T_1 m^2/s	T_2 m^2/s	T_T m^2/s	T_{MIN} m^2/s	T_{MAX} m^2/s	r_1 m	S* –	p* kPa	h_{wif} masl	CUZ	CLZ
484	504	4.08E–10	4.27E–10	2.14E–11	WBS2	1.20E–11	2.02E–11	0.04	#NV	1.60E–10	1.60E–10	1.00E–13	1.60E–10	#NV	1.00E–06	#NV	#NV	–	–
504	524	6.36E–09	6.66E–09	3.33E–10	WBS22	3.90E–11	2.02E–11	0	5.40E–09	1.90E–09	5.40E–09	1.00E–09	7.00E–09	1.8	1.00E–06	4947	9.54	–	–
524	544	5.78E–09	6.05E–09	3.03E–10	WBS22	6.30E–11	2.02E–11	0	8.20E–09	5.50E–09	8.20E–09	2.00E–09	1.00E–08	1.9	1.00E–06	5150	10.35	–	–
544	564	#NV	#NV	#NV	#NV	#NV	2.02E–11	#NV	1.00E–10	#NV	1.00E–10	1.00E–13	1.00E–10	#NV	1.00E–06	#NV	#NV	–	–
564	584	#NV	#NV	#NV	WBS2	5.10E–11	2.02E–11	0	2.80E–12	#NV	2.80E–12	1.00E–12	5.00E–11	#NV	1.00E–06	#NV	#NV	–	–
584	604	4.17E–10	4.36E–10	2.18E–11	WBS2	3.40E–11	2.02E–11	0	1.20E–10	#NV	1.20E–10	1.00E–13	1.20E–10	#NV	1.00E–06	#NV	#NV	–	–
704	724	#NV	#NV	#NV	WBS2	1.70E–10	2.02E–11	2	1.20E–10	#NV	1.20E–10	1.00E–11	3.00E–10	#NV	1.00E–06	#NV	#NV	–	–
724	744	3.11E–08	3.25E–08	1.63E–09	WBS2	1.00E–09	2.02E–11	7.9	#NV	7.60E–08	7.60E–08	6.00E–09	1.00E–07	#NV	1.00E–06	7076	8.06	–	–
744	764	1.37E–08	1.43E–08	7.15E–10	WBS2	8.90E–11	2.02E–11	32.3	#NV	8.50E–08	8.50E–08	6.00E–09	3.00E–07	#NV	1.00E–06	7274	8.39	–	–
764	784	8.19E–09	8.57E–09	4.29E–10	WBS2	4.60E–11	2.02E–11	22.5	#NV	3.70E–08	3.70E–08	1.00E–09	6.00E–08	#NV	1.00E–06	7468	8.28	–	–
784	804	1.10E–07	1.15E–07	5.75E–09	WBS2	2.40E–10	2.02E–11	32	#NV	6.60E–07	6.60E–07	5.00E–08	8.00E–07	#NV	1.00E–06	7664	8.42	–	–
804	824	2.45E–09	2.57E–09	1.29E–10	WBS2	3.80E–11	2.02E–11	32.6	#NV	1.60E–08	1.60E–08	7.00E–09	4.00E–08	#NV	1.00E–06	7865	9.04	–	–
824	844	1.62E–09	1.70E–09	8.50E–11	WBS2	7.50E–11	2.02E–11	9.25	#NV	3.80E–09	3.80E–09	8.00E–10	6.00E–09	#NV	1.00E–06	8056	8.61	–	–
844	864	4.93E–08	5.15E–08	2.58E–09	WBS2	1.10E–10	2.02E–11	30.9	#NV	3.20E–07	3.20E–07	1.00E–08	6.00E–07	#NV	1.00E–06	8260	9.58	–	–
864	884	2.28E–08	2.38E–08	1.19E–09	WBS2	7.10E–11	2.02E–11	32.5	#NV	1.50E–07	1.50E–07	1.00E–08	6.00E–07	#NV	1.00E–06	8454	9.51	–	–
884	904	1.72E–08	1.80E–08	9.00E–10	WBS2	1.10E–10	2.02E–11	32.2	#NV	1.10E–07	1.10E–07	5.00E–09	3.00E–07	#NV	1.00E–06	8658	10.50	–	–
904	924	2.86E–09	2.99E–09	1.50E–10	WBS2	4.10E–11	2.02E–11	21.1	#NV	1.30E–08	1.30E–08	5.00E–10	3.00E–08	#NV	1.00E–06	8852	10.34	–	–
922	942	1.38E–07	1.44E–07	7.20E–09	WBS2	1.40E–09	2.02E–11	19.4	#NV	6.10E–07	6.10E–07	6.00E–08	3.00E–06	#NV	1.00E–06	9038	11.50	–	–
943	963	1.91E–08	2.00E–08	1.00E–09	WBS2	4.70E–11	2.02E–11	32.6	#NV	1.20E–07	1.20E–07	7.00E–09	8.00E–07	#NV	1.00E–06	9282	15.44	–	–
964	984	1.13E–09	1.18E–09	5.90E–11	WBS2	3.70E–11	2.02E–11	5	#NV	2.00E–09	2.00E–09	5.00E–10	5.00E–09	#NV	1.00E–06	9438	10.54	–	–
984	1004	4.51E–09	4.72E–09	2.36E–10	WBS2	6.90E–11	2.02E–11	20.9	#NV	1.90E–08	1.90E–08	1.00E–09	5.00E–08	#NV	1.00E–06	9643	11.57	–	–
300	305	3.49E–08	2.88E–08	5.76E–09	WBS22	1.80E–11	5.05E–12	21.5	2.20E–08	3.20E–07	3.20E–07	1.00E–08	6.00E–07	1.9	1.00E–06	2968	10.73	–	–
305	310	2.45E–10	2.02E–10	4.04E–11	WBS2	1.70E–11	5.05E–12	26.2	#NV	7.40E–11	7.40E–11	4.00E–11	7.00E–10	#NV	1.00E–06	3004	9.41	–	–
310	315	1.23E–09	1.01E–09	2.02E–10	WBS2	1.40E–11	5.05E–12	39.1	#NV	1.80E–08	1.80E–08	9.00E–09	9.00E–08	#NV	1.00E–06	3067	10.82	–	–

Interval position		Steady state analysis			Transient analysis											Static conditions		Observations	
						Wellbore effects		Formation parameters											
up m bToC	low m bToC	Q/s m^2/s	T_M m^2/s	K_M m/s	Flow model	C_M m^3/Pa	C_T m^3/Pa	ξ_t –	T_1 m^2/s	T_2 m^2/s	T_T m^2/s	T_{MIN} m^2/s	T_{MAX} m^2/s	r_1 m	S* –	p* kPa	h_{wif} masl	CUZ	CLZ
315	320	9.03E–06	7.46E–06	1.49E–06	WBS2	6.00E–09	5.05E–12	18.6	#NV	4.20E–05	4.20E–05	1.00E–05	6.00E–05	#NV	1.00E–06	3112	10.45	x	x
320	325	#NV	#NV	#NV	#NV	#NV	5.05E–12	#NV	1.00E–10	#NV	1.00E–10	1.00E–13	1.00E–10	#NV	1.00E–06	#NV	#NV	–	–
325	330	6.51E–10	5.37E–10	1.07E–10	WBS2	1.40E–11	5.05E–12	38	#NV	7.20E–09	7.20E–09	5.00E–09	4.00E–08	#NV	1.00E–06	3216	11.08	–	–
330	335	2.45E–10	2.02E–10	4.04E–11	WBS2	1.30E–11	5.05E–12	33.2	#NV	3.90E–09	3.90E–09	1.00E–09	1.00E–08	#NV	1.00E–06	3264	11.02	–	–
335	340	1.52E–06	1.26E–06	2.52E–07	WBS22	2.80E–10	5.05E–12	34.1	2.00E–06	1.10E–07	2.00E–06	7.00E–07	3.00E–06	29	1.00E–06	3312	10.92	–	–
341	346	#NV	#NV	#NV	WBS22	1.10E–10	5.05E–12	#NV	1.80E–11	6.10E–11	6.10E–11	5.00E–12	8.00E–11	0.2	1.00E–06	#NV	#NV	–	–
385	390	2.44E–09	2.01E–09	4.02E–10	WBS2	1.80E–11	5.05E–12	33.1	#NV	1.70E–08	1.70E–08	8.00E–09	3.00E–08	#NV	1.00E–06	3780	8.89	–	–
390	395	#NV	#NV	#NV	#NV	#NV	5.05E–12	#NV	1.00E–10	#NV	1.00E–10	1.00E–13	1.00E–10	#NV	1.00E–06	#NV	#NV	–	–
395	400	#NV	#NV	#NV	#NV	#NV	5.05E–12	#NV	1.00E–11	#NV	1.00E–11	1.00E–13	1.00E–11	#NV	1.00E–06	#NV	#NV	–	–
400	405	#NV	#NV	#NV	#NV	#NV	5.05E–12	#NV	1.00E–11	#NV	1.00E–11	1.00E–13	1.00E–11	#NV	1.00E–06	#NV	#NV	–	–
420	425	#NV	#NV	#NV	#NV	#NV	5.05E–12	#NV	1.00E–11	#NV	1.00E–11	1.00E–13	1.00E–11	#NV	1.00E–06	#NV	#NV	–	–
425	430	#NV	#NV	#NV	#NV	#NV	5.05E–12	#NV	1.00E–11	#NV	1.00E–11	1.00E–13	1.00E–11	#NV	1.00E–06	#NV	#NV	–	–
429	434	#NV	#NV	#NV	#NV	#NV	5.05E–12	#NV	1.00E–11	#NV	1.00E–11	1.00E–13	1.00E–11	#NV	1.00E–06	#NV	#NV	–	–
434	439	4.10E–08	3.38E–08	6.76E–09	WBS2	6.00E–11	5.05E–12	22.8	#NV	1.70E–07	1.70E–07	1.00E–08	7.00E–07	#NV	1.00E–06	4261	9.19	–	–
440	445	#NV	#NV	#NV	#NV	#NV	5.05E–12	#NV	1.00E–11	#NV	1.00E–11	1.00E–13	1.00E–11	#NV	1.00E–06	#NV	#NV	–	–
445	450	#NV	#NV	#NV	#NV	#NV	5.05E–12	#NV	1.00E–11	#NV	1.00E–11	1.00E–13	1.00E–11	#NV	1.00E–06	#NV	#NV	–	–
450	455	#NV	#NV	#NV	#NV	#NV	5.05E–12	#NV	1.00E–11	#NV	1.00E–11	1.00E–13	1.00E–11	#NV	1.00E–06	#NV	#NV	–	–
455	460	5.34E–09	4.41E–09	8.82E–10	WBS2	1.40E–11	5.05E–12	39	#NV	3.90E–08	3.90E–08	5.00E–08	3.00E–07	#NV	1.00E–06	4465	9.14	–	–
460	465	3.23E–08	2.67E–08	5.34E–09	WBS2	1.40E–11	5.05E–12	32	#NV	1.80E–07	1.80E–07	7.00E–09	3.00E–07	#NV	1.00E–06	4516	9.29	–	–
460	465	4.99E–08	4.12E–08	8.24E–09	WBS22	1.90E–11	5.05E–12	39.1	5.40E–08	1.10E–08	5.40E–08	1.00E–08	1.00E–06	27	1.00E–06	4521	9.83	–	–
465	470	3.70E–09	3.05E–09	6.10E–10	WBS2	1.30E–11	5.05E–12	33.2	#NV	2.40E–08	2.40E–08	2.00E–09	3.00E–07	#NV	1.00E–06	4566	9.44	–	–
470	475	#NV	#NV	#NV	WBS2	1.30E–13	5.05E–12	10	#NV	3.40E–09	3.40E–09	1.00E–11	5.00E–09	#NV	1.00E–06	#NV	#NV	–	–
475	480	#NV	#NV	#NV	WBS22	1.80E–13	5.05E–12	10	1.90E–09	6.90E–09	1.90E–09	1.00E–09	1.00E–08	1.9	1.00E–06	#NV	#NV	–	–
480	485	1.50E–09	1.24E–09	2.48E–10	WBS2	6.10E–12	5.05E–12	33.4	#NV	1.10E–08	1.10E–08	9.00E–09	9.00E–08	#NV	1.00E–06	4709	9.17	–	–

Interval position		Steady state analysis			Transient analysis												Static conditions		Observations	
						Wellbore effects			Formation parameters											
up m bToC	low m bToC	Q/s m^2/s	T_M m^2/s	K_M m/s	Flow model	C_M m^3/Pa	C_T m^3/Pa	ξ_t –	T_1 m^2/s	T_2 m^2/s	T_T m^2/s	T_{MIN} m^2/s	T_{MAX} m^2/s	r_1 m	S* –	p* kPa	h_{wif} masl	CUZ	CLZ
500	505	#NV	#NV	#NV	#NV	#NV	5.05E–12	#NV	1.00E–11	#NV	1.00E–11	1.00E–13	1.00E–11	#NV	1.00E–06	#NV	#NV	–	–
505	510	#NV	#NV	#NV	#NV	#NV	5.05E–12	#NV	1.00E–11	#NV	1.00E–11	1.00E–13	1.00E–11	#NV	1.00E–06	#NV	#NV	–	–
510	515	#NV	#NV	#NV	WBS2	1.40E–11	5.05E–12	10.1	#NV	1.70E–09	1.70E–09	3.00E–11	3.00E–09	#NV	1.00E–06	5005	9.47	–	–
515	520	6.05E–09	5.00E–09	1.00E–09	WBS22	1.80E–11	5.05E–12	2	9.30E–09	2.90E–09	2.90E–09	1.00E–09	1.00E–08	2	1.00E–06	5055	9.58	–	–
520	525	#NV	#NV	#NV	WBS22	1.30E–10	5.05E–12	0.4	9.10E–12	7.30E–11	7.30E–11	5.00E–12	8.00E–11	0.1	1.00E–06	#NV	#NV	–	–
525	530	3.27E–09	2.70E–09	5.40E–10	WBS2	1.50E–11	5.05E–12	15.9	#NV	1.10E–08	1.10E–08	1.00E–09	1.00E–08	#NV	1.00E–06	5156	10.01	–	–
530	535	4.66E–09	3.85E–09	7.70E–10	WBS2	1.80E–11	5.05E–12	2	#NV	6.60E–09	6.60E–09	1.00E–09	8.00E–09	#NV	1.00E–06	5218	11.36	–	–
535	540	#NV	#NV	#NV	#NV	#NV	5.05E–12	#NV	1.00E–11	#NV	1.00E–11	1.00E–13	1.00E–11	#NV	1.00E–06	#NV	#NV	–	–
540	545	#NV	#NV	#NV	#NV	#NV	5.05E–12	#NV	1.00E–11	#NV	1.00E–11	1.00E–13	1.00E–11	#NV	1.00E–06	#NV	#NV	–	–

1 The flow model descri

set of numbers describing the fl

a homogene

2 T_1 and T_2 refer to the transmissivity(s) deri
T_1 or T_2 are reported (T_1 for near borehole and T_2 for far field), in case a two zones composite model was recommended both T_1 and T_2 are given. The recommended transmissivity T_T typically refers to the T_2 value (far field transmissivity)

3 The r_1 parameter denotes the radius of the inner composite zone, and is reported in case a two zone composite model was used.

4 The parameter p* denoted the static formation p
extrapolation.

5 CUZ and CLZ denote hydraulic comunication of the test section to the upper and lower zones, respectively.

6 CM and CT denote the matched and the

The Figures 7-1 to 7-3 present the transmissivity, conductivity and hydraulic freshwater head profiles.

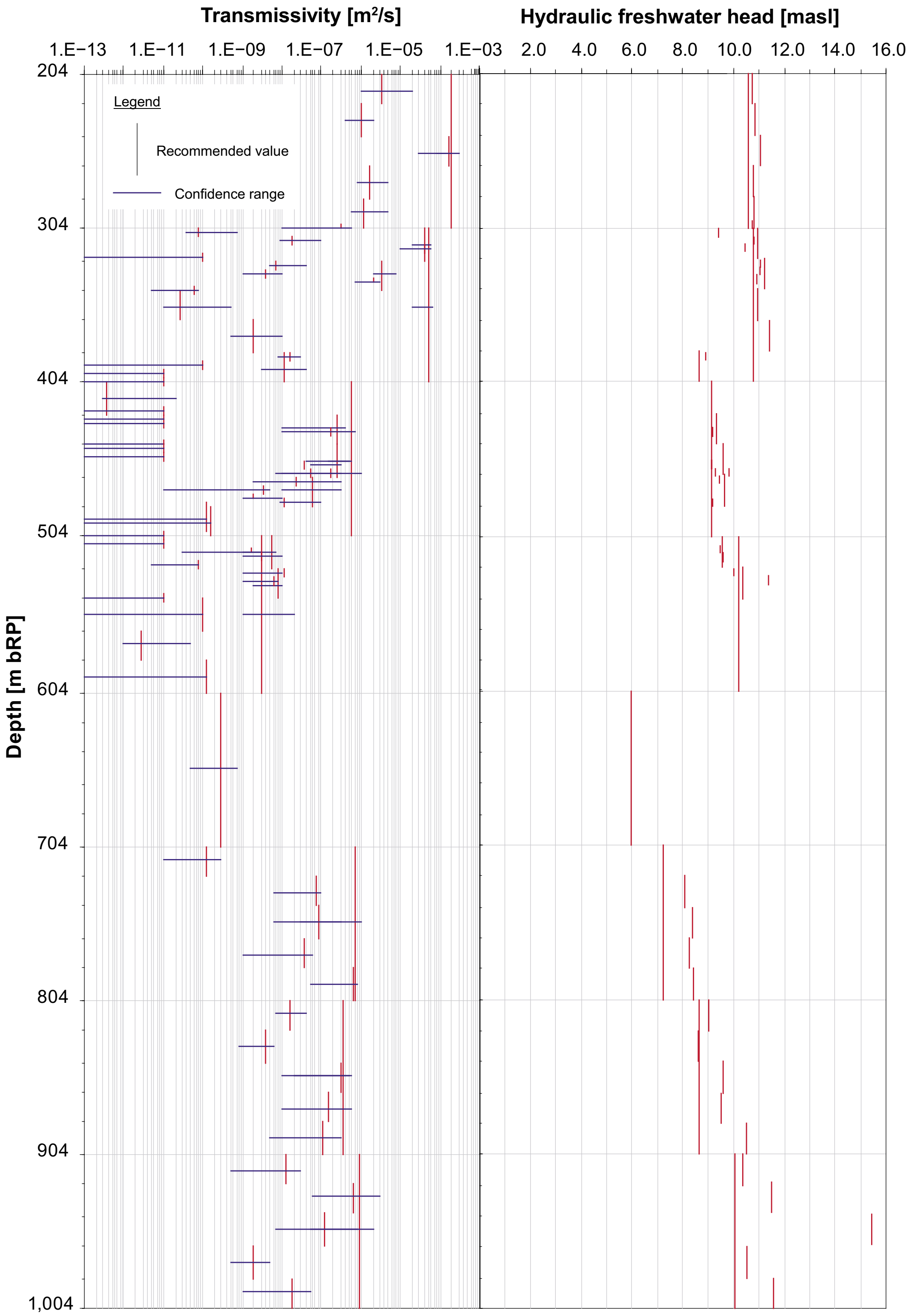


Figure 7-1. *Results summary – profiles of transmissivity and equivalent freshwater head.*

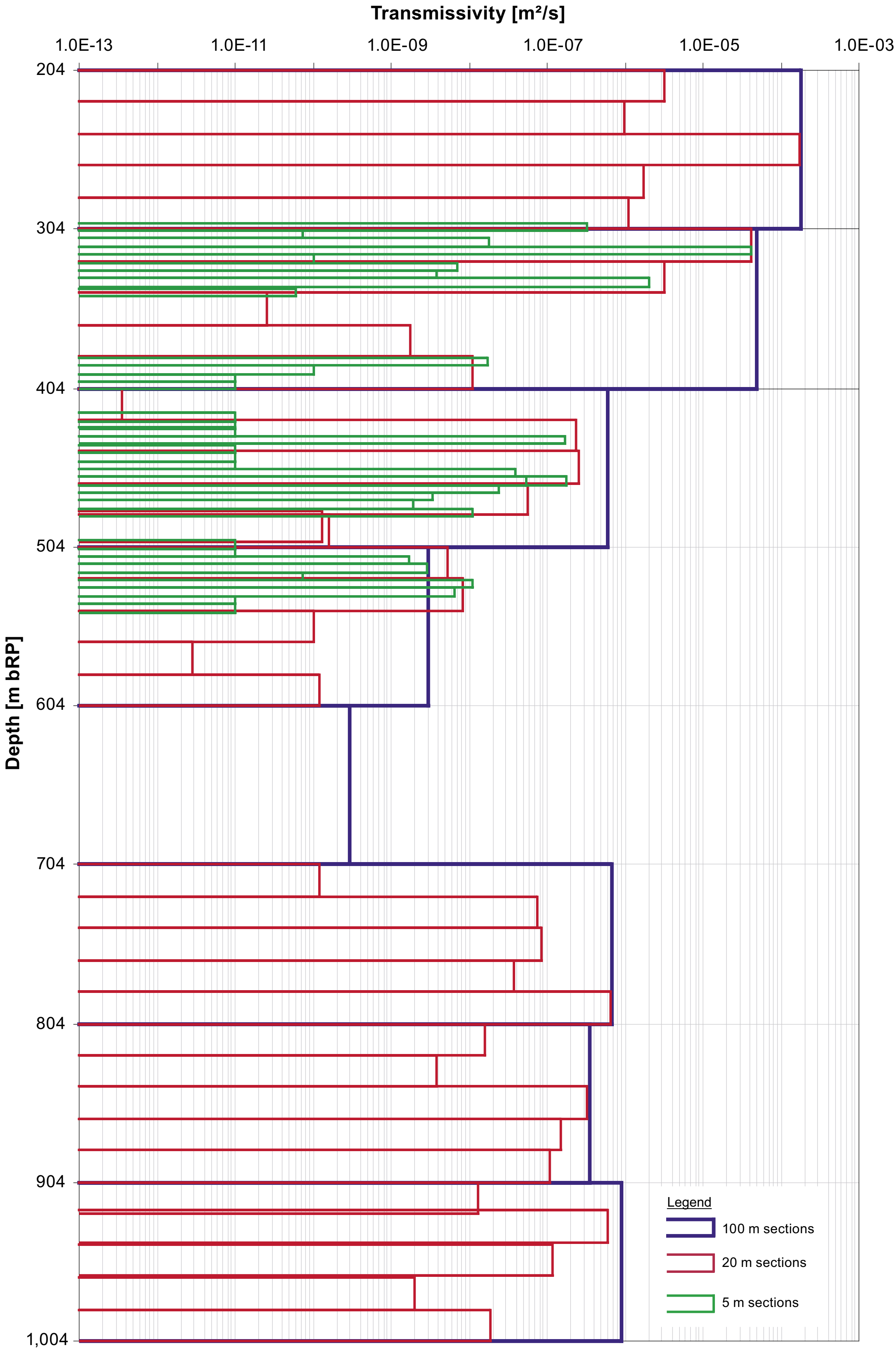


Figure 7-2. *Results summary – profile of transmissivity.*

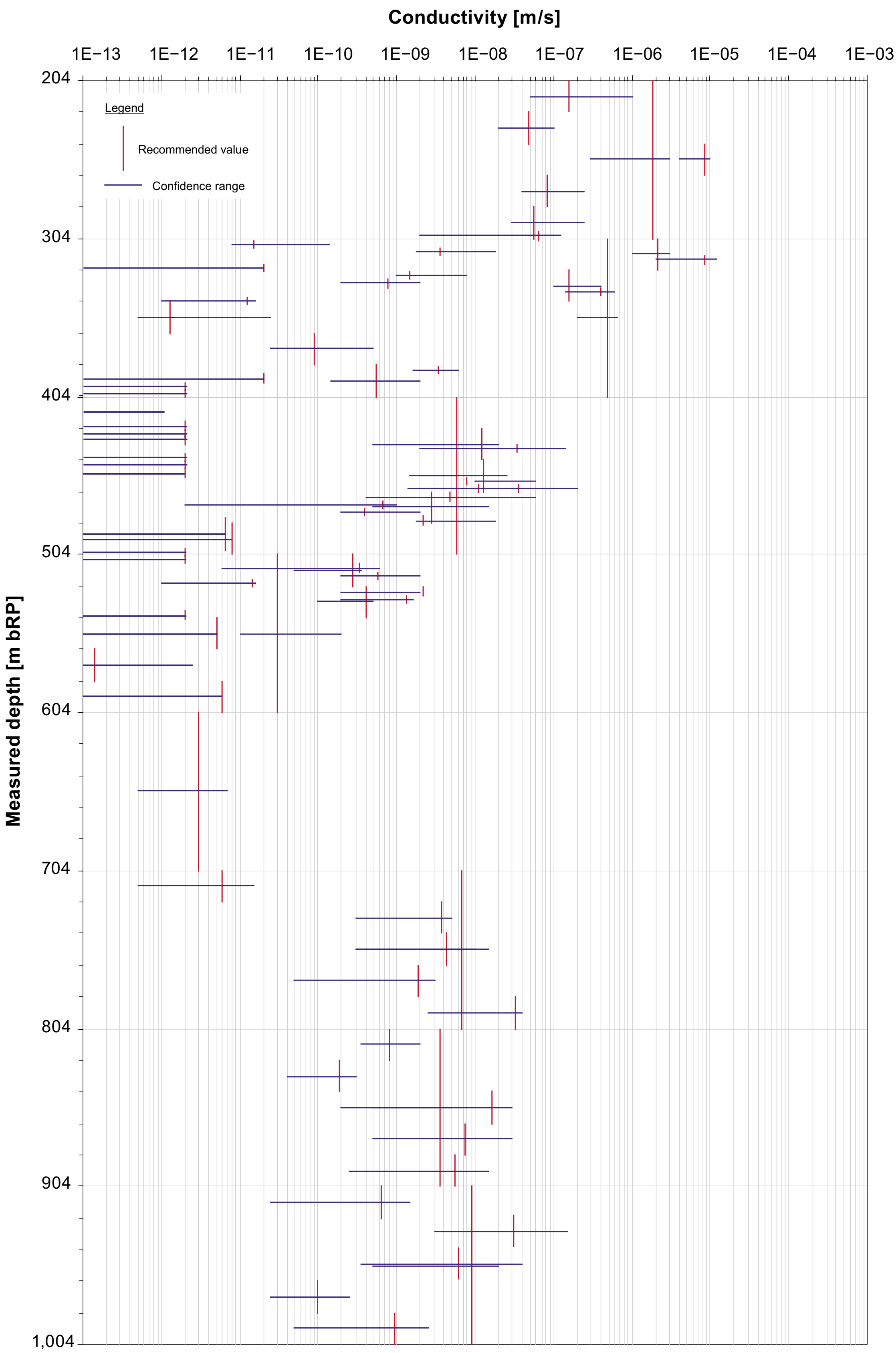


Figure 7-3. *Results summary – profile of conductivity.*

7.2 Correlation analysis

A correlation analysis was used with the aim of examining the consistency of results and deriving general conclusion regarding the testing and analysis methods used.

7.2.1 Comparison of steady state and transient analysis results

The steady state derived transmissivities (T_M and Q/s) were compared in a cross-plot with the recommended transmissivity values derived from the transient analysis (see following figure).

The correlation analysis shows that most of the steady state derived transmissivities differ by one order of magnitude or less from the transmissivities derived from the transient analysis.

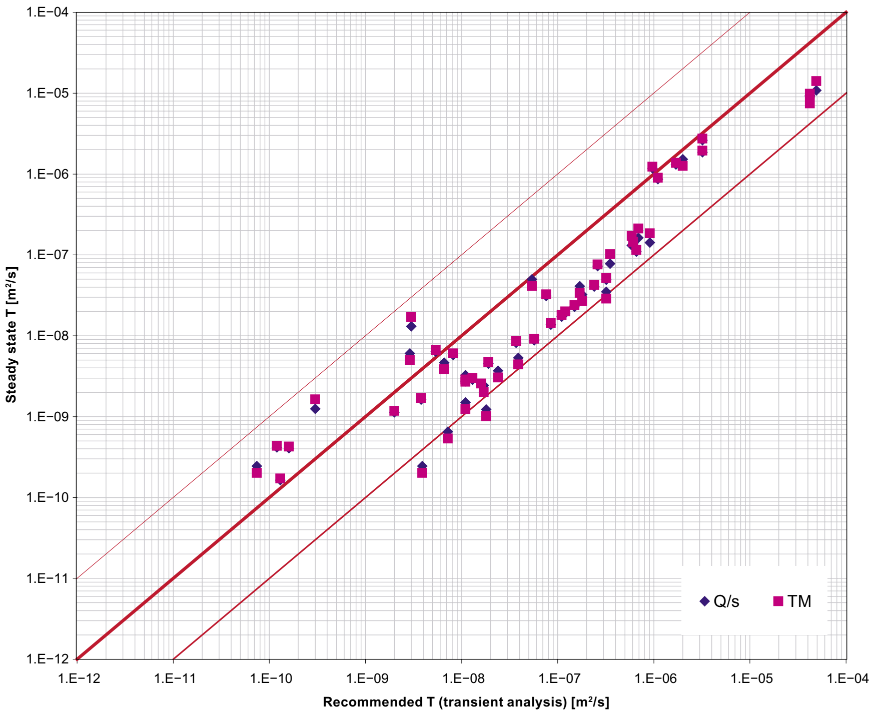


Figure 7-4. *Correlation analysis of transmissivities derived by steady state and transient methods.*

7.2.2 Comparison between the matched and theoretical wellbore storage coefficient

The wellbore storage coefficient describes the capacity of the test interval to store fluid as result to a unit pressure change in the interval. For a closed system (i.e. closed downhole valve) the theoretical value of the wellbore storage coefficient is given by the product between the interval volume and the test zone compressibility. The interval volume is calculated from the borehole radius and interval length. There are uncertainties concerning the interval volume calculation. Cavities or high transmissivity fractures intersecting the interval may enlarge the effective volume of the interval. The test zone compressibility is given by the sum of compressibilities of the individual components present in the interval (water, packer elements, other test tool components, and the borehole wall). A minimum value for the test zone compressibility is given by the water compressibility which is approx. 5E–10 1/Pa. For the calculation of the theoretical wellbore storage coefficient a test zone compressibility 0f 7E–10 1/Pa was used. The matched wellbore storage coefficient is derived from the transient type curve analysis by matching the unit slope early times derivative plotted in log-log coordinates.

The following figure presents a cross-plot of the matched and theoretical wellbore storage coefficients.

It can be seen that the matched wellbore storage coefficients are up to three orders of magnitude larger than the theoretical values. A three orders of magnitude increase is difficult to explain by volume uncertainty. Even if large fractures are connected to the interval, a volume increase by three orders of magnitude does not seem probable. The discrepancy can be more likely explained by increased compressibility of the packer system. In order to better understand this phenomenon, a serried of tool compressibility tests should be conducted in order to measure the tool compressibility and to assess to what extent the system behaves elastically.

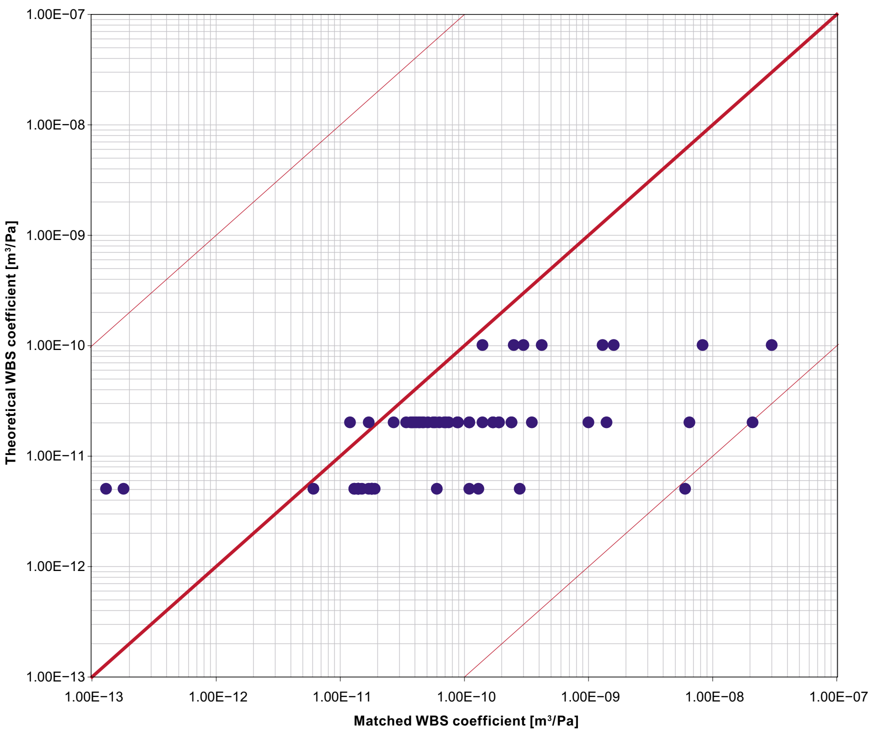


Figure 7-5. *Correlation analysis of theoretical and matched wellbore storage coefficients.*

8 Conclusions

8.1 Transmissivity

Figure 7-1 presents a profile of transmissivity, including the confidence ranges derived from the transient analysis. The method used for deriving the recommended transmissivity and its confidence range is described in Section 5.4.8.

Whenever possible, the transmissivities derived are representative for the "undisturbed formation" further away from the borehole. The borehole vicinity was typically described using a skin effect.

In some cases the tests were not analysable due to the fact that the flow rates during the CHi phase were below the range of the flowmeter (< 0.5 mL/min) or because the compliance phase following packer inflation was too long, thus indicating a very low interval transmissivity. In such cases the interval transmissivity was recommended to a value of 1.0E–11 m^2/s which was in the same time regarded as the upper boundary of the confidence range. This value is consistent with the observations made during the analysis of the other tests in the borehole (i.e. the transmissivity must be lower than in the cases when the test was analysable).

8.2 Equivalent freshwater head

Figure 7-1 presents a profile of the derived equivalent freshwater head expressed in meters above sea level. The method used for deriving the equivalent freshwater head is described in Section 5.4.7.

The head profile shows three distinct zones. The first zone between 204 m and 384 m depth shows slightly increasing freshwater heads between 10.5 and 11.5 m asl. The second zone between 384 and 604 m depth shows steadily increasing freshwater heads between 8.5 and 10.5 m asl which is distinctly different from the heads derived from the upper zone. Finally, the third zone at depths below 604 m shows freshwater heads between 6 and 11.5 m asl with steadily increasing tendency towards greater depth.

It should be noted that the head differences may be explained by salinity differences if we assume that the salinity increases with depth. In this case the freshwater heads would have to increase with depth, what the actual profile shows for the distinct zones. Further hydraulic effects have to be considered for the differences between the zones.

8.3 Flow regimes encountered

The flow models used in analysis were derived from the shape of the pressure derivative calculated with respect to log time and plotted in log-log coordinates.

In several cases the pressure derivative suggests a change of transmissivity with the distance from the borehole. In such cases a composite flow model was used in the analysis.

In other cases, the use of a homogeneous flow model led to very large skin factors (e.g. 20). In these cases, in addition to the homogeneous flow model analysis an analysis using a composite flow model was conducted. In these cases the skin was represented explicitly as inner composite zone.

The frequent occurrence of large skins (as large as 40) is unusual and should be further examined. There are several possible explanations to this behaviour:

- If the behaviour is to be completely attributed to changes of transmissivity in the formation, this indicates the presence of larger transmissivity zones in the borehole vicinity, which could be caused by steep fractures that do not intersect the test interval, but are connected to the interval by lower transmissivity fractures. The fact that in many cases the test derivatives of adjacent test sections (in the normalized plot – see Appendix 5) converge at late times seems to support this hypothesis.
- A further possibility is that the large skins are caused by turbulent flow taking place in the tool or in fractures connected to the test interval. This hypothesis is more difficult to examine. However, considering the fact that high skins were observed in sections with transmissivities as low as 1E–9 m^2/s (which imply low flow rates) seems to speak against this hypothesis.

The flow dimension displayed by the test can be diagnosed from the slope of the pressure derivative. A slope of 0.5 indicates linear flow, a slope of 0 (horizontal derivative) indicates radial flow and a slope of –0.5 indicates spherical flow. The flow dimension diagnosis was commented for each of the tests. However, in all cases it was possible to achieve to acceptable analysis results (good match quality) by using radial flow geometry (flow dimension of 2).

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APPENDIX 1

File Description Table

HYDROTESTING WITH PSS					DRILLHOLE IDENTIFICATION NO.: KLX02				
TEST- AND FILEPROTOCOL					Testorder dated : 2003-07-09				
Teststart		Interval boundaries		Name of Datafiles		Testtype	Copied to	Plotted (date)	Sign.
Date	Time	Upper	Lower	(*.HT2-file)	(*.CSV-file)		disk/CD		
10.07.2003	08:19	204	304	KLX02_1700.50_200307100819.ht2	KLX02_204-304_030710_1_CHir_Q_r.csv	Injection	10.07.2003	10.07.2003	
10.07.2003	12:50	304	404	KLX02_1700.50_200307101250.ht2	KLX02_304-404_030710_1_CHir_Q_r.csv	Injection	10.07.2003	10.07.2003	
10.07.2003	14:22	304	404	KLX02_1700.50_200307101422.ht2	KLX02_304-404_030710_2_CHir_Q_r.csv	Injection	10.07.2003	10.07.2003	
10.07.2003	17:13	404	504	KLX02_1700.50_200307101713.ht2	KLX02_404-504_030711_1_CHir_Q_r.csv	Injection	10.07.2003	10.07.2003	
11.07.2003	10:04	504	604	KLX02_1700.50_200307111004.ht2	KLX02_504-604_030711_1_CHir_Q_r.csv	Injection	11.07.2003	11.07.2003	
11.07.2003	11:10	505	604	KLX02_1700.50_200307111110.ht2	KLX02_504-604_030711_2_CHir_Q_r.csv	Injection	11.07.2003	11.07.2003	
11.07.2003	12:52	505	604	KLX02_1700.50_200307111252.ht2	KLX02_504-604_030711_3_CHir_Q_r.csv	Injection	11.07.2003	11.07.2003	
11.07.2003	14:25	505	604	KLX02_1700.50_200307111425.ht2	KLX02_504-604_030711_4_CHir_Q_r.csv	Injection	11.07.2003	11.07.2003	
11.07.2003	18:44	604	704	KLX02_1700.50_200307111844.ht2	KLX02_604-704_030711_1_CHir_Q_r.csv	Injection	11.07.2003	11.07.2003	
12.07.2003	09:15	704	804	KLX02_1700.50_200307120915.ht2	KLX02_704-804_030712_1_CHir_Q_r.csv	Injection	12.07.2003	12.07.2003	
12.07.2003	14:28	804	904	KLX02_1700.50_200307121428.ht2	KLX02_804-904_030712_1_CHir_Q_r.csv	Injection	12.07.2003	12.07.2003	
12.07.2003	17:45	904	1004	KLX02_1700.50_200307121745.ht2	KLX02_804-904_030712_1_CHir_Q_r.csv	Injection	12.07.2003	12.07.2003	
14.07.2003	12:15	204	224	KLX02_1700.50_200307141215.ht2	KLX02_204-224_030714_1_CHir_Q_r.csv	Injection	14.07.2003	14.07.2003	
14.07.2003	13:39	204	224	KLX02_1700.50_200307141339.ht2	KLX02_204-224_030714_2_CHir_Q_r.csv	Injection	14.07.2003	14.07.2003	
14.07.2003	15:19	224	244	KLX02_1700.50_200307141519.ht2	KLX02_224-244_030714_1_CHir_Q_r.csv	Injection	14.07.2003	14.07.2003	

HYDROTESTING WITH PSS					DRILLHOLE IDENTIFICATION NO.: KLX02				
TEST- AND FILEPROTOCOL					**Testorder dated : 2003-07-09**				
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Date	Time	Upper	Lower	(*.HT2-file)	(*.CSV-file)		disk/CD	(date)	
14.07.2003	17:50	244	264	___KLX02_1700.50_200307141750.ht2	KLX02_244-264_030714_1_CHir_Q_r.csv	Injection	14.07.2003	14.07.2003	
15.07.2003	08:26	264	284	___KLX02_1700.50_200307150826.ht2	KLX02_264-284_030715_1_CHir_Q_r.csv	Injection	15.07.2003	15.07.2003	
15.07.2003	10:46	284	304	___KLX02_1700.50_200307151046.ht2	KLX02_284-304_030715_1_CHir_Q_r.csv	Injection	15.07.2003	15.07.2003	
15.07.2003	12:55	304	324	___KLX02_1700.50_200307151255.ht2	KLX02_304-324_030715_1_CHir_Q_r.csv	Injection	15.07.2003	15.07.2003	
15.07.2003	15:33	324	344	___KLX02_1700.50_200307151533.ht2	KLX02_324-344_030715_1_CHir_Q_r.csv	Injection	17.07.2003	16.07.2003	
15.07.2003	17:30	344	364	___KLX02_1700.50_200307151730.ht2	KLX02_344-364_030715_1_CHir_Q_r.csv	Injection	17.07.2003	16.07.2003	
16.07.2003	08:34	364	384	___KLX02_1700.50_200307160834.ht2	KLX02_364-384_030716_1_CHir_Q_r.csv	Injection	17.07.2003	16.07.2003	
16.07.2003	10:20	384	404	___KLX02_1700.50_200307161020.ht2	KLX02_384-404_030716_1_CHir_Q_r.csv	Injection	17.07.2003	16.07.2003	
16.07.2003	14:22	404	424	___KLX02_1700.50_200307161422.ht2	KLX02_404-424_030716_1_CHir_Q_r.csv	Injection	17.07.2003	16.07.2003	
16.07.2003	16:06	424	444	___KLX02_1700.50_200307161606.ht2	KLX02_424-444_030716_1_CHir_Q_r.csv	Injection	17.07.2003	16.07.2003	
16.07.2003	18:03	444	464	___KLX02_1700.50_200307161803.ht2	KLX02_444-464_030716_1_CHir_Q_r.csv	Injection	17.07.2003	17.07.2003	
17.07.2003	08:07	464	484	___KLX02_1700.50_200307170807.ht2	KLX02_464-484_030717_1_CHir_Q_r.csv	Injection	17.07.2003	17.07.2003	
17.07.2003	10:47	481	501	___KLX02_1700.50_200307171047.ht2	KLX02_481-501_030717_1_CHir_Q_r.csv	Injection	17.07.2003	17.07.2003	
17.07.2003	13:20	484	504	___KLX02_1700.50_200307171320.ht2	KLX02_484-504_030717_1_CHir_Q_r.csv	Injection	19.07.2003	17.07.2003	
17.07.2003	15:40	504	524	___KLX02_1700.50_200307171540.ht2	KLX02_504-524_030717_1_CHir_Q_r.csv	Injection	19.07.2003	17.07.2003	
17.07.2003	19:24	524	544	___KLX02_1700.50_200307171924.ht2	KLX02_524-544_030717_1_CHir_Q_r.csv	Injection	19.07.2003	18.07.2003	

HYDROTESTING WITH PSS					DRILLHOLE IDENTIFICATION NO.: KLX02				
TEST- AND FILEPROTOCOL					**Testorder dated : 2003-07-09**				
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18.07.2003	14:15	564	584	KLX02_1700.50_200307181415.ht2	KLX02_564-584_030718_1_CHir_Q_r.csv	Injection	19.07.2003	18.07.2003	
18.07.2003	17:11	584	604	KLX02_1700.50_200307181711.ht2	KLX02_584-604_030718_1_CHir_Q_r.csv	Injection	19.07.2003	18.07.2003	
19.07.2003	09:16	704	724	KLX02_1700.50_200307190916.ht2	KLX02_704-724_030719_1_CHir_Q_r.csv	Injection	19.07.2003	19.07.2003	
19.07.2003	11:21	724	744	KLX02_1700.50_200307191121.ht2	KLX02_724-744_030719_1_CHir_Q_r.csv	Injection	19.07.2003	19.07.2003	
19.07.2003	13:00	724	744	KLX02_1700.50_200307191300.ht2	KLX02_724-744_030719_2_CHir_Q_r.csv	Injection	19.07.2003	19.07.2003	
19.07.2003	14:06	724	744	KLX02_1700.50_200307191406.ht2	KLX02_724-744_030719_3_CHir_Q_r.csv	Injection	19.07.2003	19.07.2003	
19.07.2003	16:20	744	764	KLX02_1700.50_200307191620.ht2	KLX02_744-764_030719_1_CHir_Q_r.csv	Injection	19.07.2003	19.07.2003	
19.07.2003	18:44	764	784	KLX02_1700.50_200307191844.ht2	KLX02_764-784_030719_1_CHir_Q_r.csv	Injection	20.07.2003	20.07.2003	
20.07.2003	08:28	784	804	KLX02_1700.50_200307200828.ht2	KLX02_784-804_030720_1_CHir_Q_r.csv	Injection	20.07.2003	20.07.2003	
20.07.2003	10:35	804	824	KLX02_1700.50_200307201035.ht2	KLX02_804-824_030720_1_CHir_Q_r.csv	Injection	20.07.2003	20.07.2003	
20.07.2003	13:38	824	844	KLX02_1700.50_200307201338.ht2	KLX02_824-844_030720_1_CHir_Q_r.csv	Injection	20.07.2003	20.07.2003	
20.07.2003	16:41	844	864	KLX02_1700.50_200307201641.ht2	KLX02_844-864_030720_1_CHir_Q_r.csv	Injection	21.07.2003	21.07.2003	
21.07.2003	08:10	864	884	KLX02_1700.50_200307210810.ht2	KLX02_864-884_030721_1_CHir_Q_r.csv	Injection	21.07.2003	21.07.2003	
21.07.2003	10:43	884	904	KLX02_1700.50_200307211043.ht2	KLX02_884-904_030721_1_CHir_Q_r.csv	Injection	21.07.2003	21.07.2003	

HYDROTESTING WITH PSS					DRILLHOLE IDENTIFICATION NO.: KLX02				
TEST- AND FILEPROTOCOL					Testorder dated : 2003-07-09				
Teststart		Interval boundaries		Name of Datafiles		Testtype	Copied to	Plotted (date)	Sign.
Date	Time	Upper	Lower	(*.HT2-file)	(*.CSV-file)		disk/CD		
21.07.2003	13:10	904	924	KLX02_1700.50_200307211310.ht2	KLX02_904-924_030721_1_CHir_Q_r.csv	Injection	21.07.2003	21.07.2003	
21.07.2003	16:46	922	942	KLX02_1700.50_200307211646.ht2	KLX02_922-942_030721_1_CHir_Q_r.csv	Injection	22.07.2003	22.07.2003	
22.07.2003	09:27	943	963	KLX02_1700.50_200307220927.ht2	KLX02_943-963_030722_1_CHir_Q_r.csv	Injection	22.07.2003	22.07.2003	
22.07.2003	10:51	964	984	KLX02_1700.50_200307221051.ht2	KLX02_964-984_030722_1_CHir_Q_r.csv	Injection	22.07.2003	22.07.2003	
22.07.2003	13:38	984	1004	KLX02_1700.50_200307221338.ht2	KLX02_984-1004_030722_1_CHir_Q_r.csv	Injection	22.07.2003	22.07.2003	
24.07.2003	10:32	300	305	KLX02_1700.50_200307241032.ht2	KLX02_300-305_030724_1_CHir_Q_r.csv	Injection	24.07.2003	24.07.2003	
24.07.2003	13:00	305	310	KLX02_1700.50_200307241300.ht2	KLX02_305-310_030724_1_CHir_Q_r.csv	Injection	24.07.2003	24.07.2003	
24.07.2003	16:34	310	315	KLX02_1700.50_200307241634.ht2	KLX02_310-315_030724_1_CHir_Q_r.csv	Injection	25.07.2003	25.07.2003	
25.07.2003	08:24	315	320	KLX02_1700.50_200307250824.ht2	KLX02_315-320_030725_1_CHir_Q_r.csv	Injection	25.07.2003	25.07.2003	
25.07.2003	10:10	320	325	KLX02_1700.50_200307251010.ht2	KLX02_320-325_030725_1_CHir_Q_r.csv	Injection	25.07.2003	25.07.2003	
25.07.2003	13:16	325	330	KLX02_1700.50_200307251316.ht2	KLX02_325-330_030725_1_CHir_Q_r.csv	Injection	25.07.2003	25.07.2003	
25.07.2003	15:36	330	335	KLX02_1700.50_200307251536.ht2	KLX02_330-335_030725_1_CHir_Q_r.csv	Injection	25.07.2003	25.07.2003	
25.07.2003	18:04	335	340	KLX02_1700.50_200307251804.ht2	KLX02_335-340_030725_1_CHir_Q_r.csv	Injection	26.07.2003	26.07.2003	
26.07.2003	08:18	341	346	KLX02_1700.50_200307260818.ht2	KLX02_341-346_030726_1_CHir_Q_r.csv	Injection	26.07.2003	26.07.2003	
26.07.2003	11:20	385	390	KLX02_1700.50_200307261120.ht2	KLX02_385-390_030726_1_CHir_Q_r.csv	Injection	26.07.2003	26.07.2003	
26.07.2003	14:11	390	395	KLX02_1700.50_200307261411.ht2	KLX02_390-395_030726_1_CHir_Q_r.csv	Injection	26.07.2003	26.07.2003	

HYDROTESTING WITH PSS					DRILLHOLE IDENTIFICATION NO.: KLX02				
TEST- AND FILEPROTOCOL					**Testorder dated : 2003-07-09**				
Teststart		Interval boundaries		Name of Datafiles		Testtype	Copied to	Plotted	Sign.
Date	Time	Upper	Lower	(*.HT2-file)	(*.CSV-file)		disk/CD	(date)	
26.07.2003	16:35	395	400	KLX02_1700.50_200307261635.ht2	KLX02_395-400_030726_1_CHir_Q_r.csv	Injection	27.07.2003	27.07.2003	
27.07.2003	08:37	400	405	KLX02_1700.50_200307270837.ht2	KLX02_400-405_030727_1_CHir_Q_r.csv	Injection	27.07.2003	27.07.2003	
27.07.2003	09:54	420	425	KLX02_1700.50_200307270954.ht2	KLX02_420-425_030727_1_CHir_Q_r.csv	Injection	27.07.2003	27.07.2003	
27.07.2003	11:24	425	430	KLX02_1700.50_200307271124.ht2	KLX02_425-430_030727_1_CHir_Q_r.csv	Injection	27.07.2003	27.07.2003	
27.07.2003	13:20	429	434	KLX02_1700.50_200307271320.ht2	KLX02_429-434_030727_1_CHir_Q_r.csv	Injection	27.07.2003	27.07.2003	
27.07.2003	14:48	434	439	KLX02_1700.50_200307271448.ht2	KLX02_434-439_030727_1_CHir_Q_r.csv	Injection	27.07.2003	27.07.2003	
27.07.2003	16:57	440	445	KLX02_1700.50_200307271657.ht2	KLX02_440-445_030727_1_CHir_Q_r.csv	Injection	27.07.2003	27.07.2003	
28.07.2003	08:12	445	450	KLX02_1700.50_200307280812.ht2	KLX02_445-450_030728_1_CHir_Q_r.csv	Injection	28.07.2003	28.07.2003	
28.07.2003	09:36	450	455	KLX02_1700.50_200307280936.ht2	KLX02_450-455_030728_1_CHir_Q_r.csv	Injection	28.07.2003	28.07.2003	
28.07.2003	11:01	455	460	KLX02_1700.50_200307281101.ht2	KLX02_455-460_030728_1_CHir_Q_r.csv	Injection	28.07.2003	28.07.2003	
28.07.2003	13:53	460	465	KLX02_1700.50_200307281353.ht2	KLX02_460-465_030728_1_CHir_Q_r.csv	Injection	28.07.2003	28.07.2003	
28.07.2003	15:54	465	470	KLX02_1700.50_200307281554.ht2	KLX02_465-470_030728_1_CHir_Q_r.csv	Injection	28.07.2003	28.07.2003	
28.07.2003	18:07	470	475	KLX02_1700.50_200307281807.ht2	KLX02_470-475_030728_1_CHir_Q_r.csv	Injection	29.07.2003	29.07.2003	
29.07.2003	08:58	475	480	KLX02_1700.50_200307290858.ht2	KLX02_475-480_030729_1_CHir_Q_r.csv	Injection	29.07.2003	29.07.2003	
29.07.2003	10:53	480	485	KLX02_1700.50_200307291053.ht2	KLX02_480-485_030729_1_CHir_Q_r.csv	Injection	29.07.2003	29.07.2003	
29.07.2003	14:00	500	505	KLX02_1700.50_200307291400.ht2	KLX02_500-505_030729_1_CHir_Q_r.csv	Injection	29.07.2003	29.07.2003	

HYDROTESTING WITH PSS					DRILLHOLE IDENTIFICATION NO.: KLX02				
TEST- AND FILEPROTOCOL					**Testorder dated : 2003-07-09**				
Teststart		Interval boundaries		Name of Datafiles		Testtype	Copied to	Plotted	Sign.
Date	Time	Upper	Lower	(*.HT2-file)	(*.CSV-file)		disk/CD	(date)	
29.07.2003	15:28	505	510	KLX02_1700.50_200307291528.ht2	KLX02_505-510_030729_1_CHir_Q_r.csv	Injection	29.07.2003	29.07.2003	
29.07.2003	16:53	510	515	KLX02_1700.50_200307291653.ht2	KLX02_510-515_030729_1_CHir_Q_r.csv	Injection	30.07.2003	30.07.2003	
30.07.2003	08:12	515	520	KLX02_1700.50_200307300812.ht2	KLX02_515-520_030730_1_CHir_Q_r.csv	Injection	30.07.2003	30.07.2003	
30.07.2003	13:24	520	525	KLX02_1700.50_200307301324.ht2	KLX02_520-525_030730_1_CHir_Q_r.csv	Injection	30.07.2003	30.07.2003	
30.07.2003	15:36	525	530	KLX02_1700.50_200307301536.ht2	KLX02_525-530_030730_1_CHir_Q_r.csv	Injection	30.07.2003	30.07.2003	
30.07.2003	17:21	530	535	KLX02_1700.50_200307301721.ht2	KLX02_530-535_030730_1_CHir_Q_r.csv	Injection	31.07.2003	31.07.2003	
31.07.2003	08:08	535	540	KLX02_1700.50_200307310808.ht2	KLX02_535-540_030731_1_CHir_Q_r.csv	Injection	31.07.2003	31.07.2003	
31.07.2003	09:43	540	545	KLX02_1700.50_200307310943.ht2	KLX02_540-545_030731_1_CHir_Q_r.csv	Injection	31.07.2003	31.07.2003	
31.07.2003	11:05	530	535	KLX02_1700.50_200307311105.ht2	KLX02_530-535_030731_2_CHir_Q_r.csv	Injection	31.07.2003	31.07.2003	
31.07.2003	14:48	515	520	KLX02_1700.50_200307311448.ht2	KLX02_515-520_030731_2_CHir_Q_r.csv	Injection	31.07.2003	31.07.2003	
31.07.2003	18:16	510	515	KLX02_1700.50_200307311816.ht2	KLX02_510-515_030731_2_Pulse_P_r.csv	Pulse	01.08.2003	01.08.2003	
01.08.2003	08:19	480	485	KLX02_1700.50_200308010819.ht2	KLX02_480-485_030801_2_Pulse_P_r.csv	Pulse	01.08.2003	01.08.2003	
01.08.2003	09:44	475	480	KLX02_1700.50_200308010944.ht2	KLX02_475-480_030801_2_Pulse_P_r.csv	Pulse	01.08.2003	01.08.2003	
01.08.2003	11:51	460	465	KLX02_1700.50_200308011151.ht2	KLX02_460-465_030801_2_CHir_Q_r.csv	Injection	01.08.2003	01.08.2003	
01.08.2003	16:15	480	485	KLX02_1700.50_200308011615.ht2	KLX02_480-485_030801_3_Pulse_P_r.csv	Pulse	01.08.2003	01.08.2003	

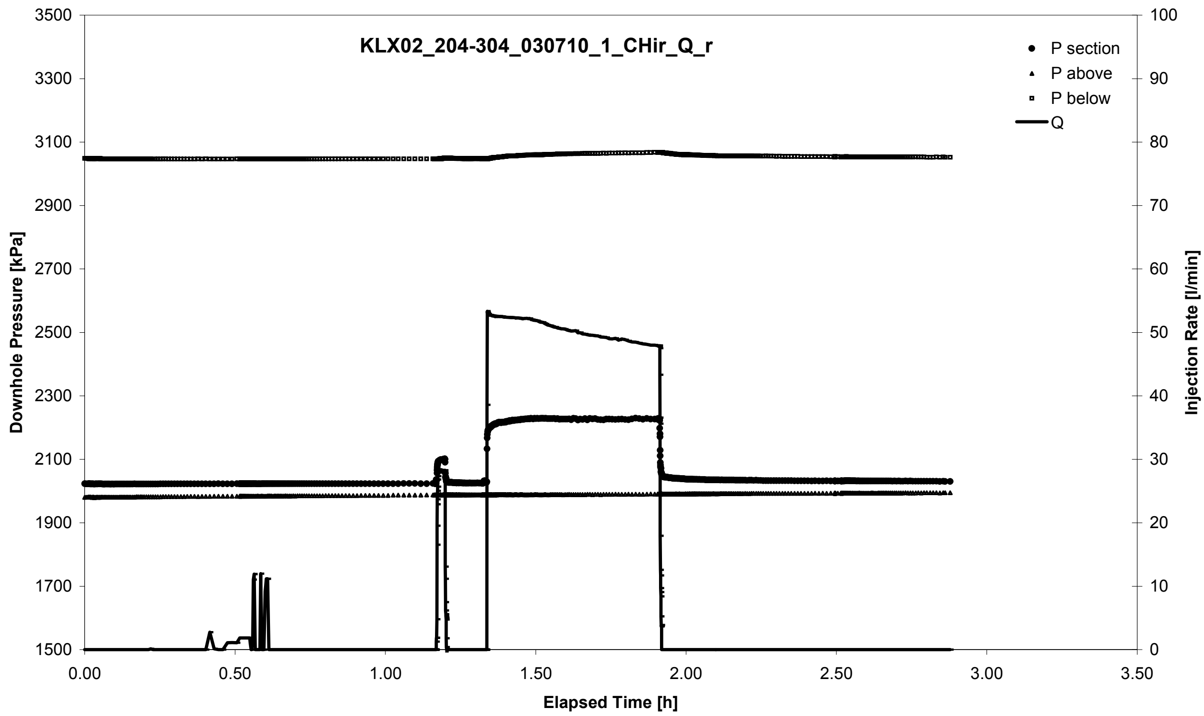
APPENDIX 2

Test Analyses Diagrams

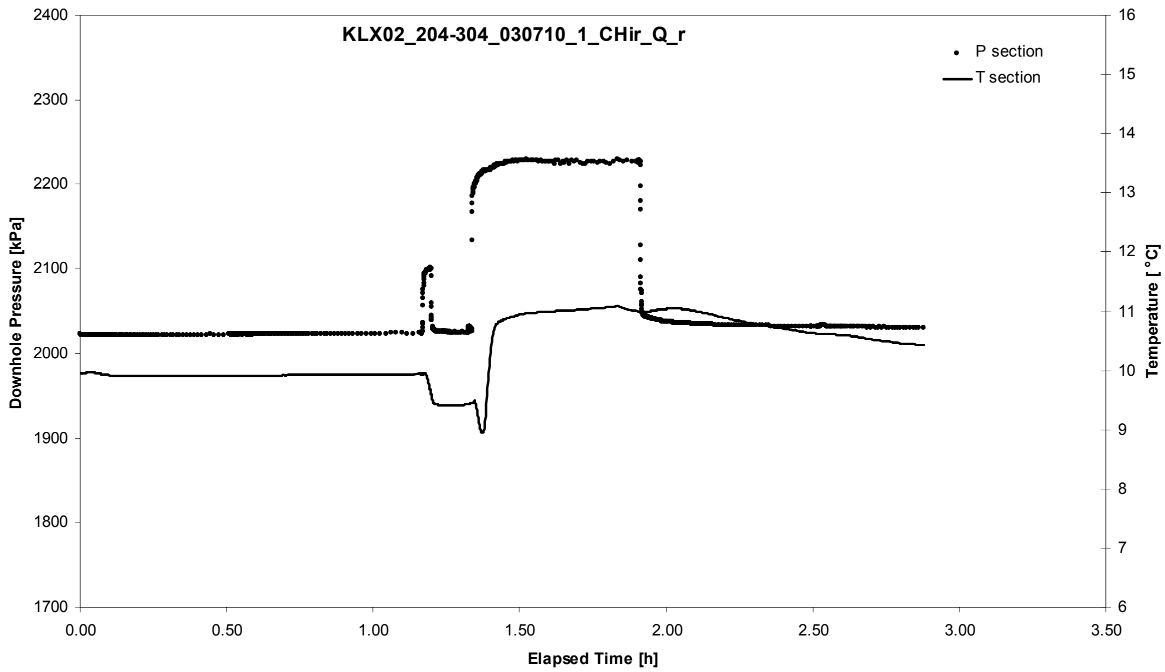
APPENDIX 2-1

Test 204 – 304 m

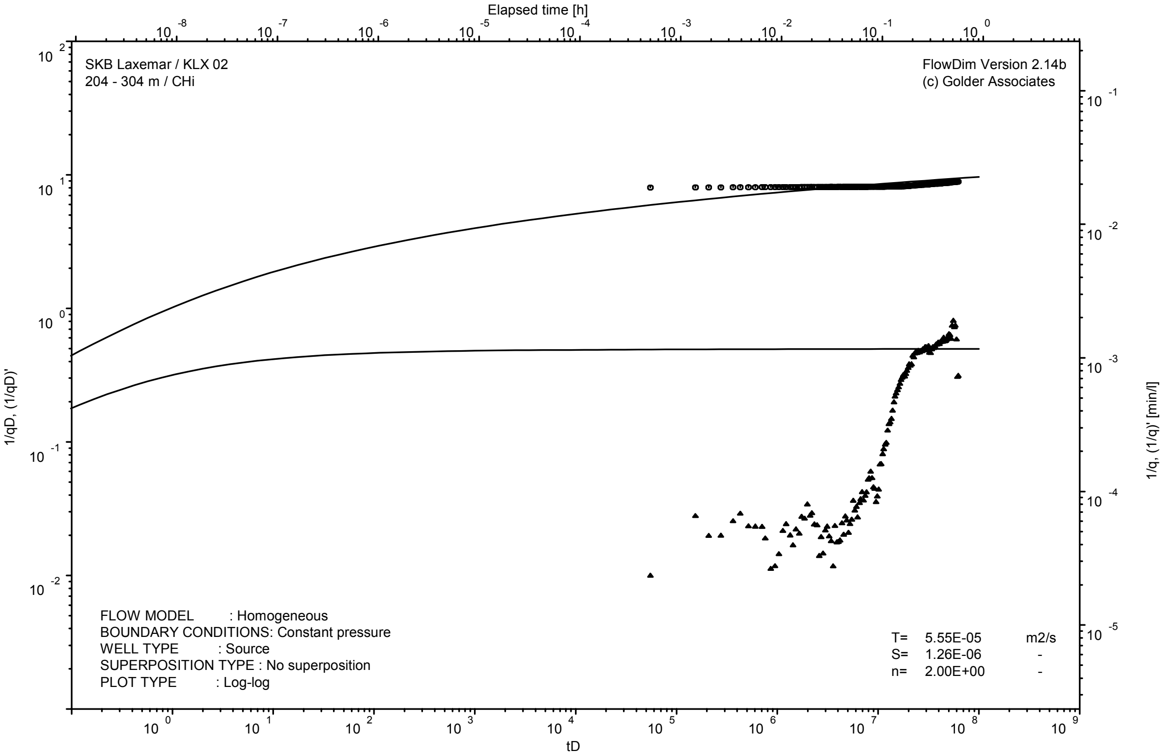
Analysis diagrams



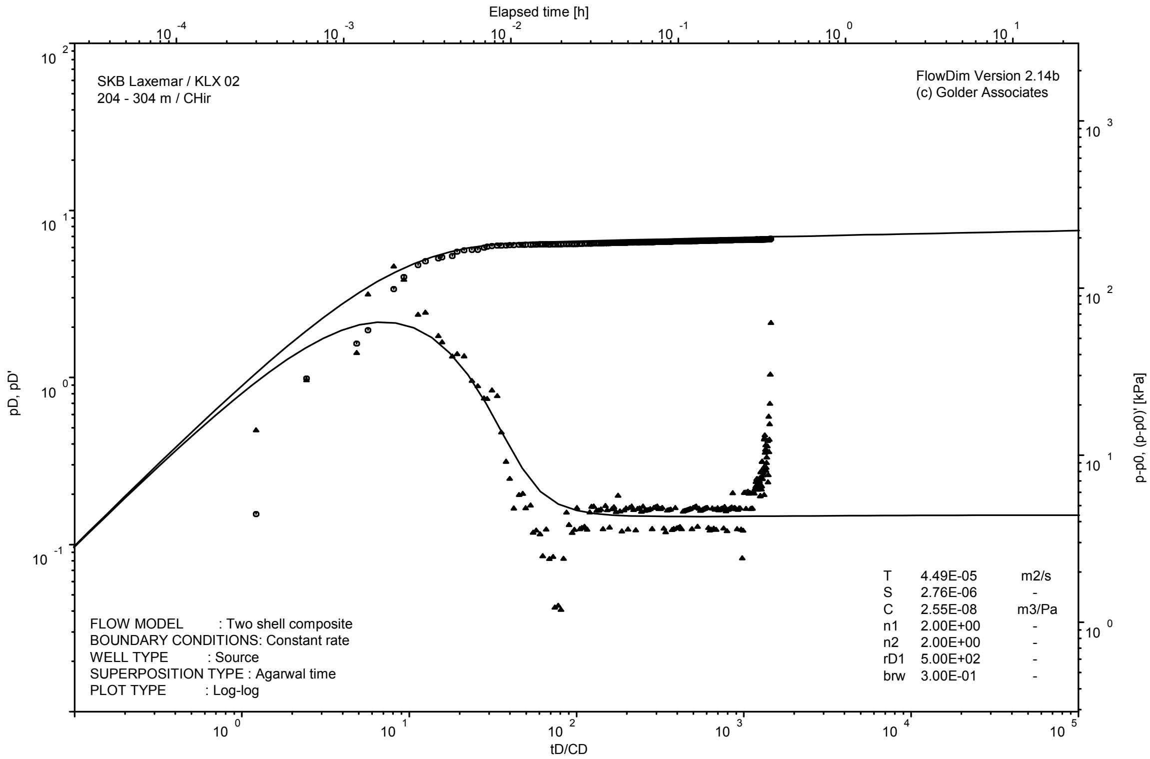
Pressure and flow rate vs. time; cartesian plot



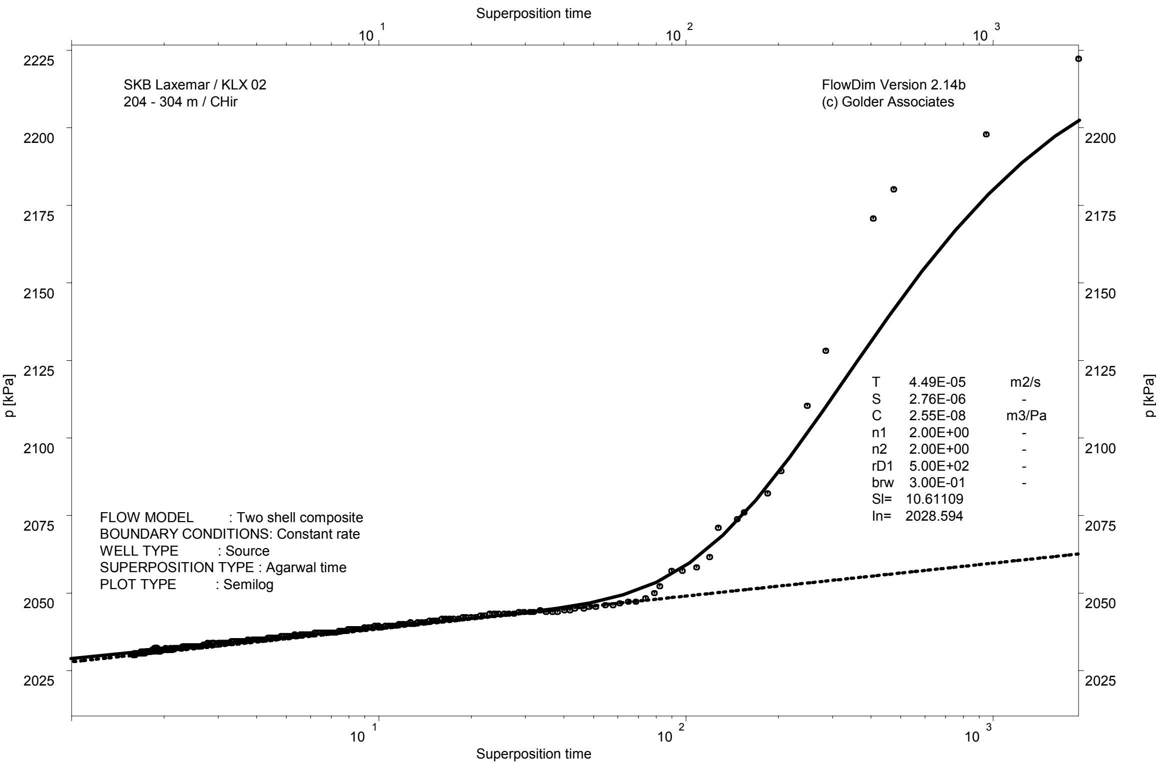
Pressure and temperature in the test section; cartesian plot



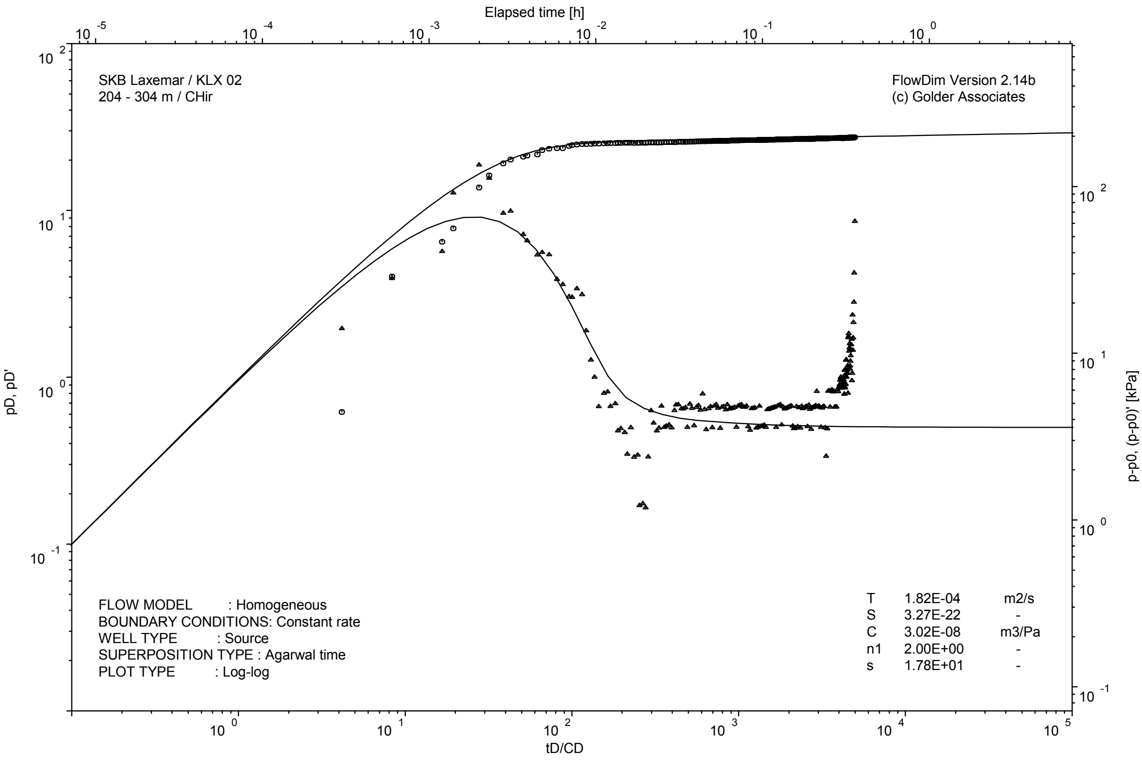
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

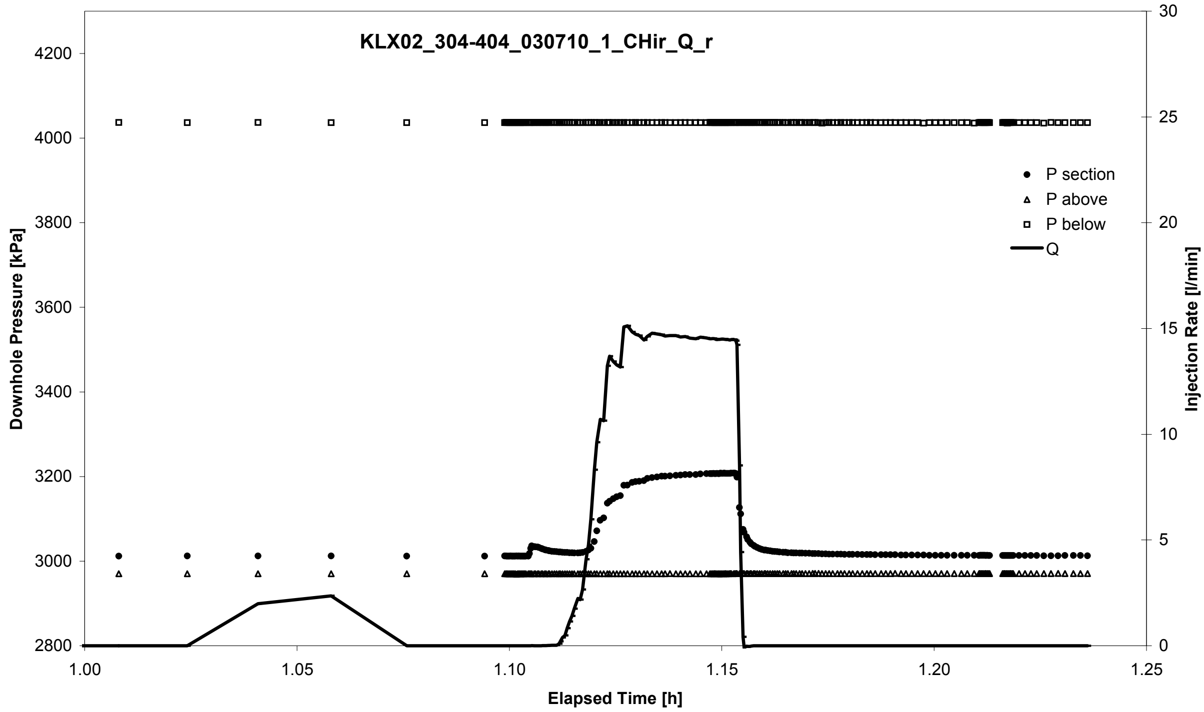


CHIR phase; Homogeneous model analyses, log-log match

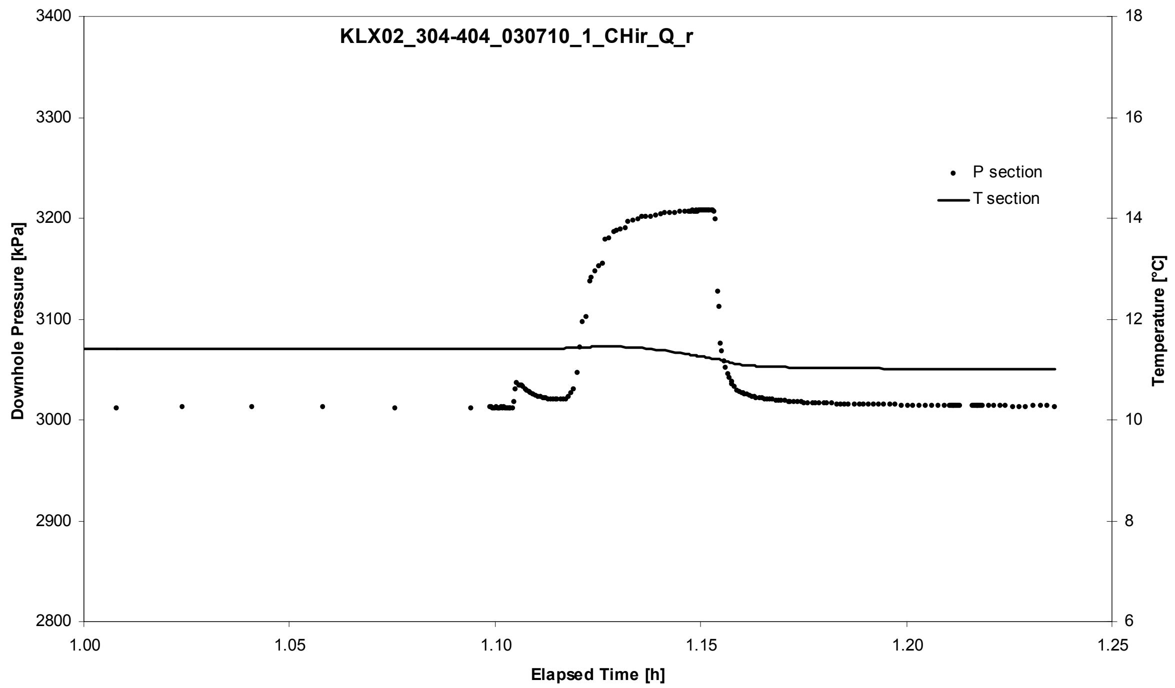
APPENDIX 2-2

Test 304 – 404 m

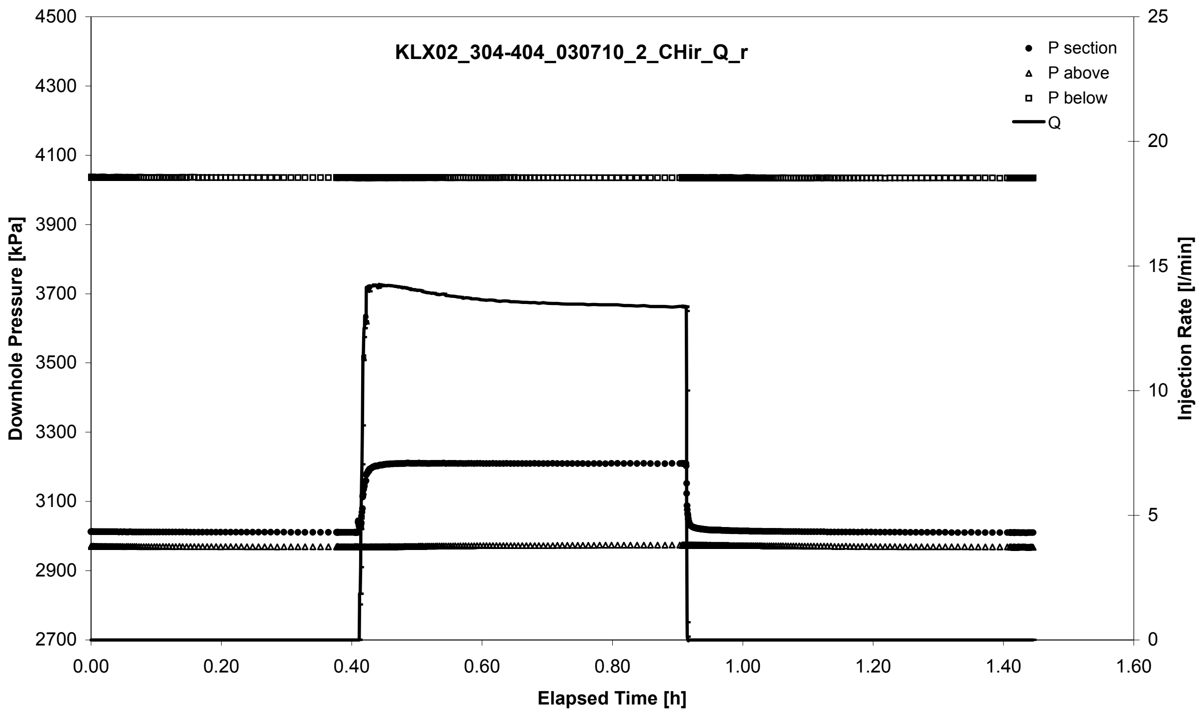
Analysis diagrams



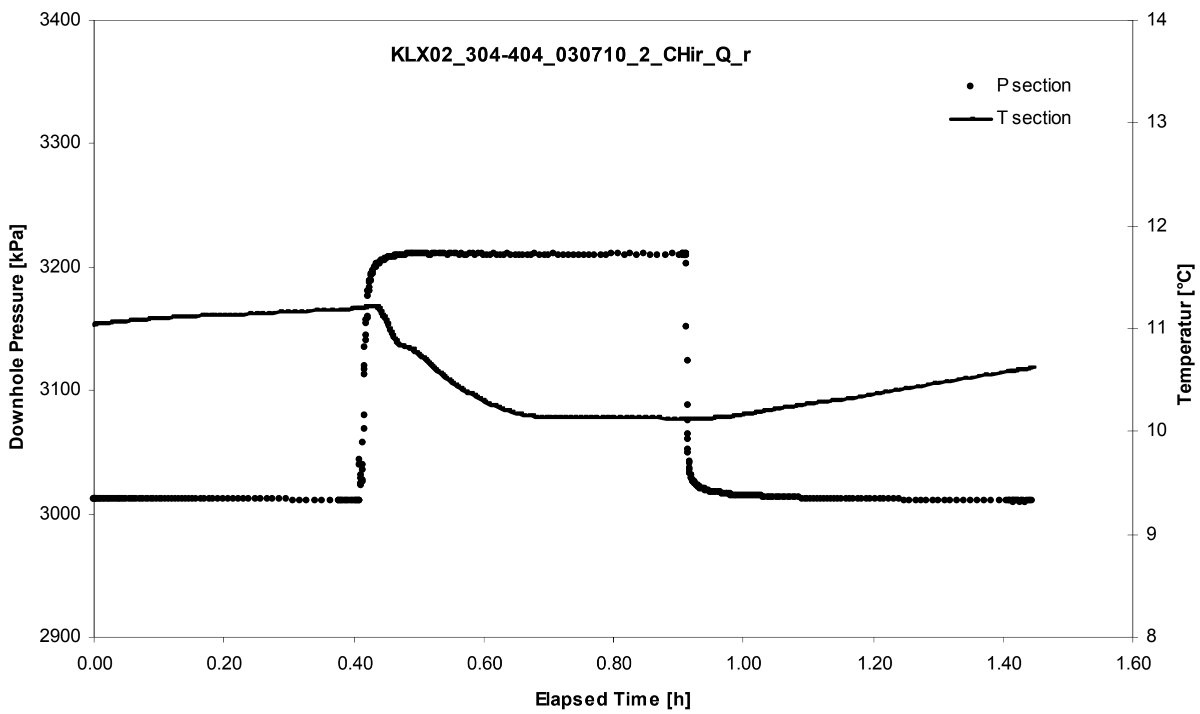
Pressure and flow rate vs. time; cartesian plot (test repeated)



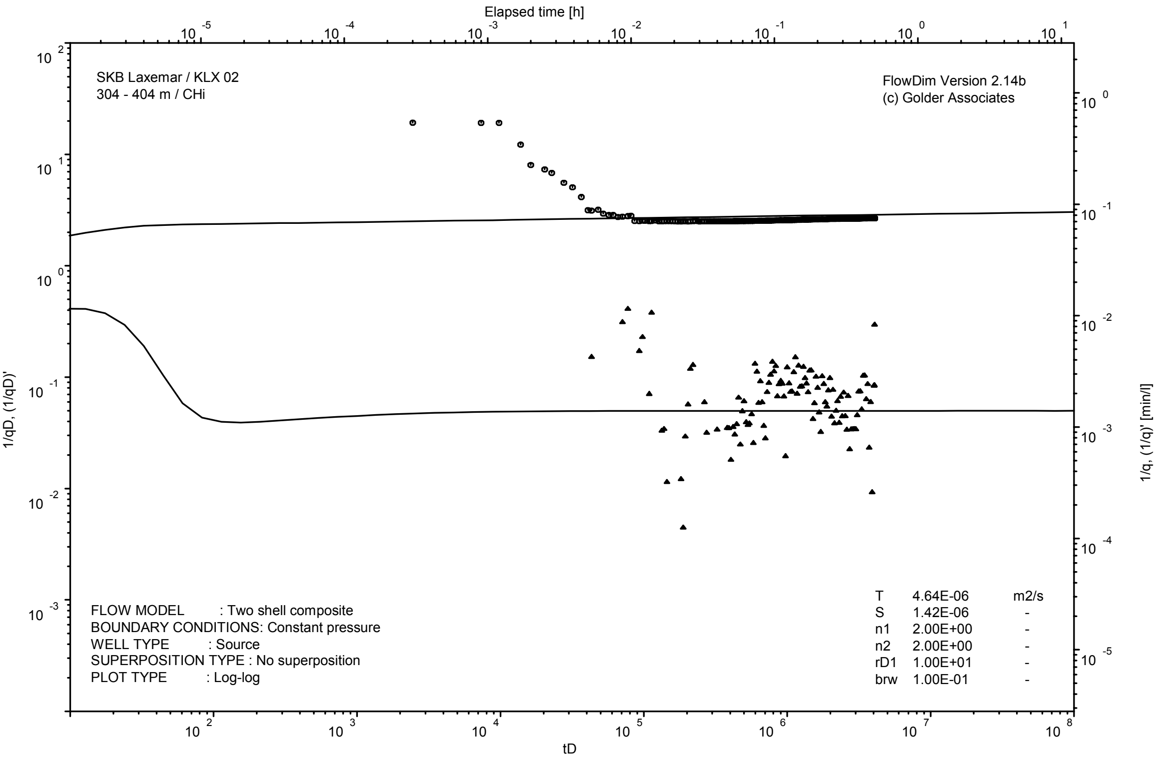
Pressure and temperature in the test section; cartesian plot (test repeated)



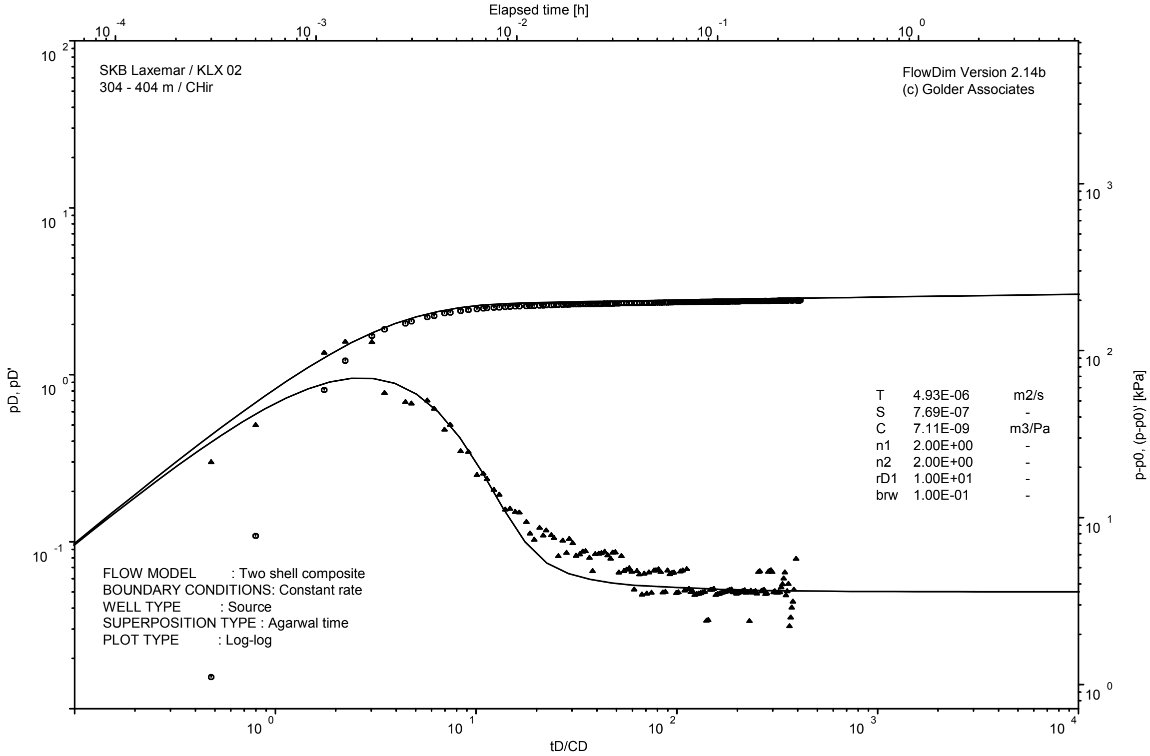
Pressure and flow rate vs. time; cartesian plot (analysed)



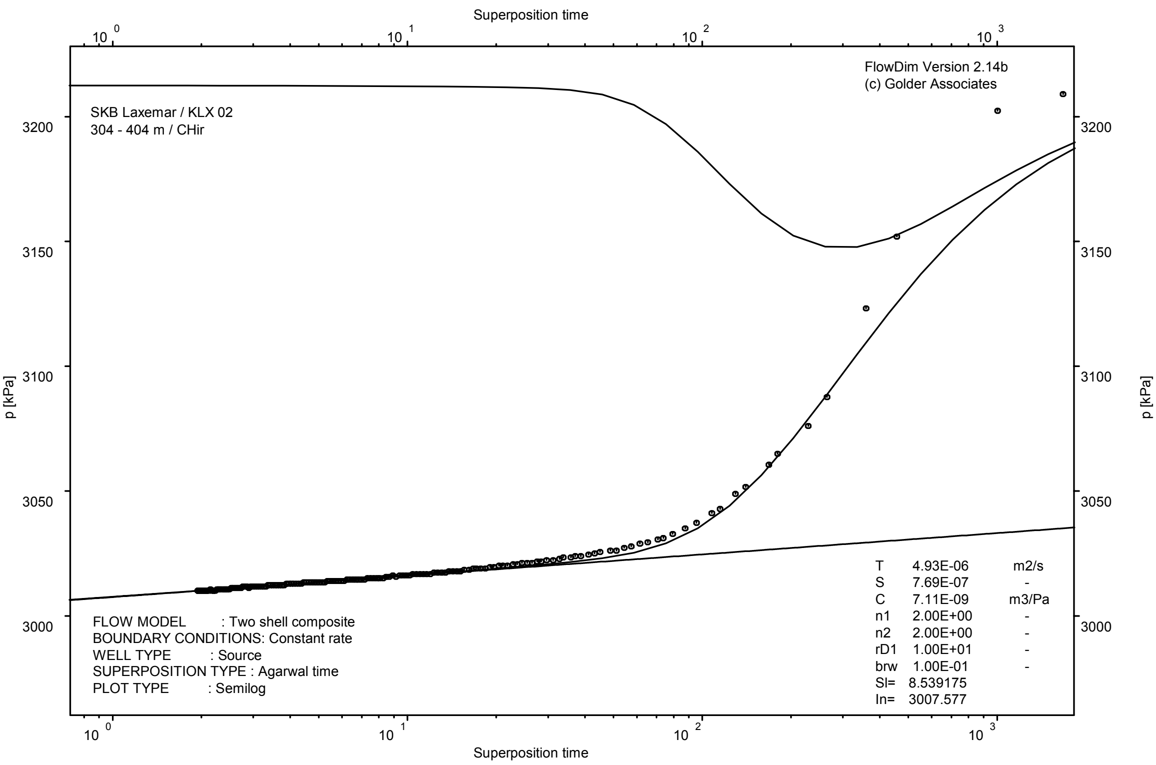
Pressure and temperature in the test section; cartesian plot (analysed)



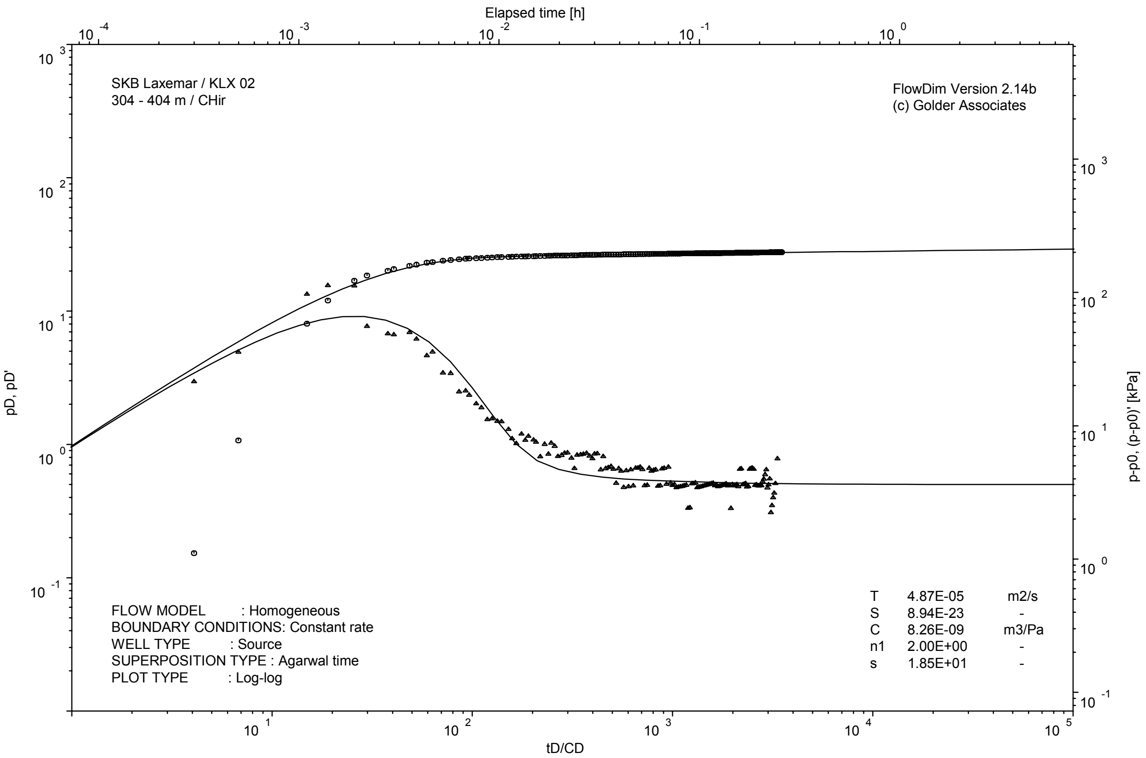
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

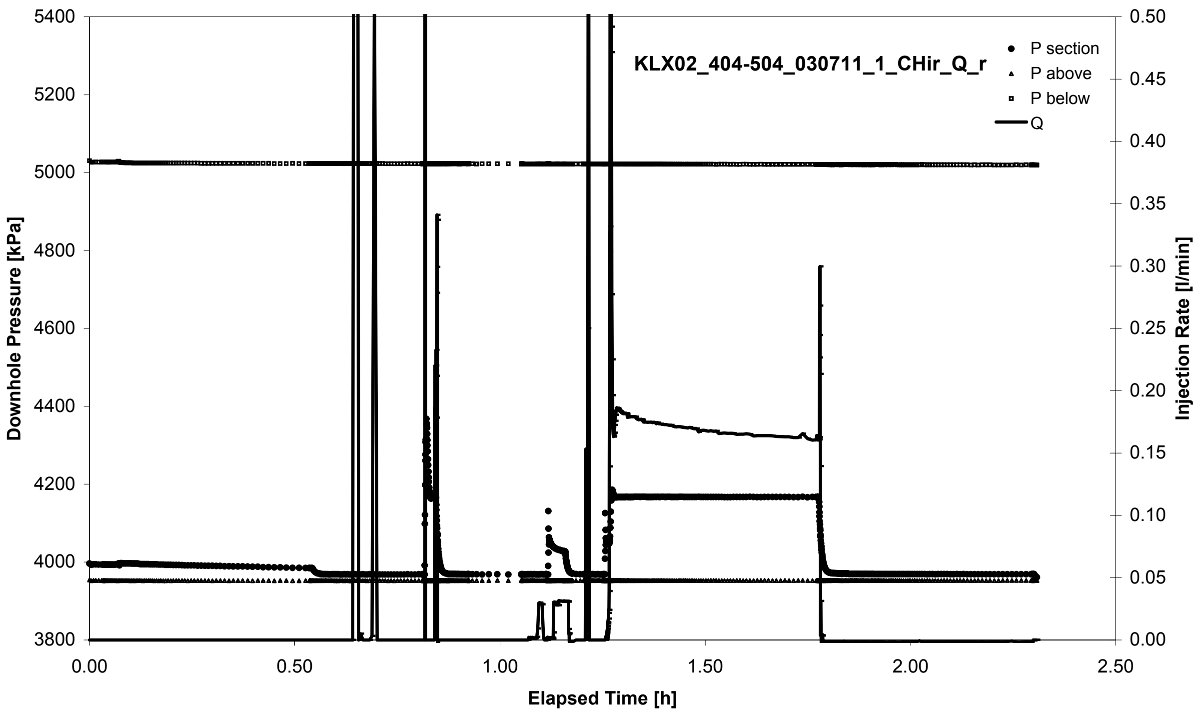


CHIR phase; Homogeneous model analyses, log-log match

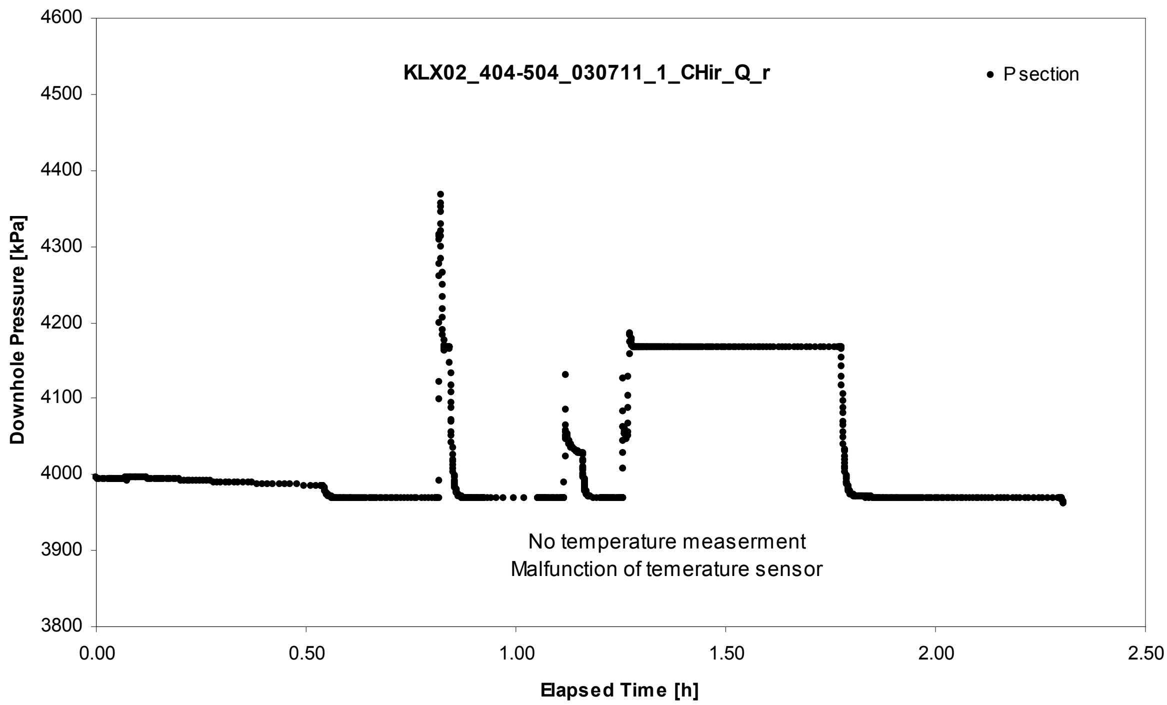
APPENDIX 2-3

Test 404 – 504 m

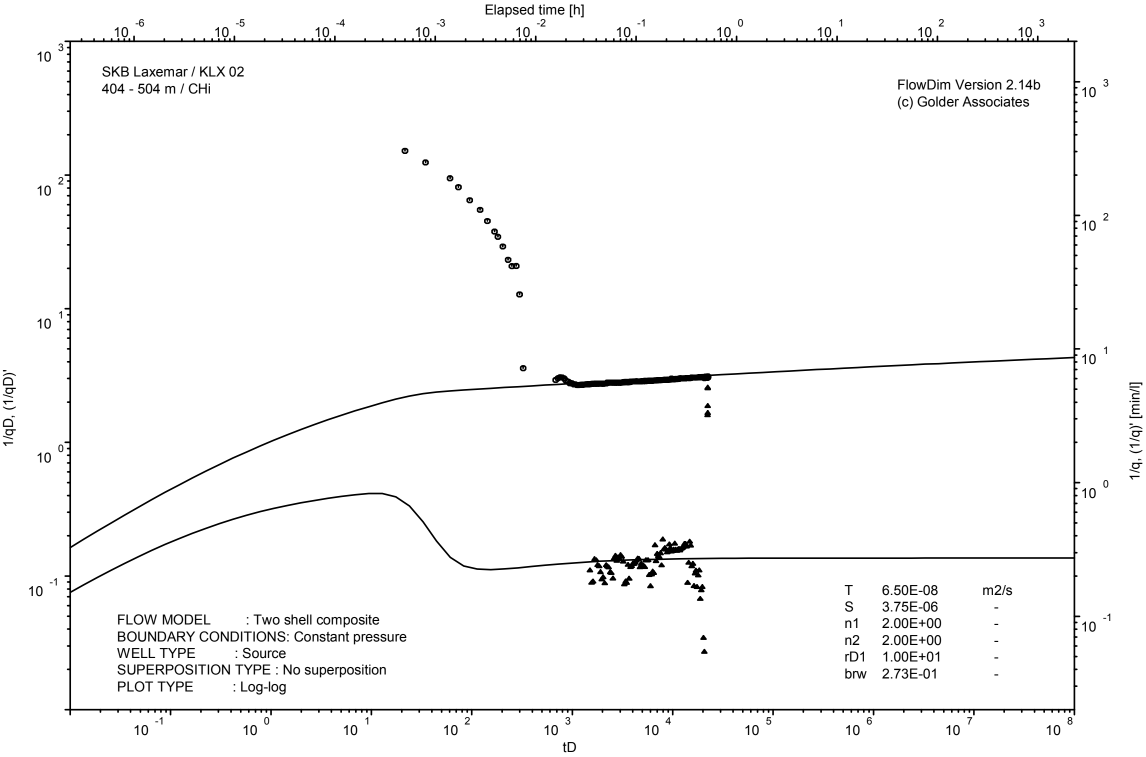
Analysis diagrams



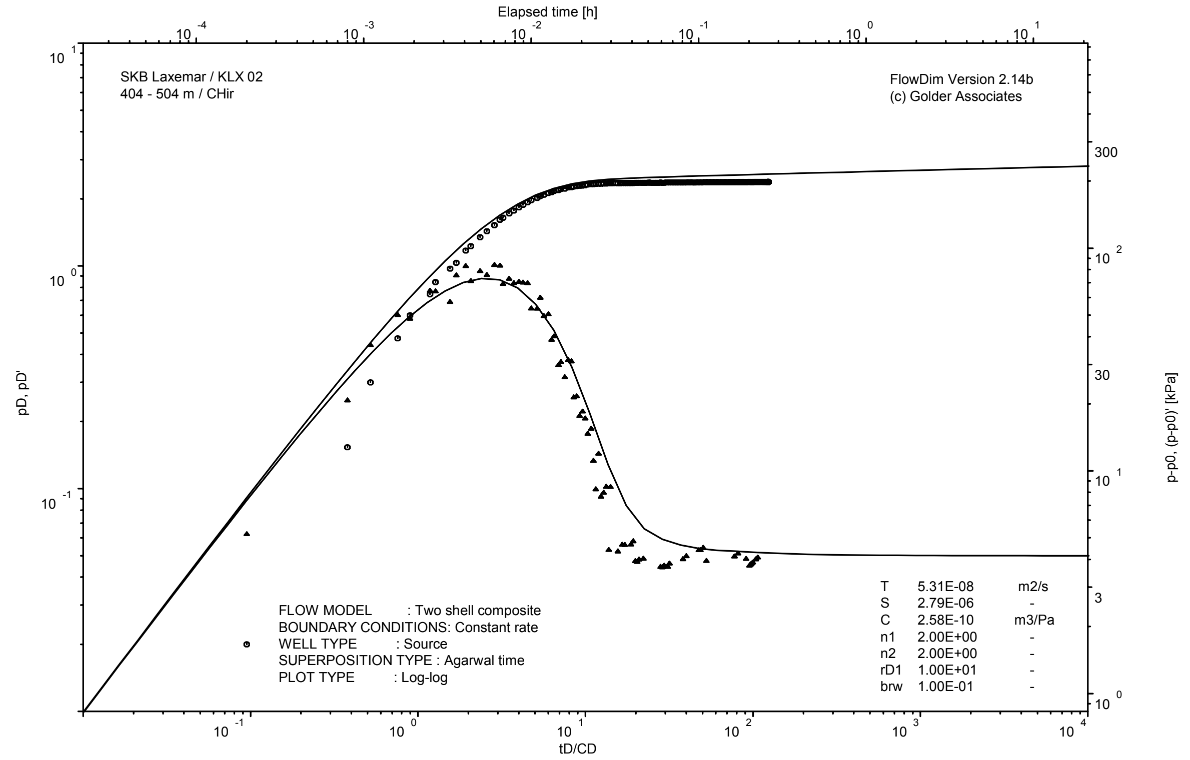
Pressure and flow rate vs. time; cartesian plot



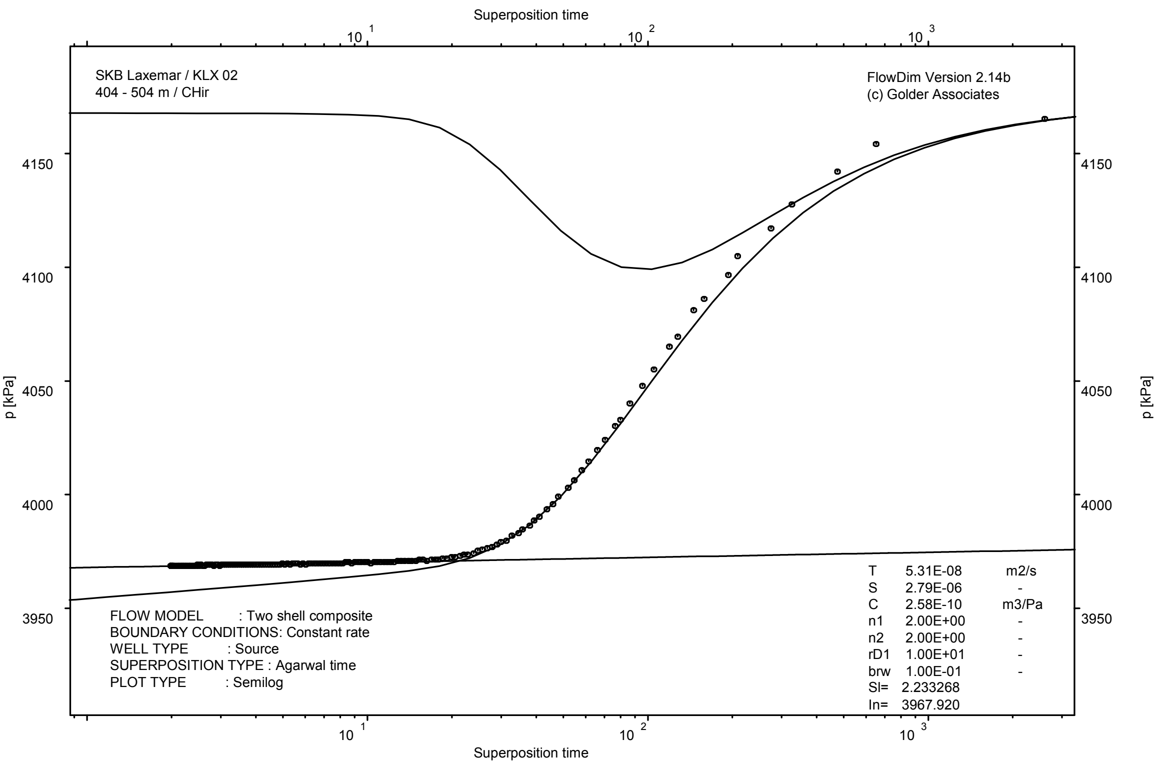
Pressure and temperature in the test section; cartesian plot



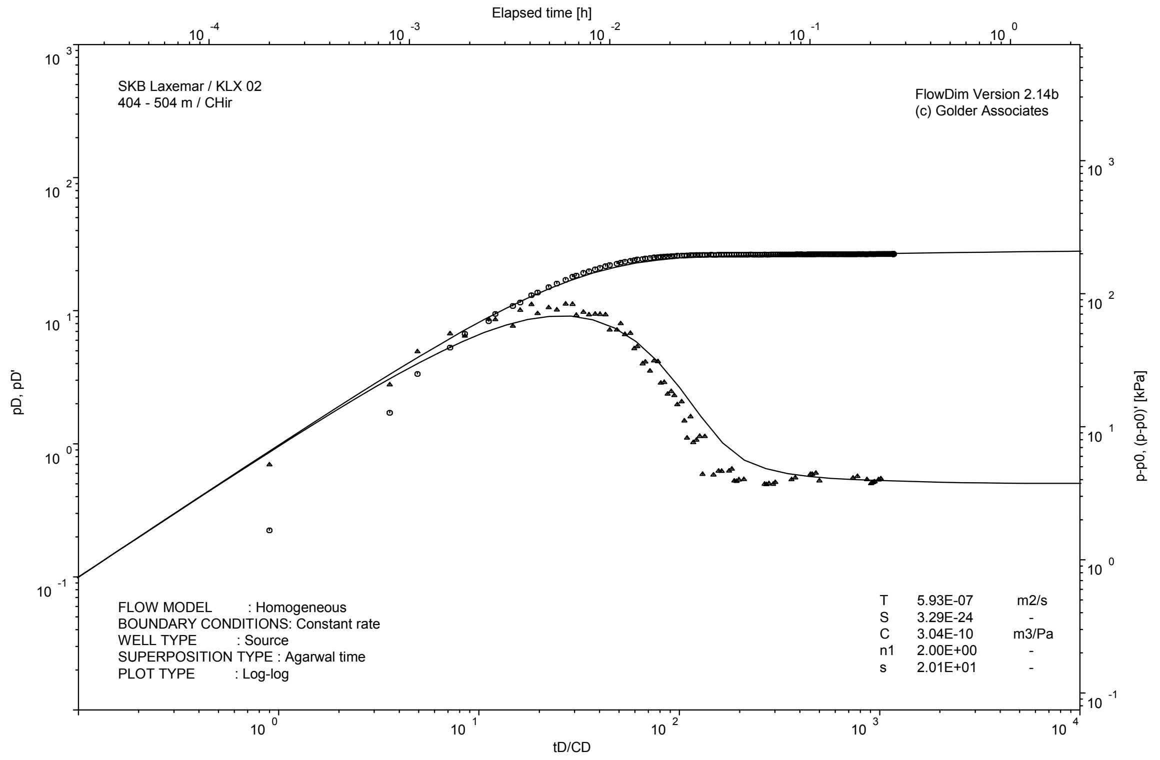
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

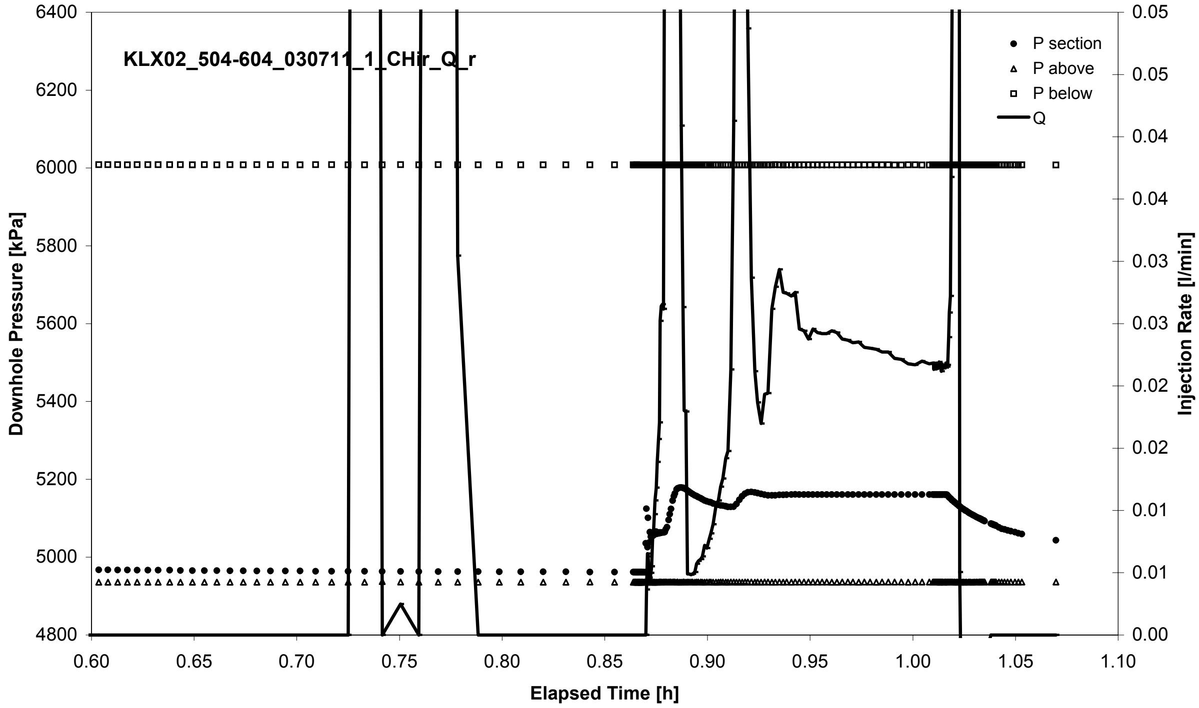


CHIR phase; Homogeneous model analyses, log-log match

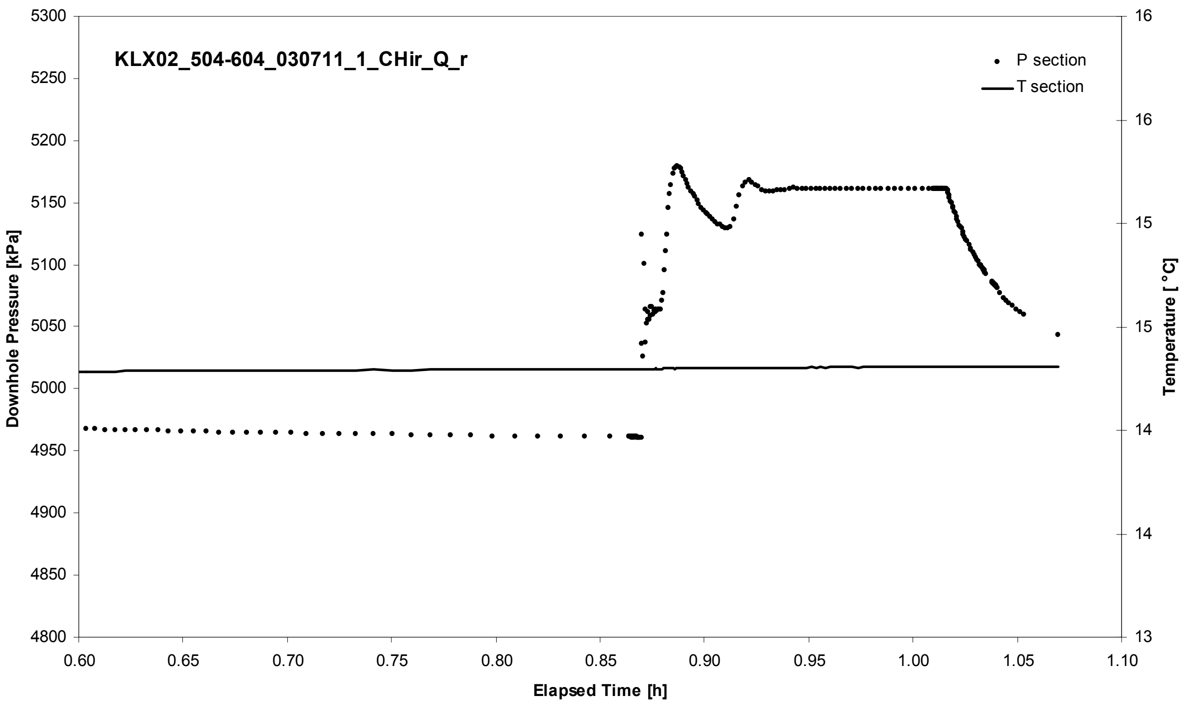
APPENDIX 2-4

Test 504 – 604 m

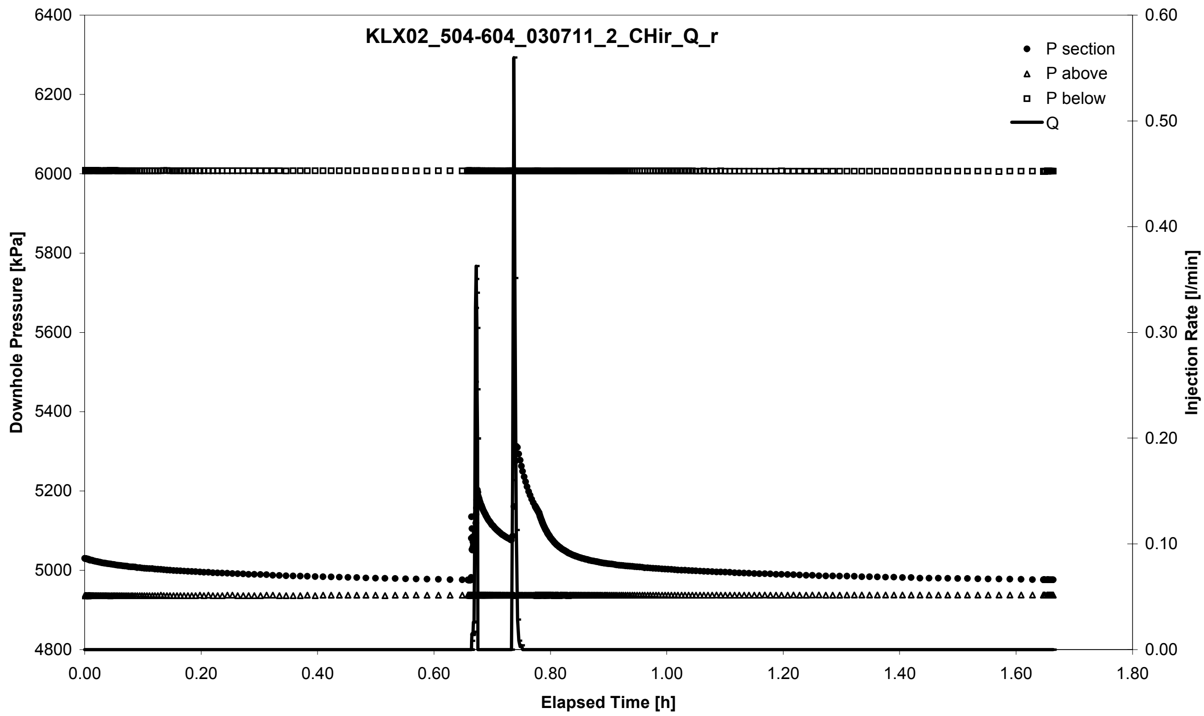
Analysis diagrams



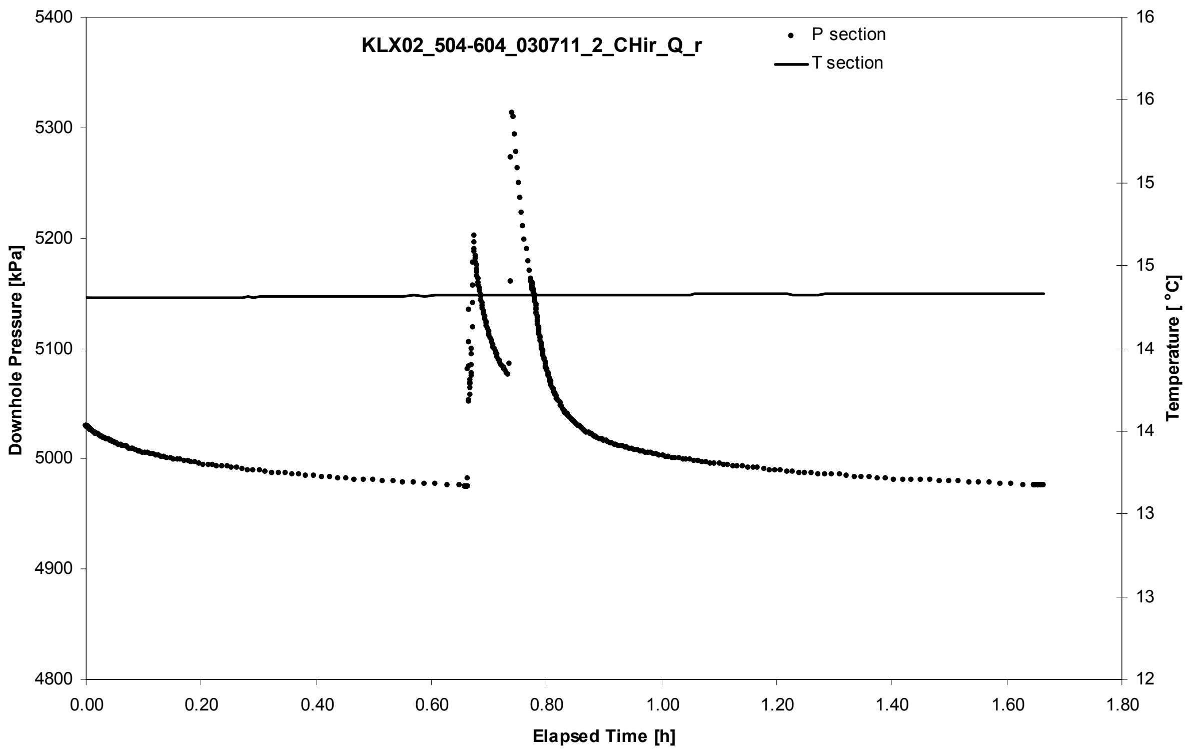
Pressure and flow rate vs. time; cartesian plot (test repeated)



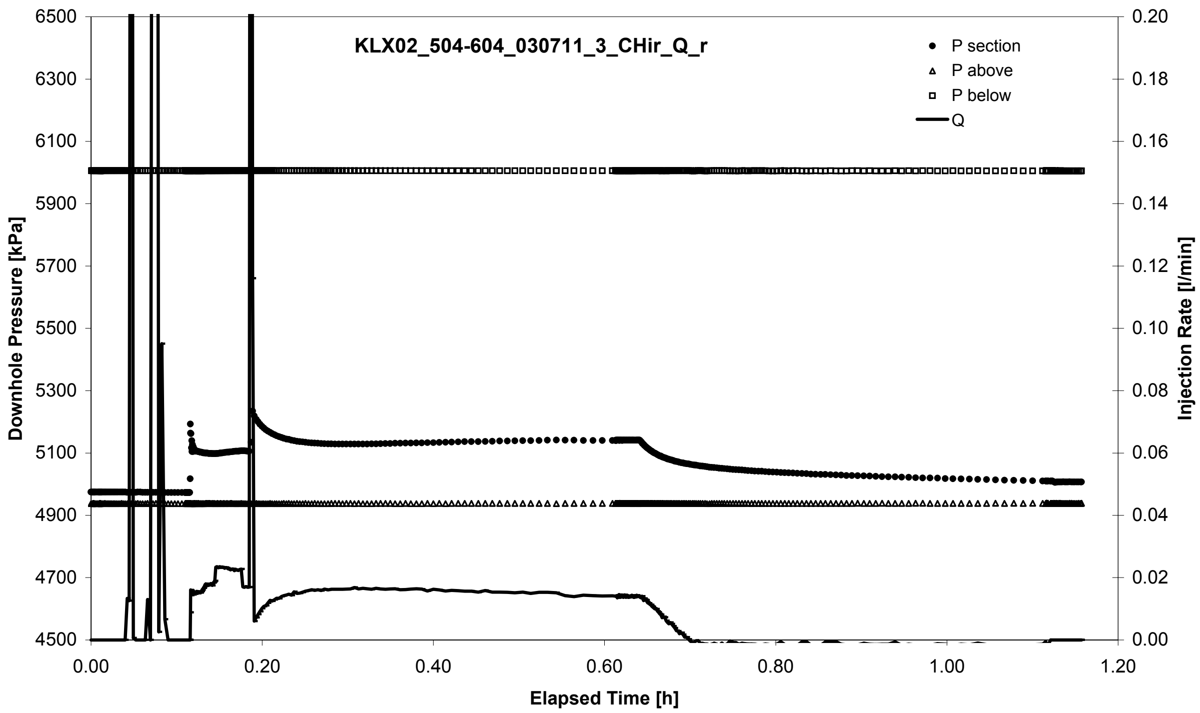
Pressure and temperature in the test section; cartesian plot (test repeated)



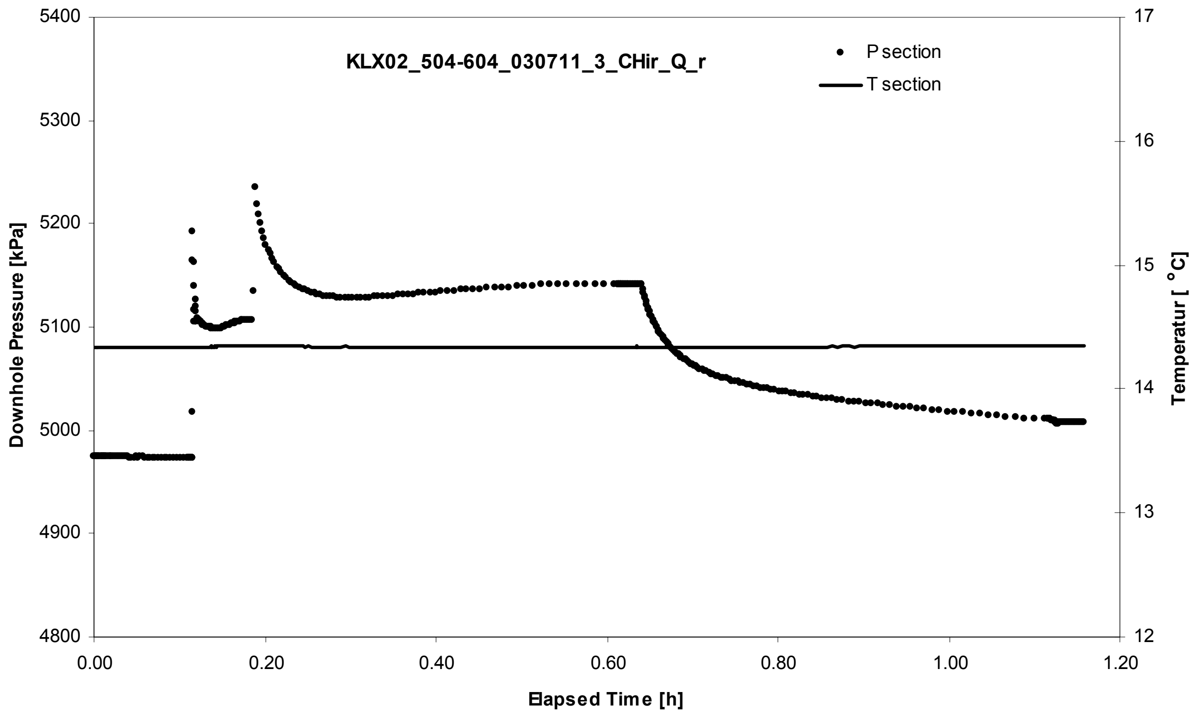
Pressure and flow rate vs. time; cartesian plot (test repeated)



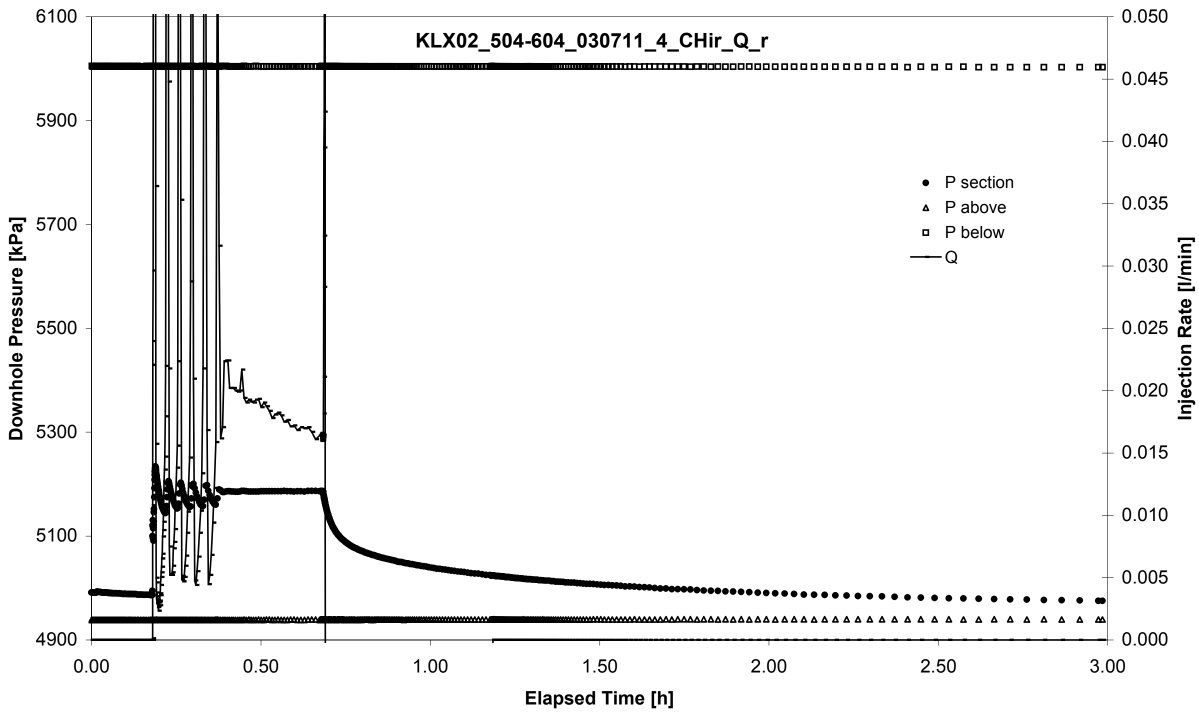
Pressure and temperature in the test section; cartesian plot (test repeated)



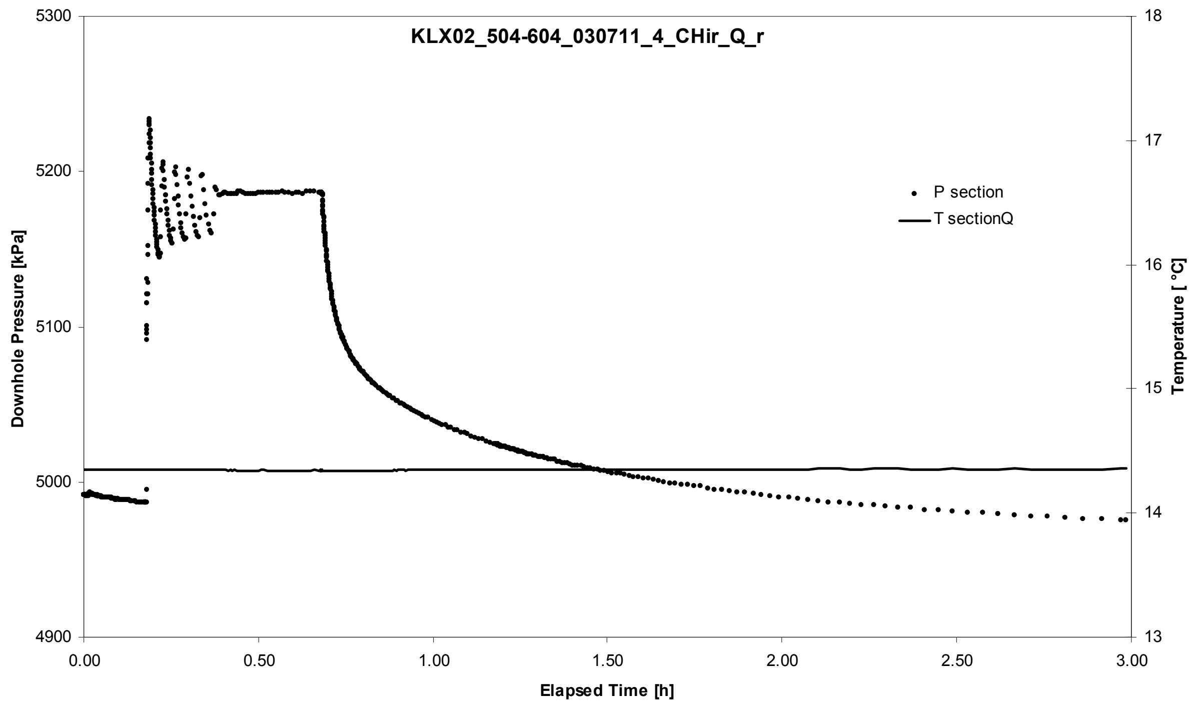
Pressure and flow rate vs. time; cartesian plot (test repeated)



Pressure and temperature in the test section; cartesian plot (test repeated)



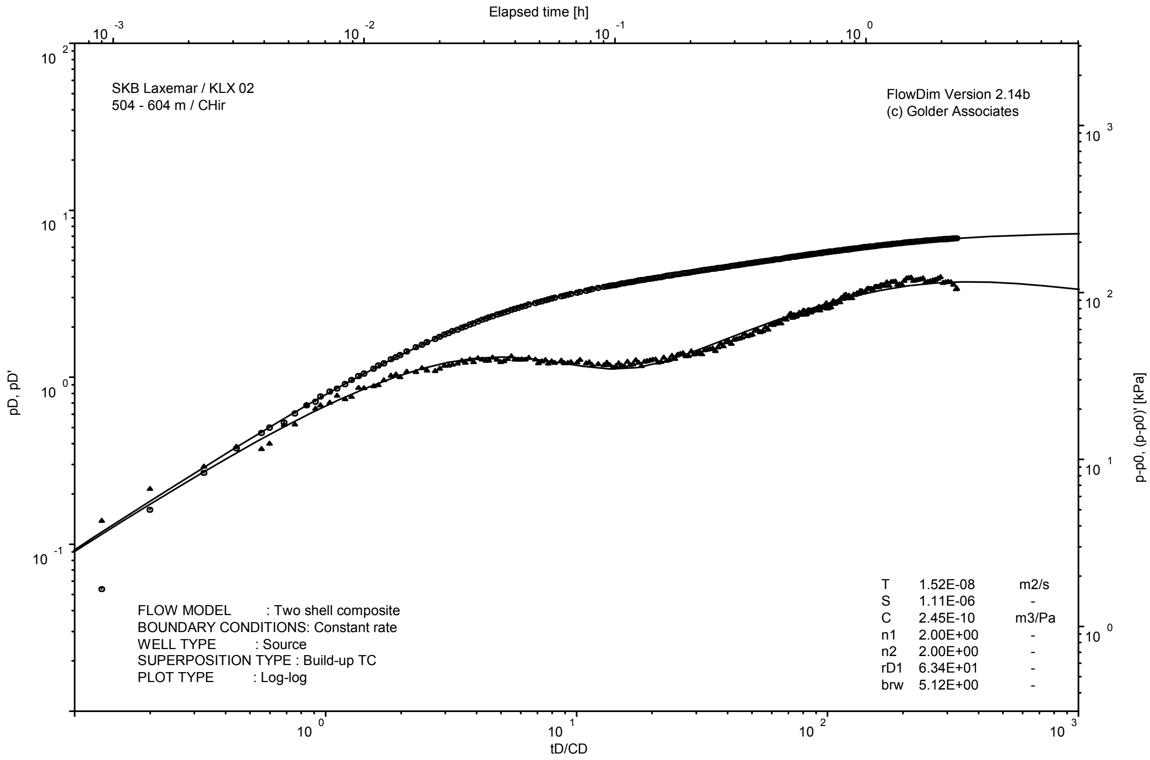
Pressure and flow rate vs. time; cartesian plot (analysed)



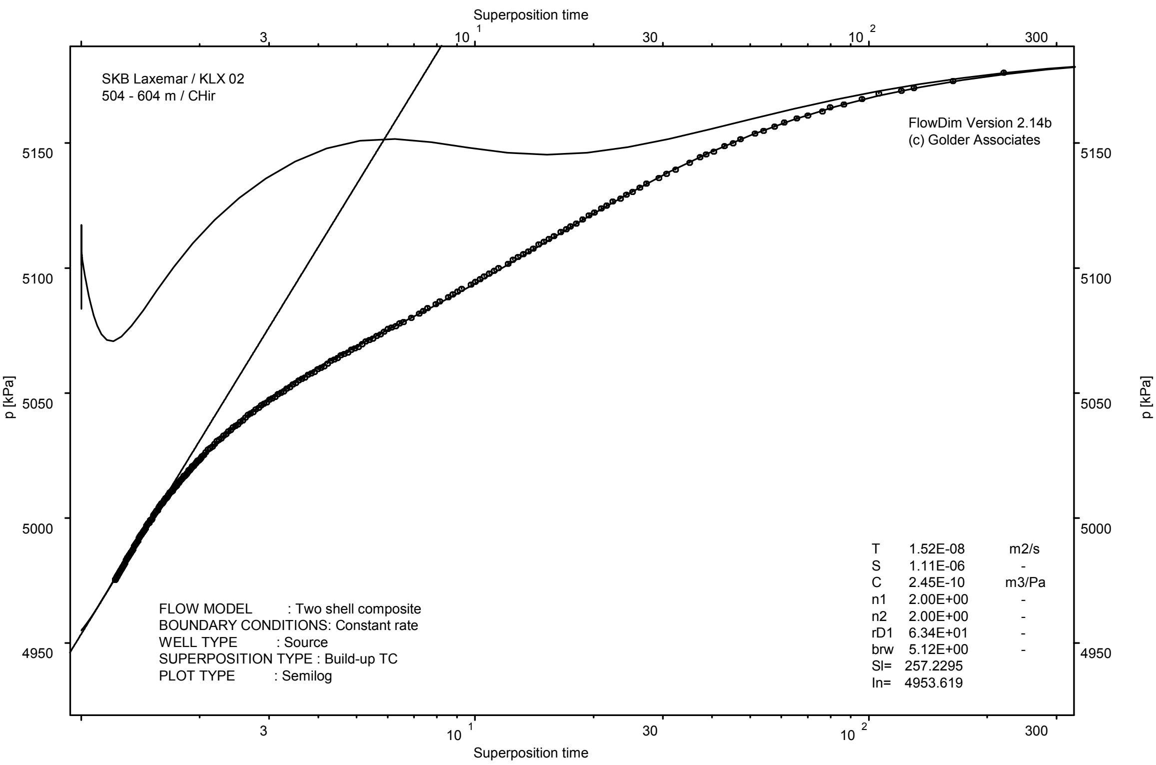
Pressure and temperature in the test section; cartesian plot (analysed)

Not Analysed

CHI phase; log-log match



CHIR phase; log-log match

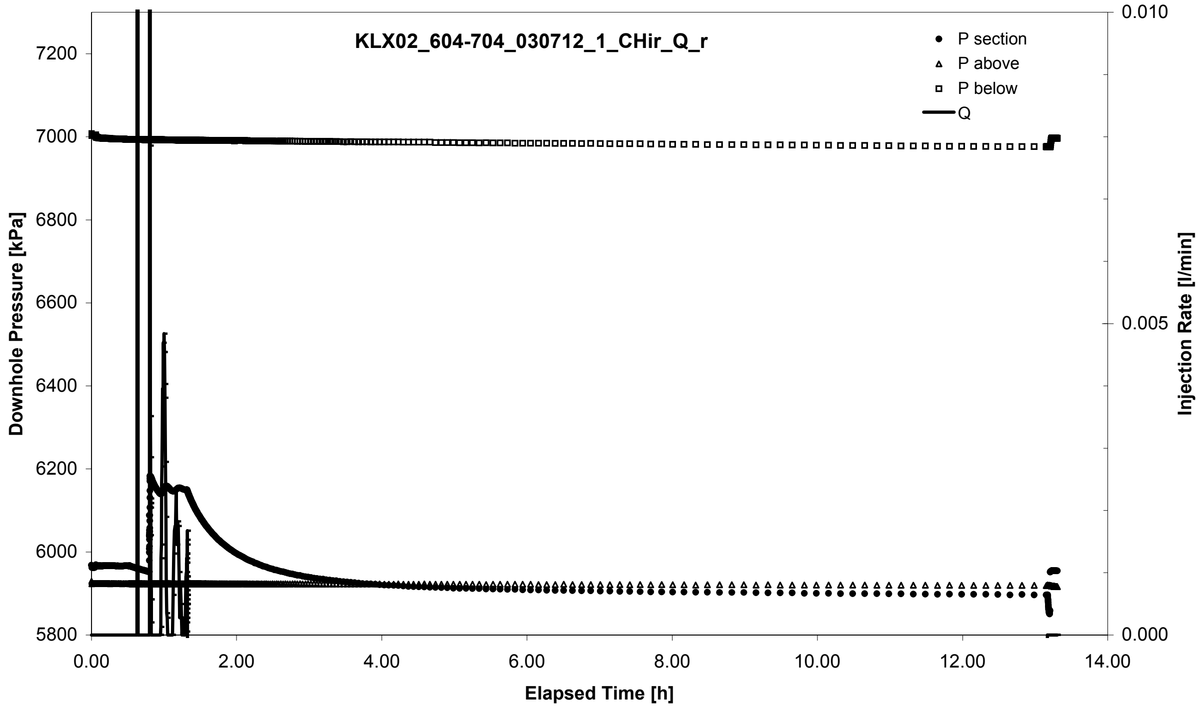


CHIR phase; HORNER match

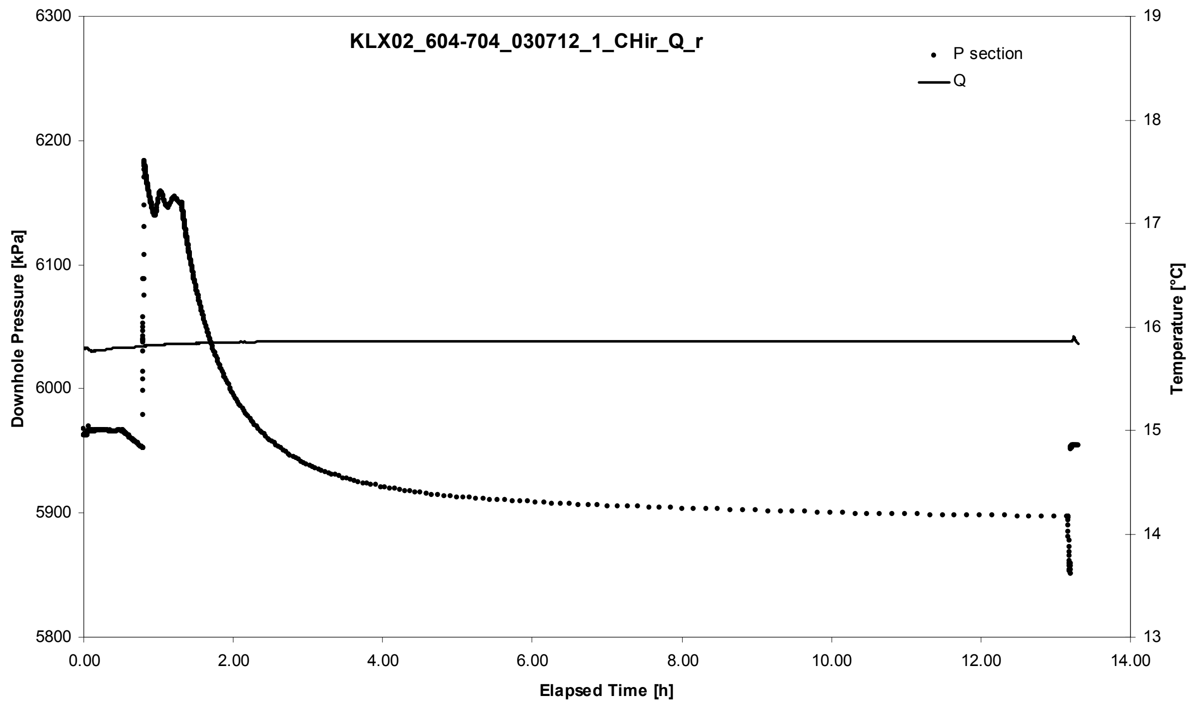
APPENDIX 2-5

Test 604 – 704 m

Analysis diagrams



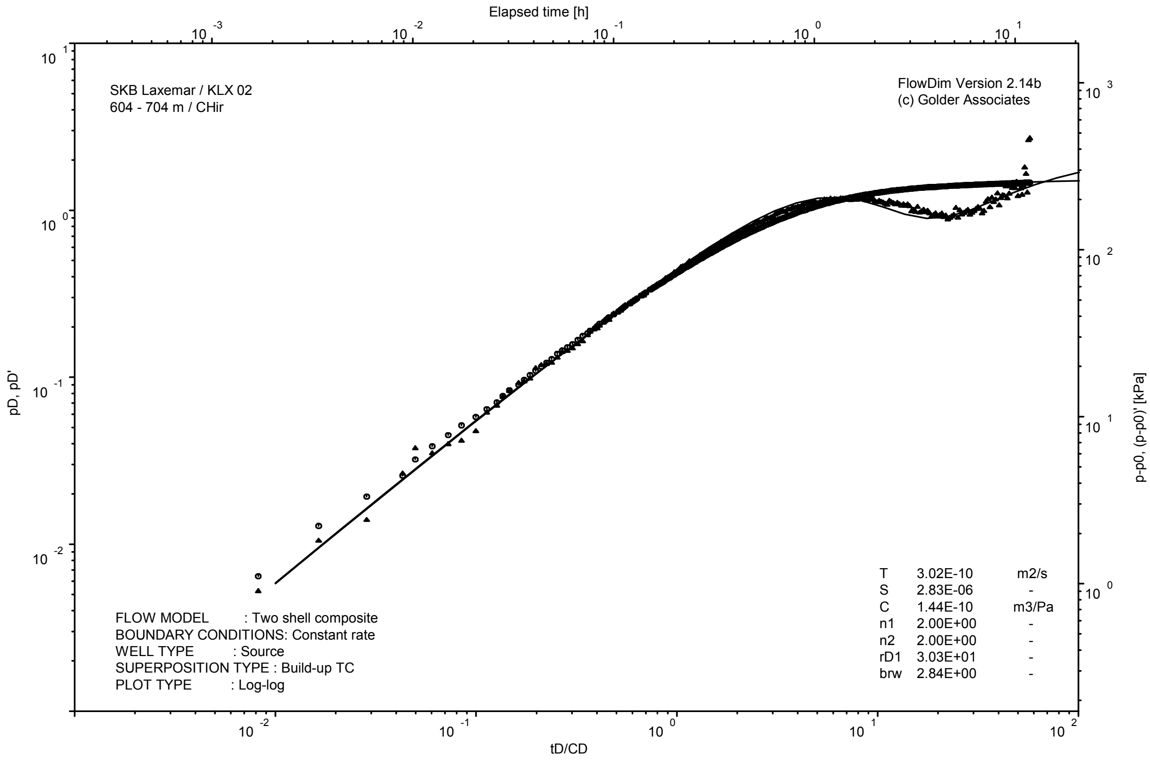
Pressure and flow rate vs. time; cartesian plot



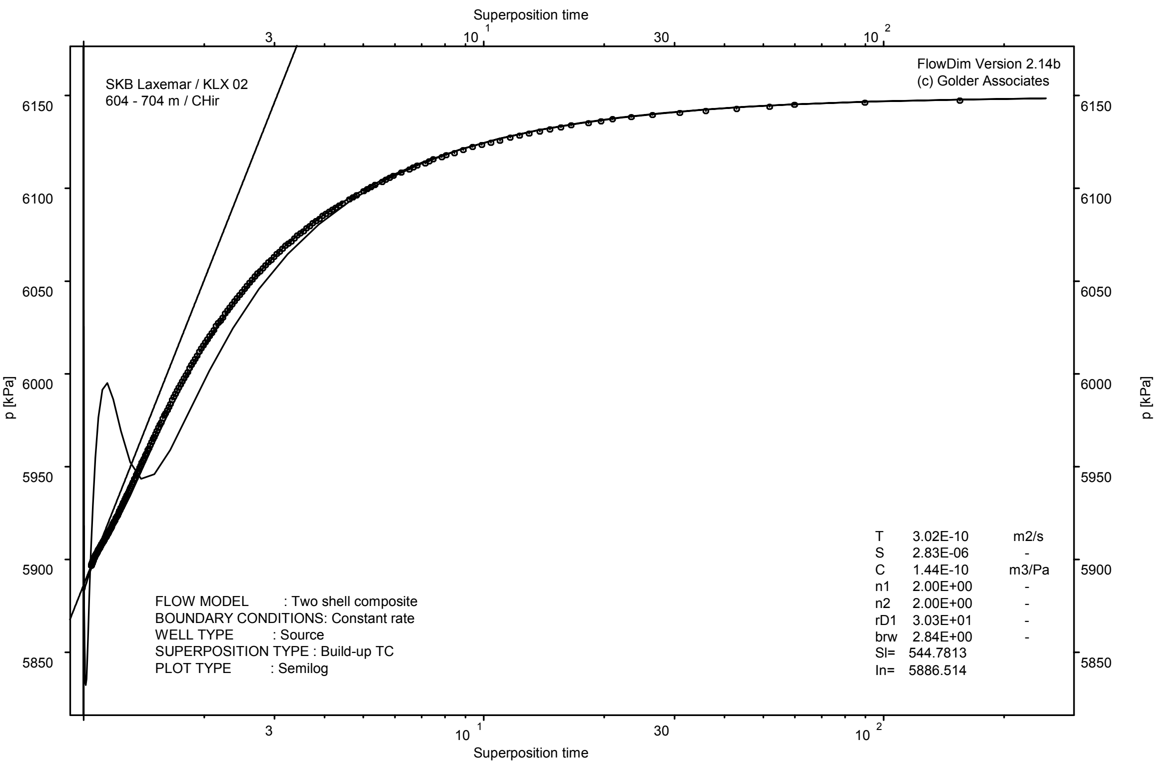
Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match



CHIR phase; log-log match

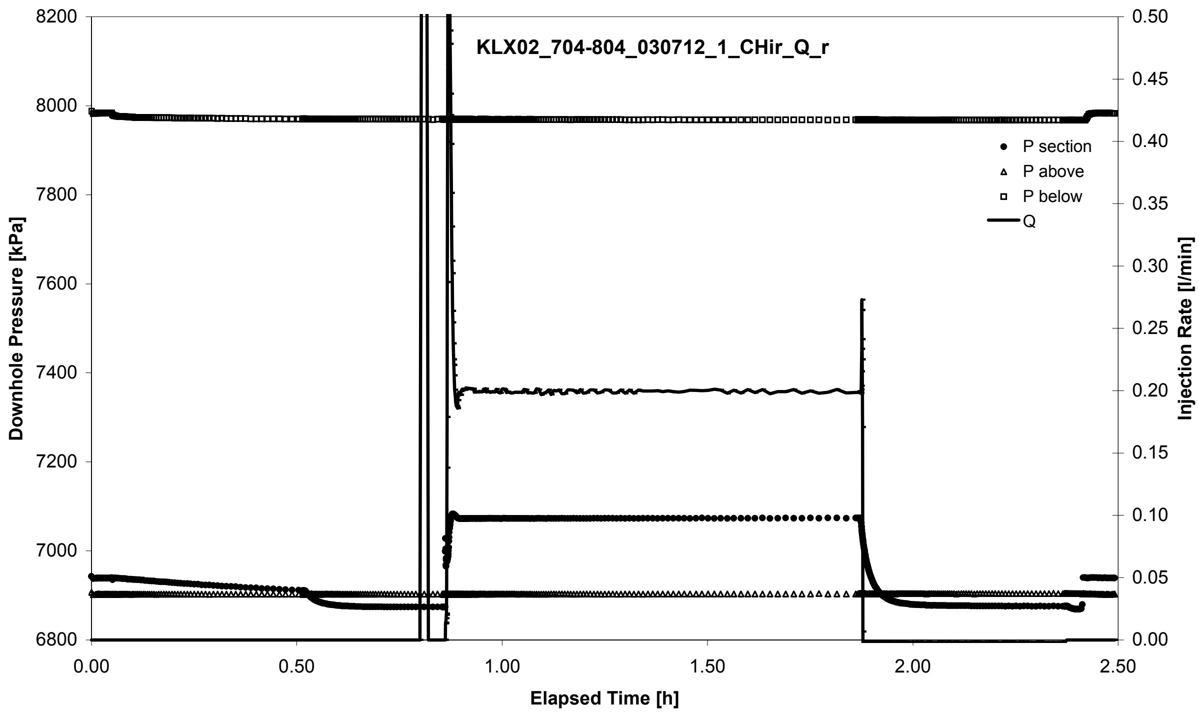


CHIR phase; HORNER match

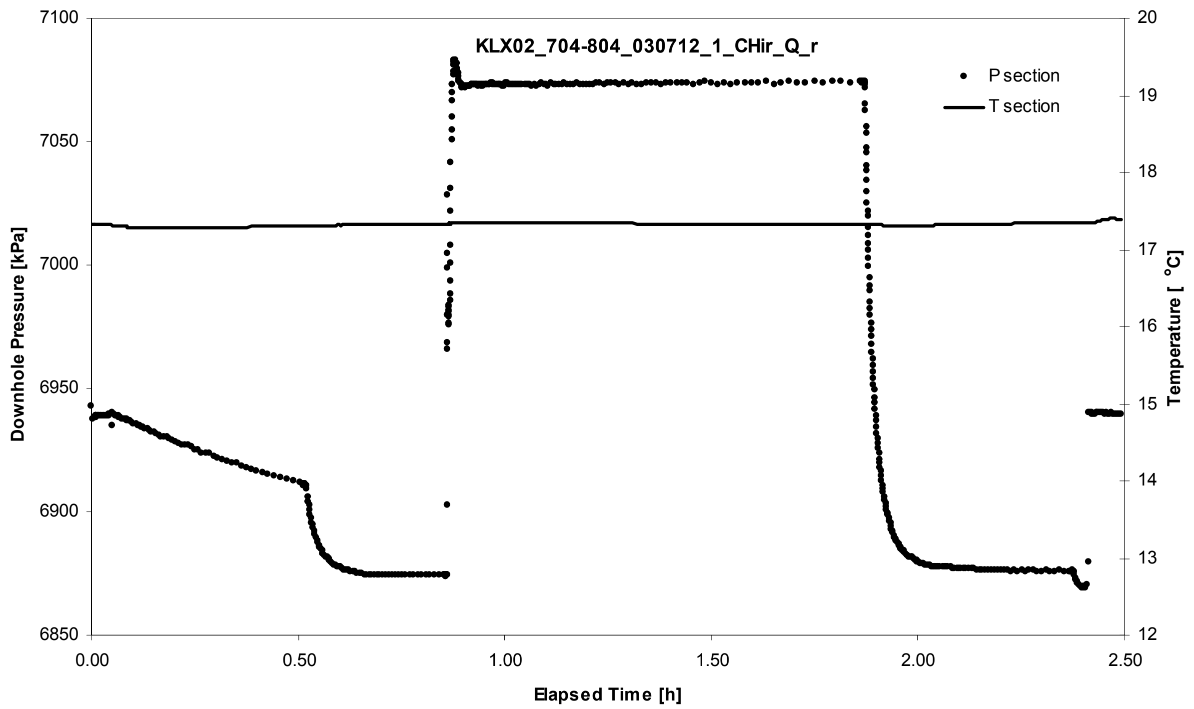
APPENDIX 2-6

Test 704 – 804 m

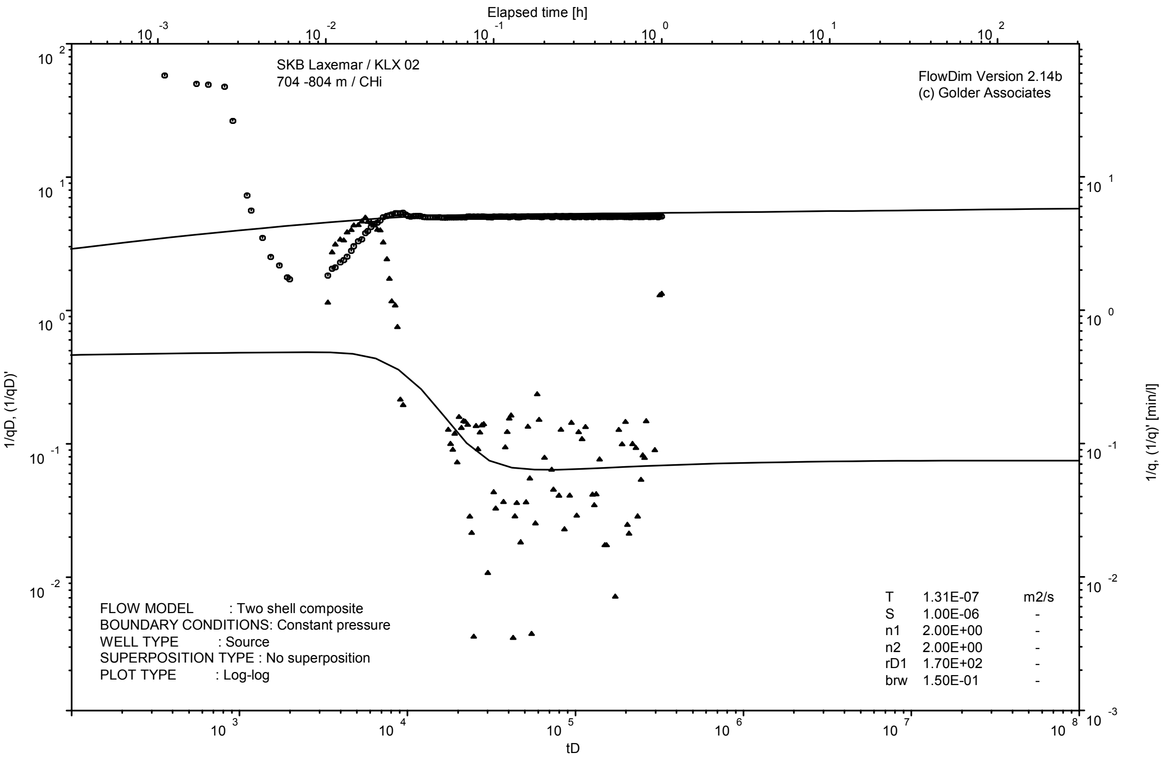
Analysis diagrams



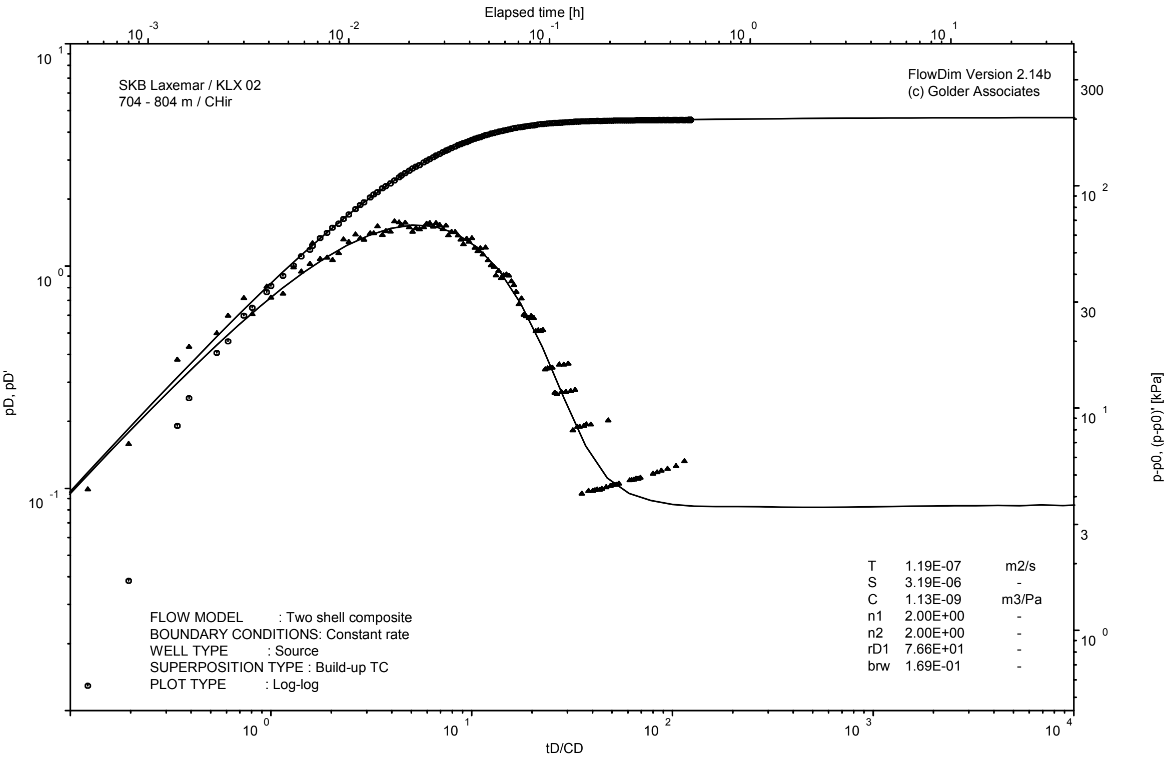
Pressure and flow rate vs. time; cartesian plot



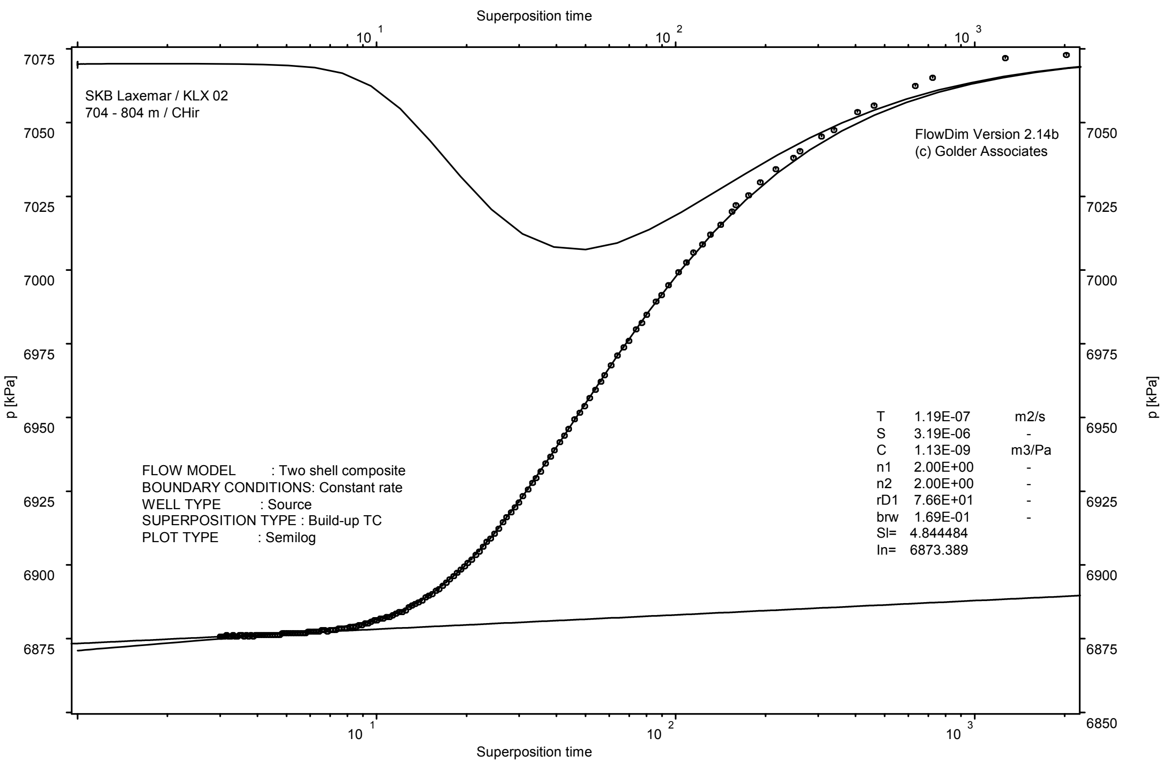
Pressure and temperature in the test section; cartesian plot



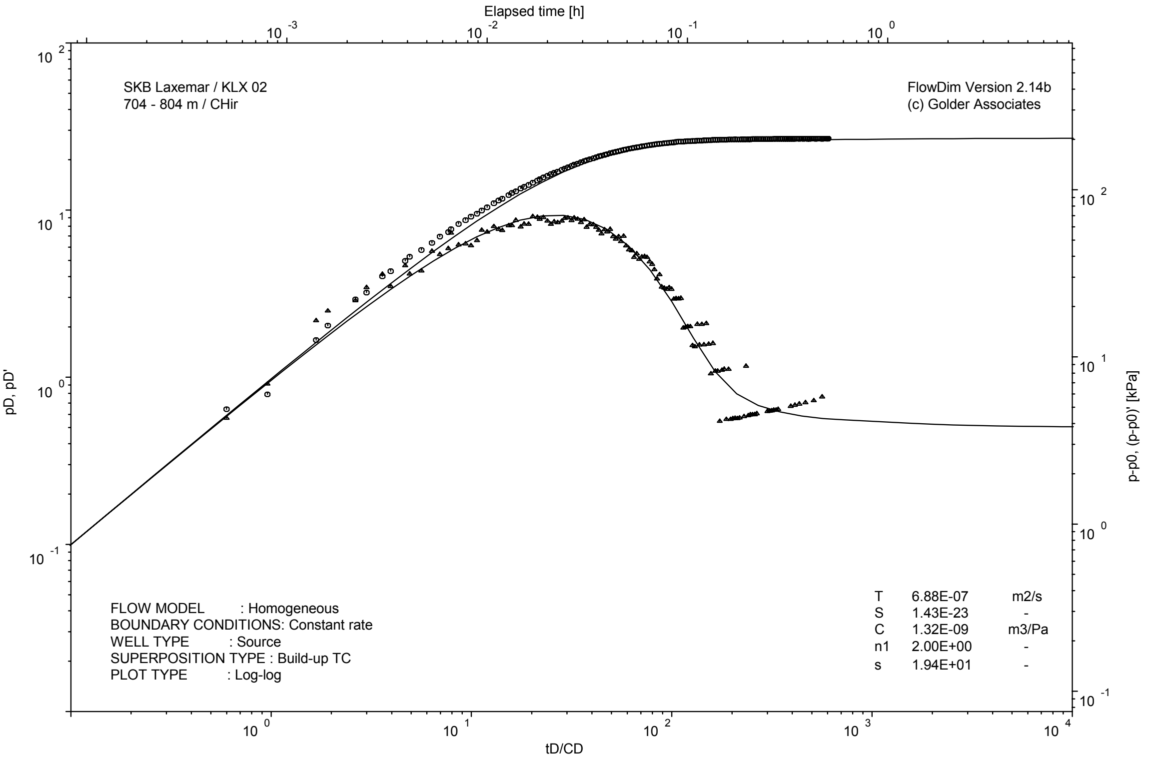
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

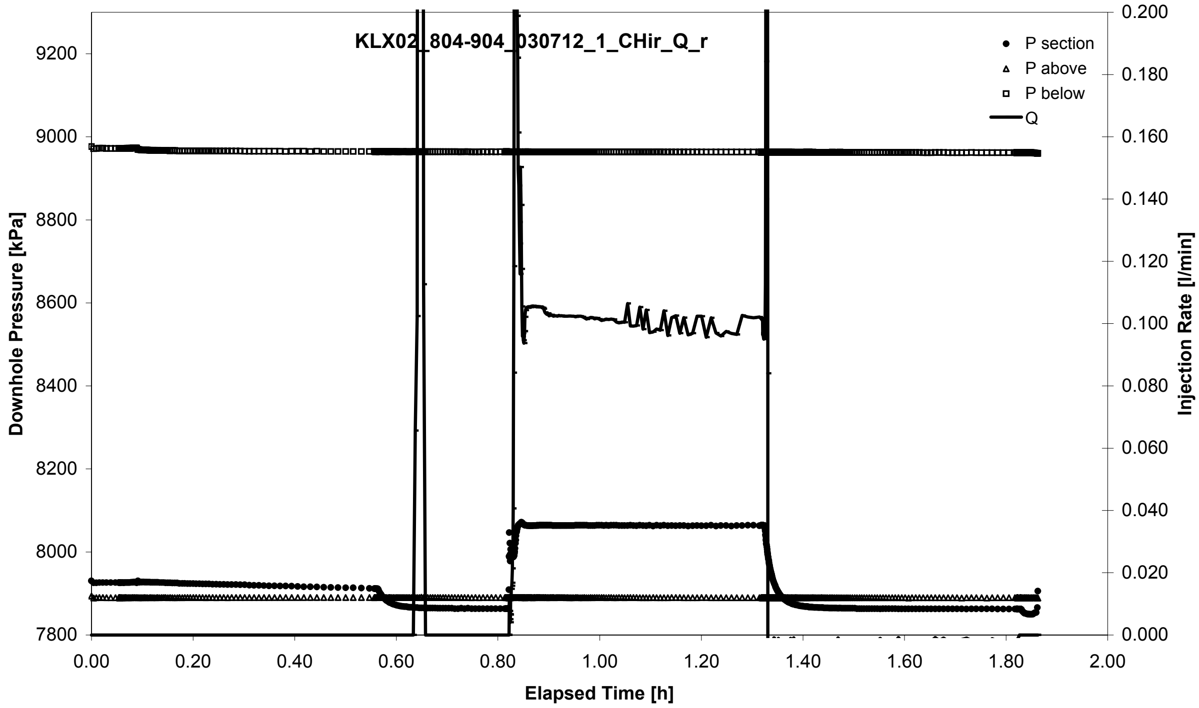


CHIR phase; Homogeneous model analyses, log-log match

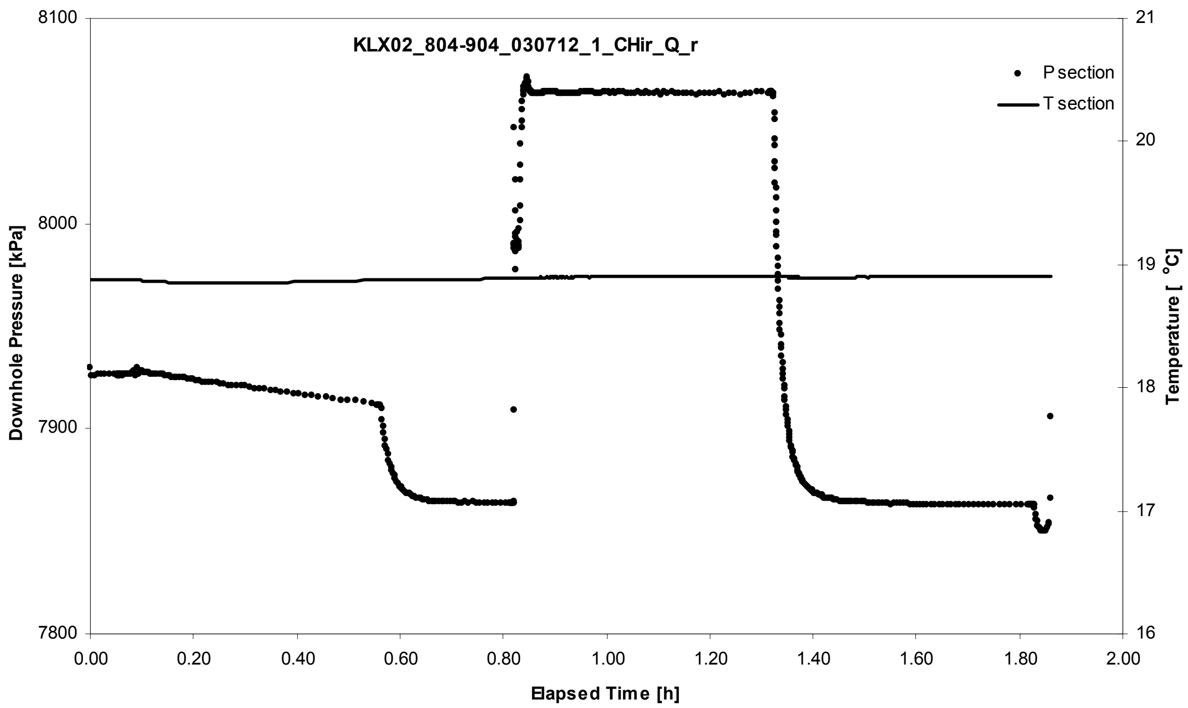
APPENDIX 2-7

Test 804 – 904 m

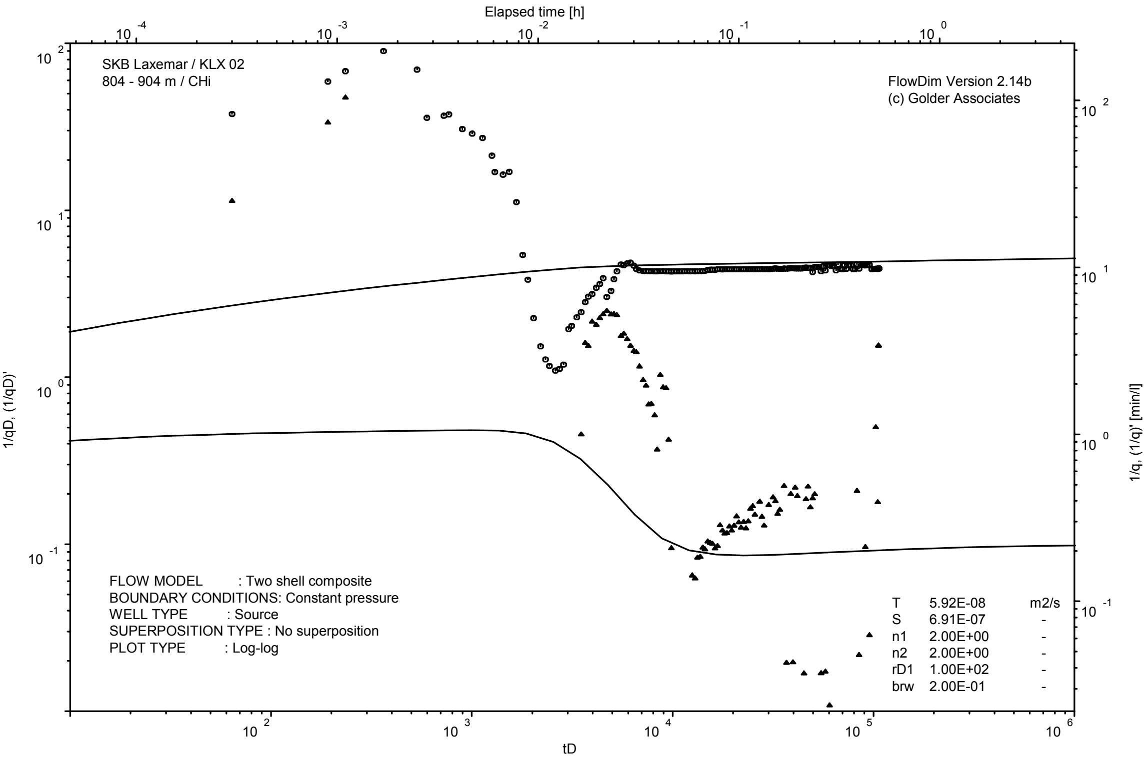
Analysis diagrams



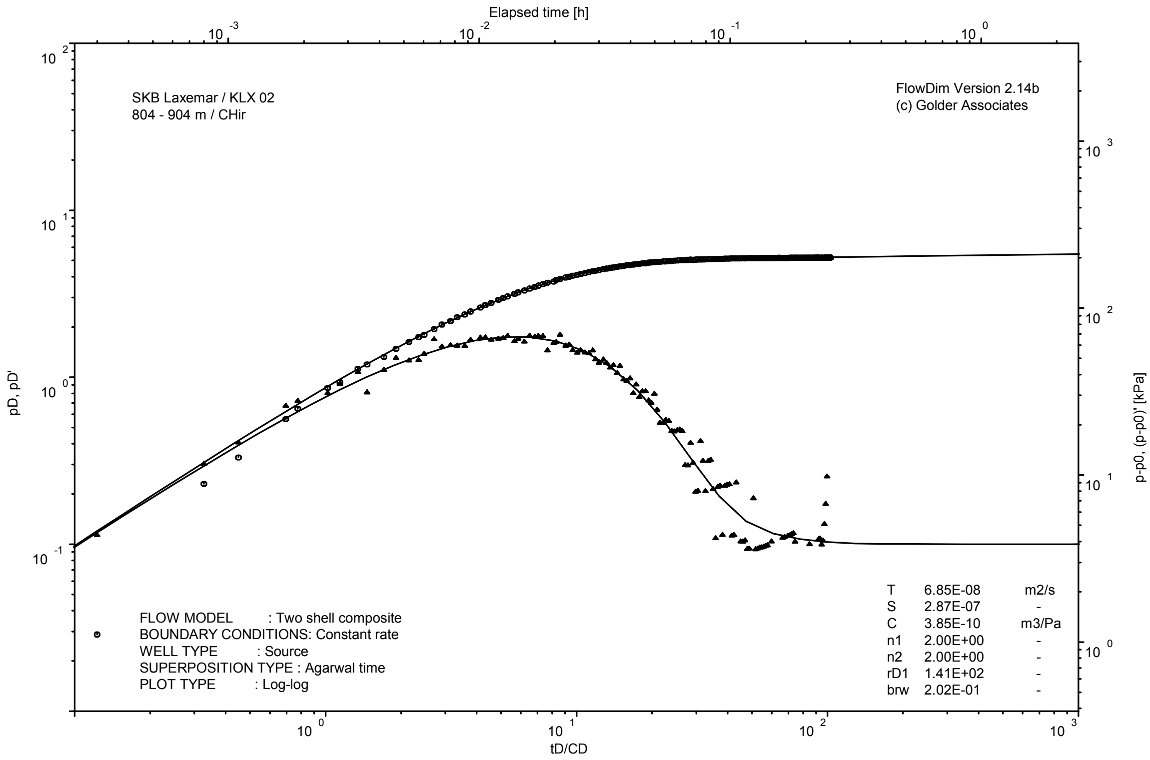
Pressure and flow rate vs. time; cartesian plot



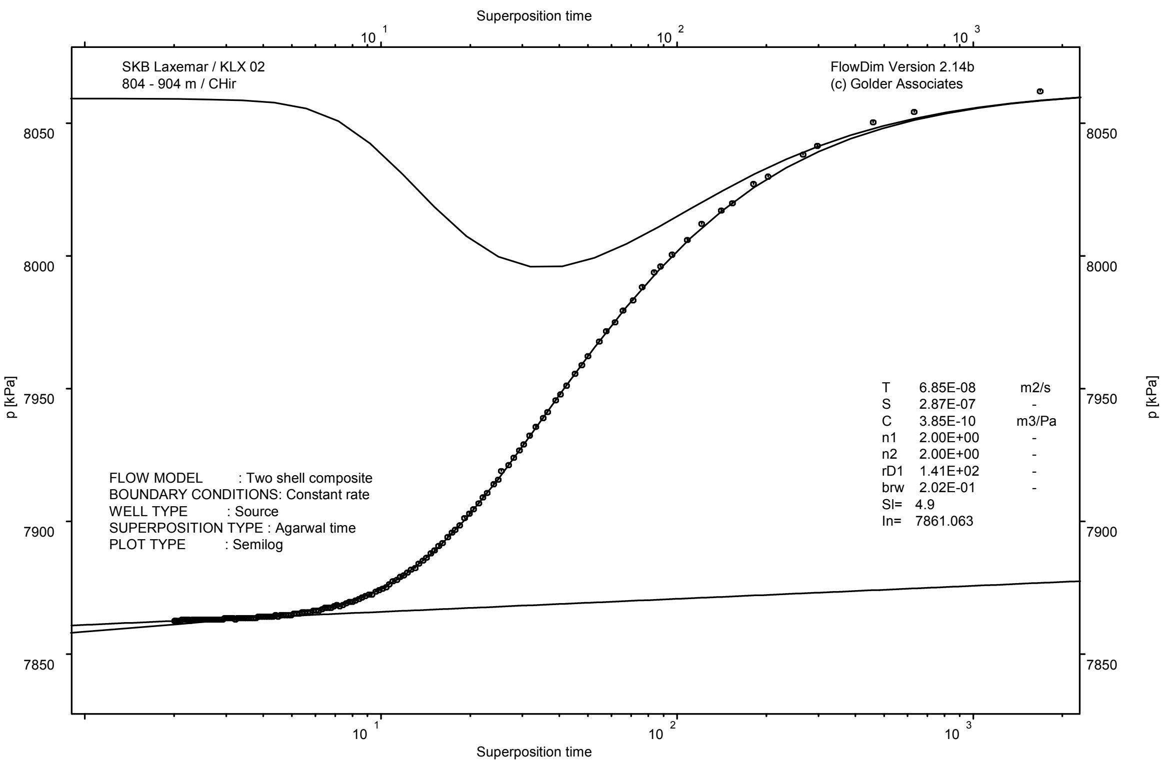
Pressure and temperature in the test section; cartesian plot



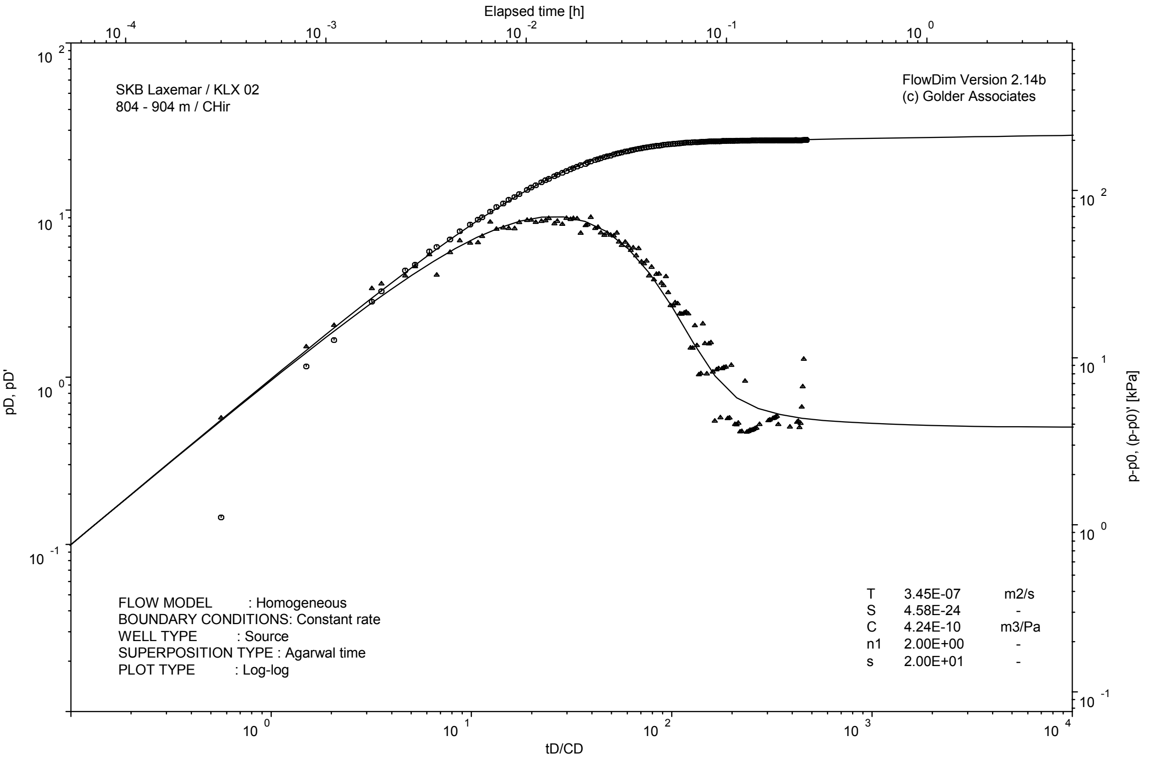
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

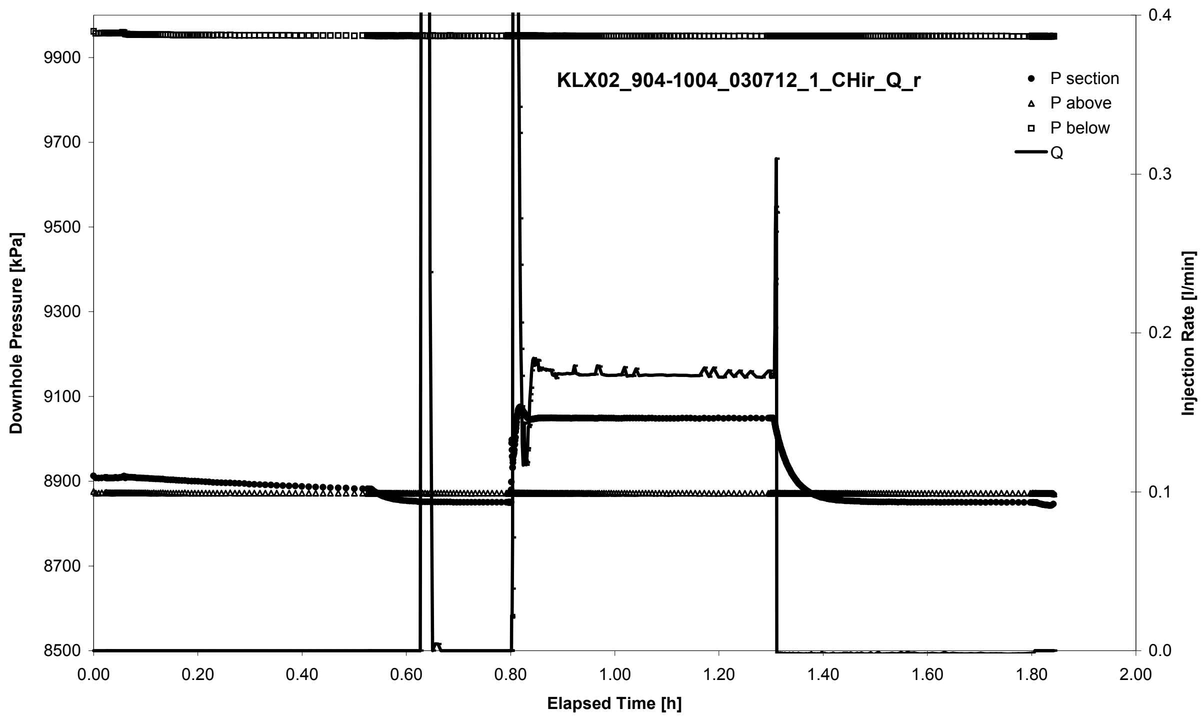


CHIR phase; Homogeneous model analyses, log-log match

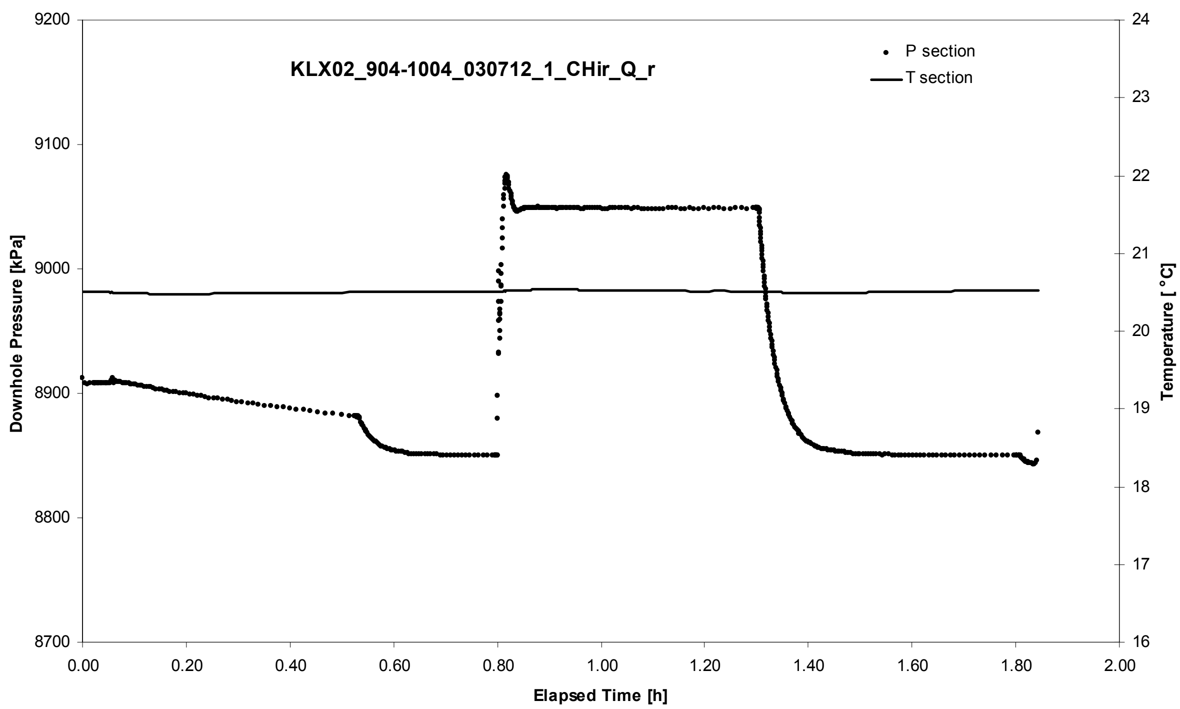
APPENDIX 2-8

Test 904 – 1004 m

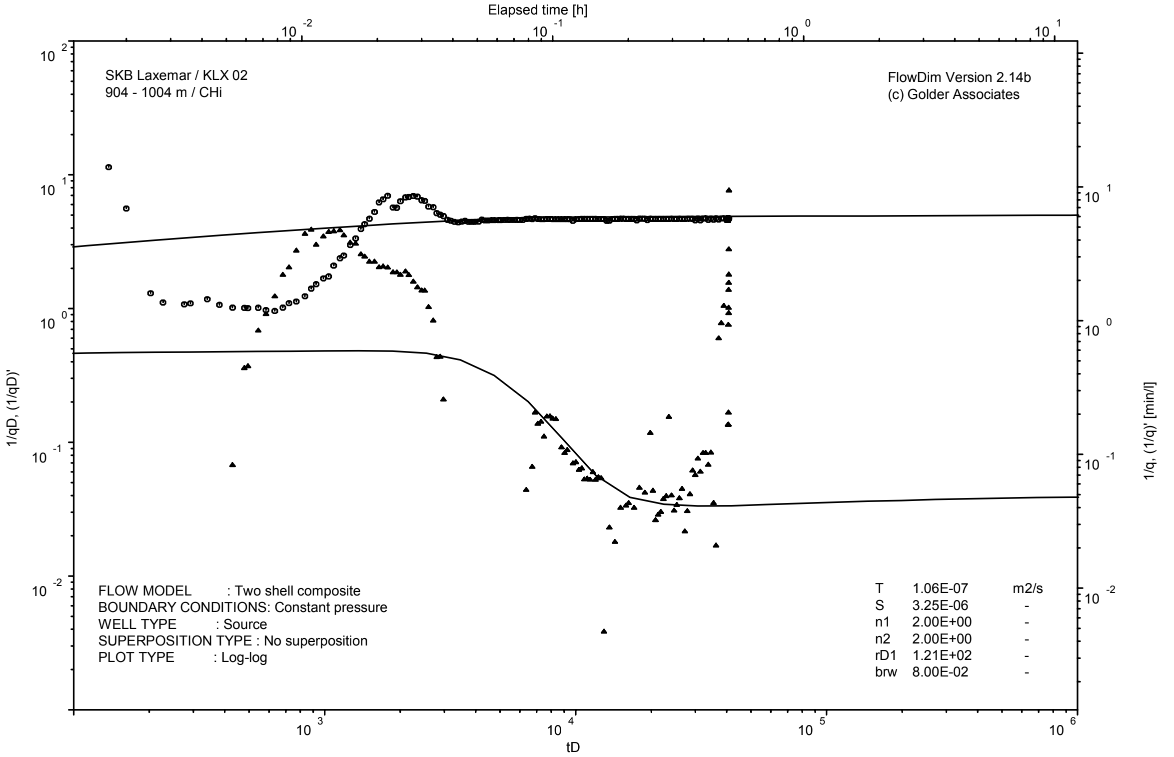
Analysis diagrams



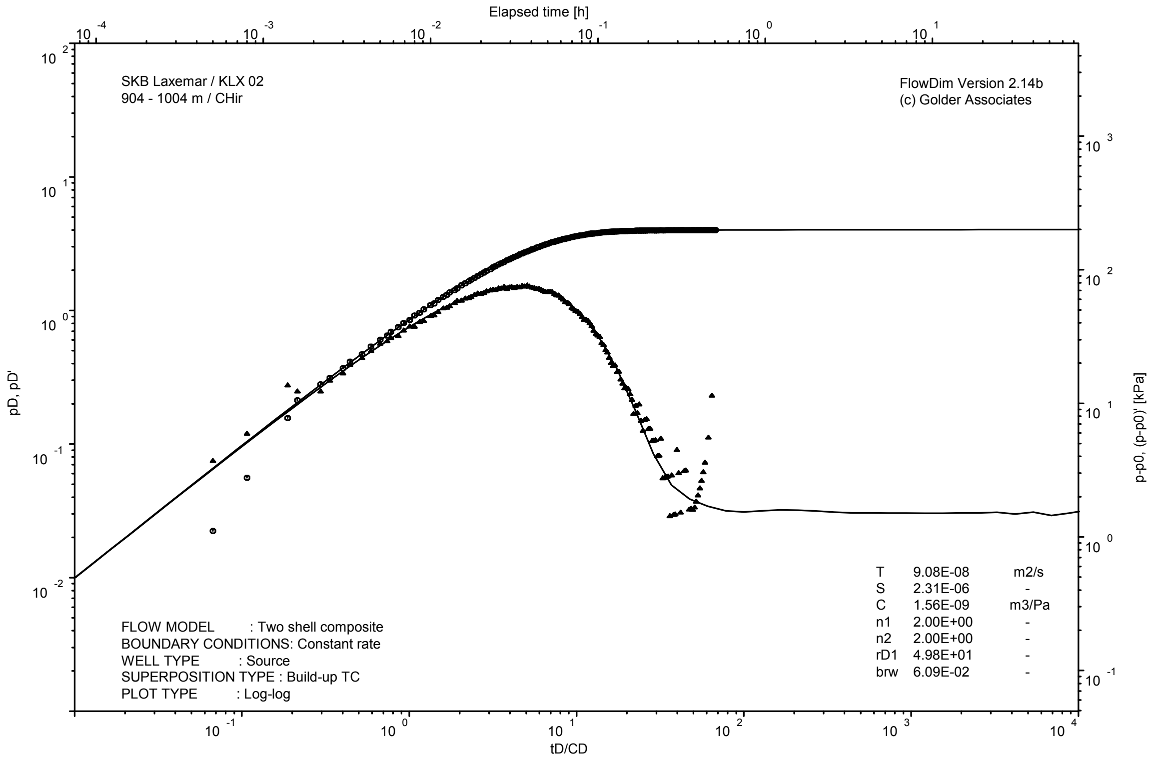
Pressure and flow rate vs. time; cartesian plot



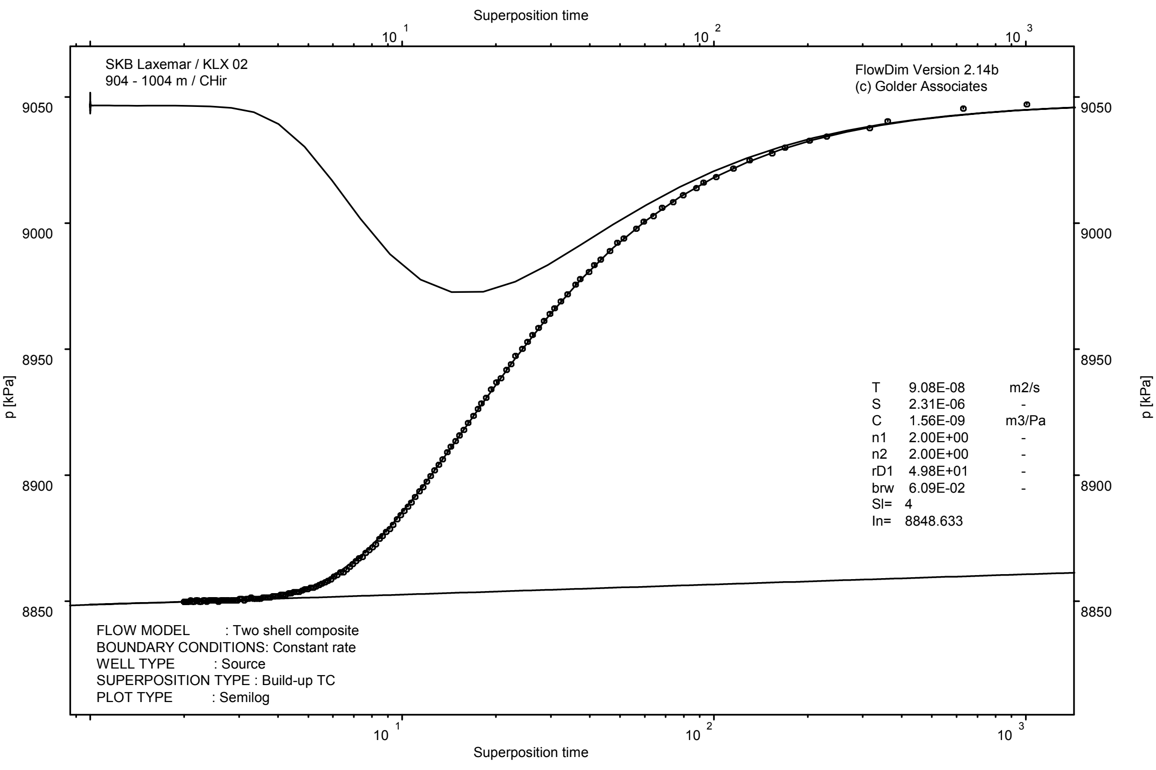
Pressure and temperature in the test section; cartesian plot



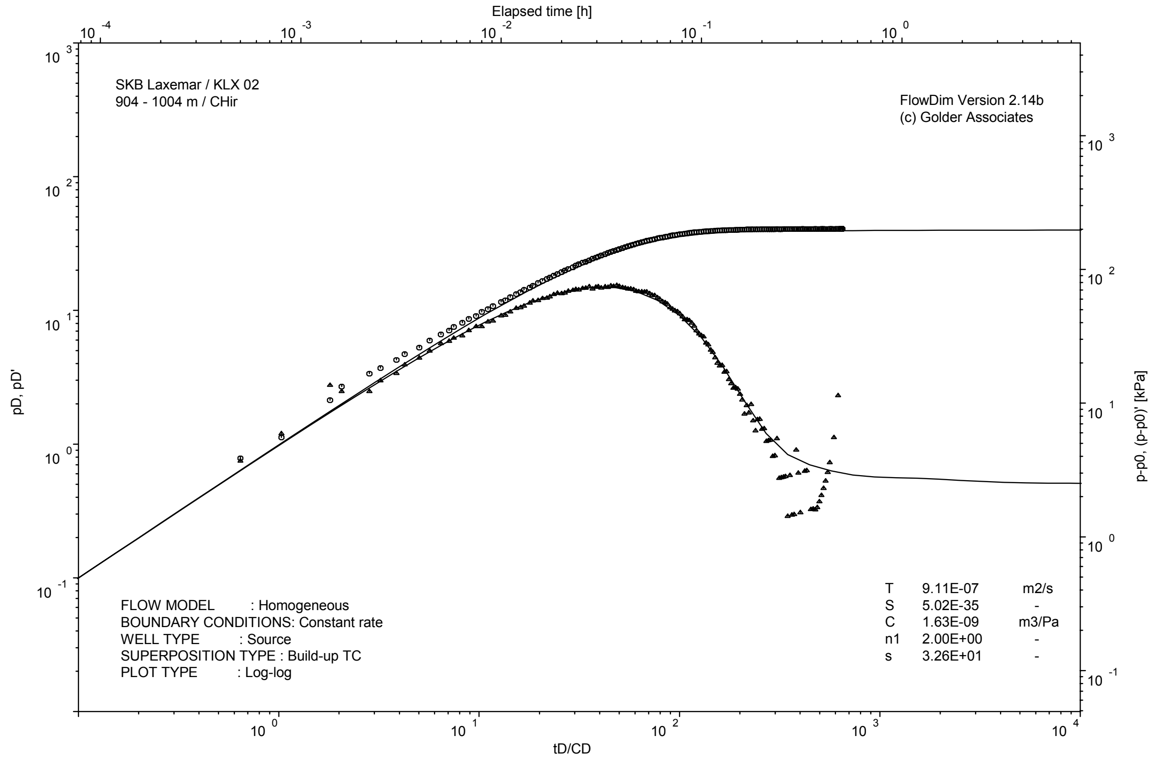
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

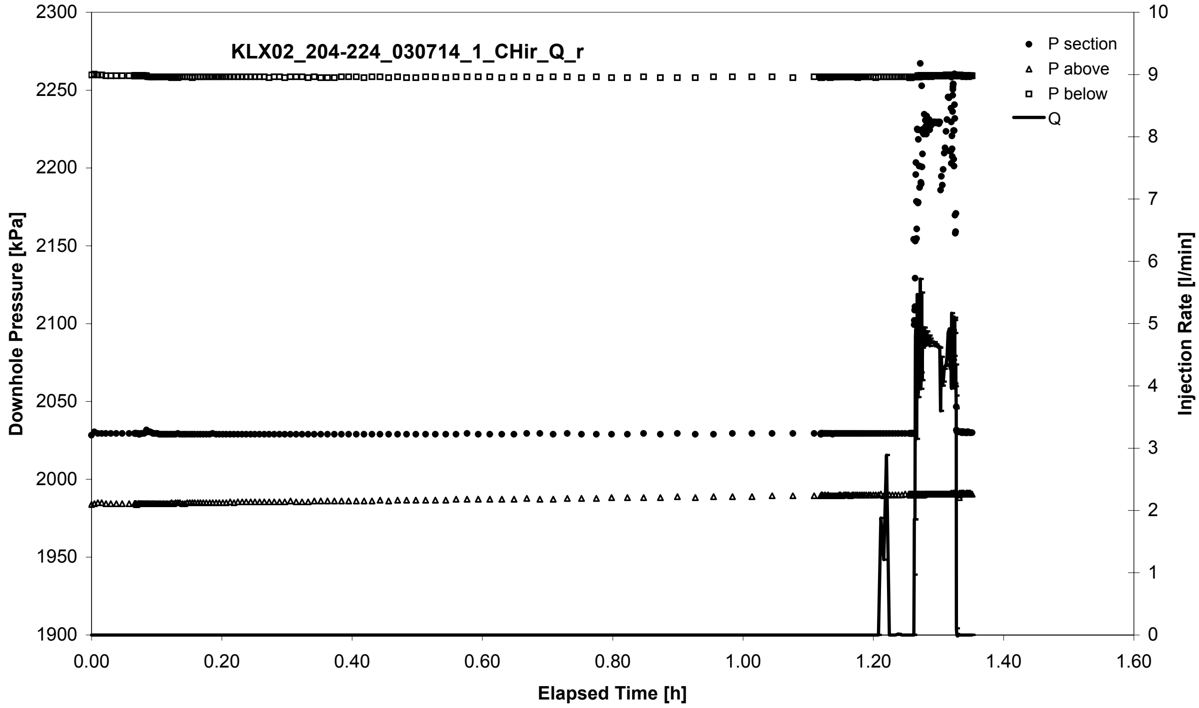


CHIR phase; Homogeneous model analyses, log-log match

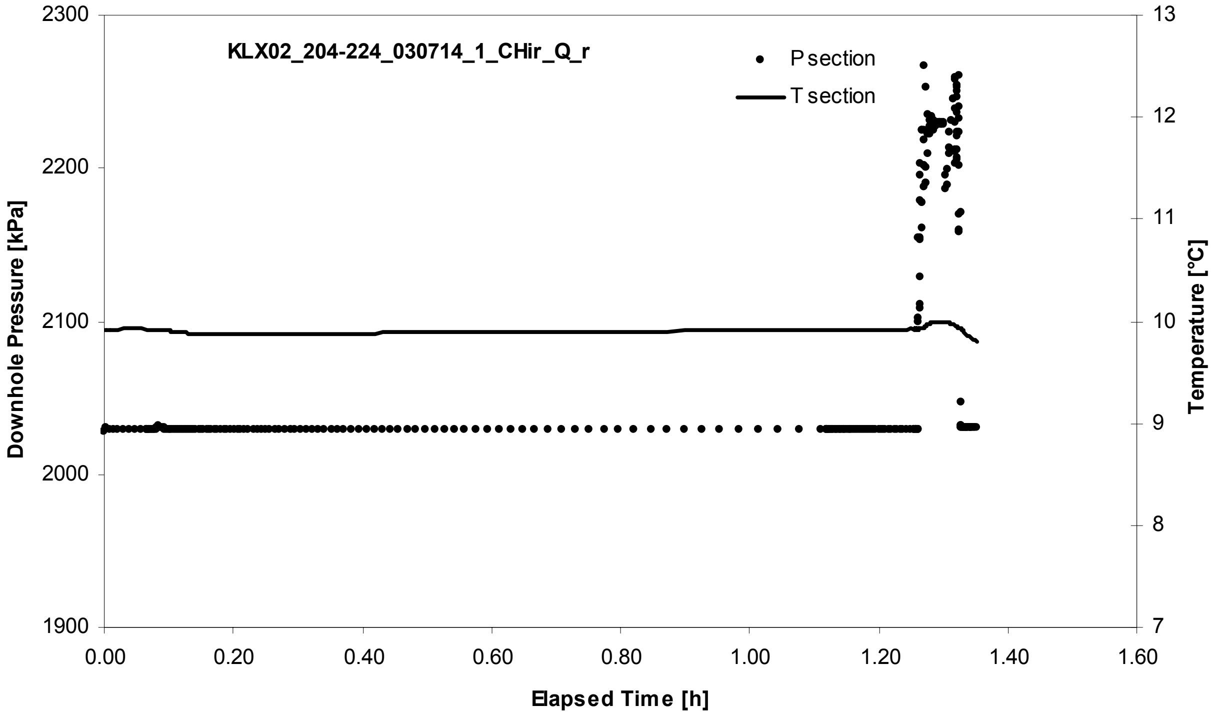
APPENDIX 2-9

Test 204 – 224 m

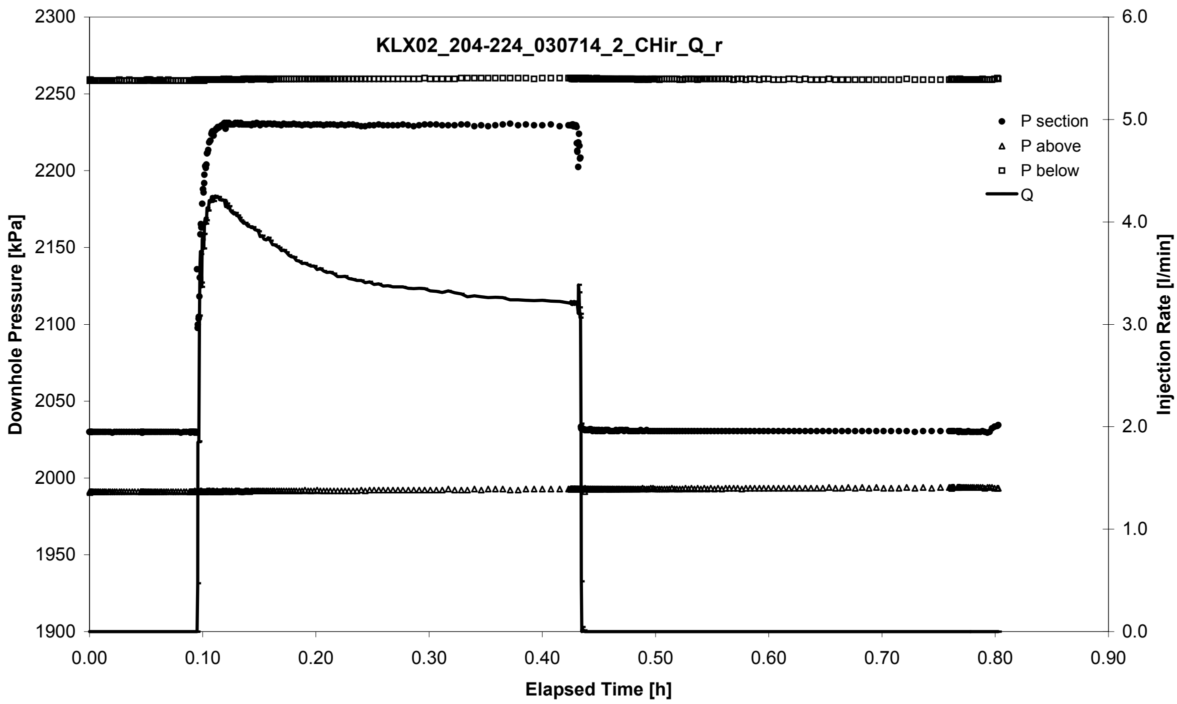
Analysis diagrams



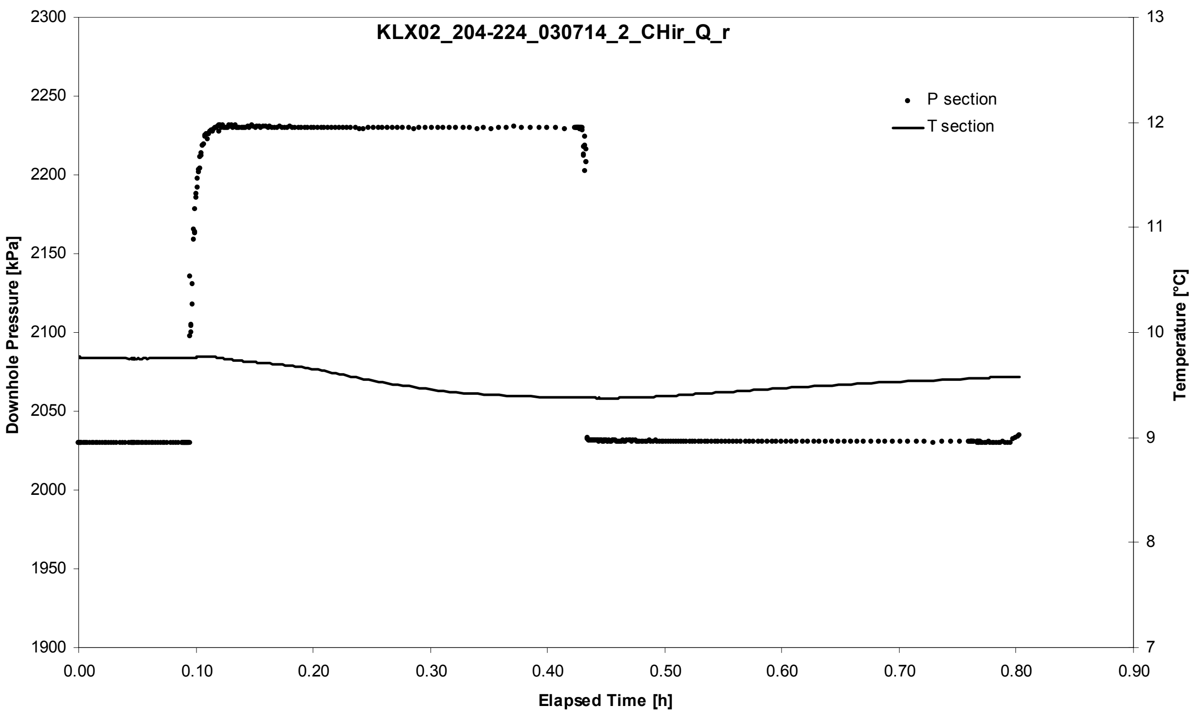
Pressure and flow rate vs. time; cartesian plot (test repeated)



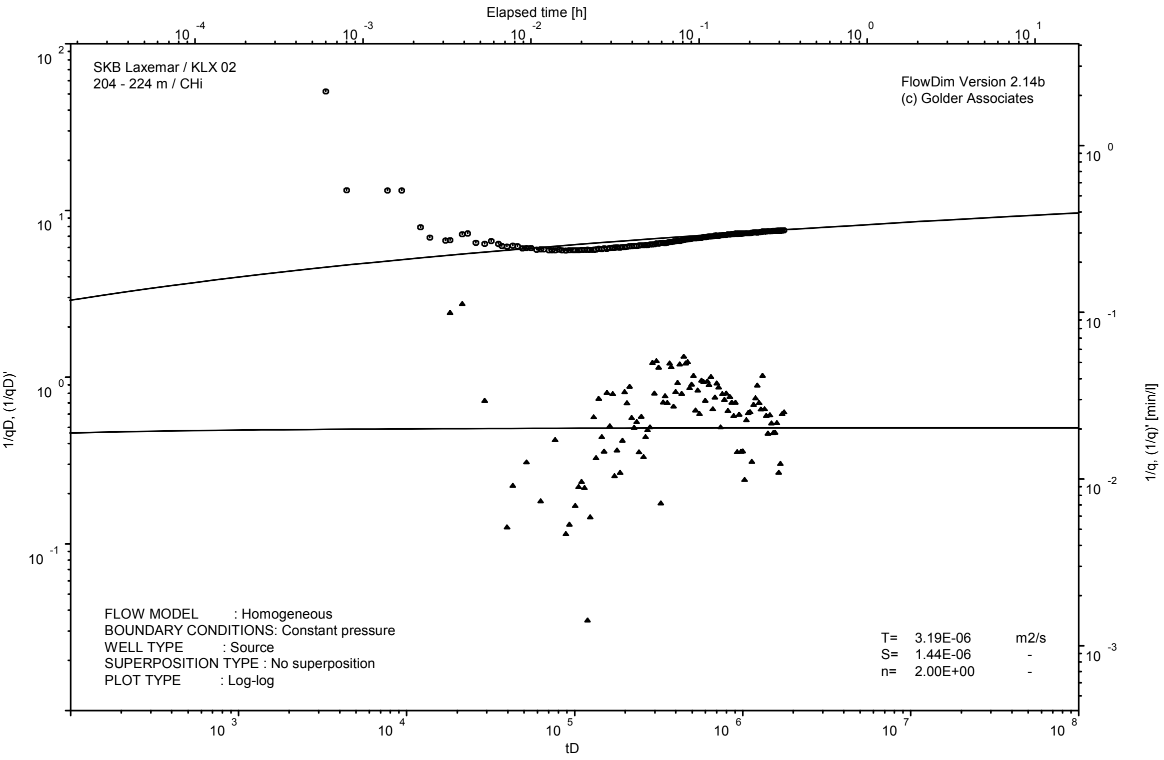
Pressure and temperature in the test section; cartesian plot (test repeated)



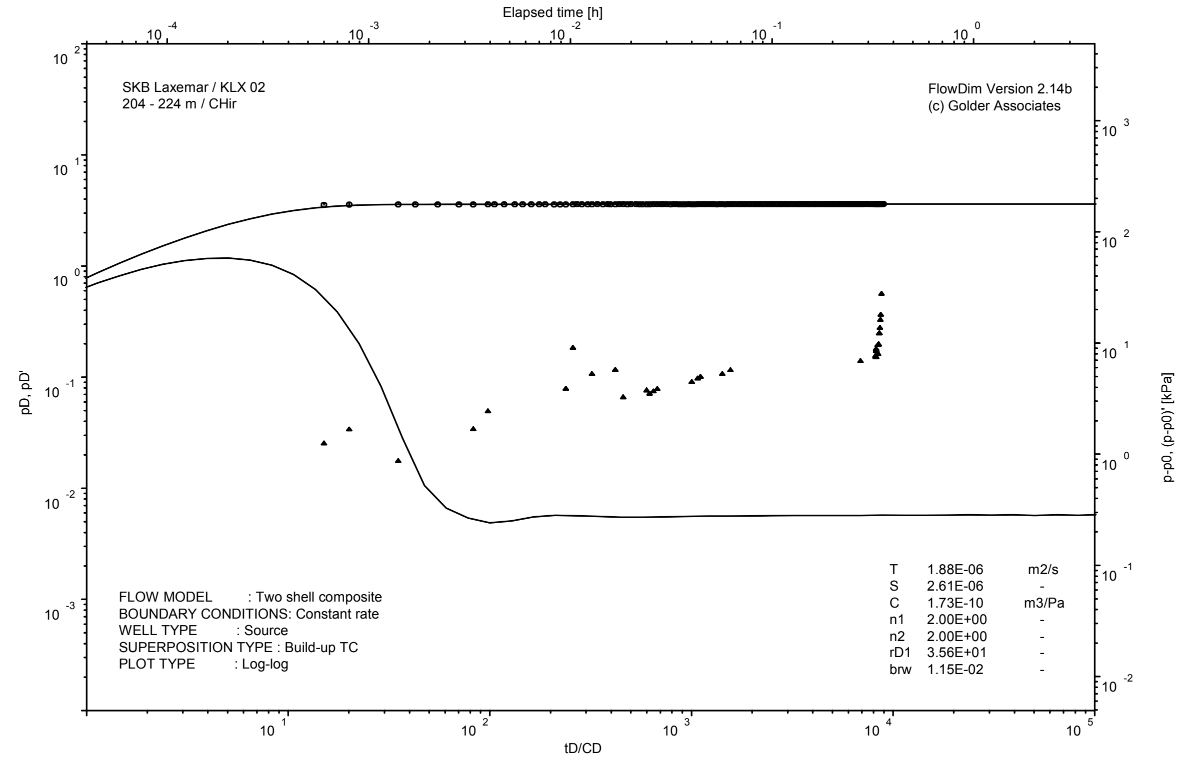
Pressure and flow rate vs. time; cartesian plot (analysed)



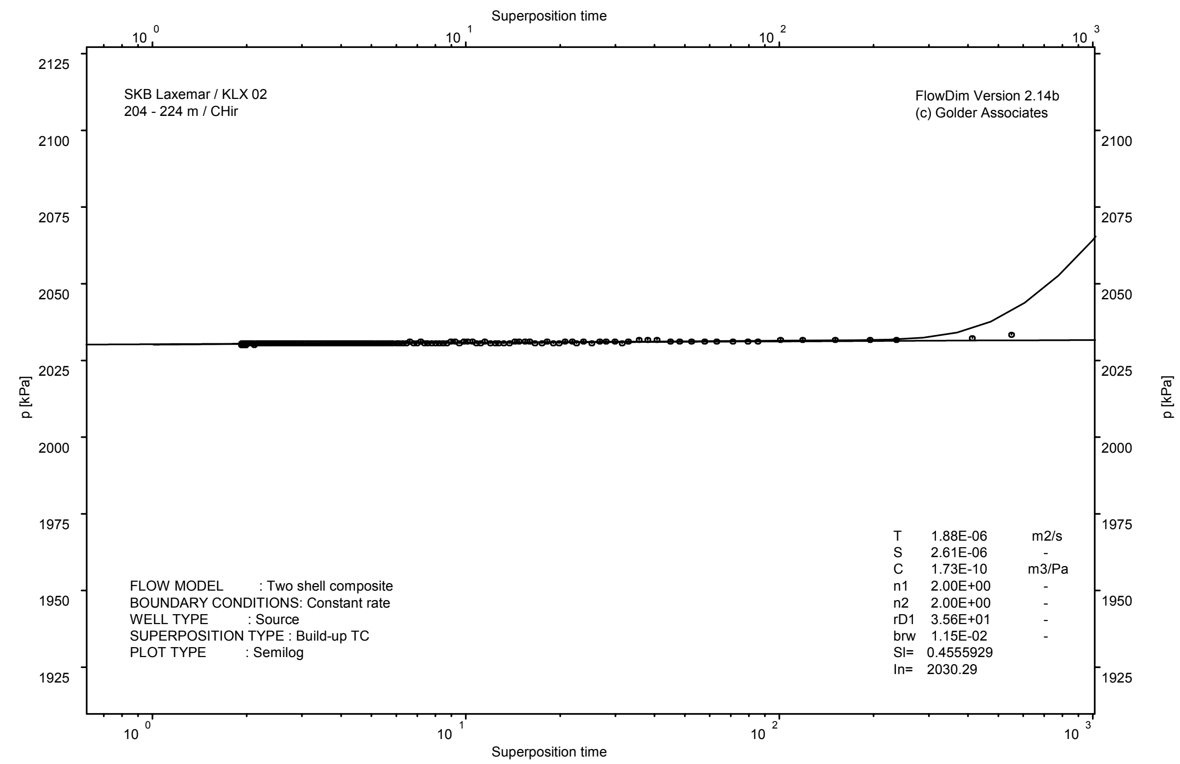
Pressure and temperature in the test section; cartesian plot (analysed)



CHI phase; log-log match



CHIR phase; log-log match

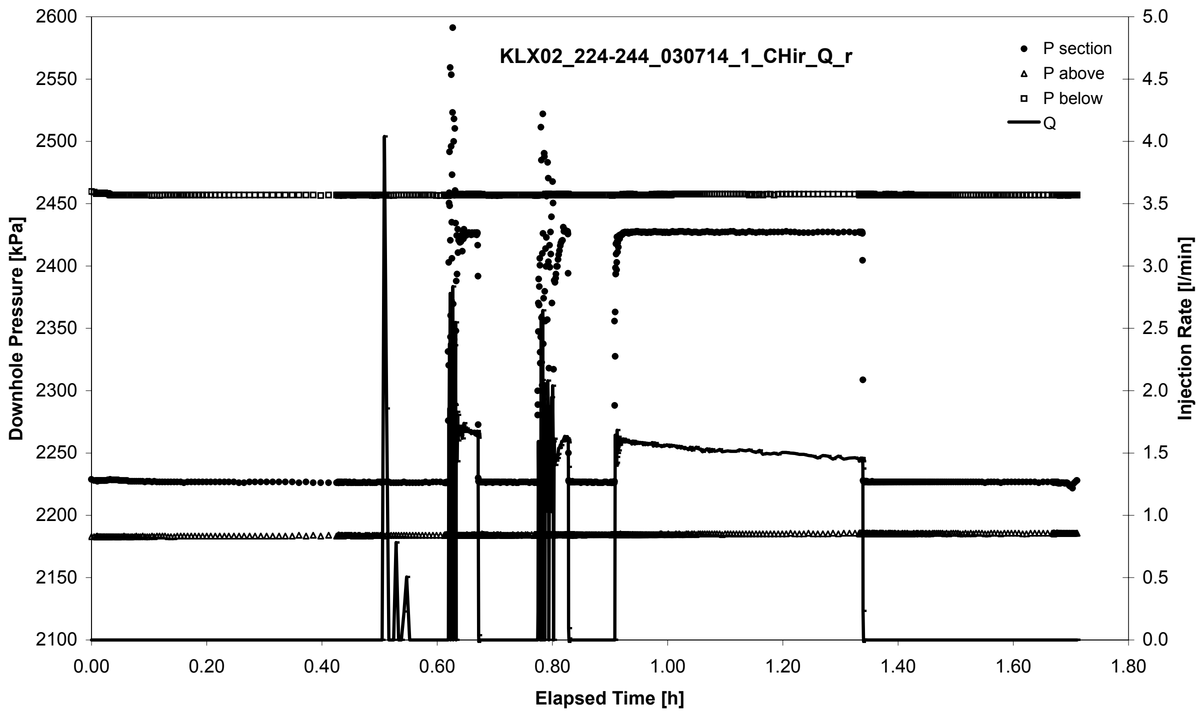


CHIR phase; HORNER match

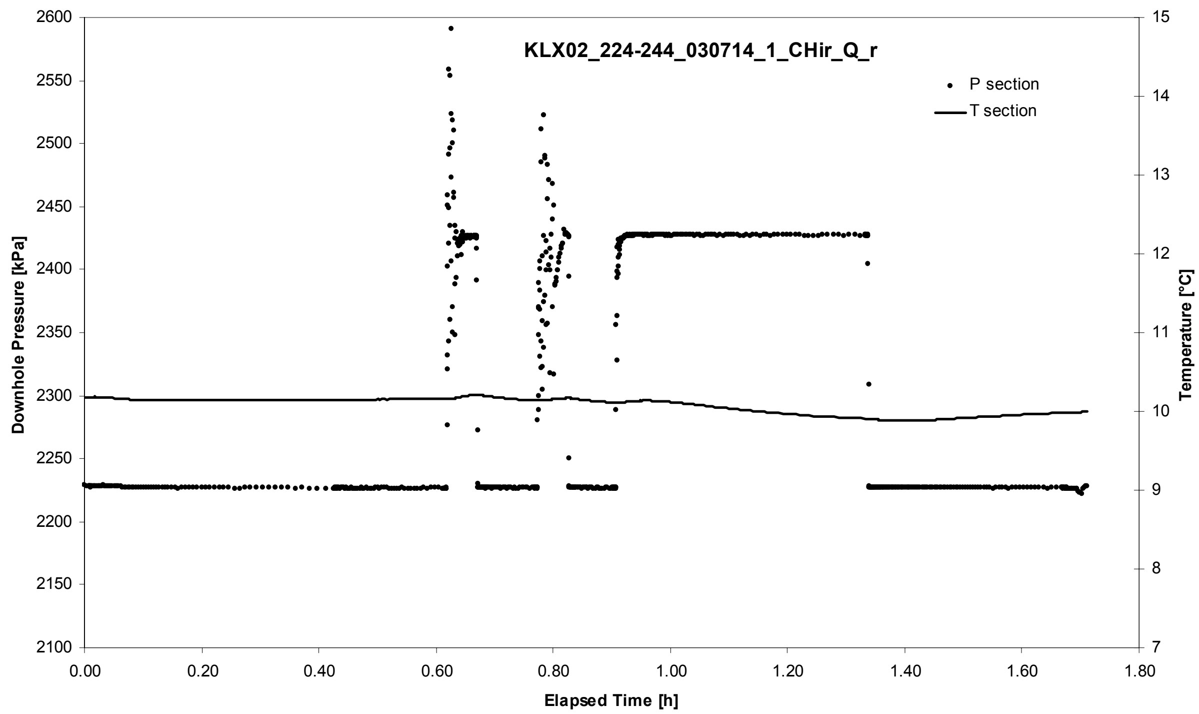
APPENDIX 2-10

Test 224 – 244 m

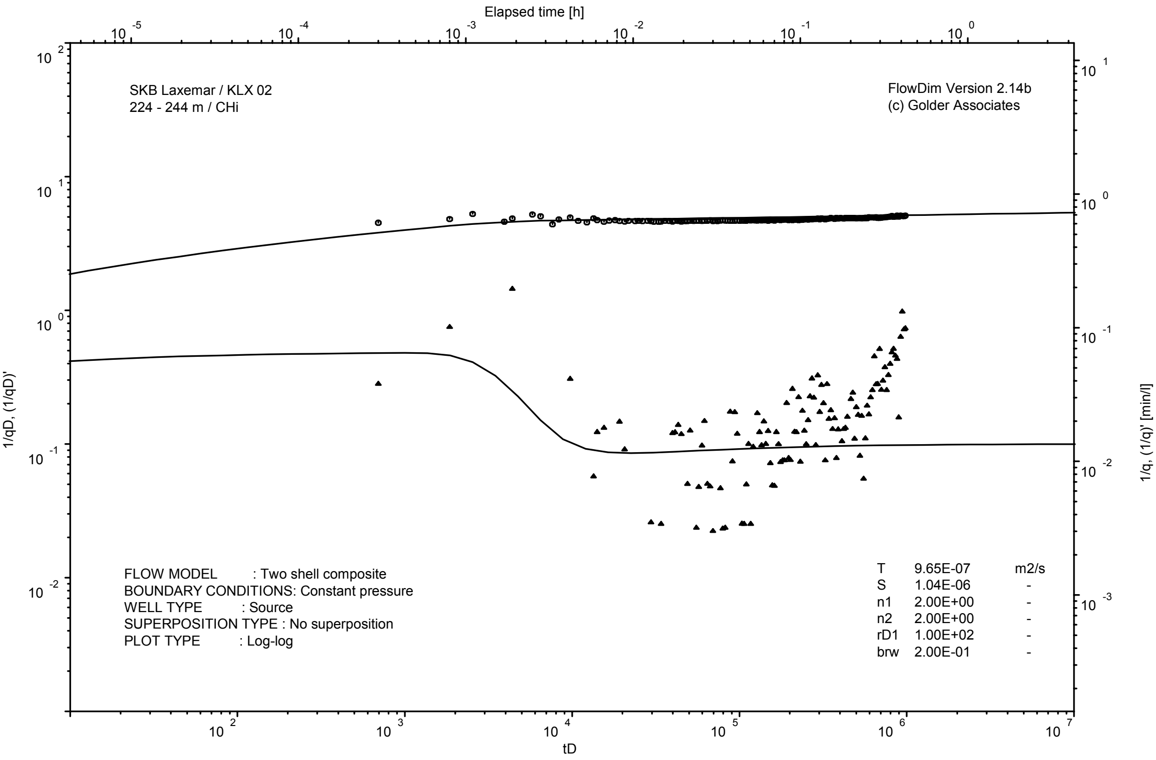
Analysis diagrams



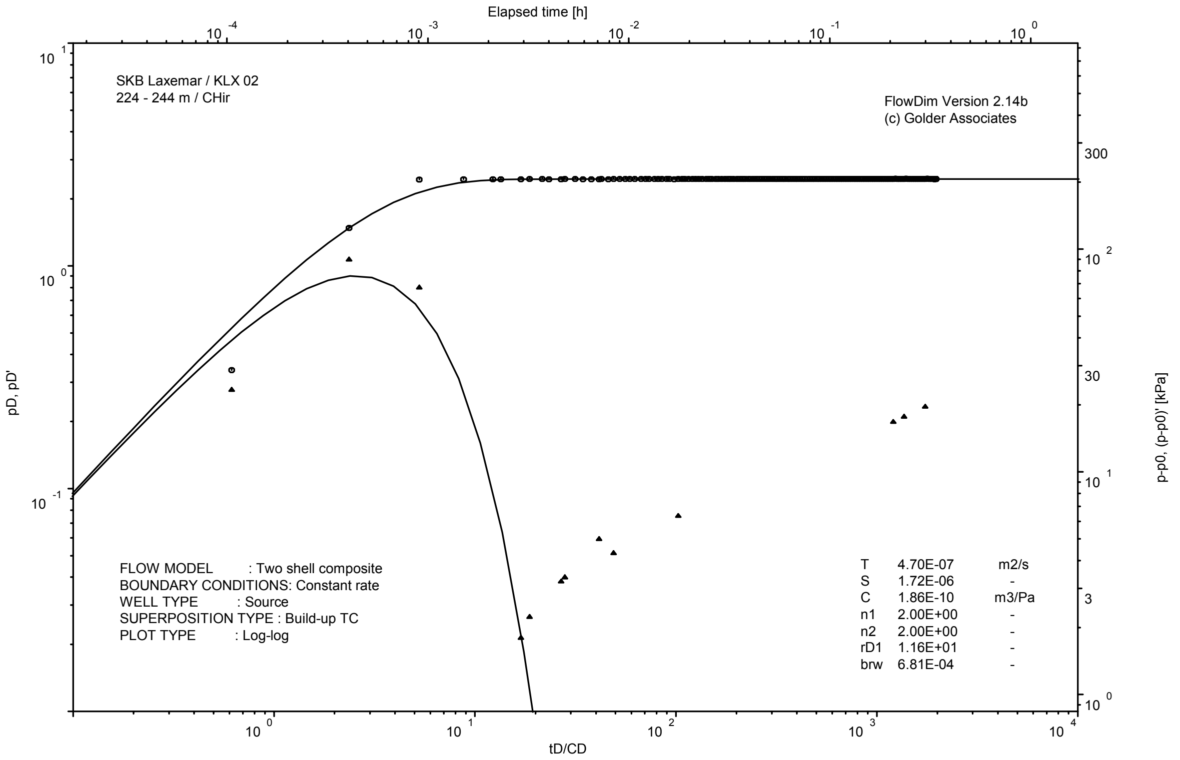
Pressure and flow rate vs. time; cartesian plot



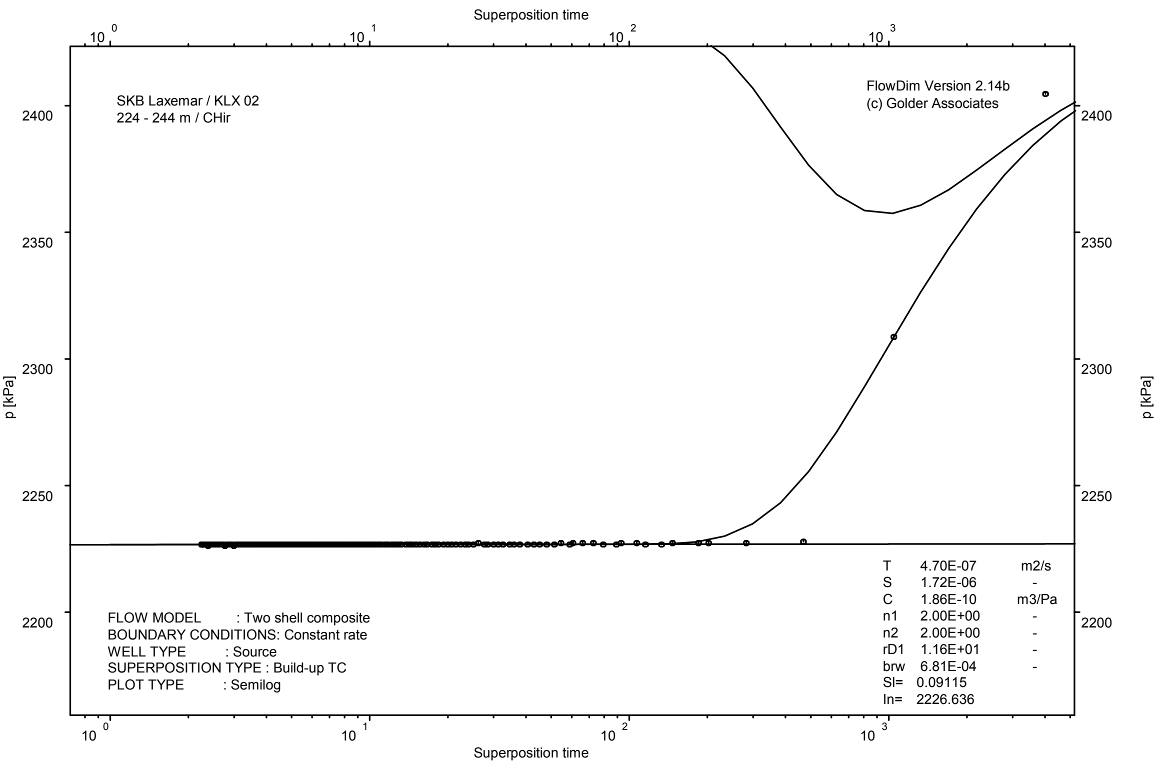
Pressure and temperature in the test section; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

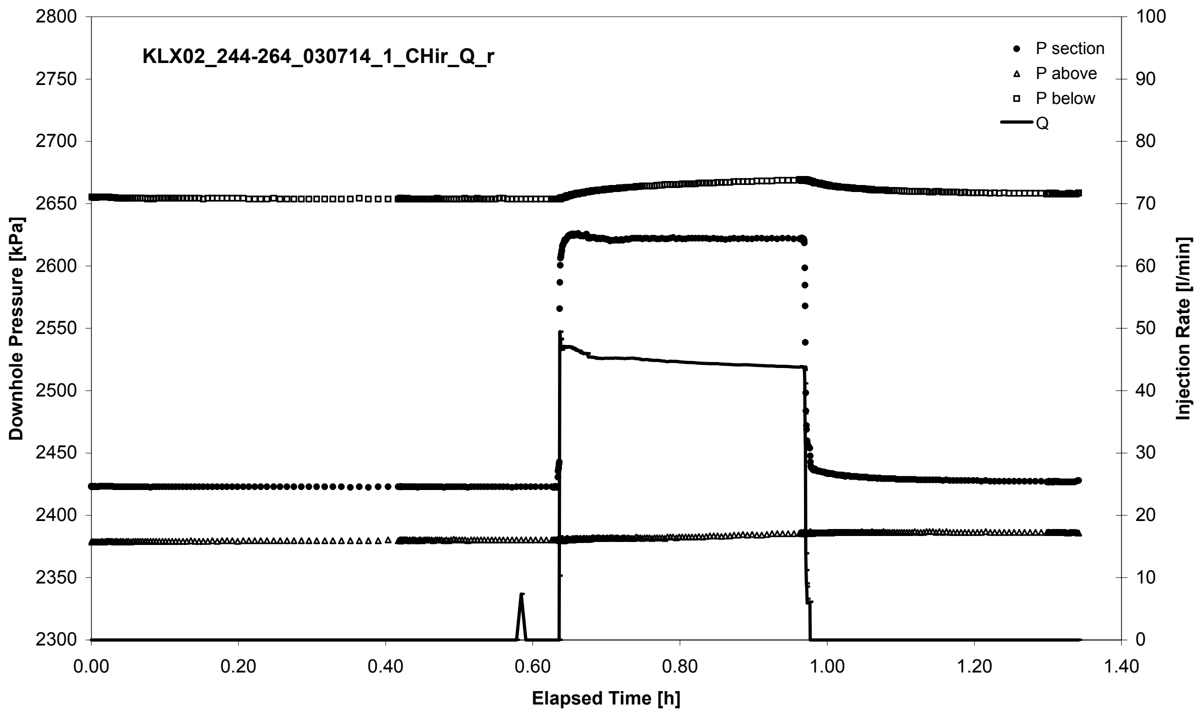


CHIR phase; HORNER match

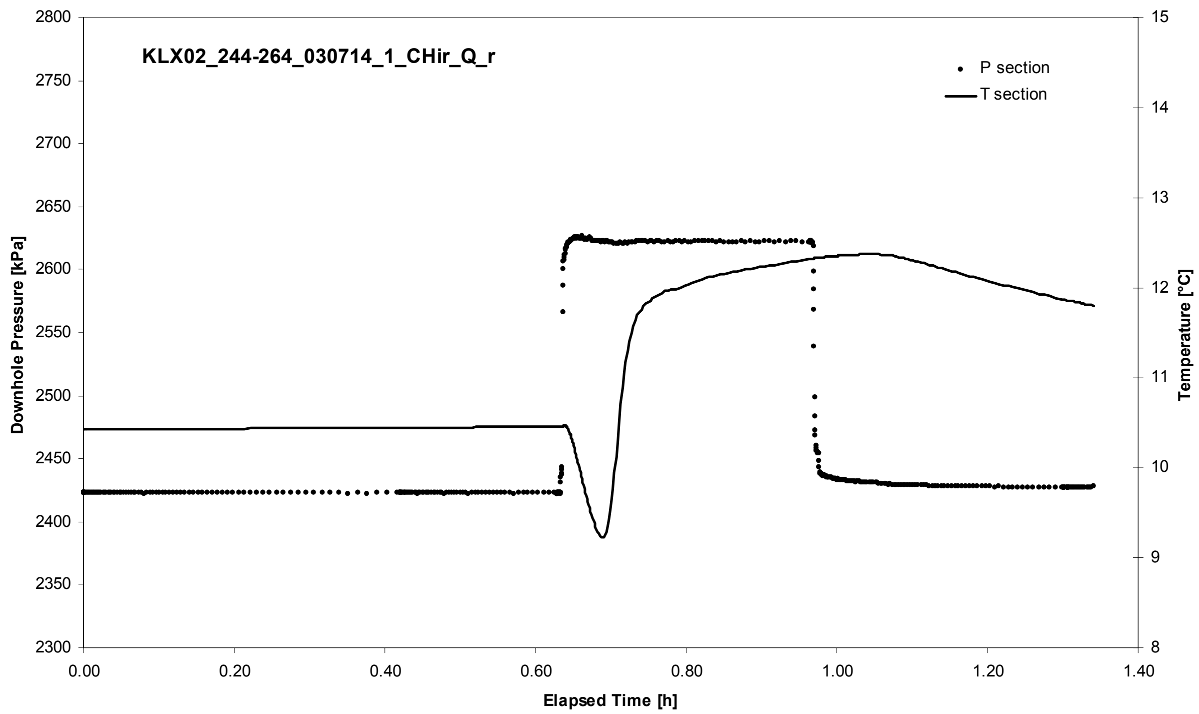
APPENDIX 2-11

Test 244 – 264 m

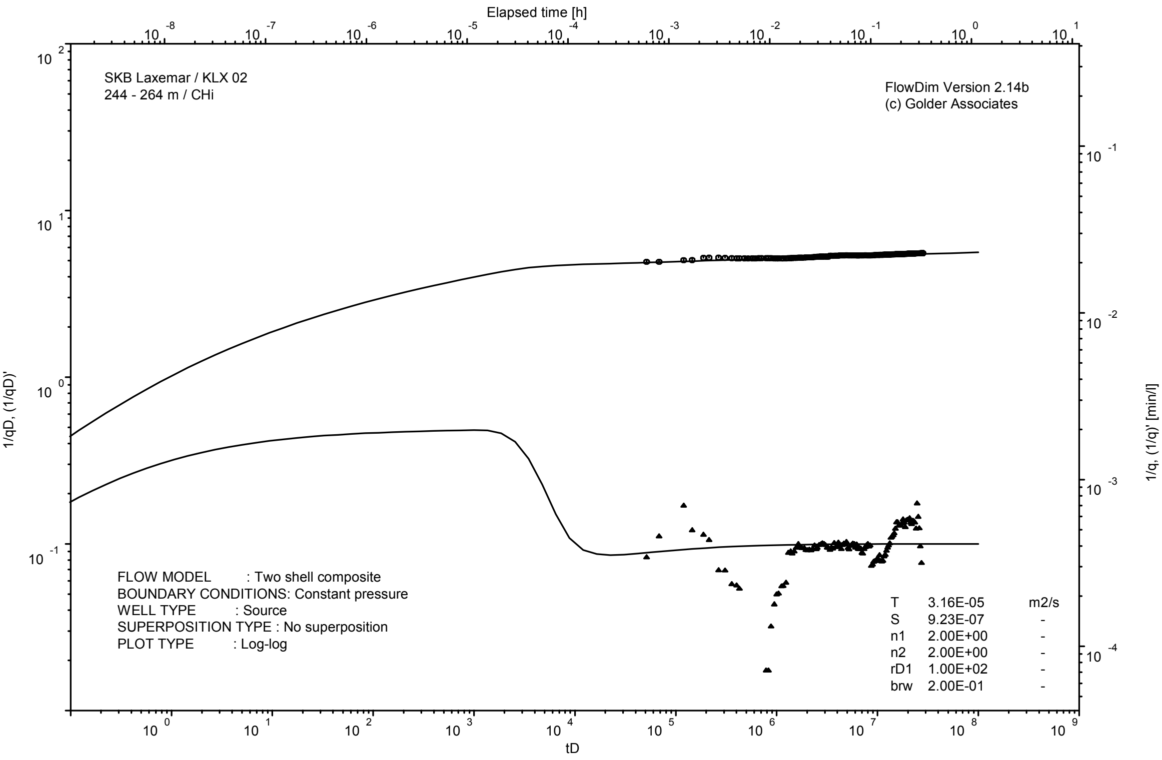
Analysis diagrams



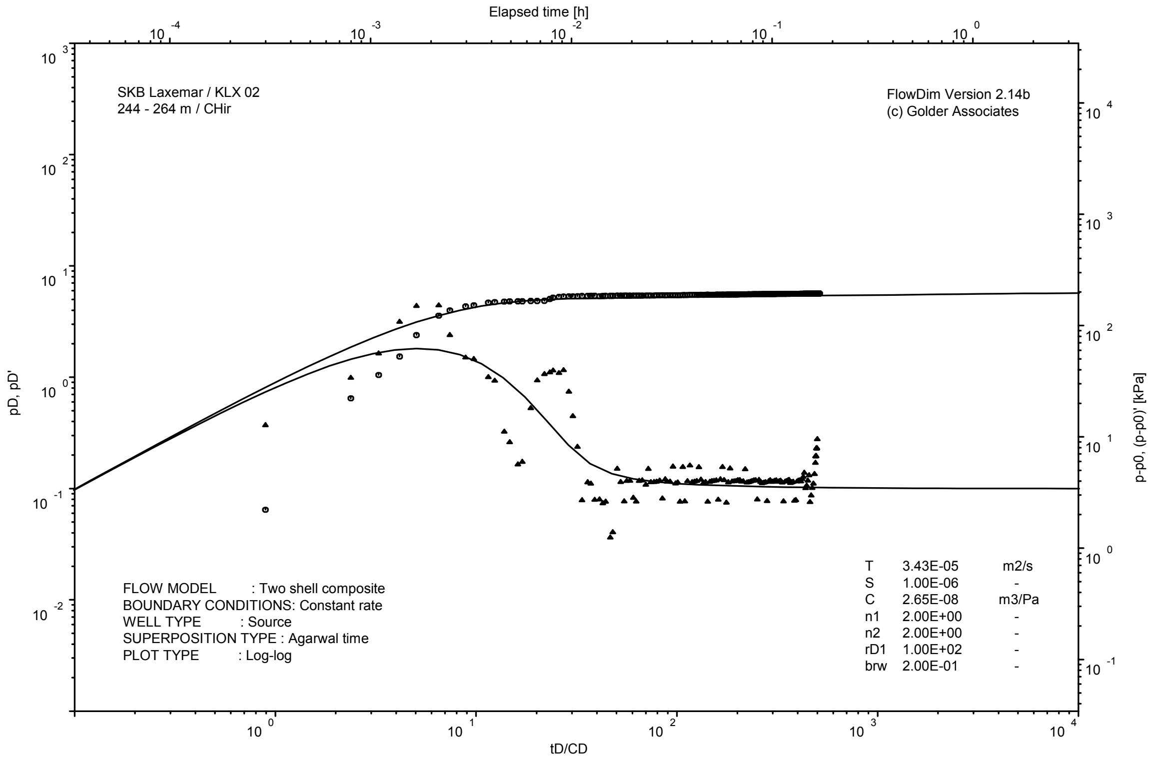
Pressure and flow rate vs. time; cartesian plot



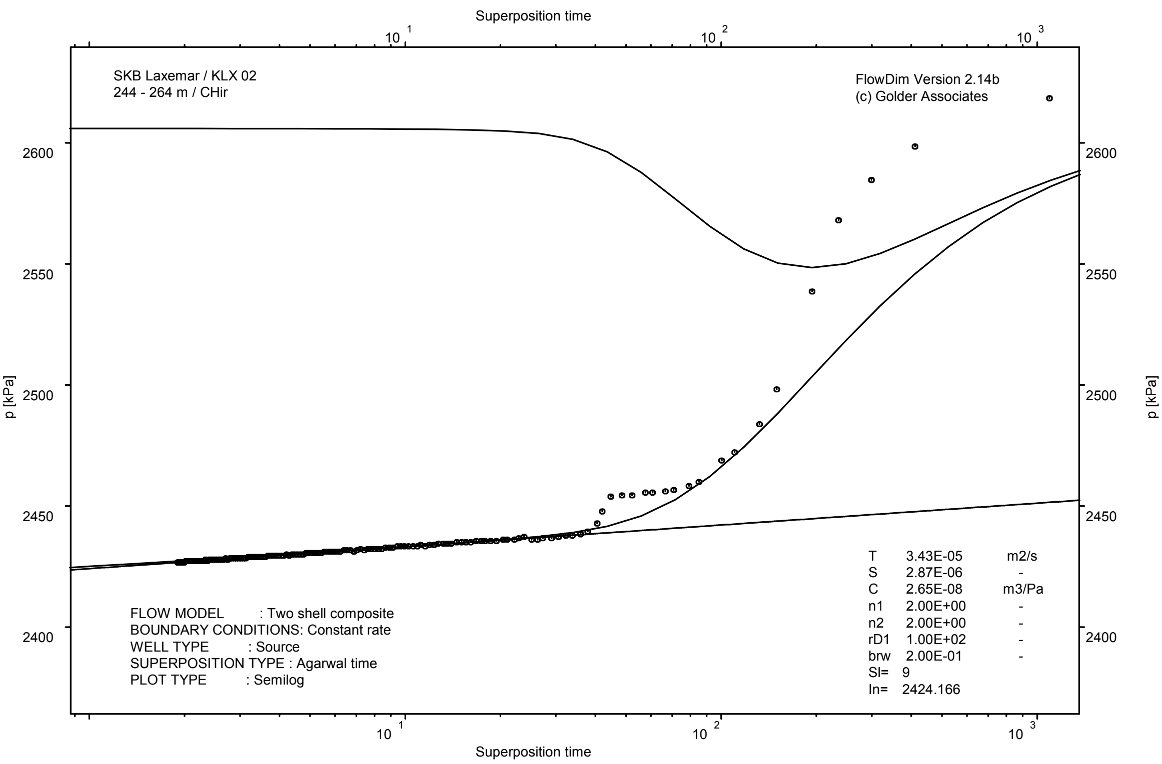
Pressure and temperature in the test section; cartesian plot



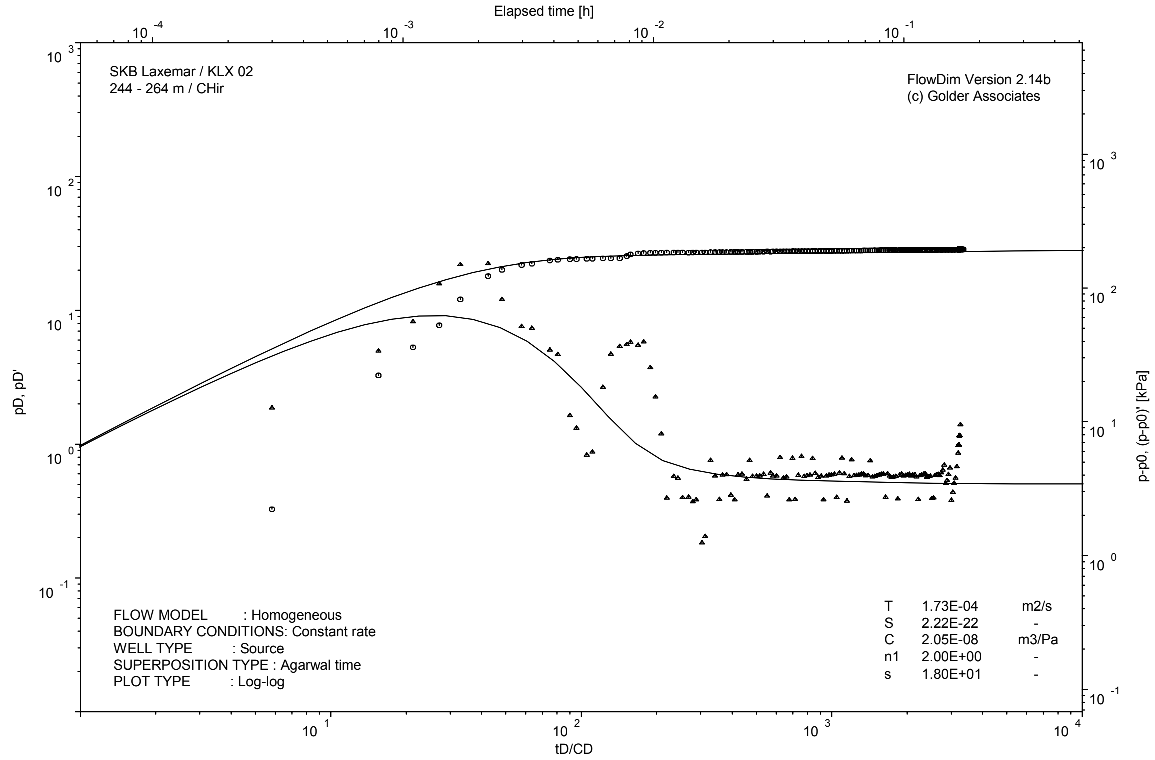
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

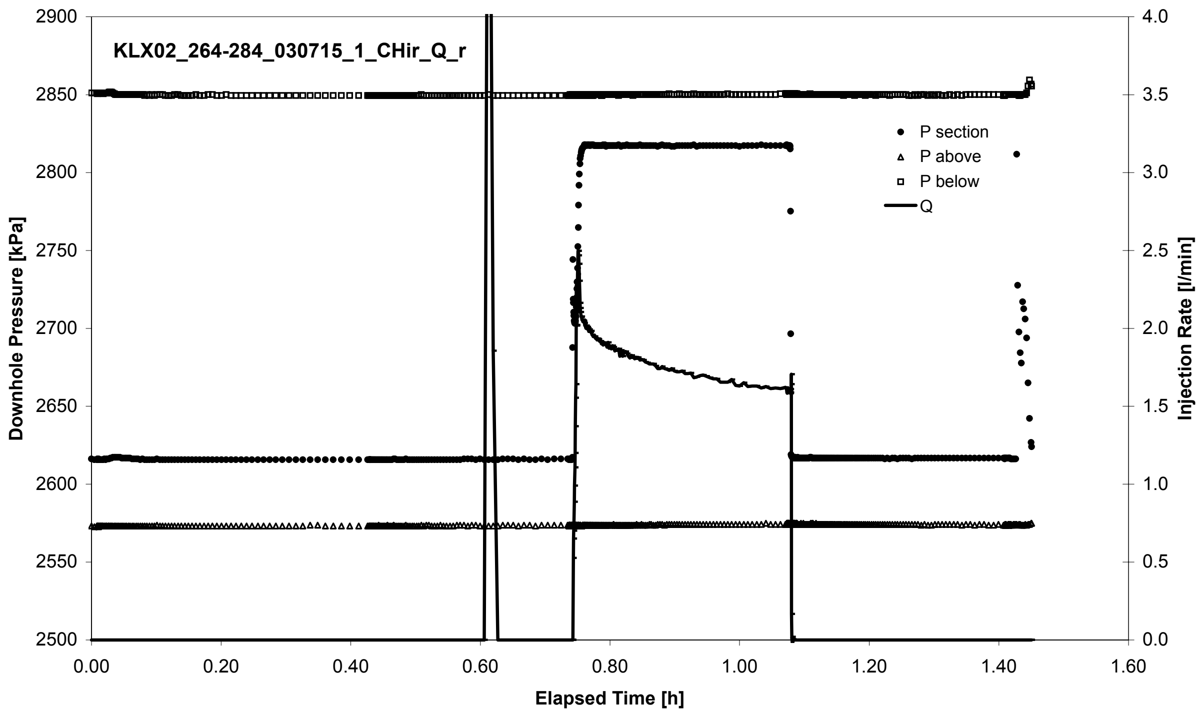


CHIR phase; Homogeneous model analyses, log-log match

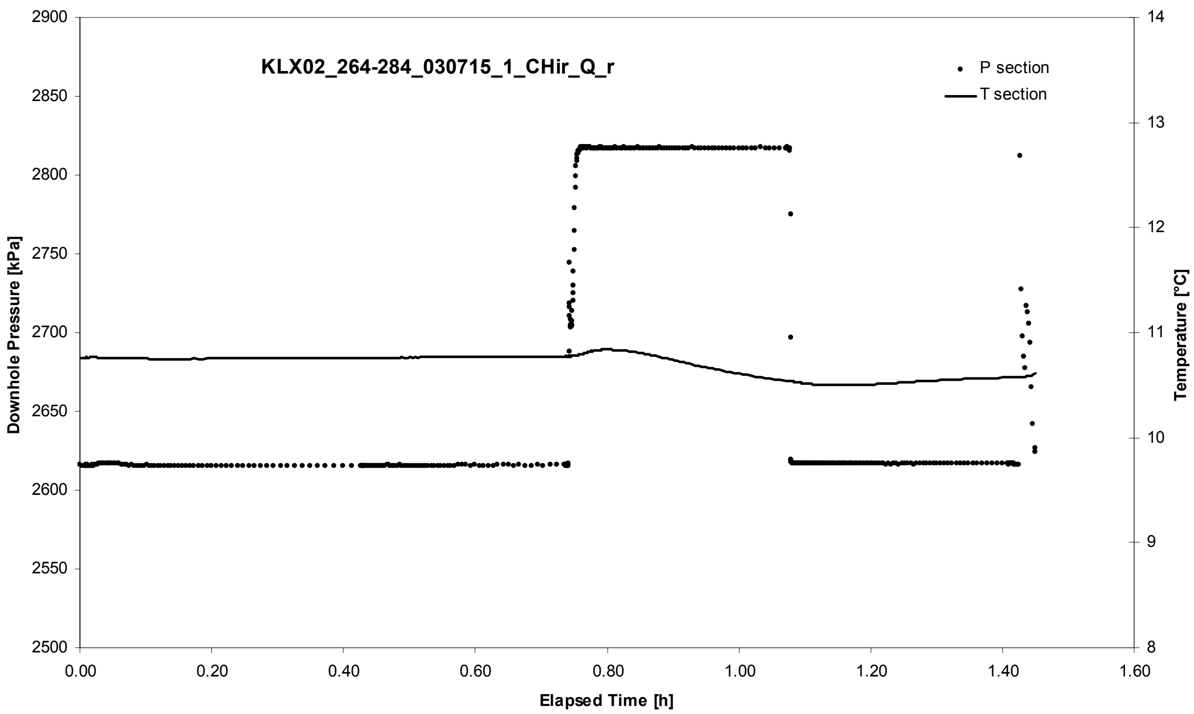
APPENDIX 2-12

Test 264 – 284 m

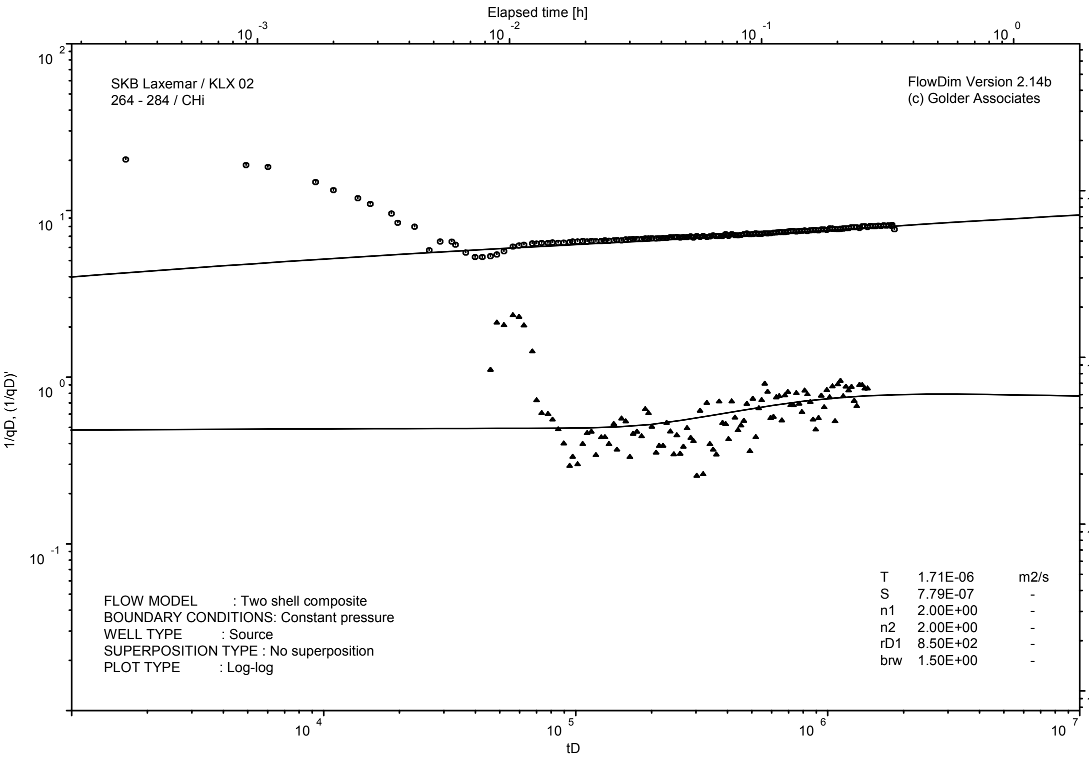
Analysis diagrams



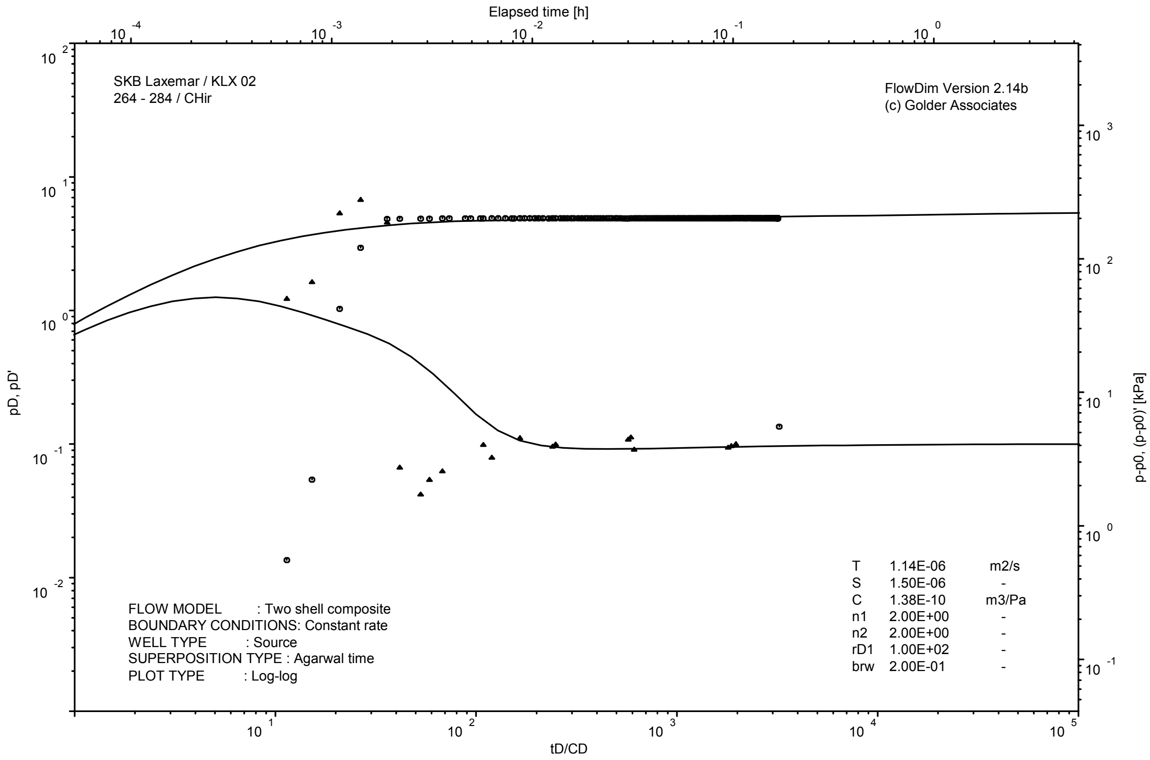
Pressure and flow rate vs. time; cartesian plot



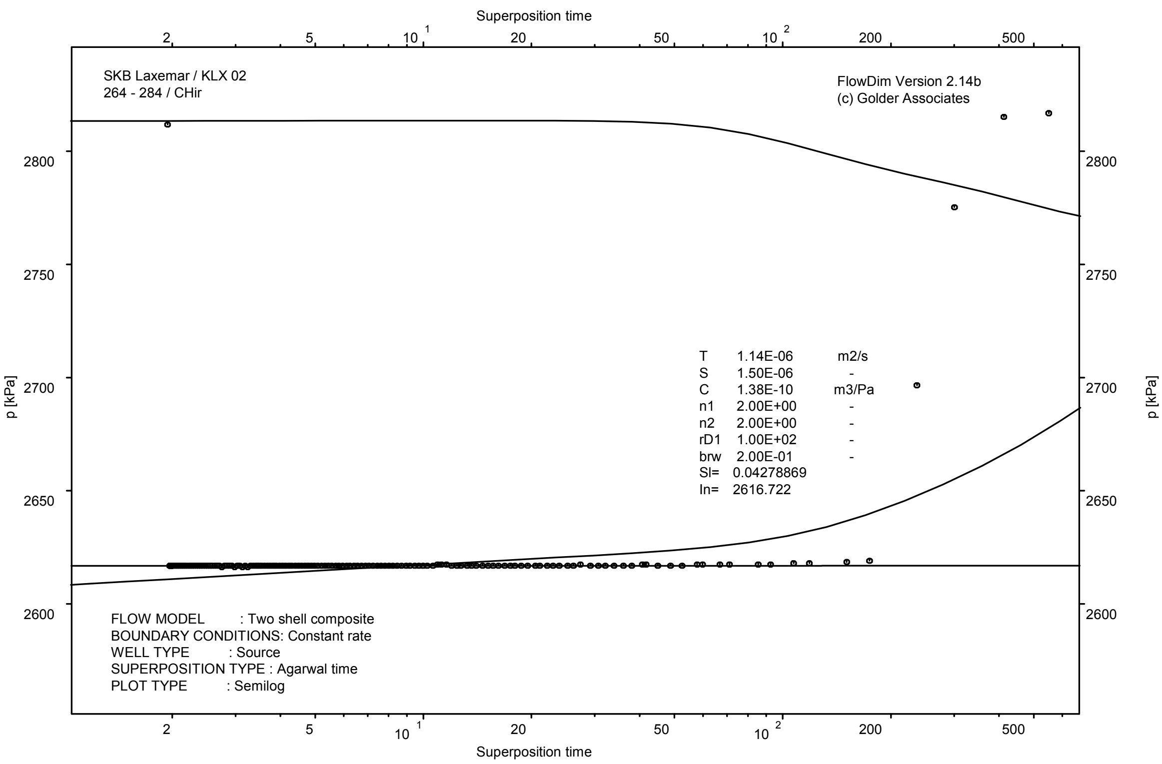
Pressure and temperature in the test section; cartesian plot



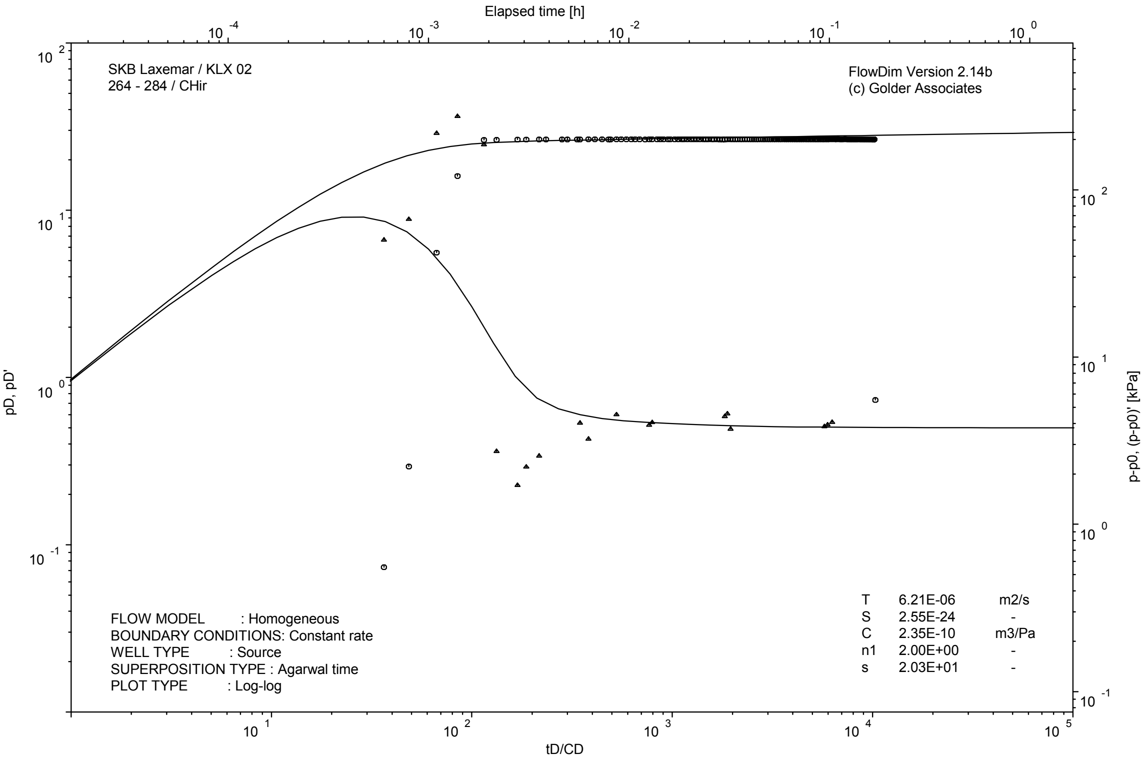
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

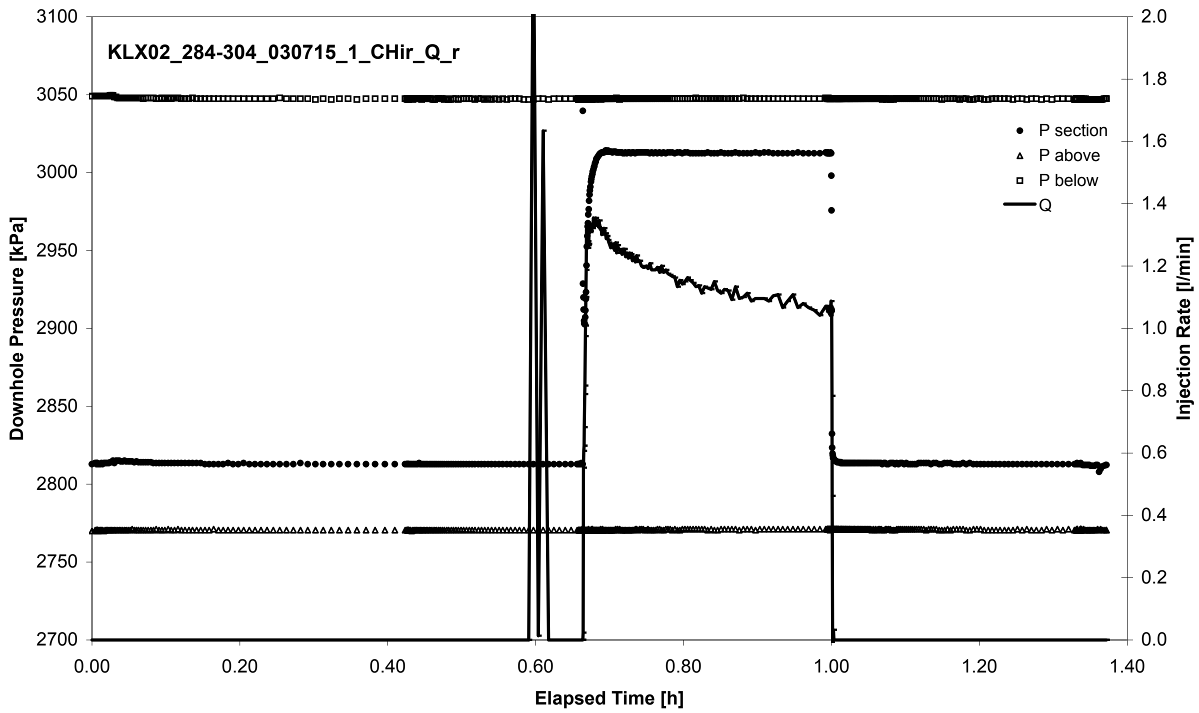


CHIR phase; Homogeneous model analyses, log-log match

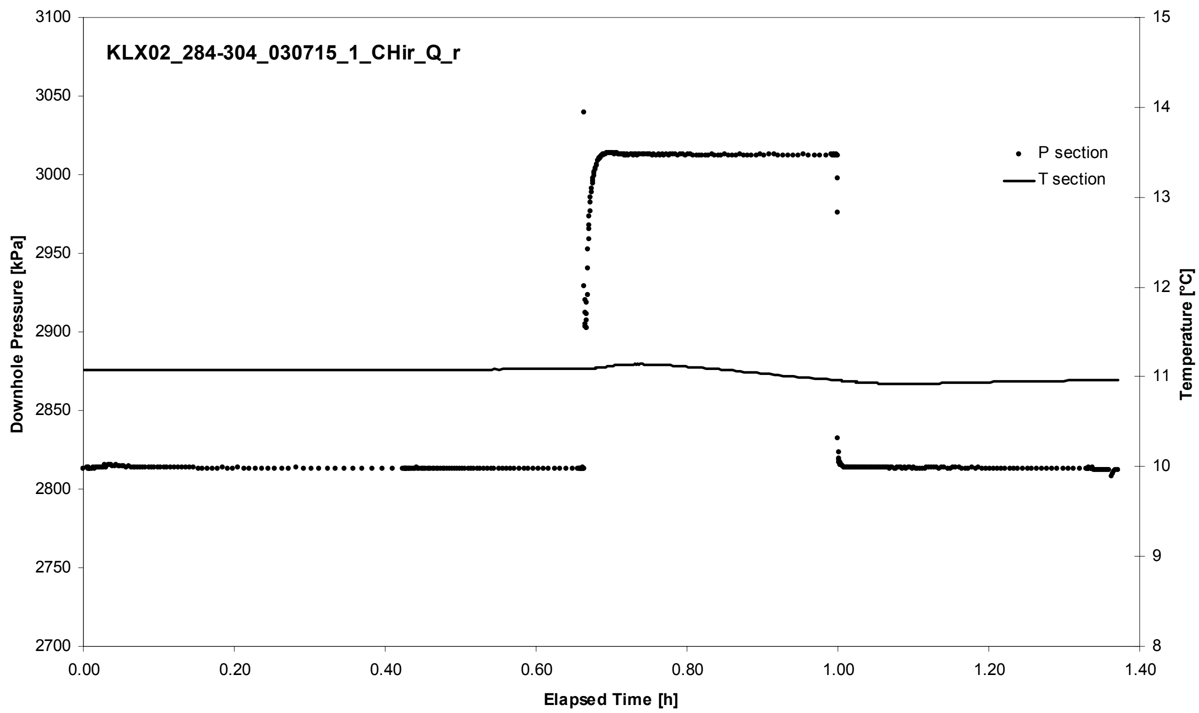
APPENDIX 2-13

Test 284 – 304 m

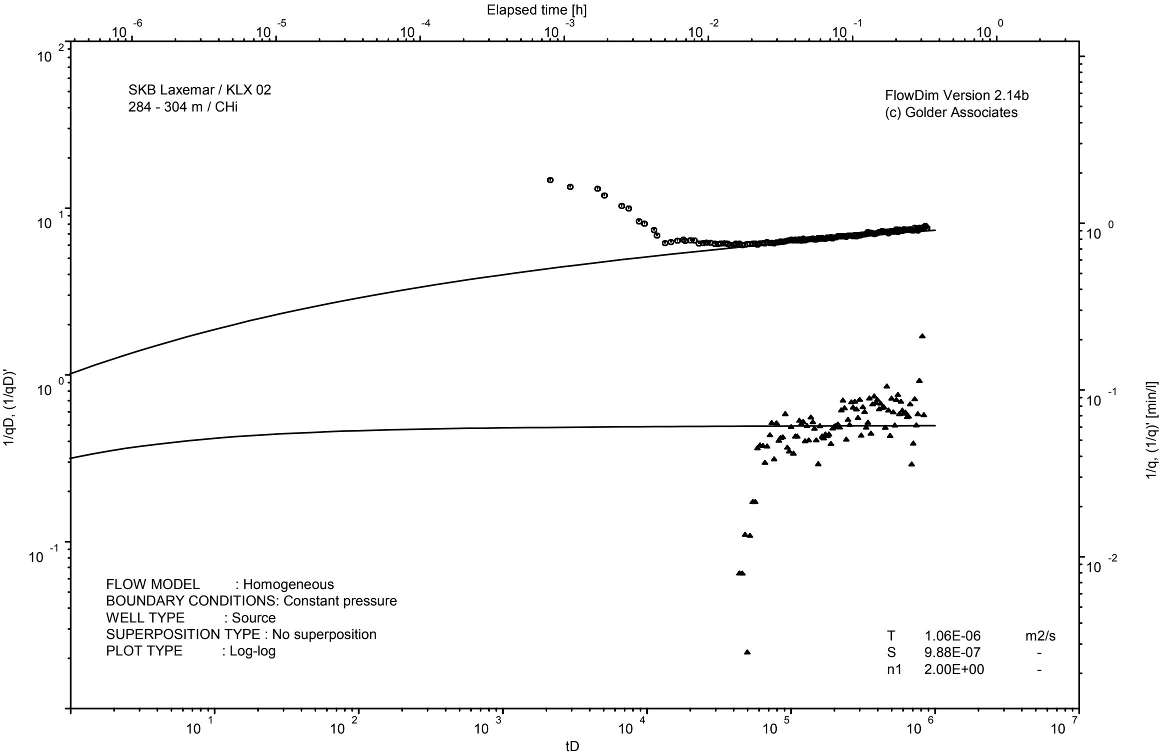
Analysis diagrams



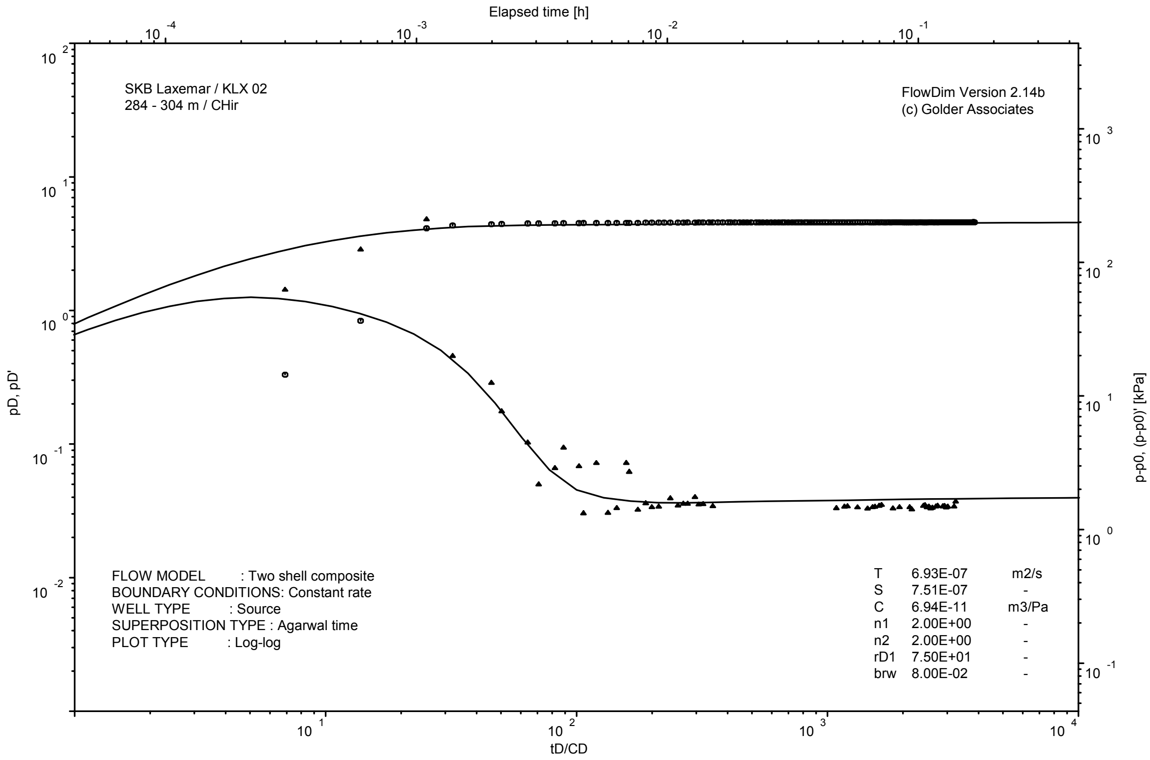
Pressure and flow rate vs. time; cartesian plot



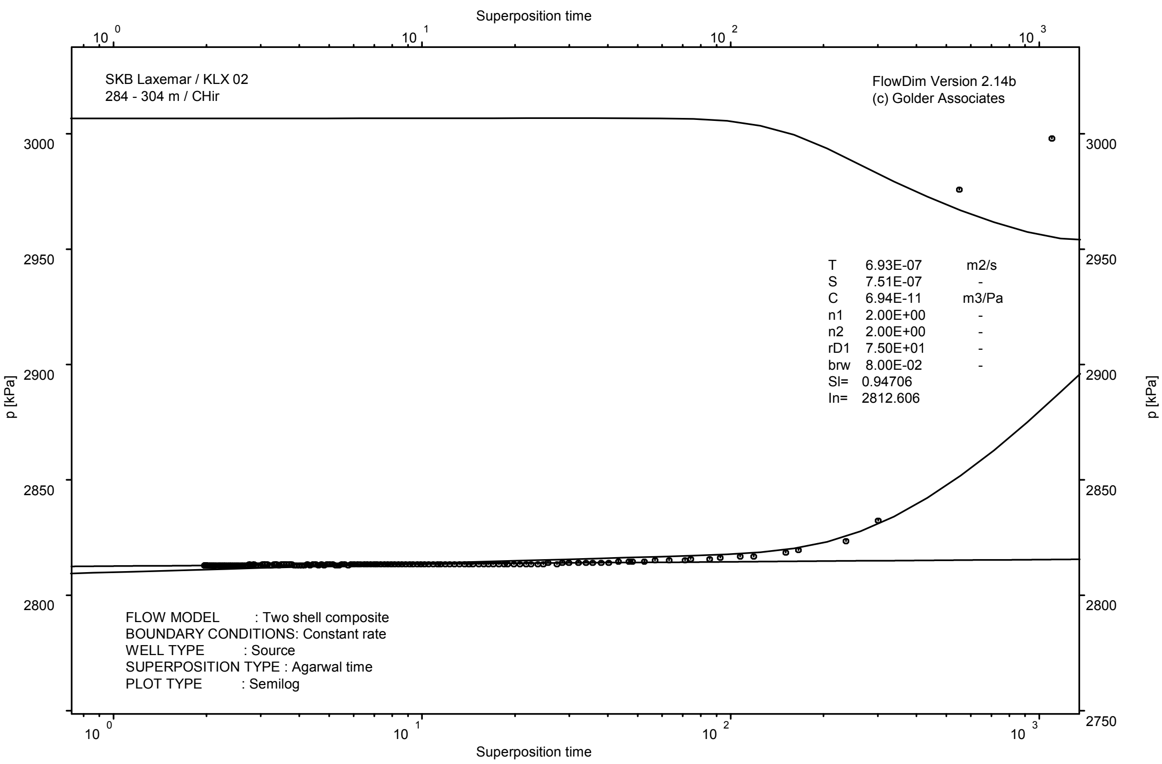
Pressure and temperature in the test section; cartesian plot



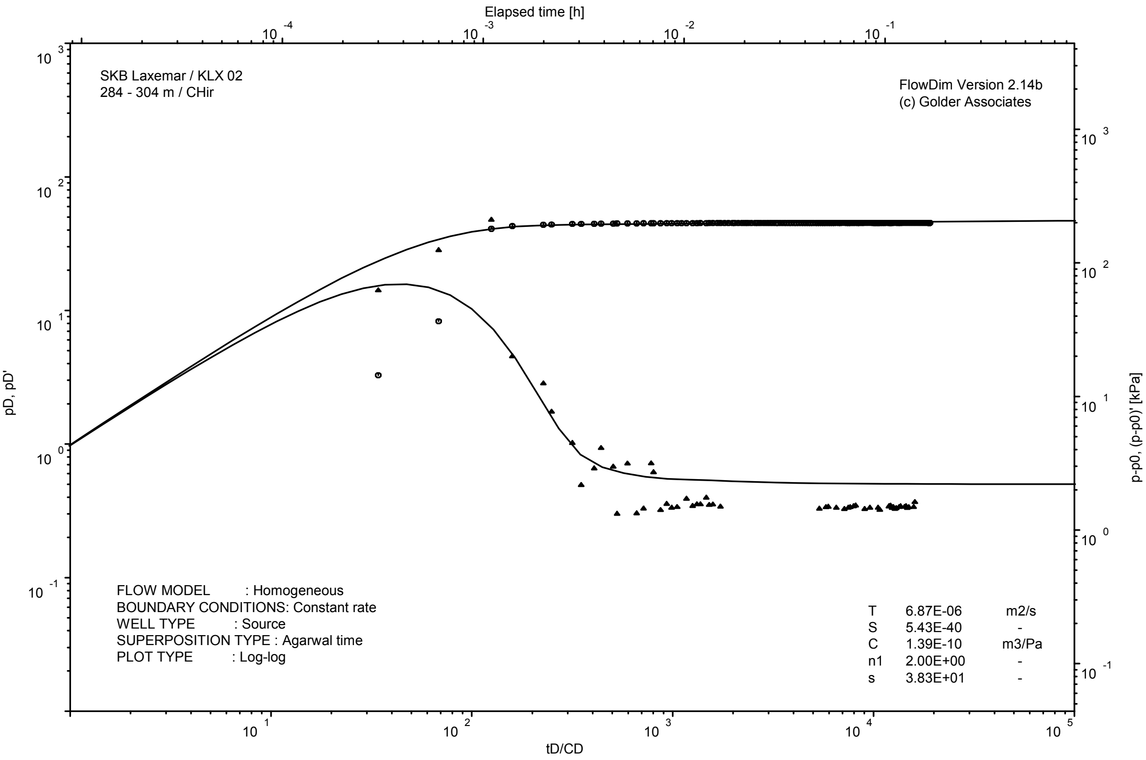
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

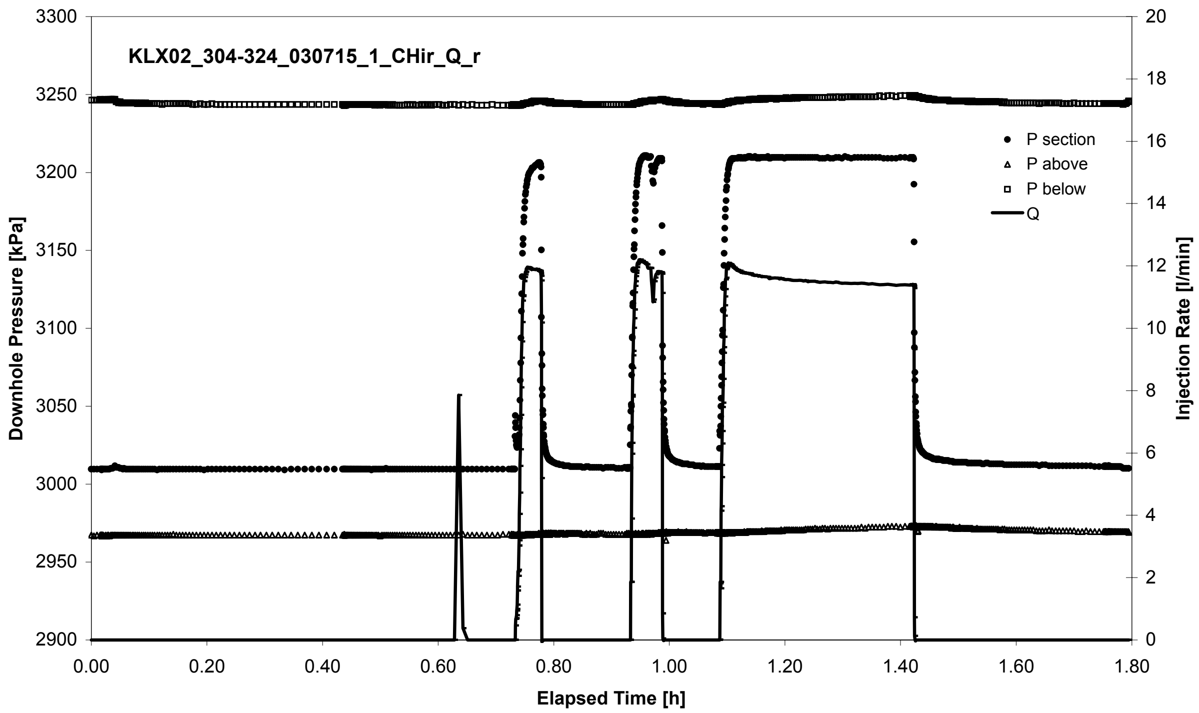


CHIR phase; Homogeneous model analyses, log-log match

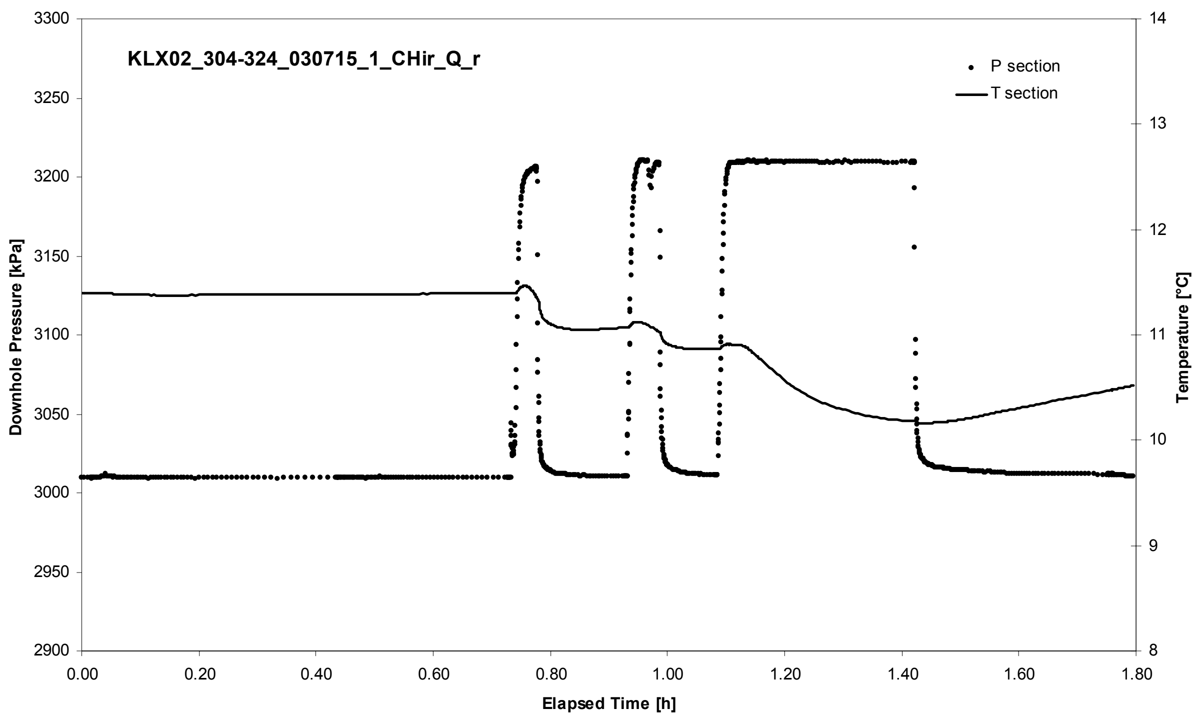
APPENDIX 2-14

Test 304 – 324 m

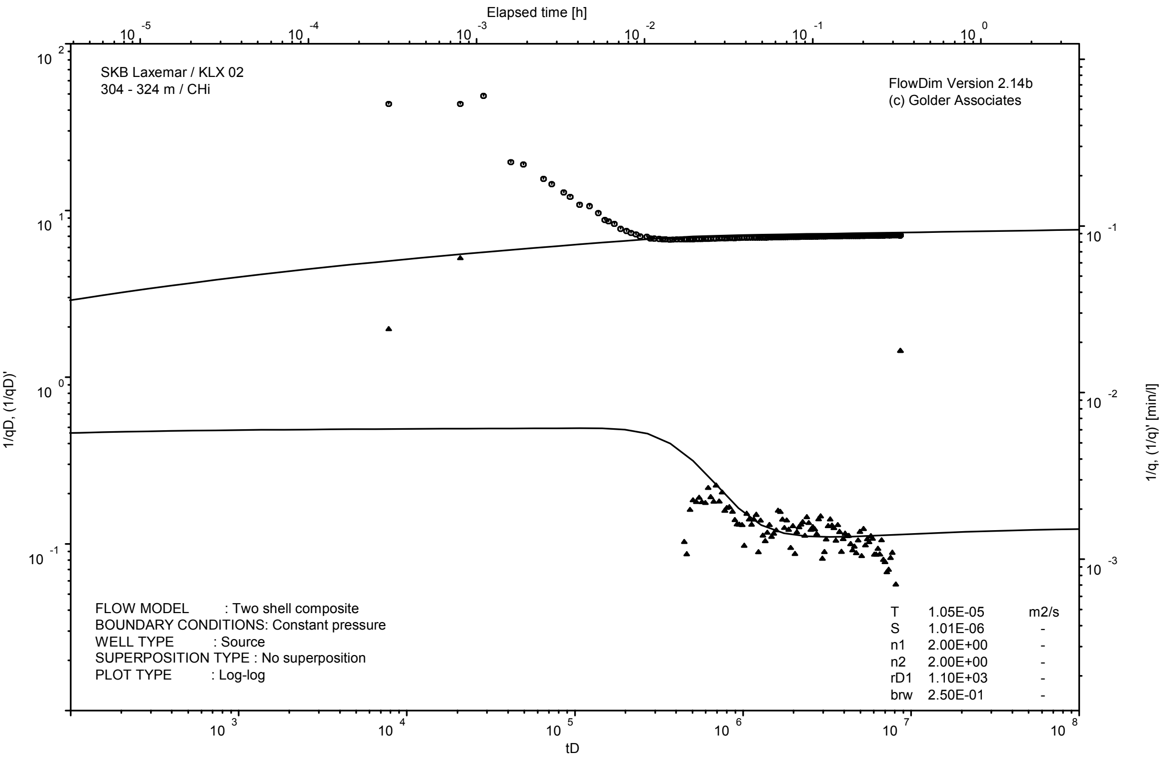
Analysis diagrams



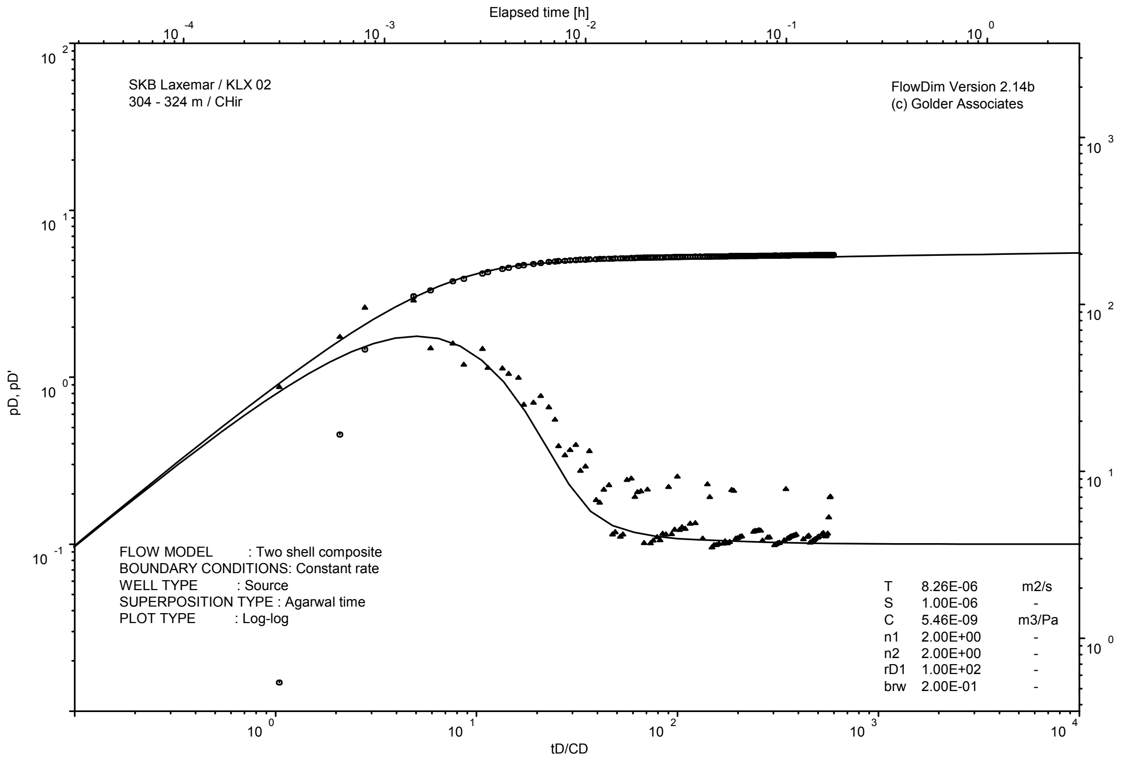
Pressure and flow rate vs. time; cartesian plot



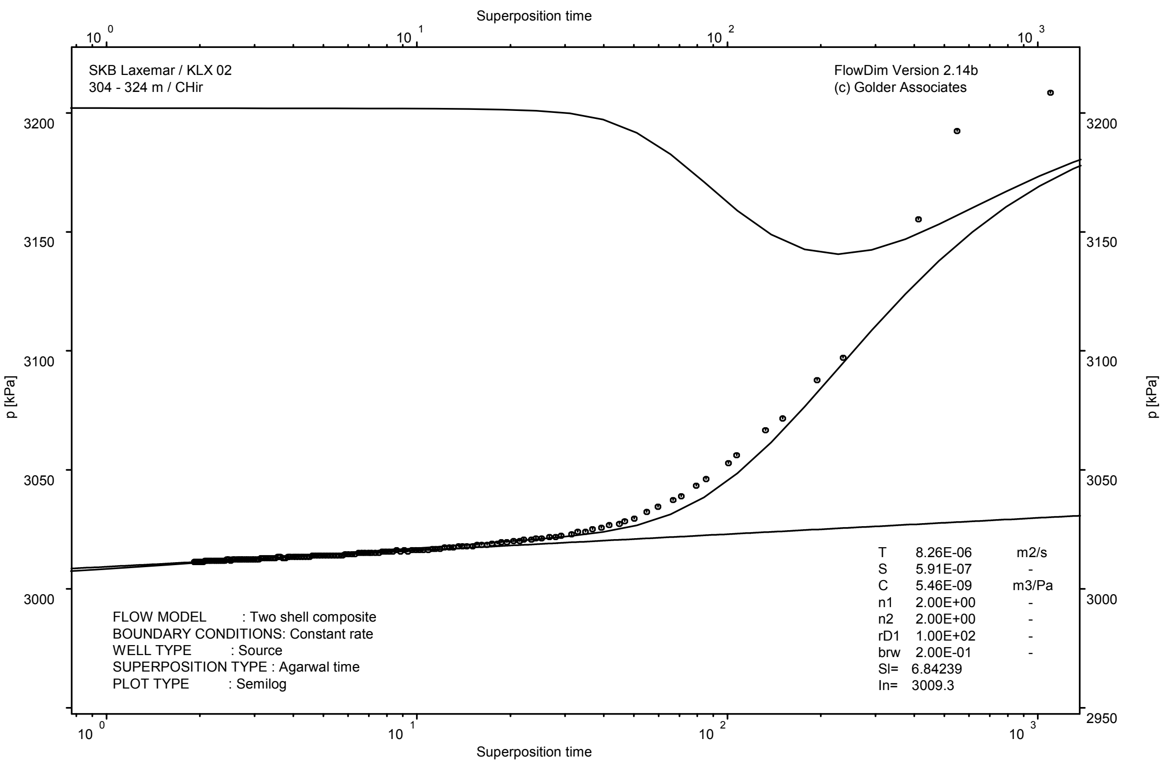
Pressure and temperature in the test section; cartesian plot



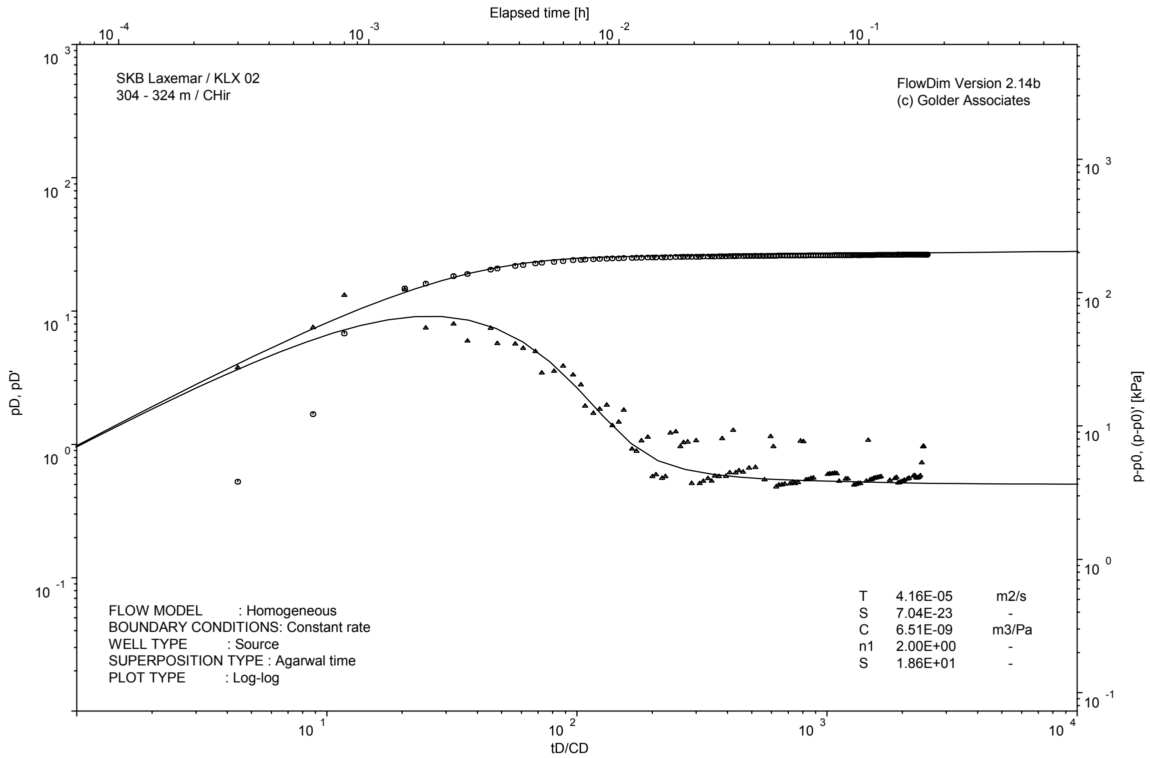
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

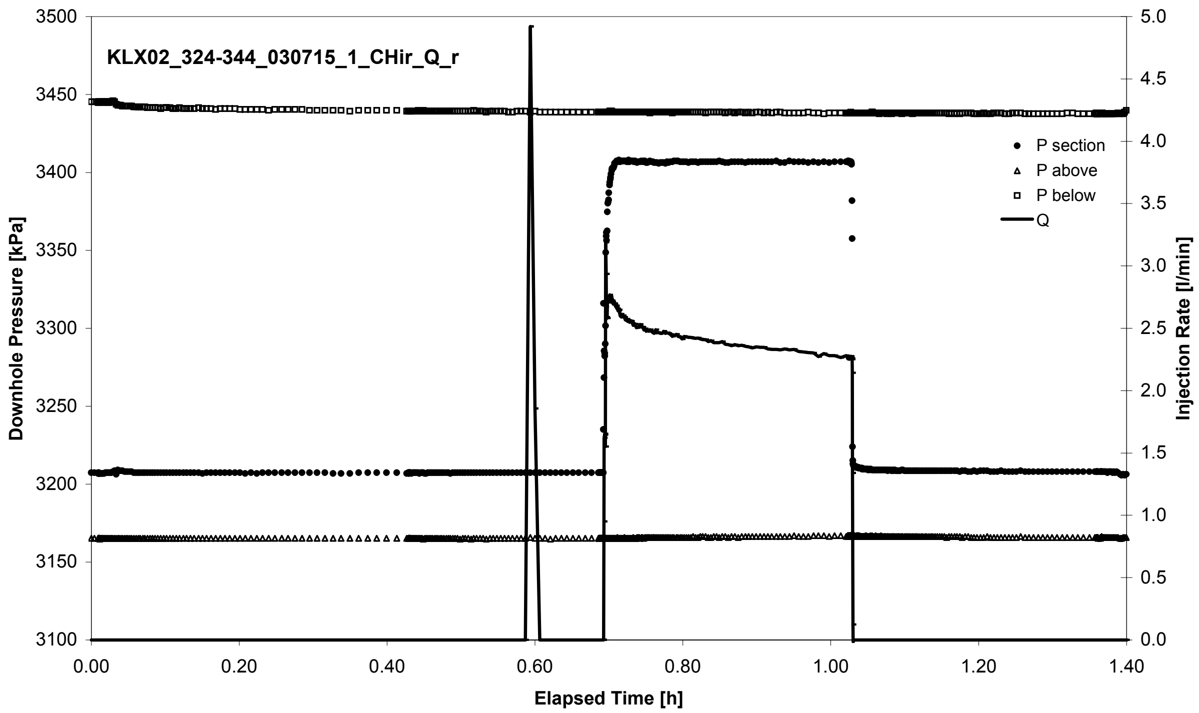


CHIR phase; Homogeneous model analyses, log-log match

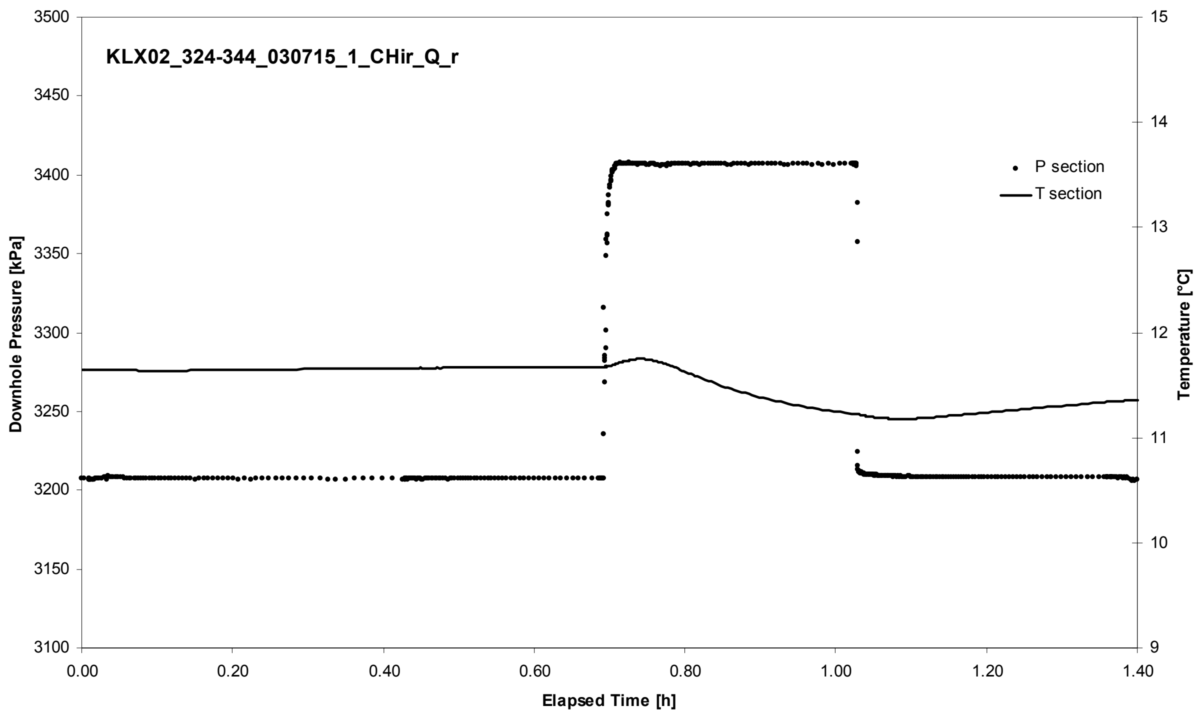
APPENDIX 2-15

Test 324 – 344 m

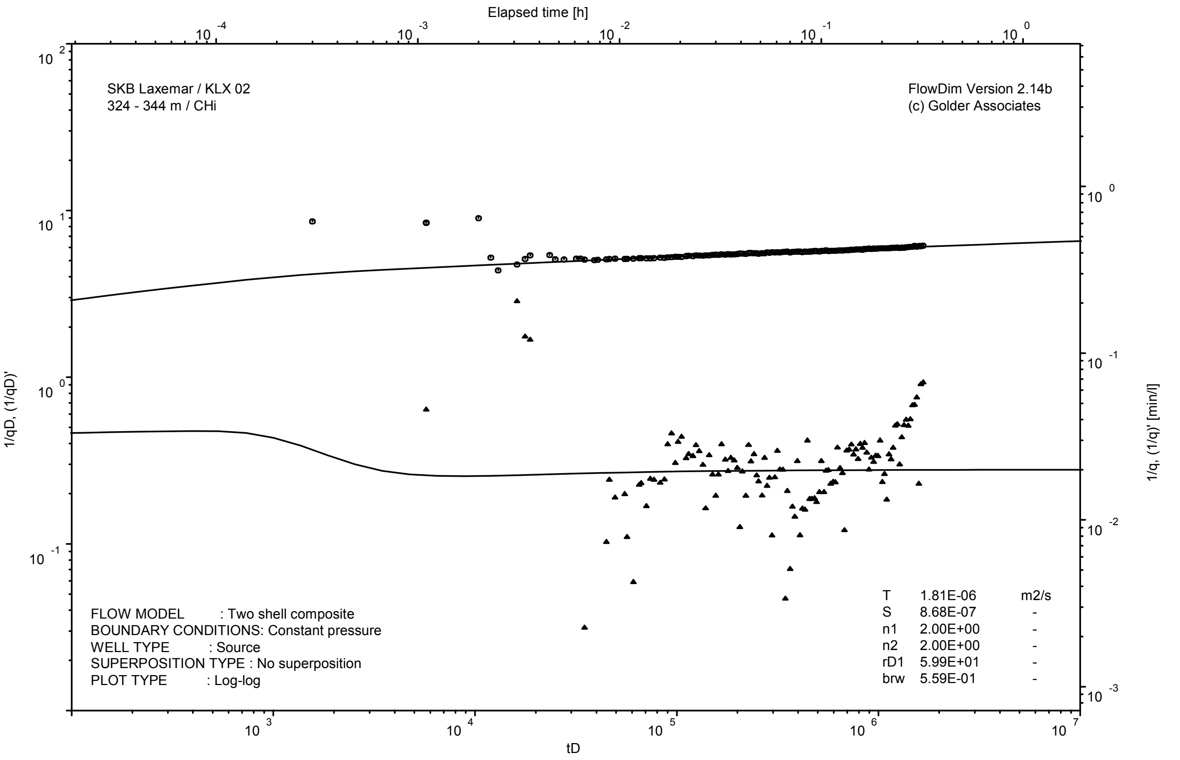
Analysis diagrams



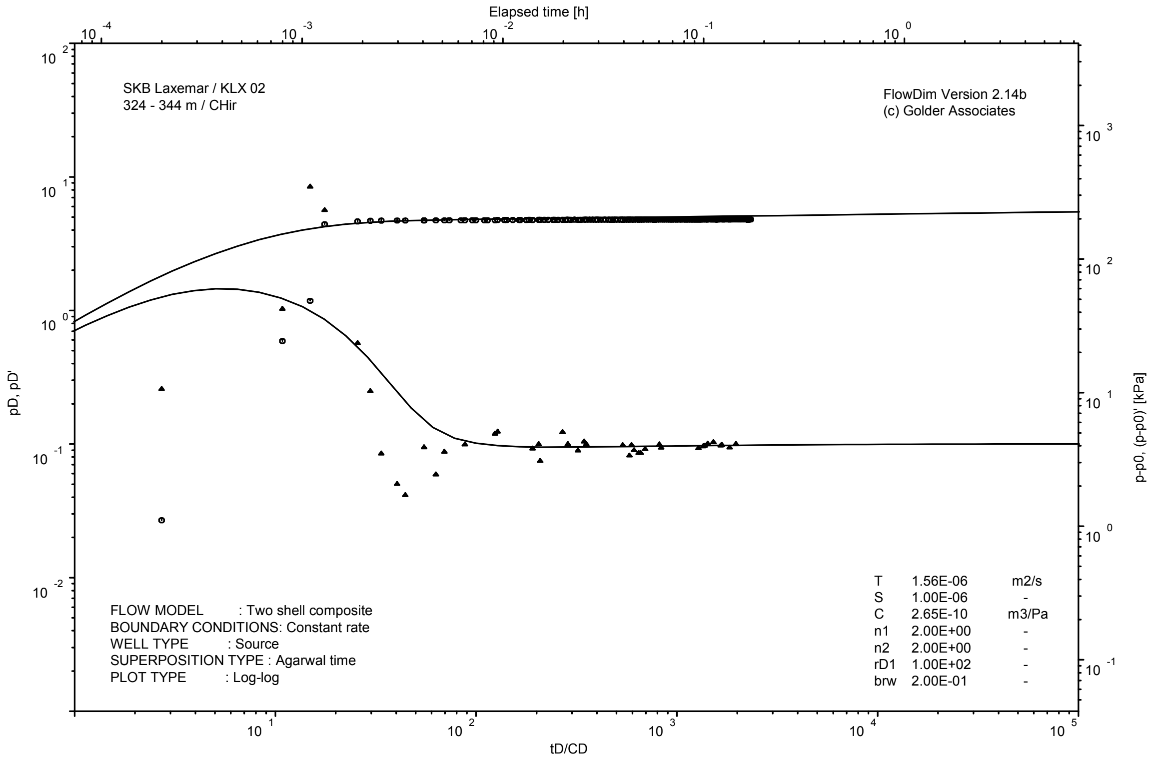
Pressure and flow rate vs. time; cartesian plot



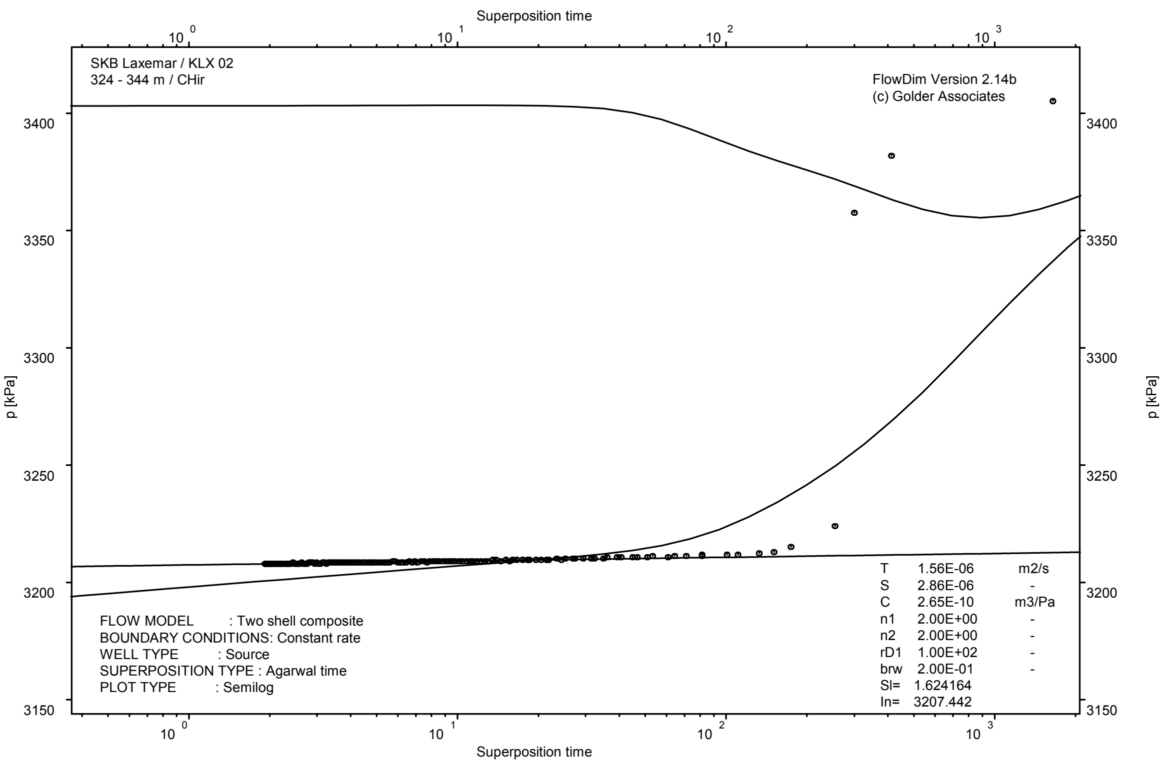
Pressure and temperature in the test section; cartesian plot



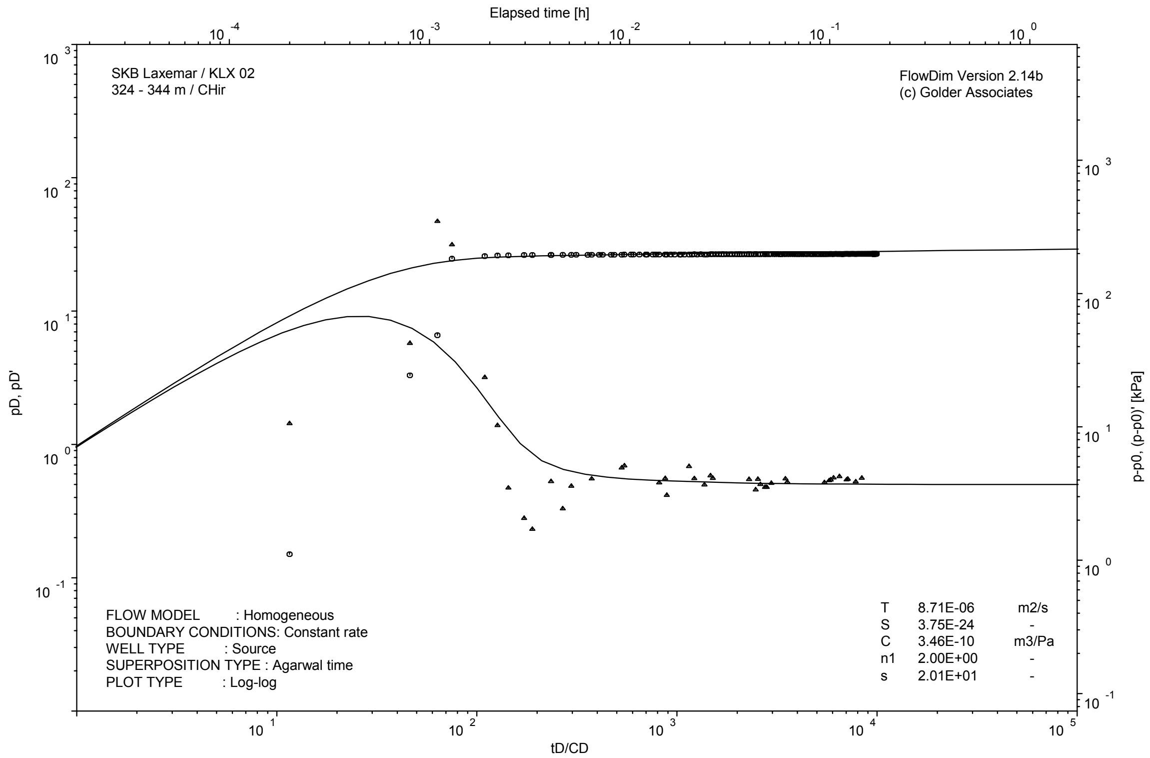
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

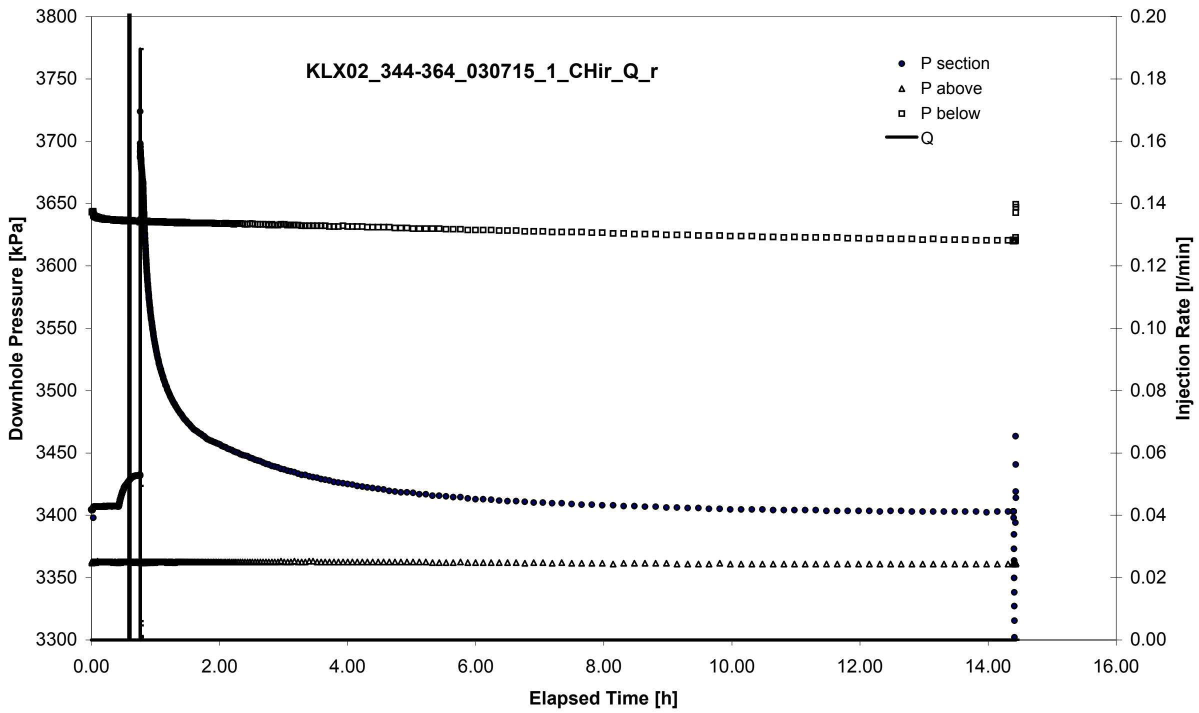


CHIR phase; Homogeneous model analyses, log-log match

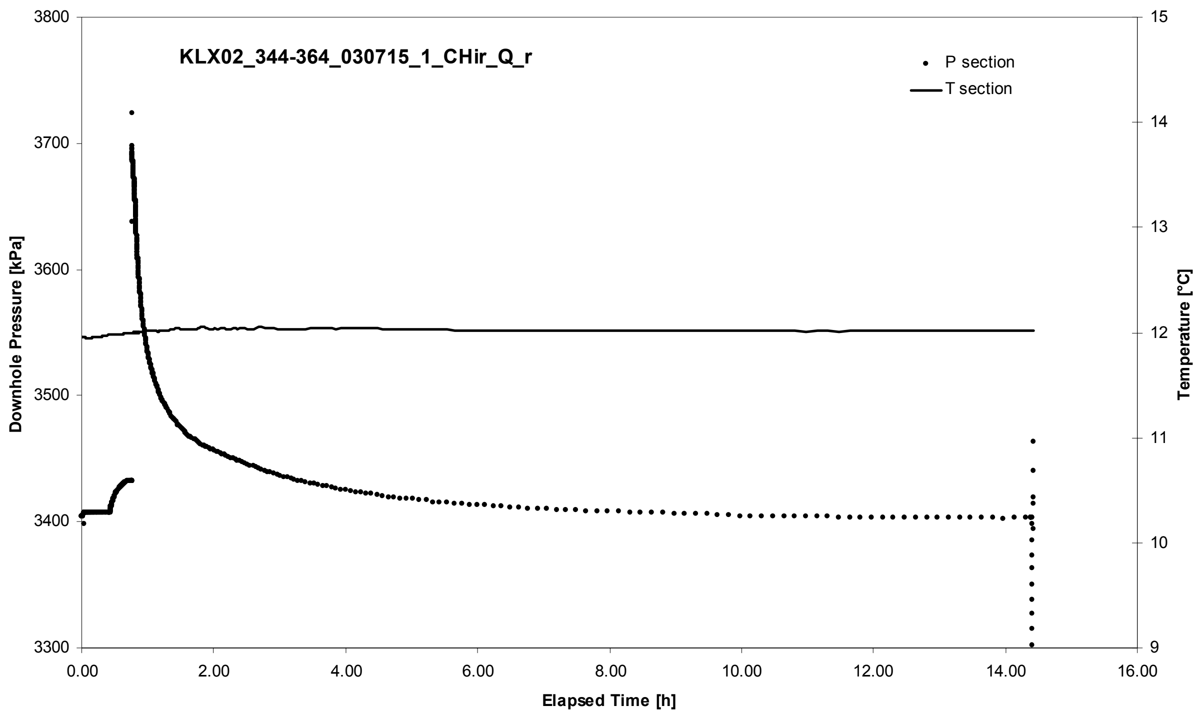
APPENDIX 2-16

Test 344 – 364 m

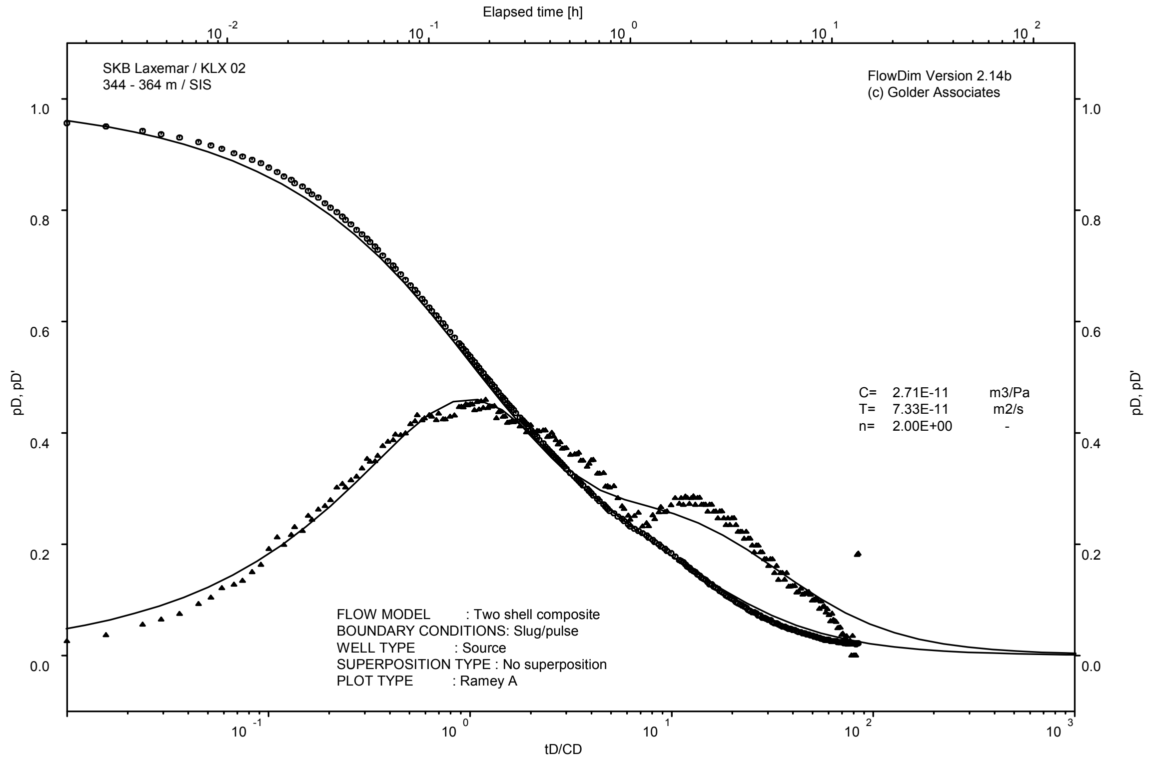
Analysis diagrams



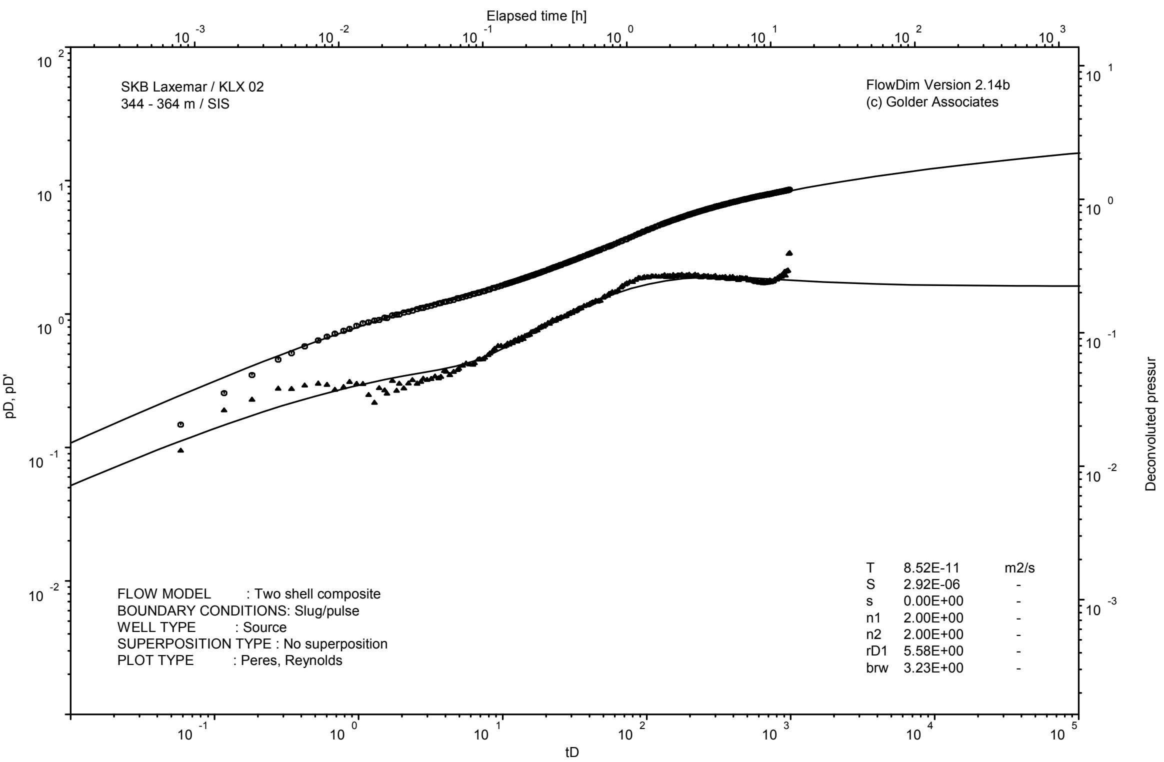
Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot



CHIR phase; RAMEY match

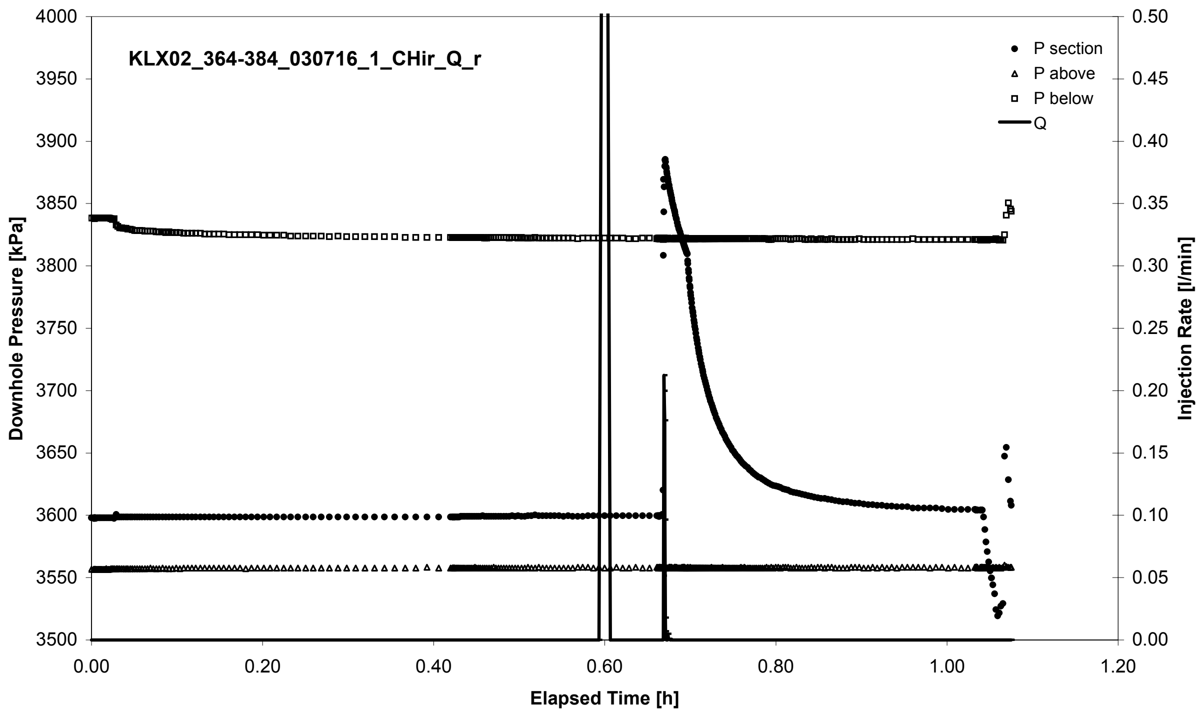


CHIR phase analysed as pulse injection; deconvolution match

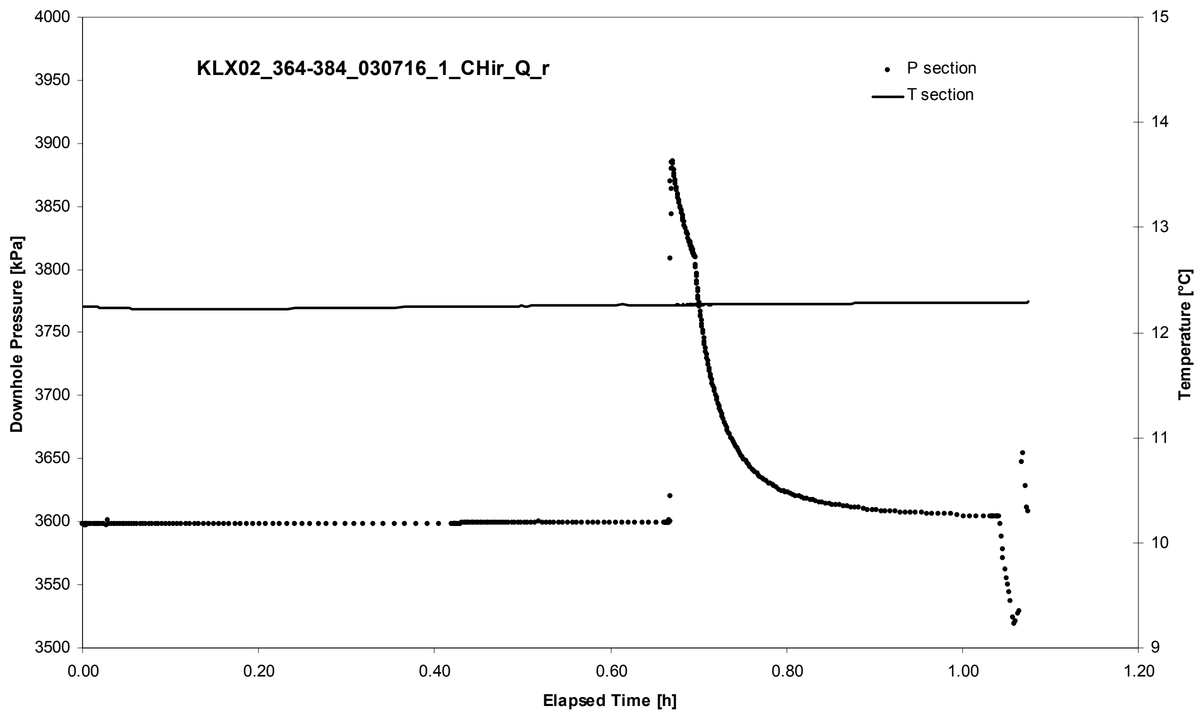
APPENDIX 2-17

Test 364 – 384 m

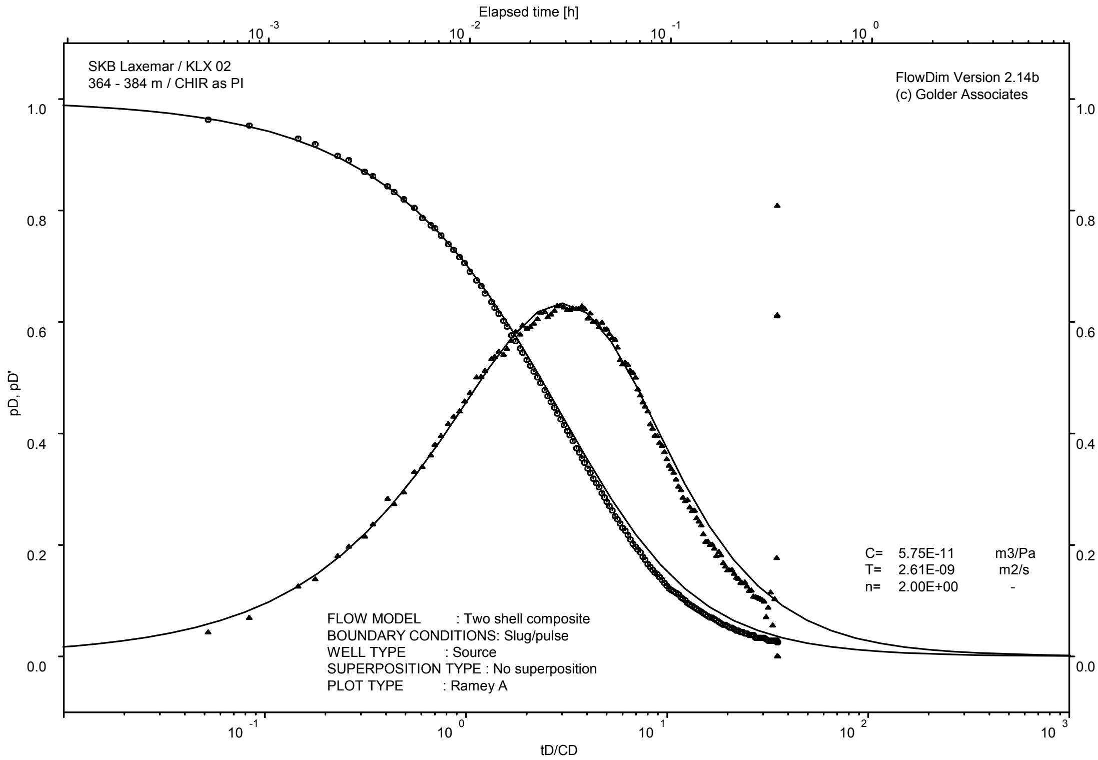
Analysis diagrams



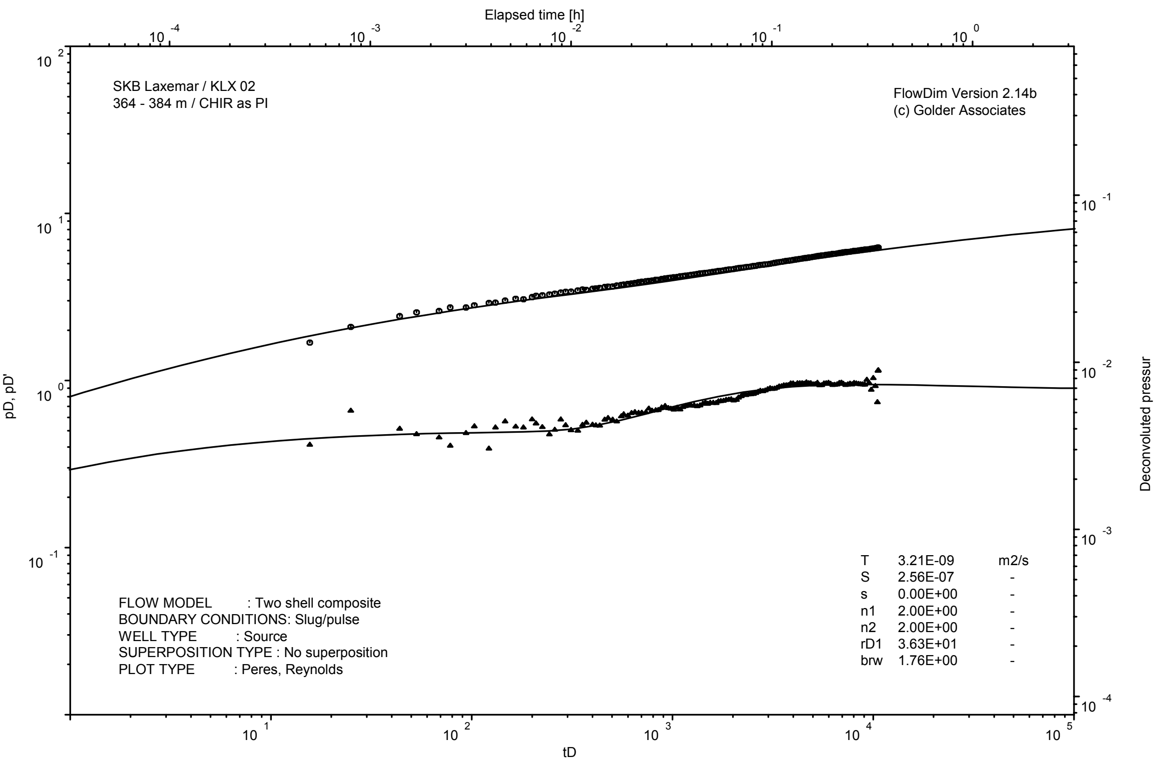
Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot



CHIR phase; RAMEY match

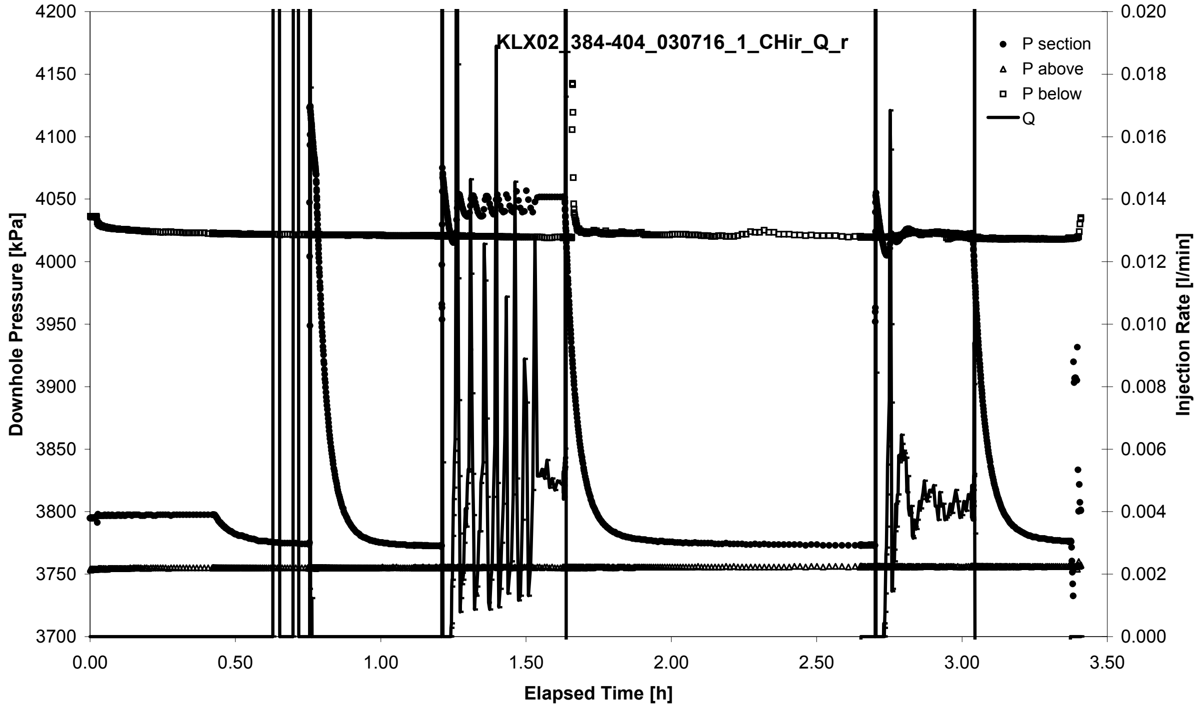


CHIR phase analysed as pulse injection; deconvolution match

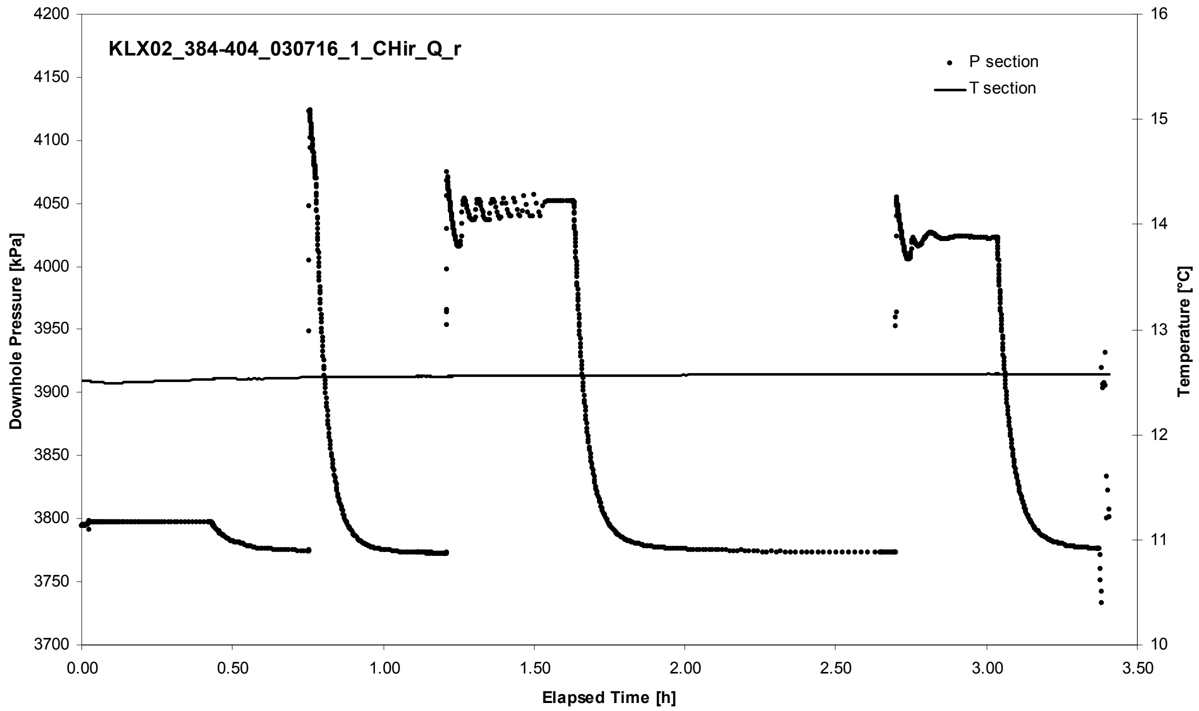
APPENDIX 2-18

Test 384 – 404 m

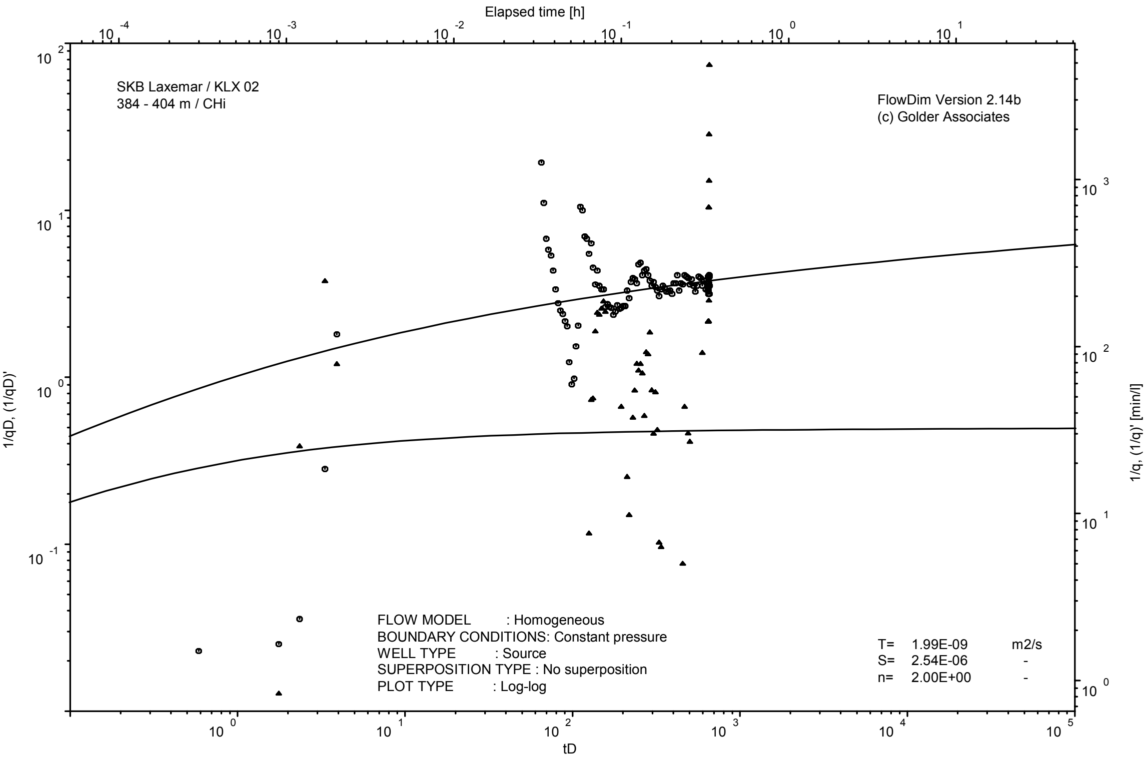
Analysis diagrams



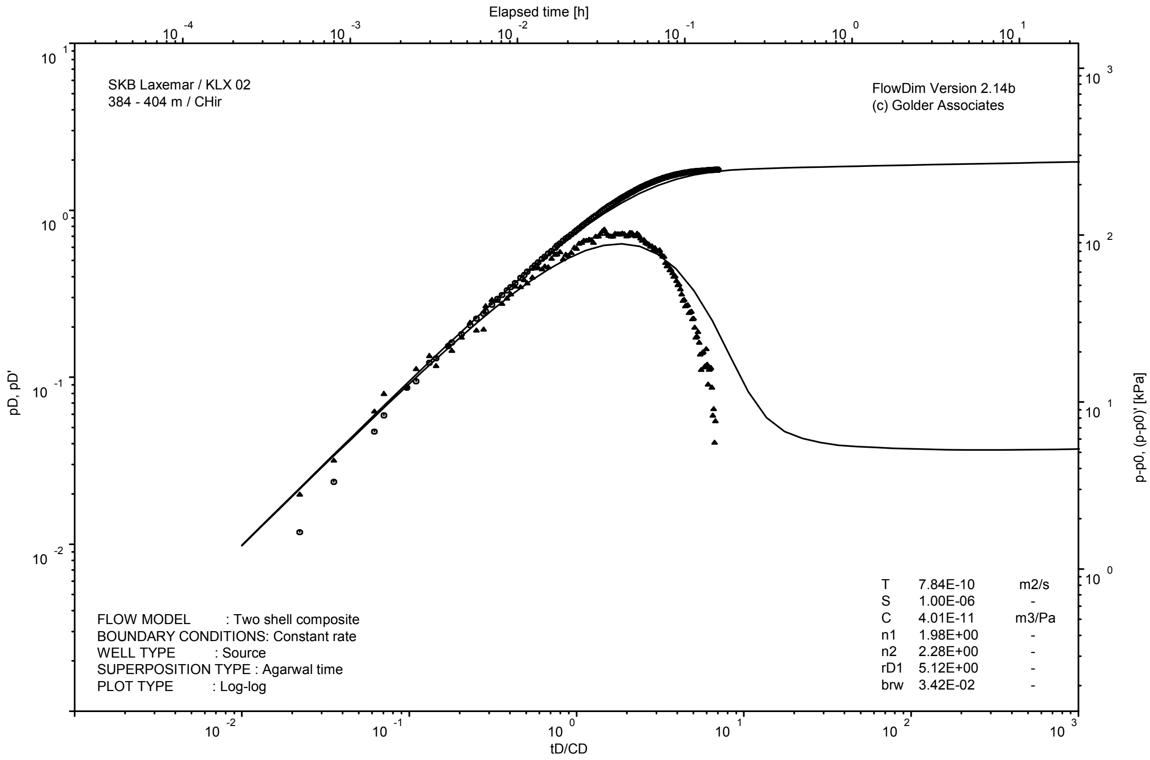
Pressure and flow rate vs. time; cartesian plot



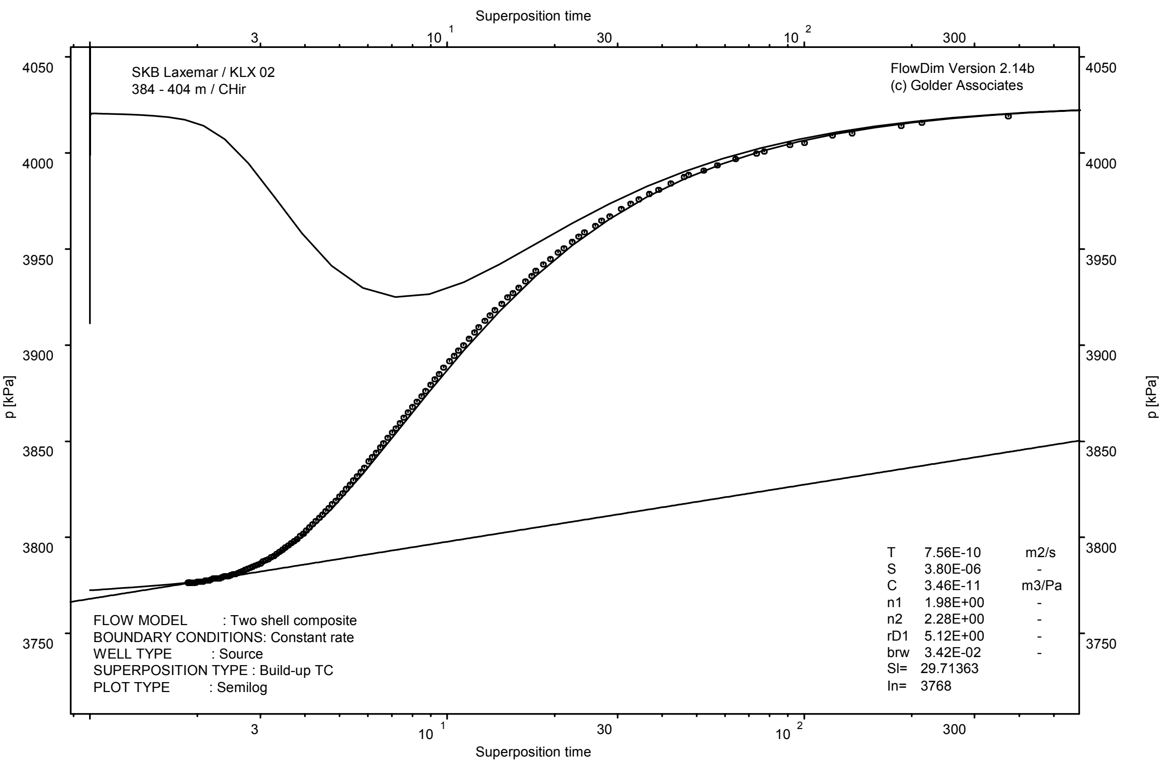
Pressure and temperature in the test section; cartesian plot



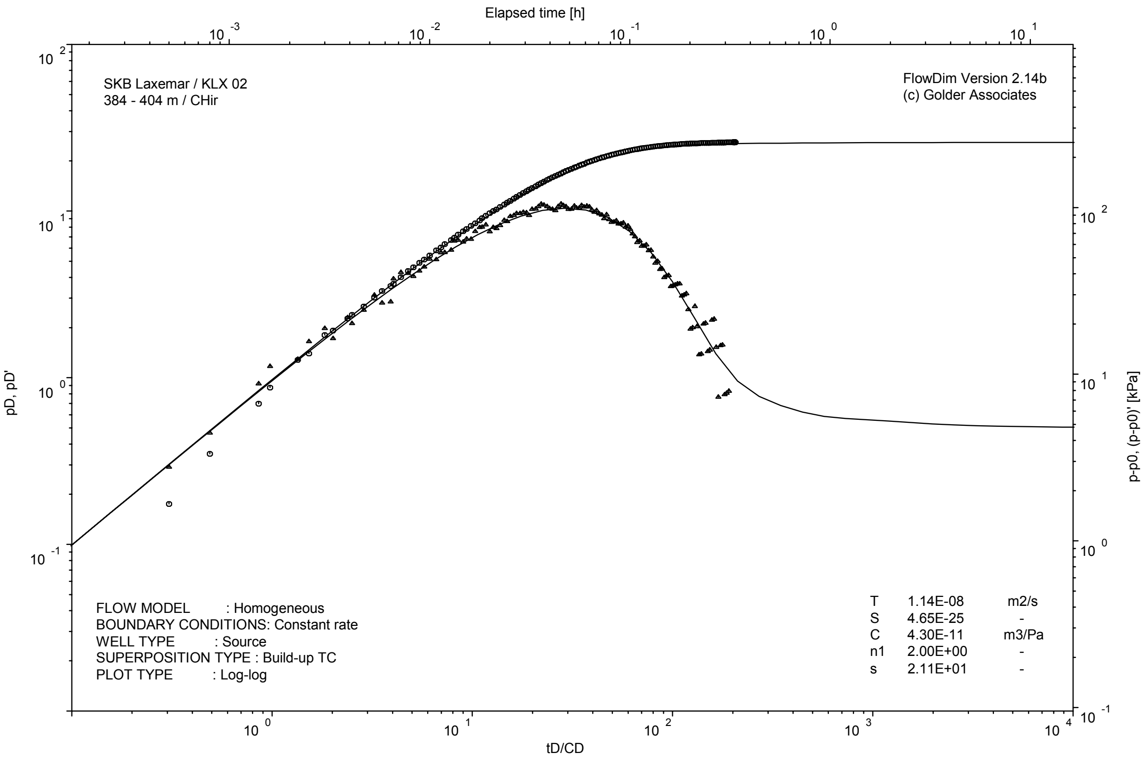
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

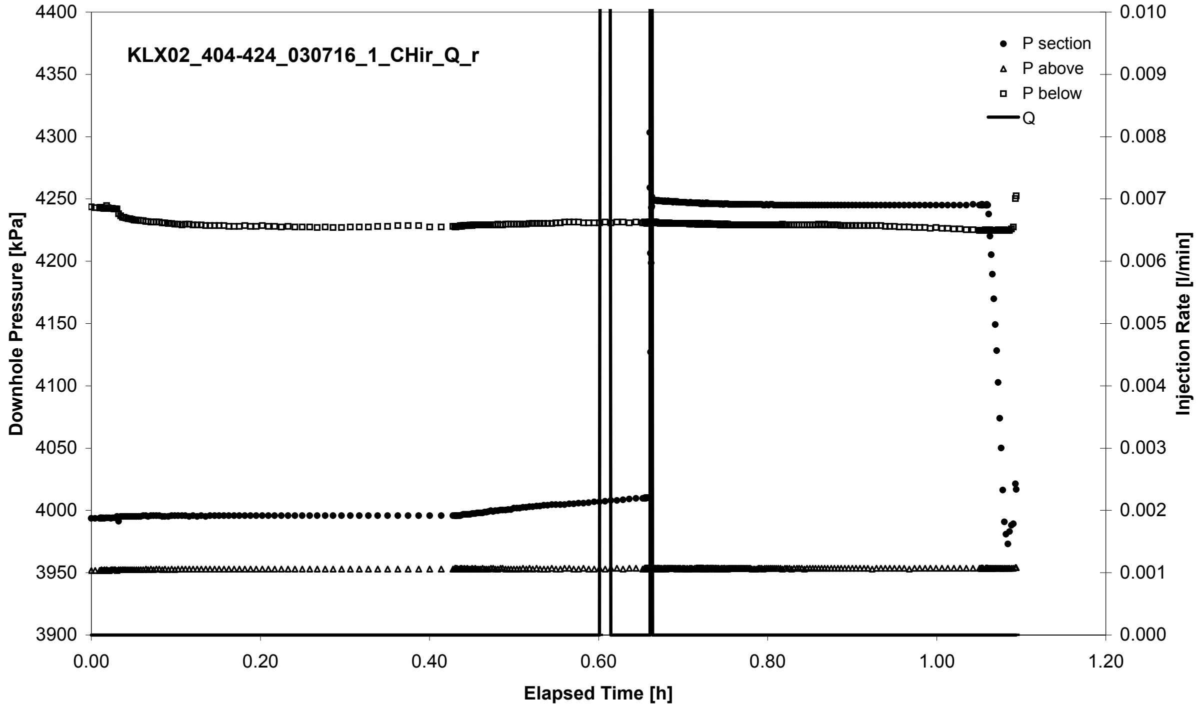


CHIR phase; Homogeneous model analyses, log-log match

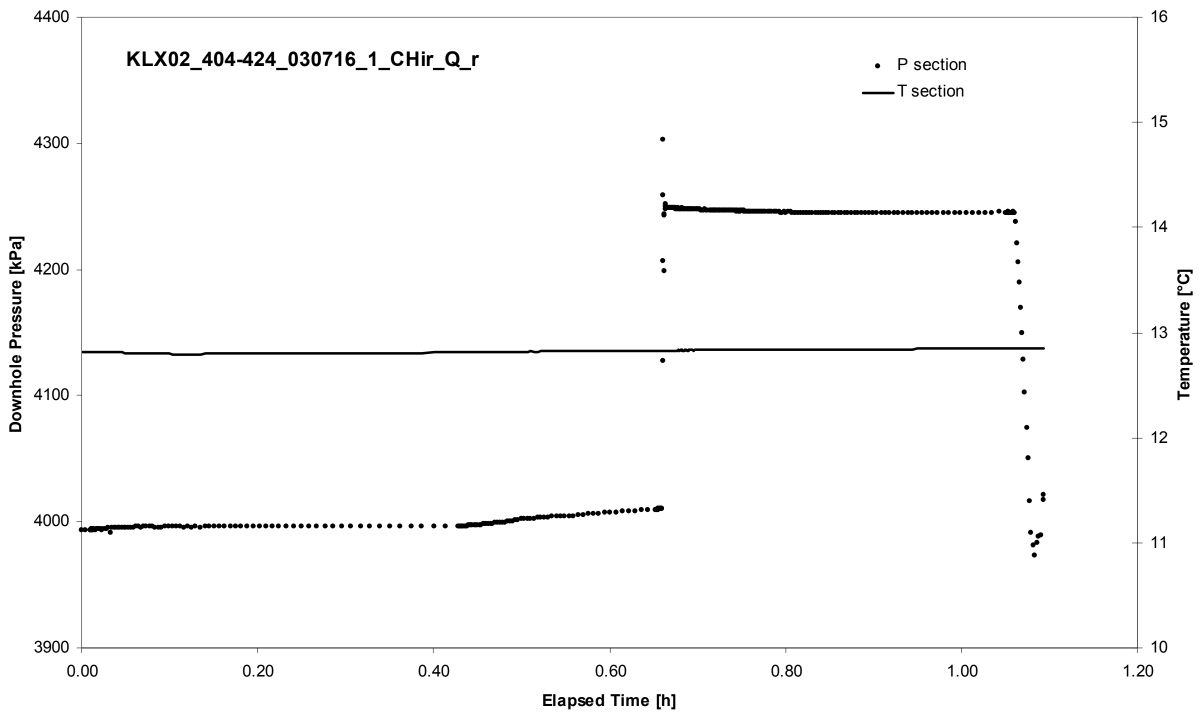
APPENDIX 2-19

Test 404 – 424 m

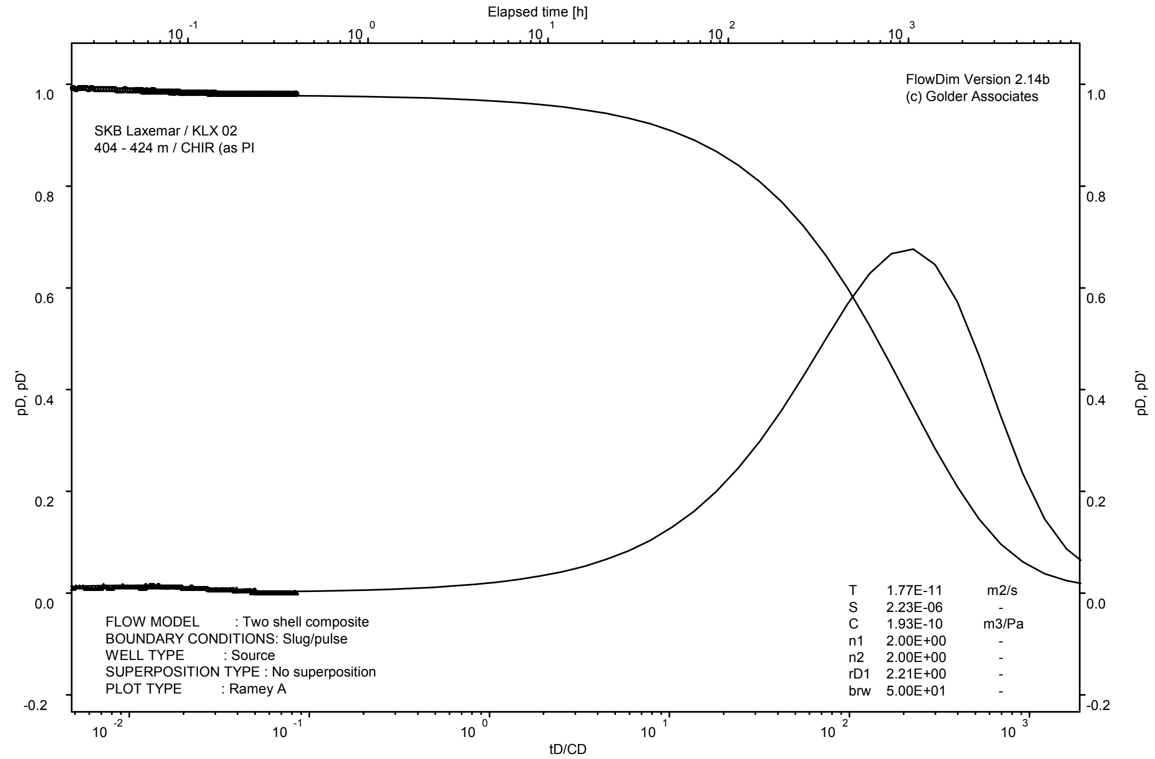
Analysis diagrams



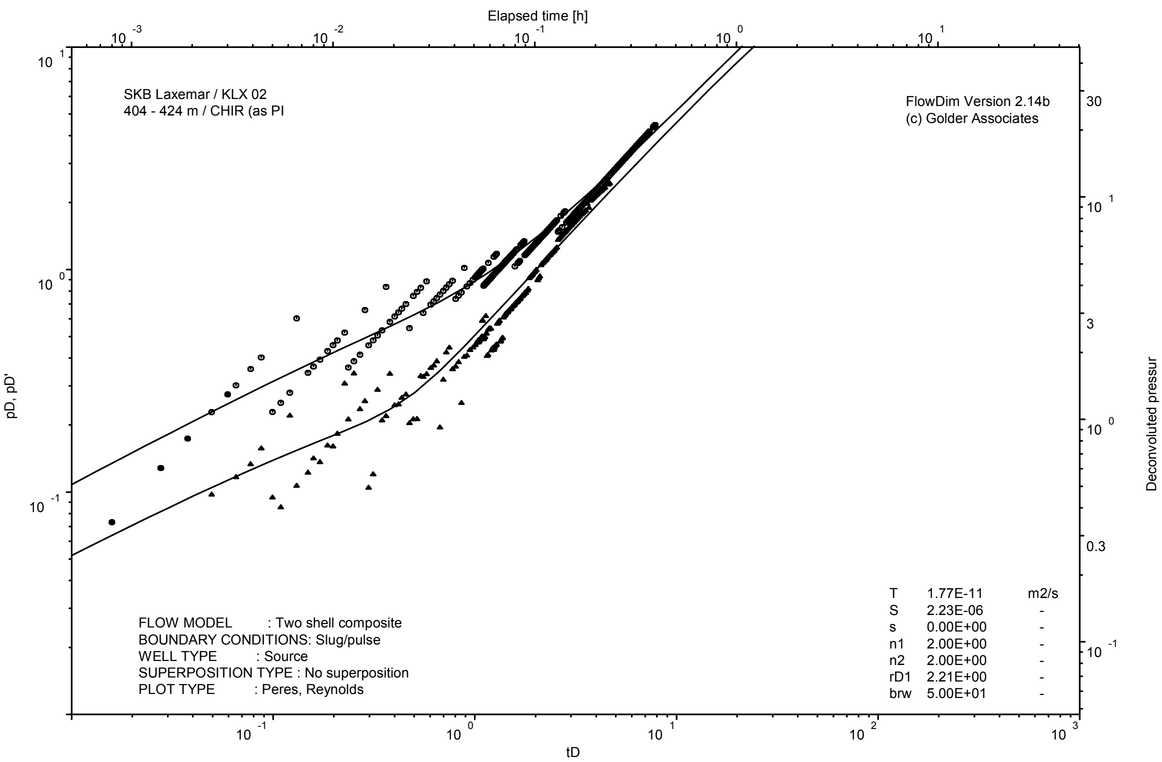
Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot



CHIR phase; RAMEY match

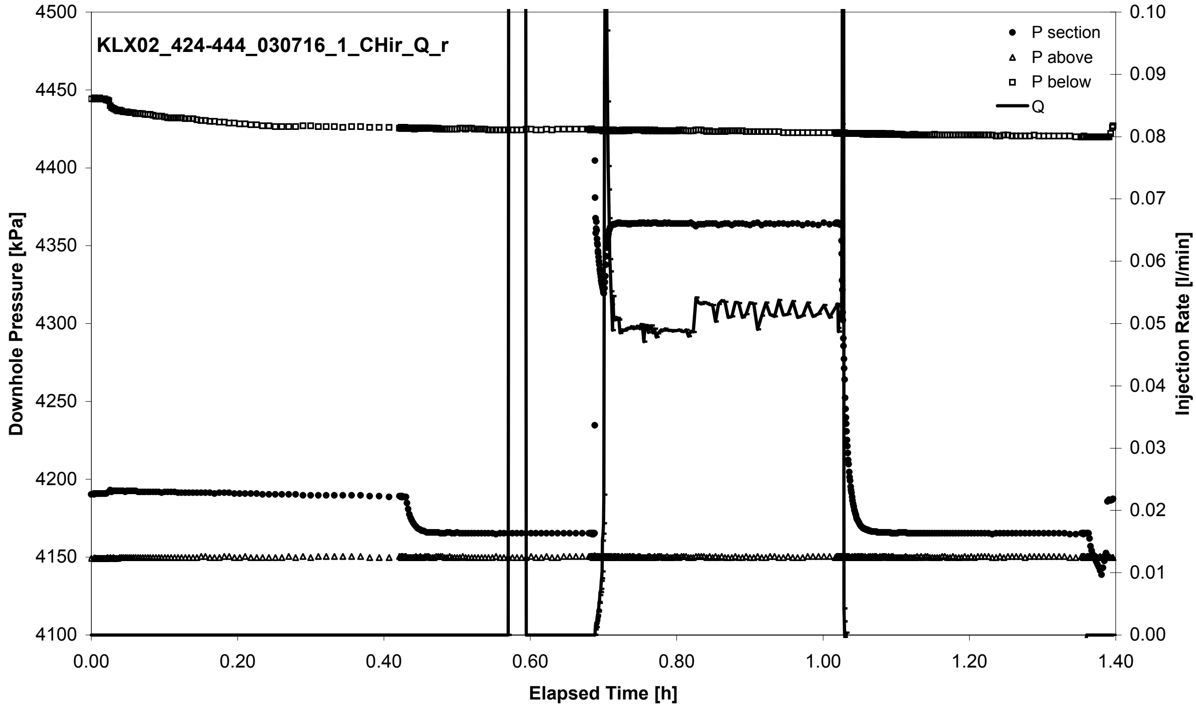


CHIR phase analysed as pulse injection; deconvolution match

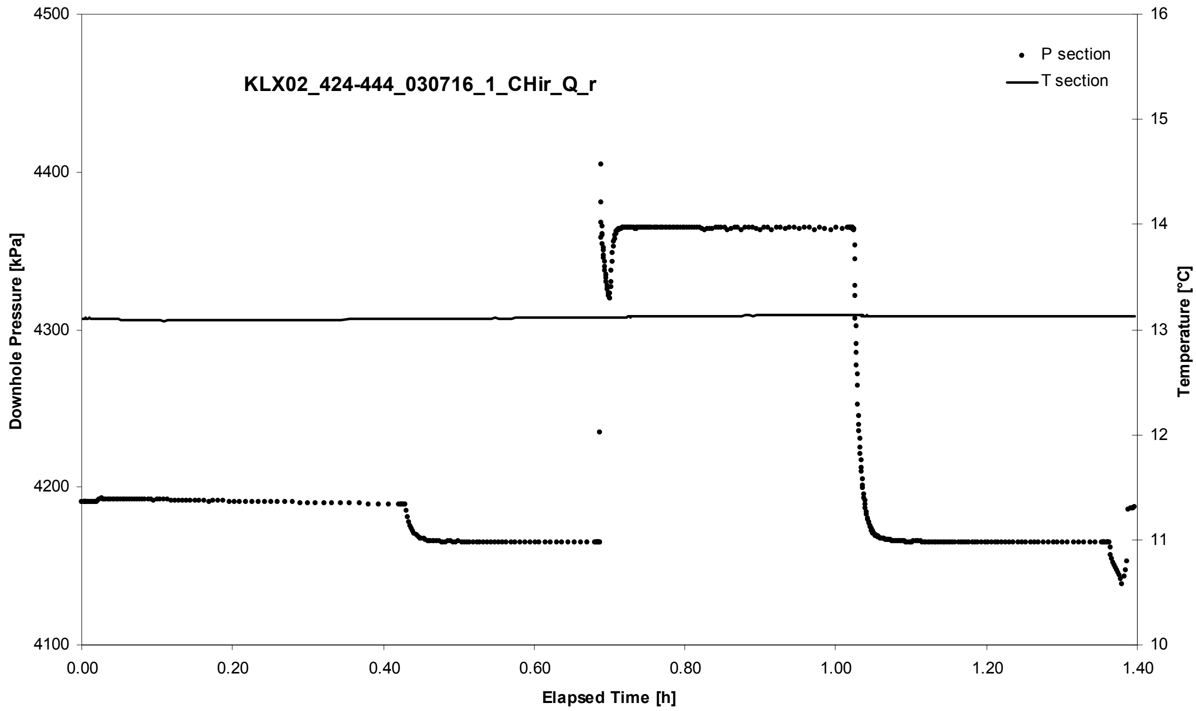
APPENDIX 2-20

Test 424 – 444 m

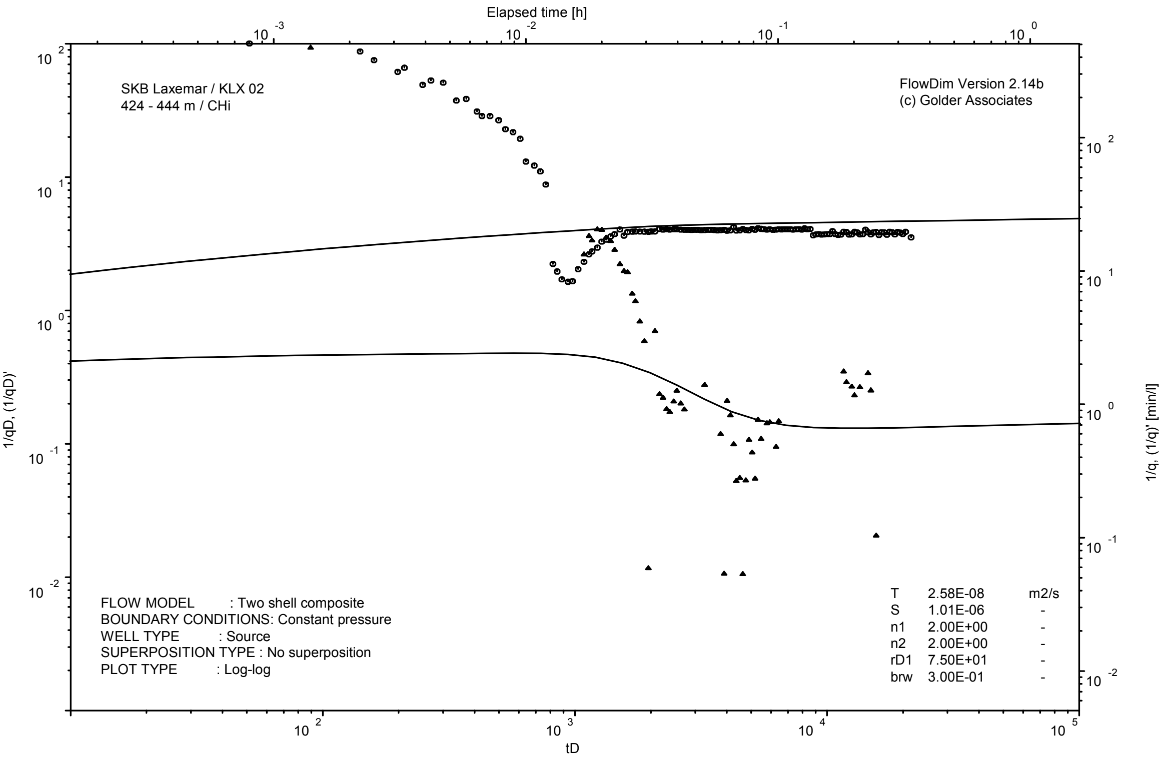
Analysis diagrams



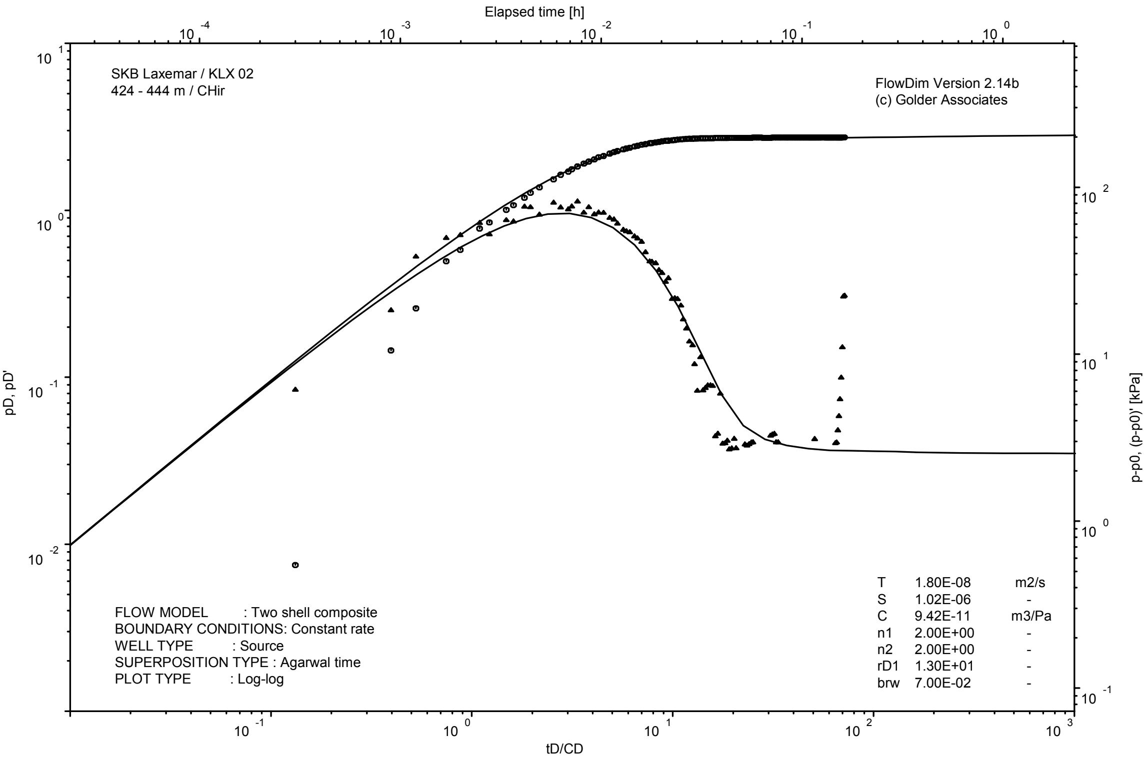
Pressure and flow rate vs. time; cartesian plot



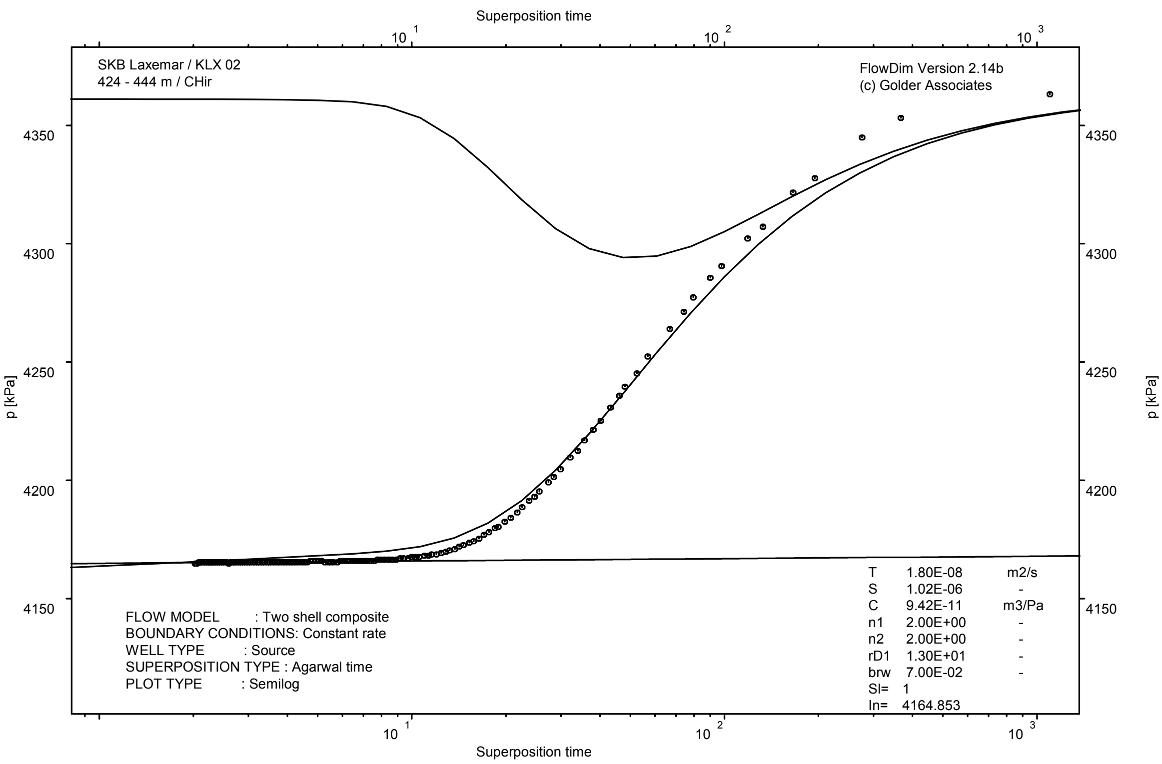
Pressure and temperature in the test section; cartesian plot



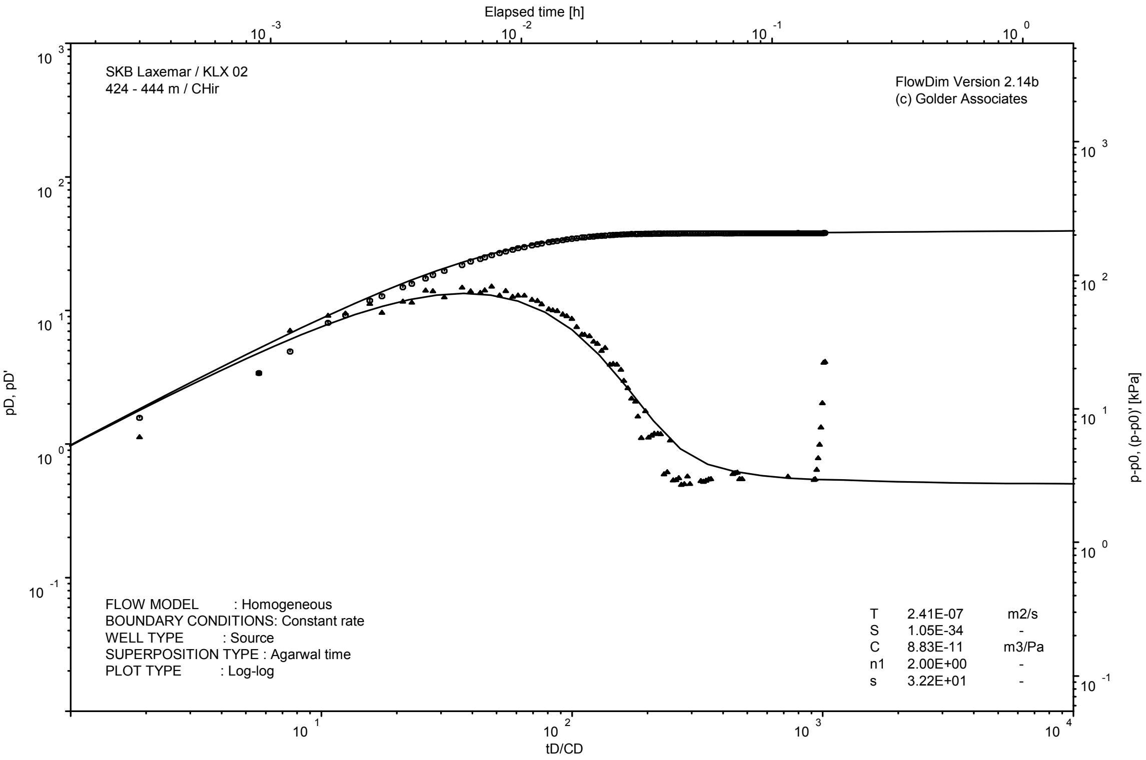
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

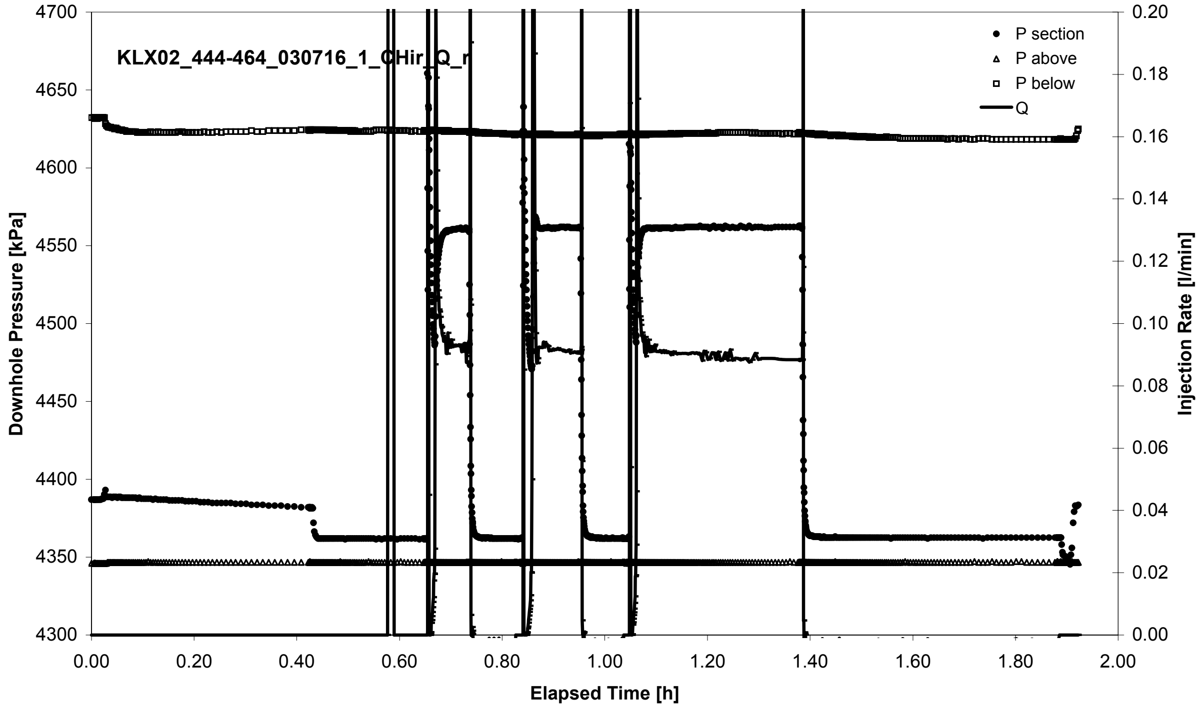


CHIR phase; Homogeneous model analyses, log-log match

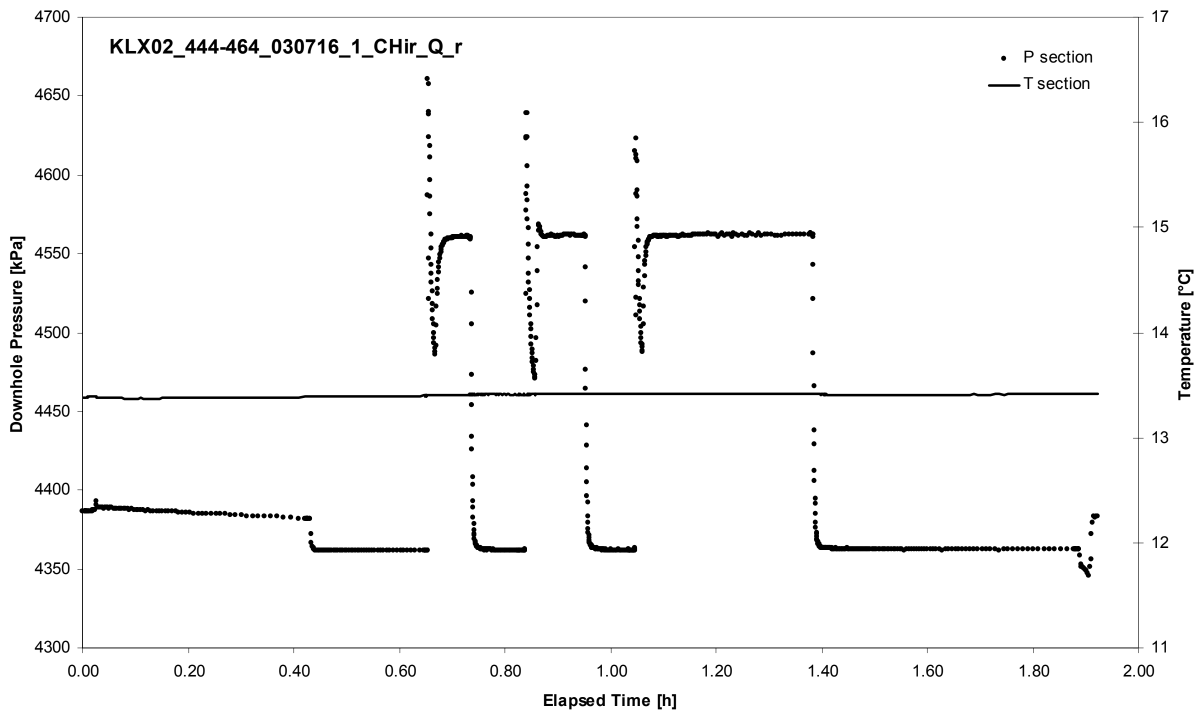
APPENDIX 2-21

Test 444 – 464 m

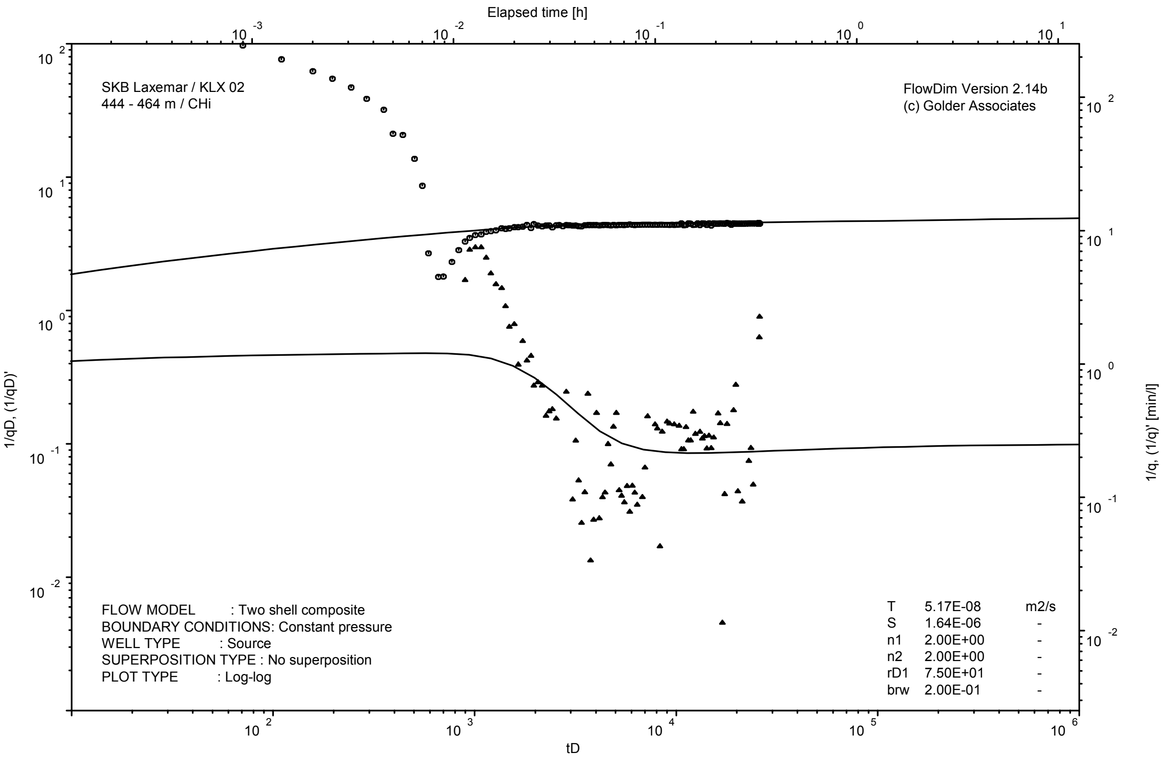
Analysis diagrams



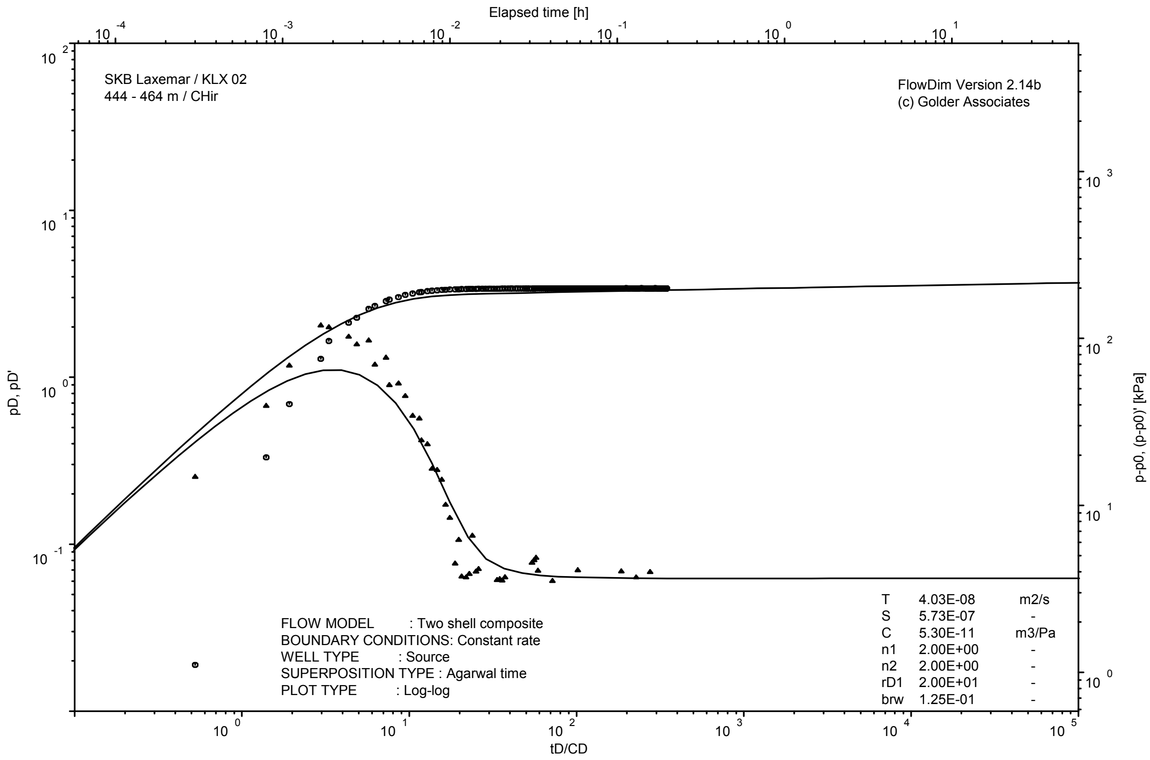
Pressure and flow rate vs. time; cartesian plot



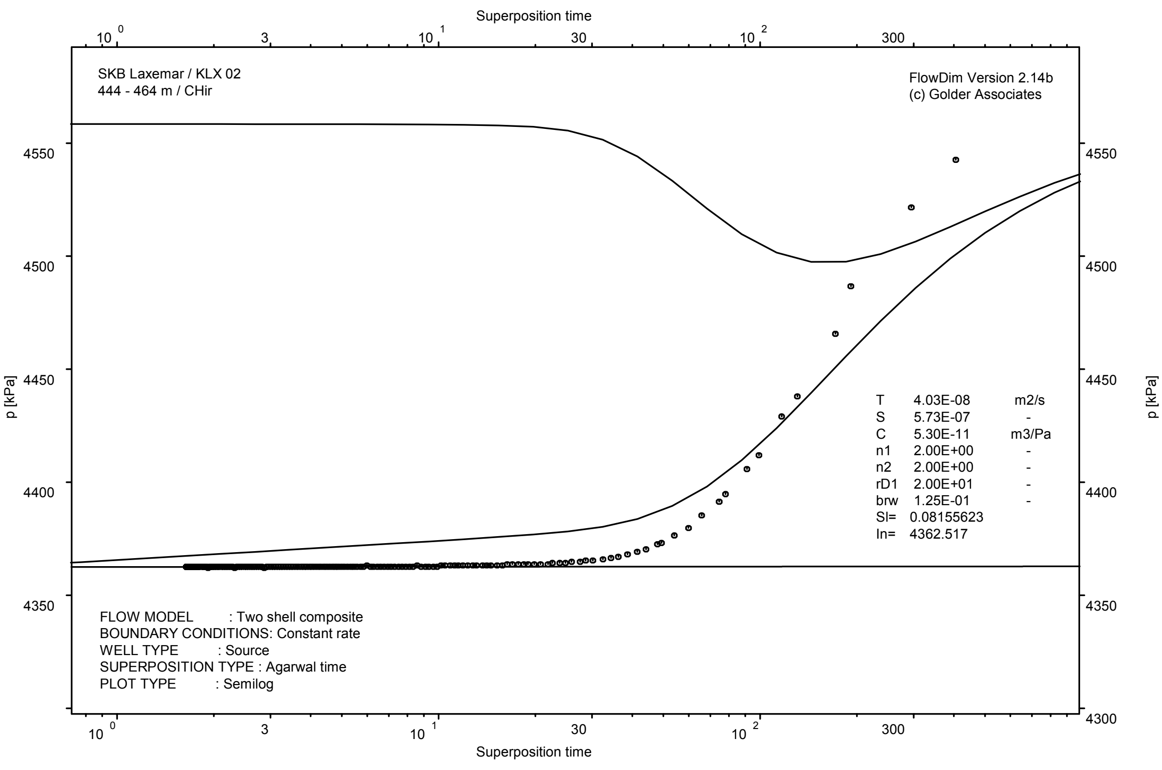
Pressure and temperature in the test section; cartesian plot



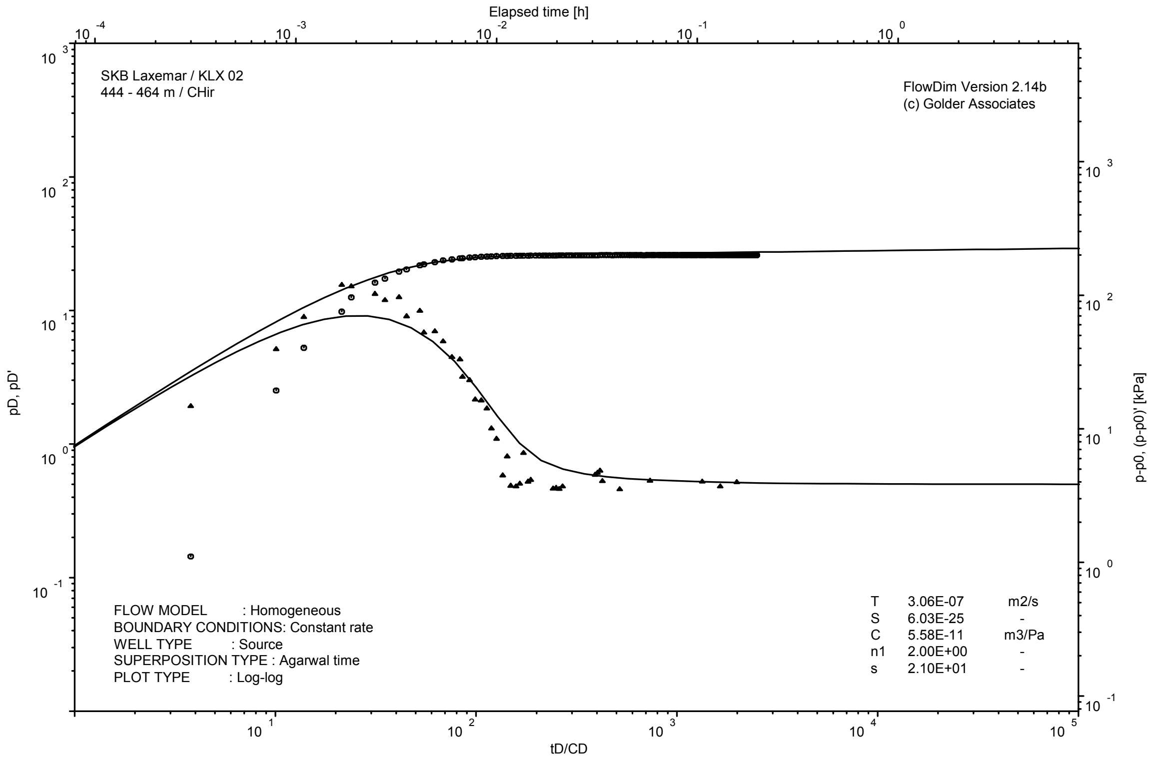
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

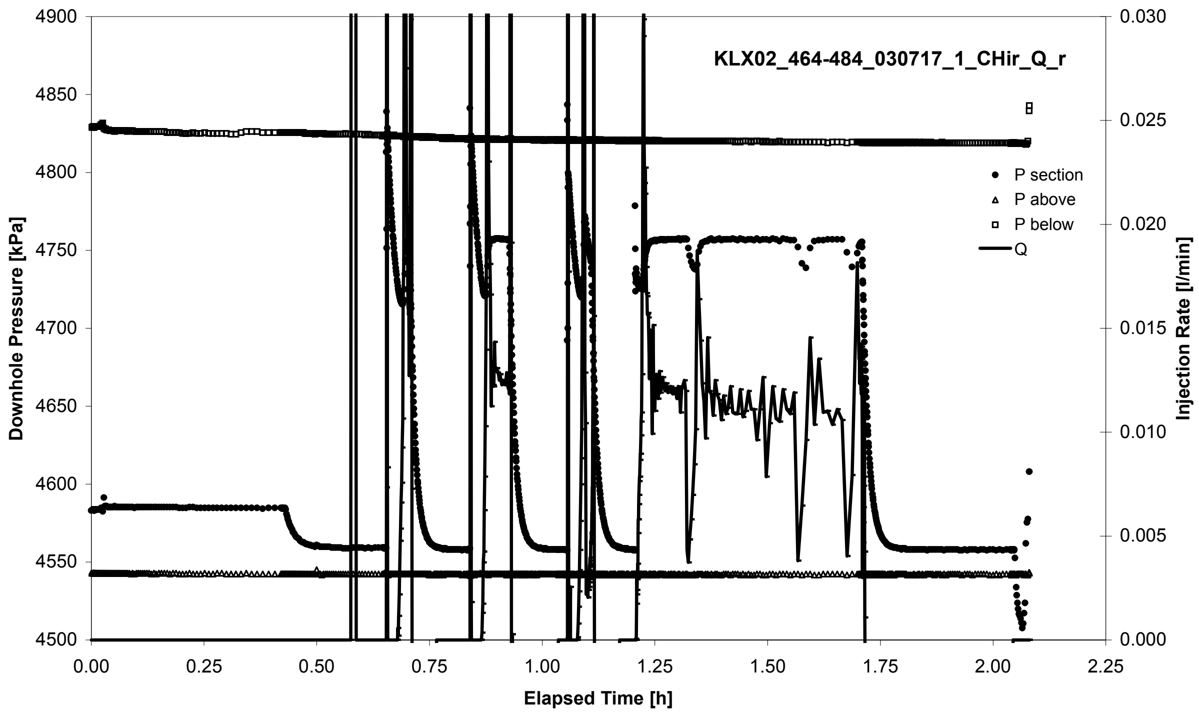


CHIR phase; Homogeneous model analyses, log-log match

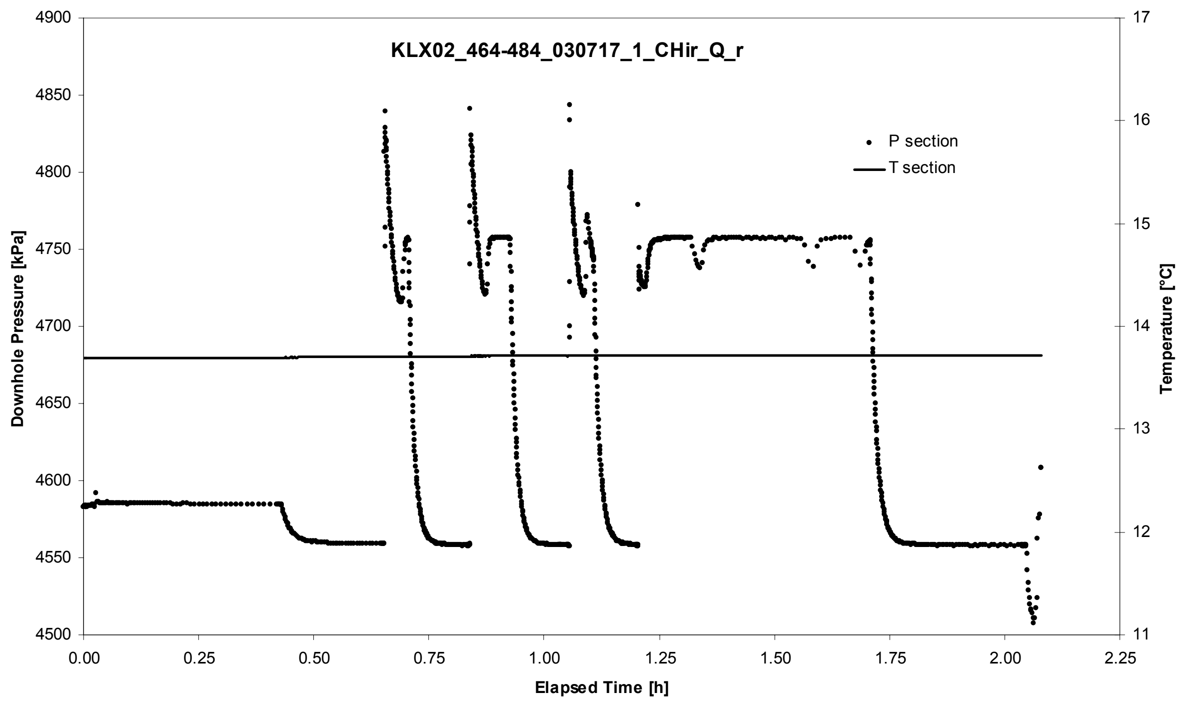
APPENDIX 2-22

Test 464 – 484 m

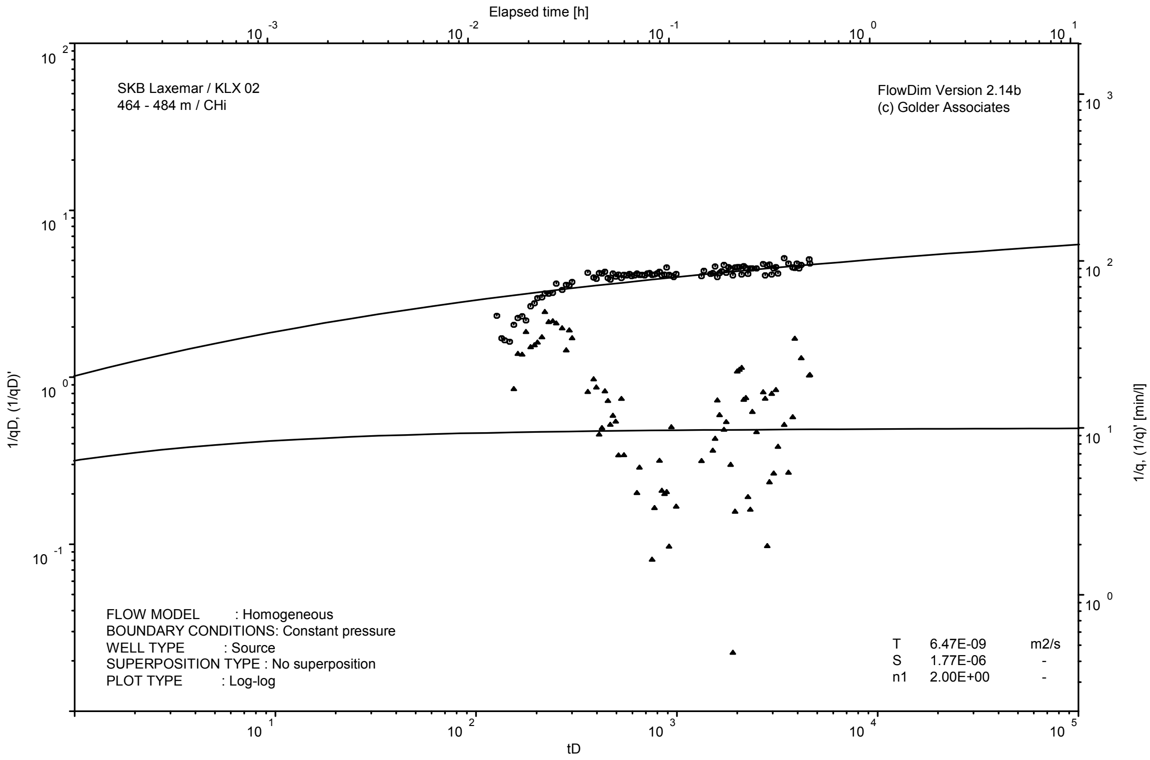
Analysis diagrams



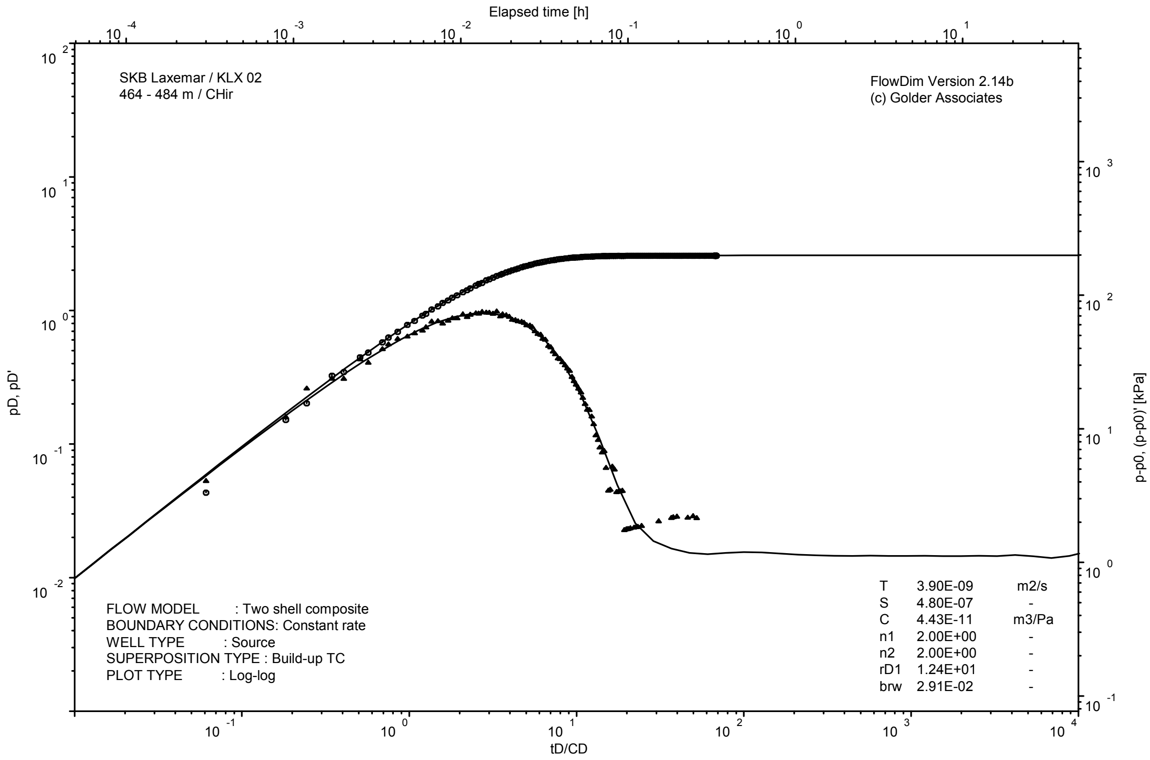
Pressure and flow rate vs. time; cartesian plot



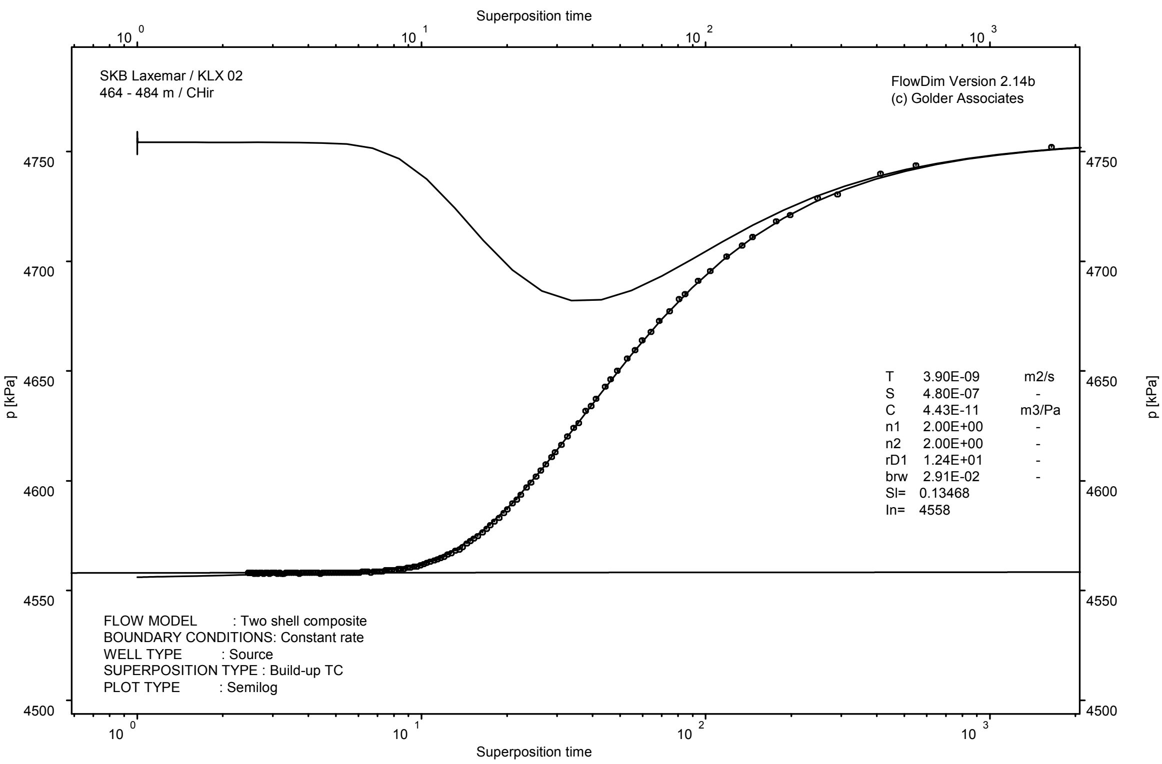
Pressure and temperature in the test section; cartesian plot



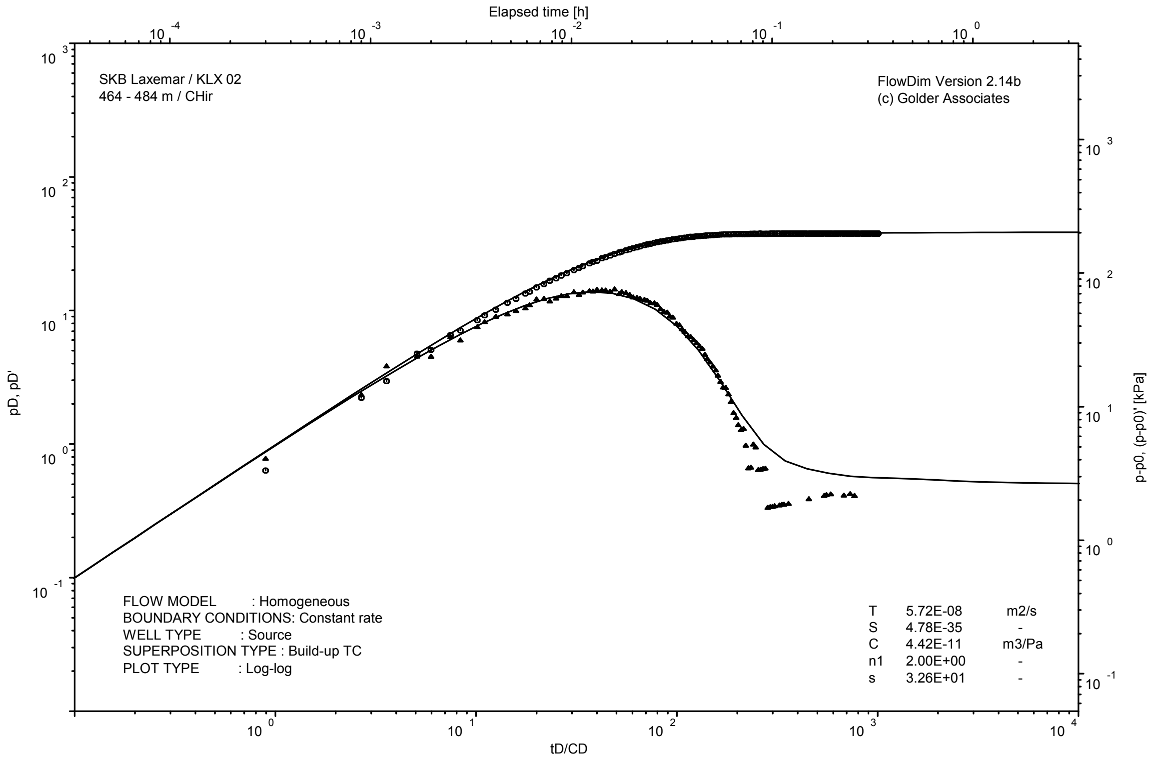
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

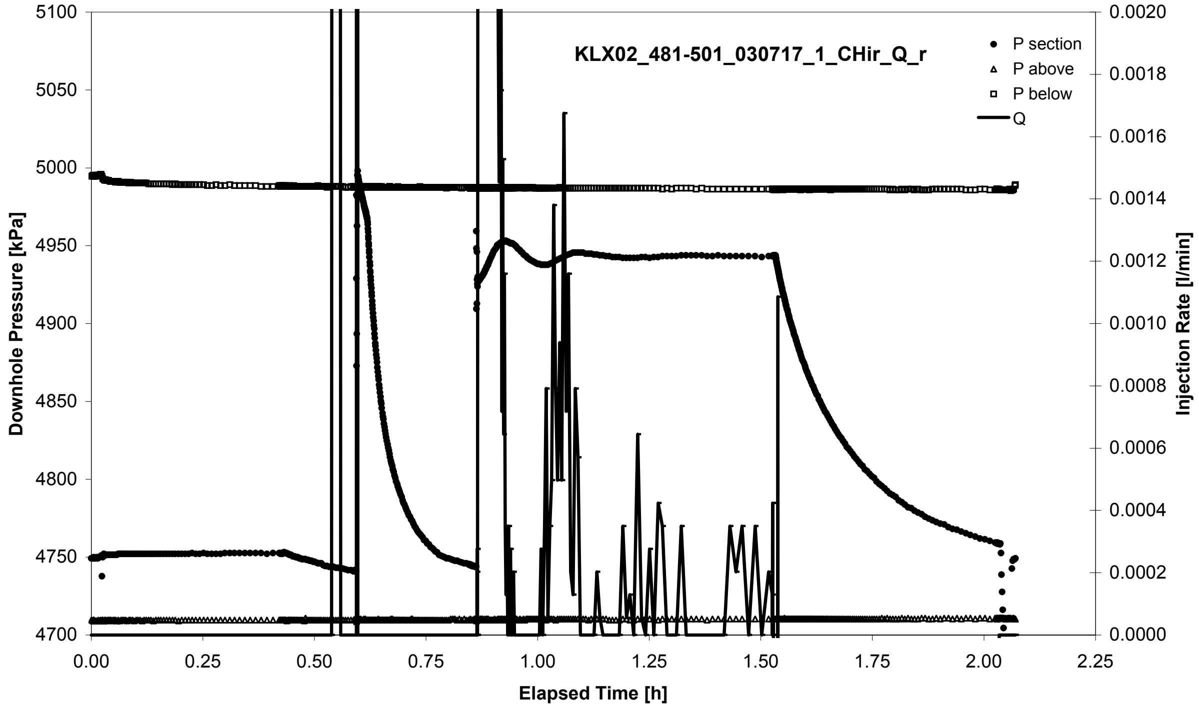


CHIR phase; Homogeneous model analyses, log-log match

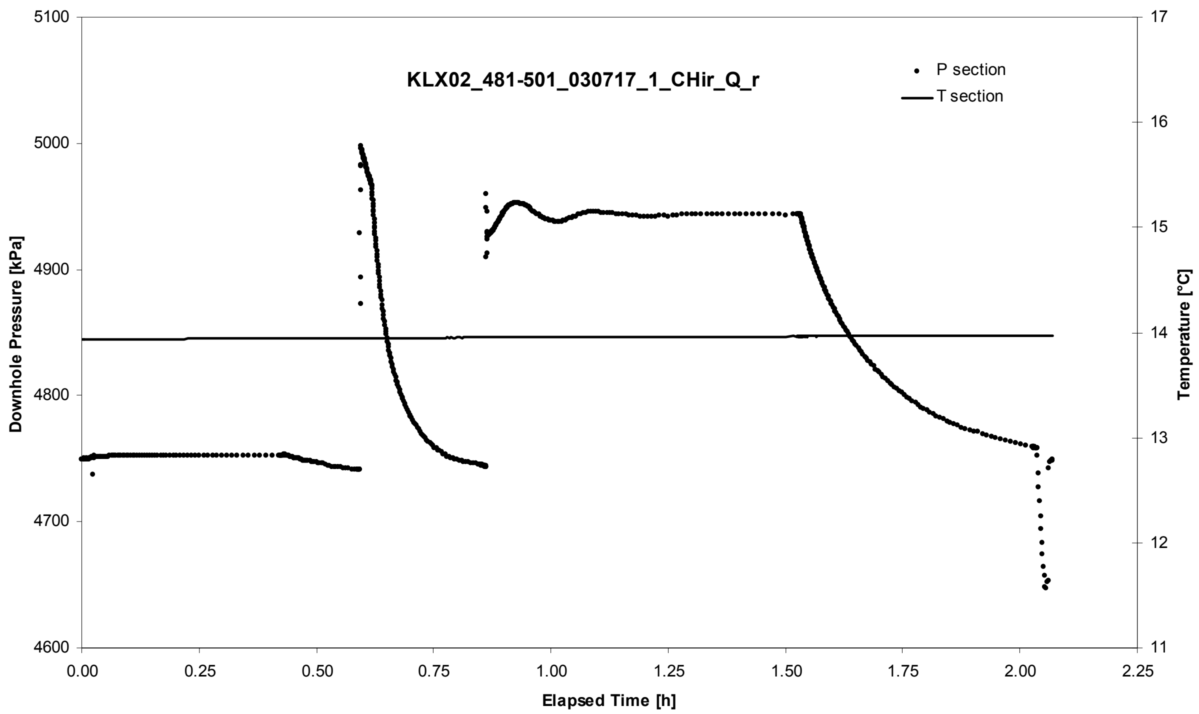
APPENDIX 2-23

Test 481 – 501 m

Analysis diagrams



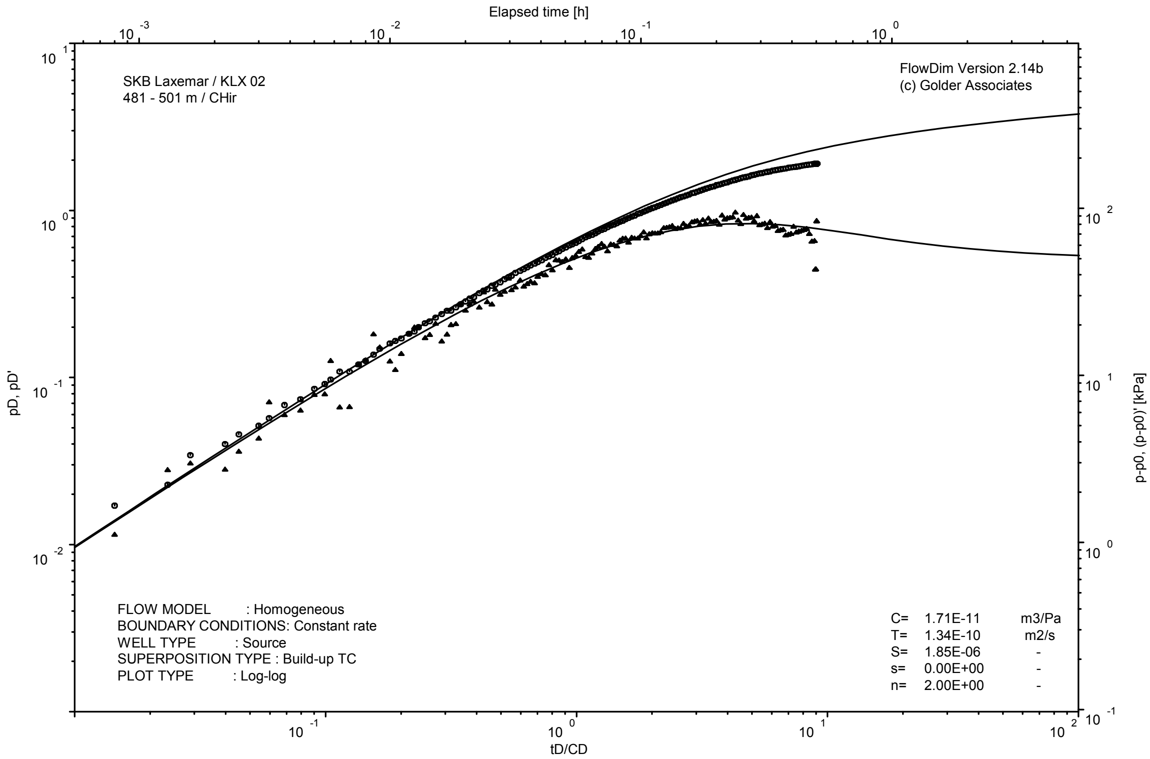
Pressure and flow rate vs. time; cartesian plot



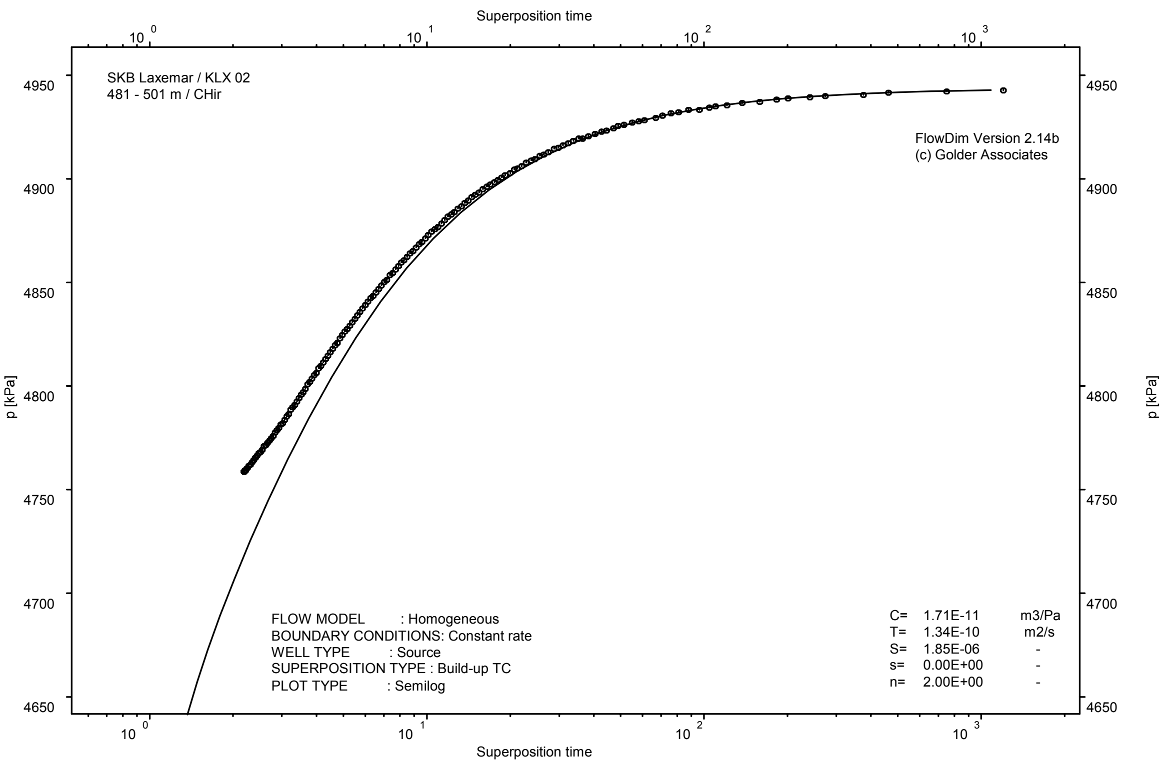
Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match



CHIR phase; log-log match

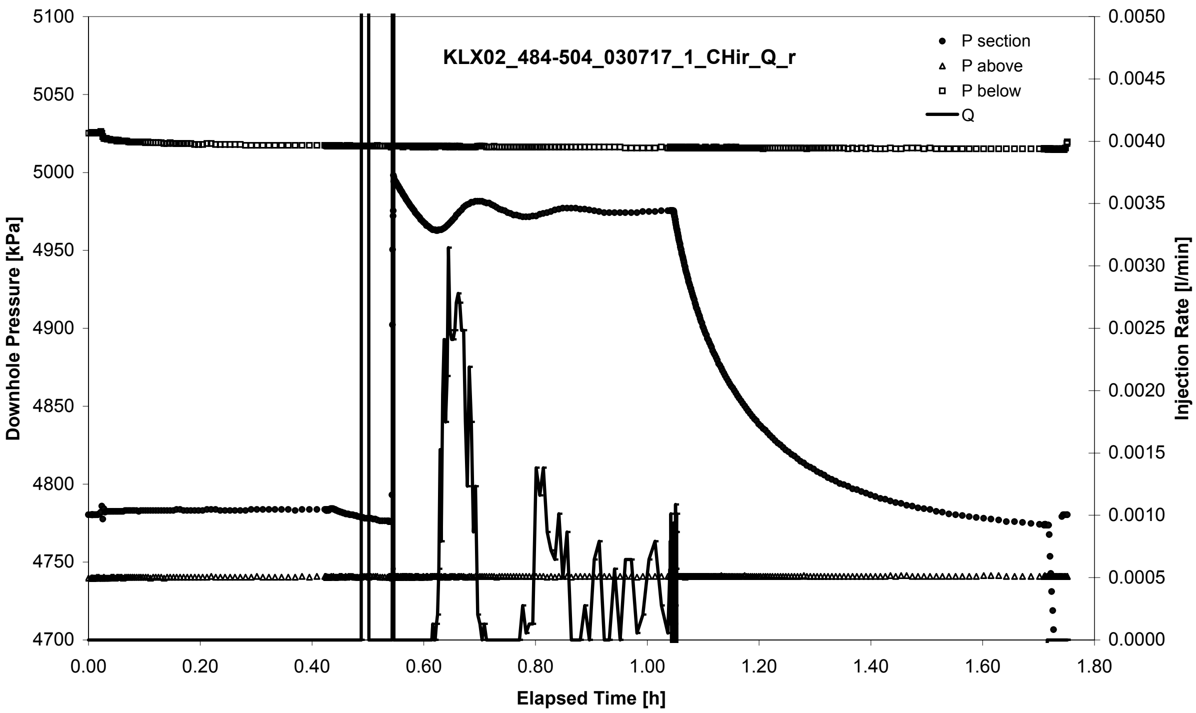


CHIR phase; HORNER match

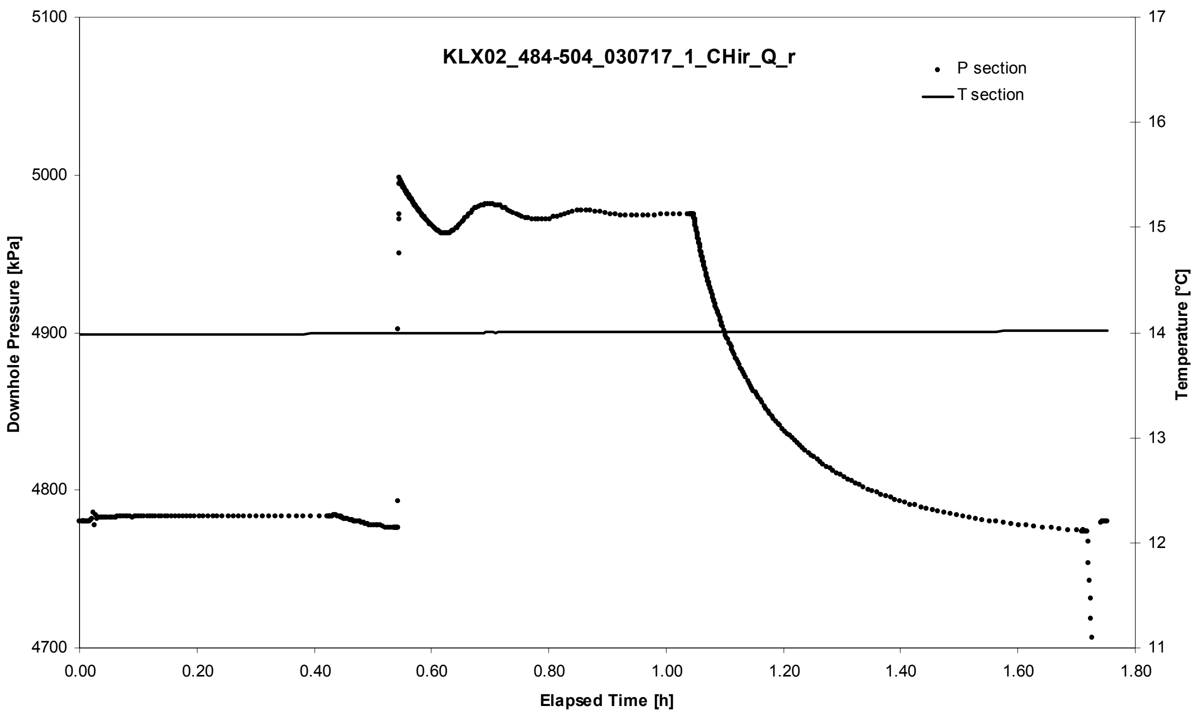
APPENDIX 2-24

Test 484 – 504 m

Analysis diagrams



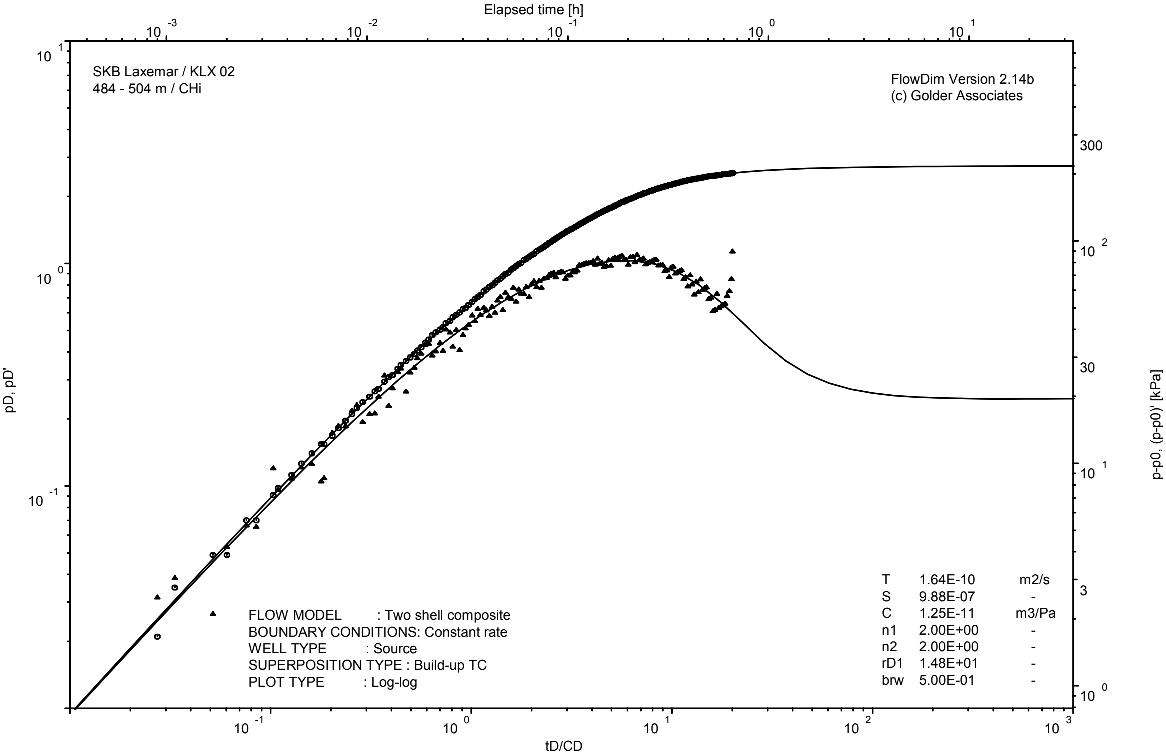
Pressure and flow rate vs. time; cartesian plot



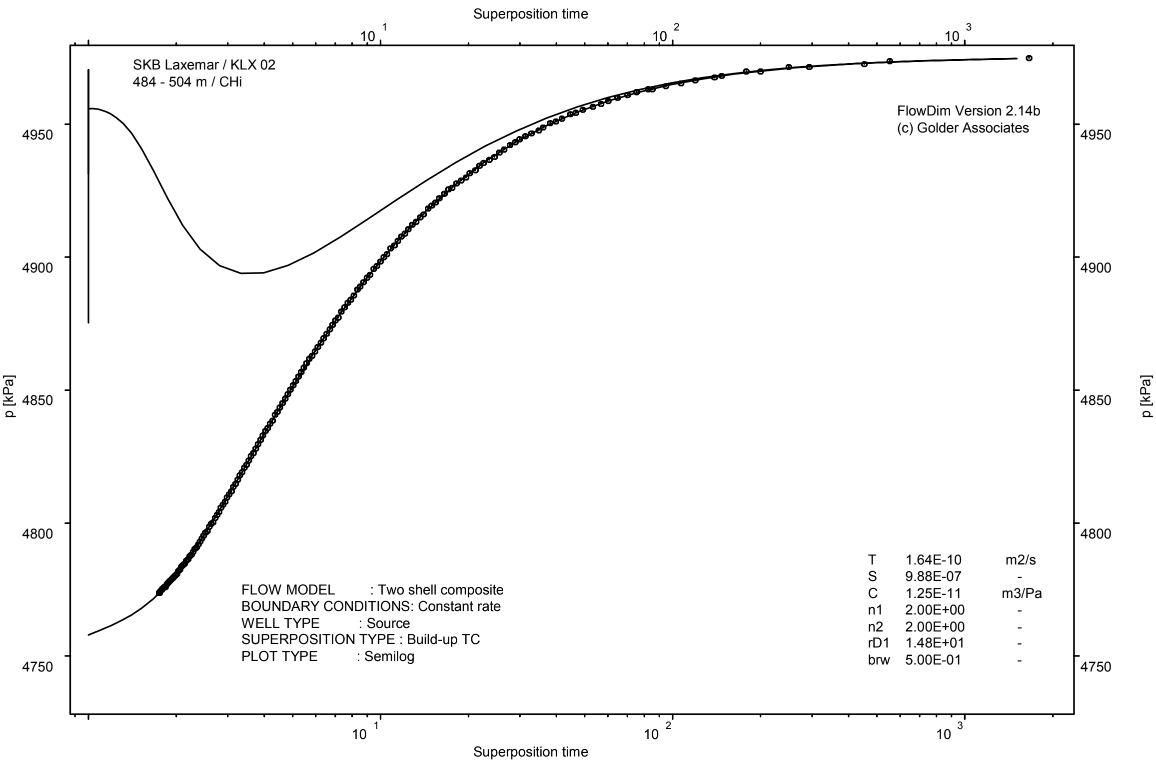
Pressure and temperature in the test section; cartesian plot

Not Analysed

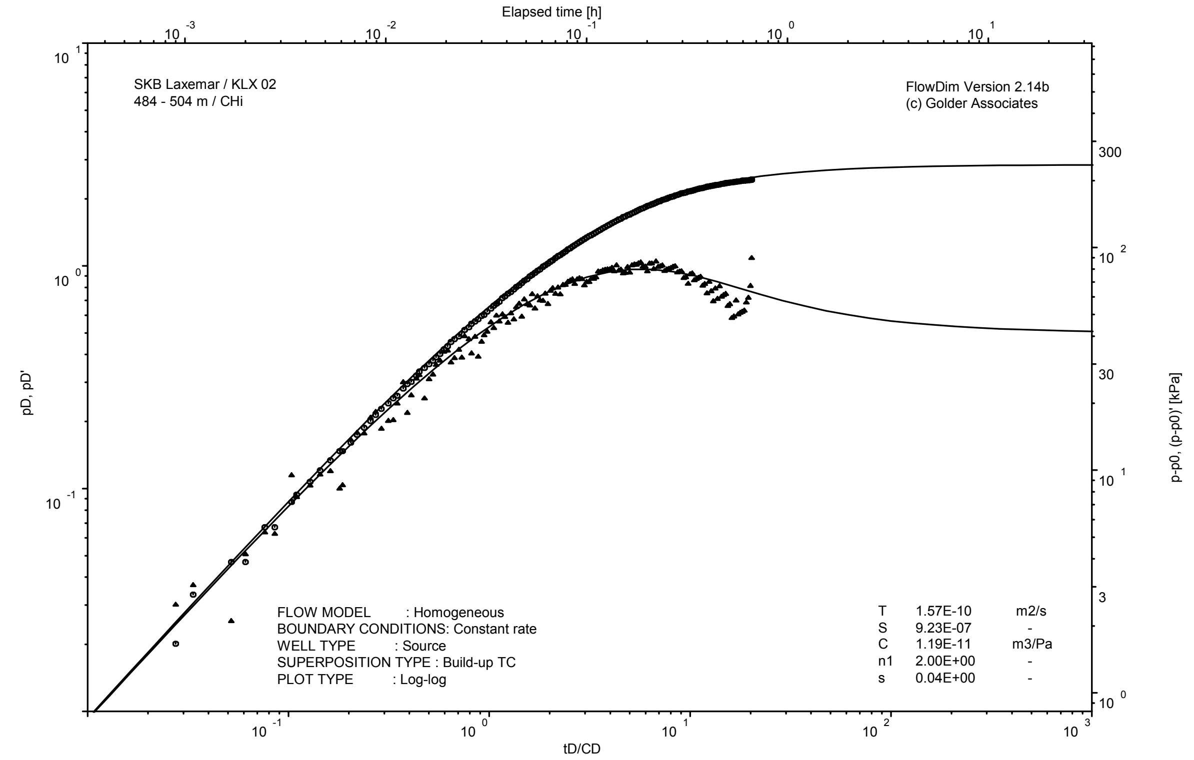
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

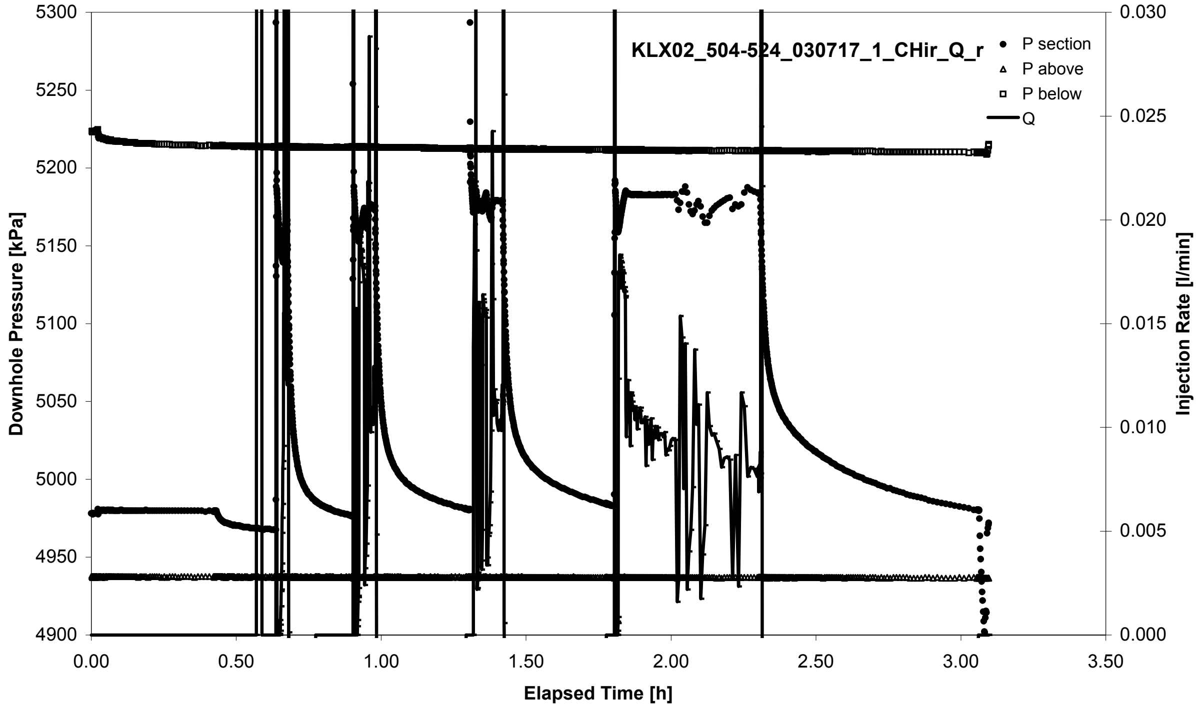


CHIR phase; Homogeneous model analyses, log-log match

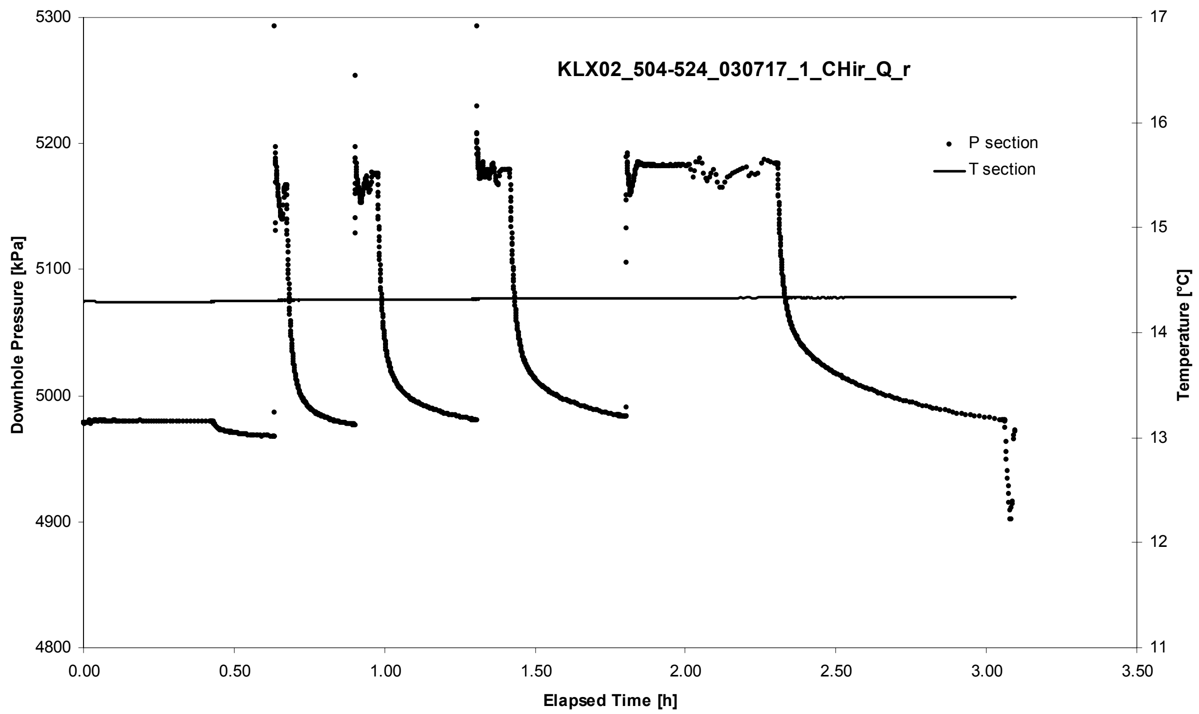
APPENDIX 2-25

Test 504 – 524 m

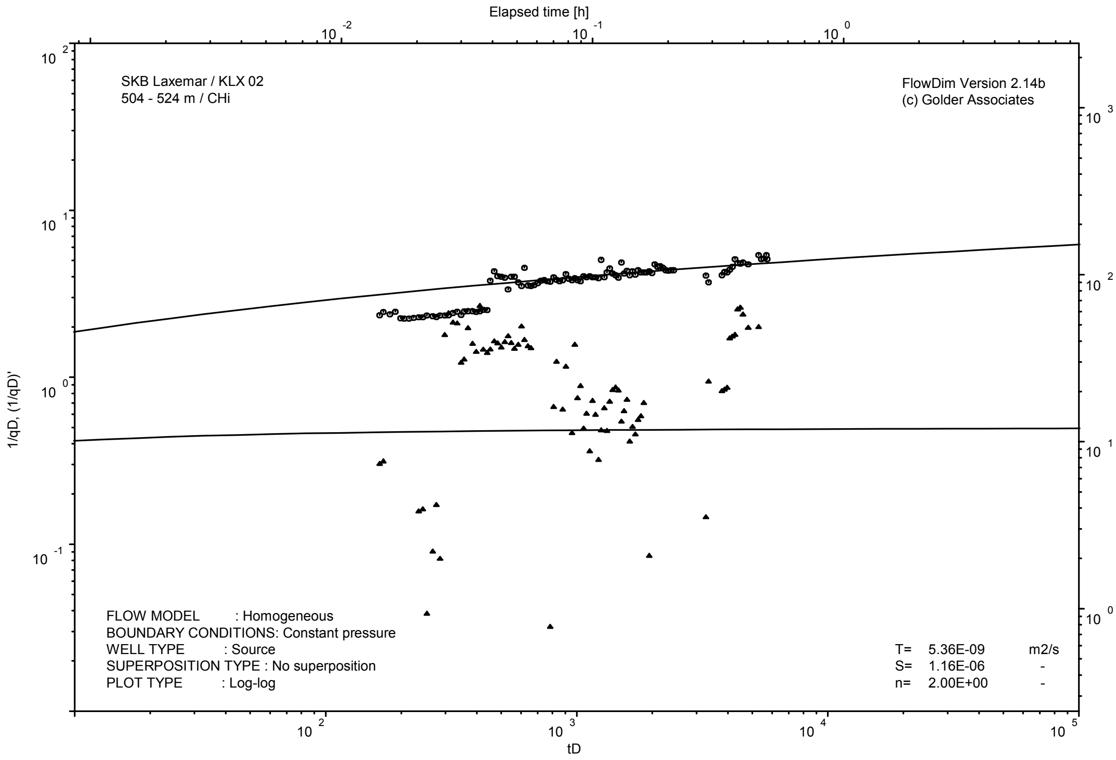
Analysis diagrams



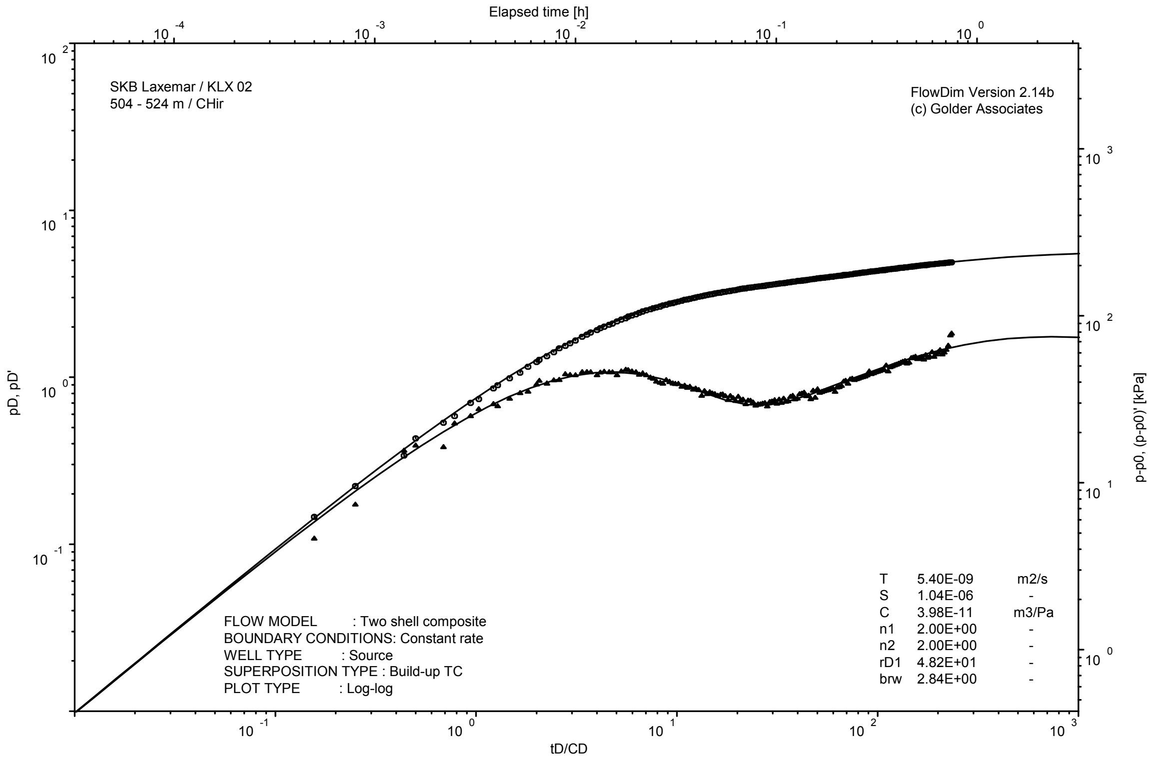
Pressure and flow rate vs. time; cartesian plot



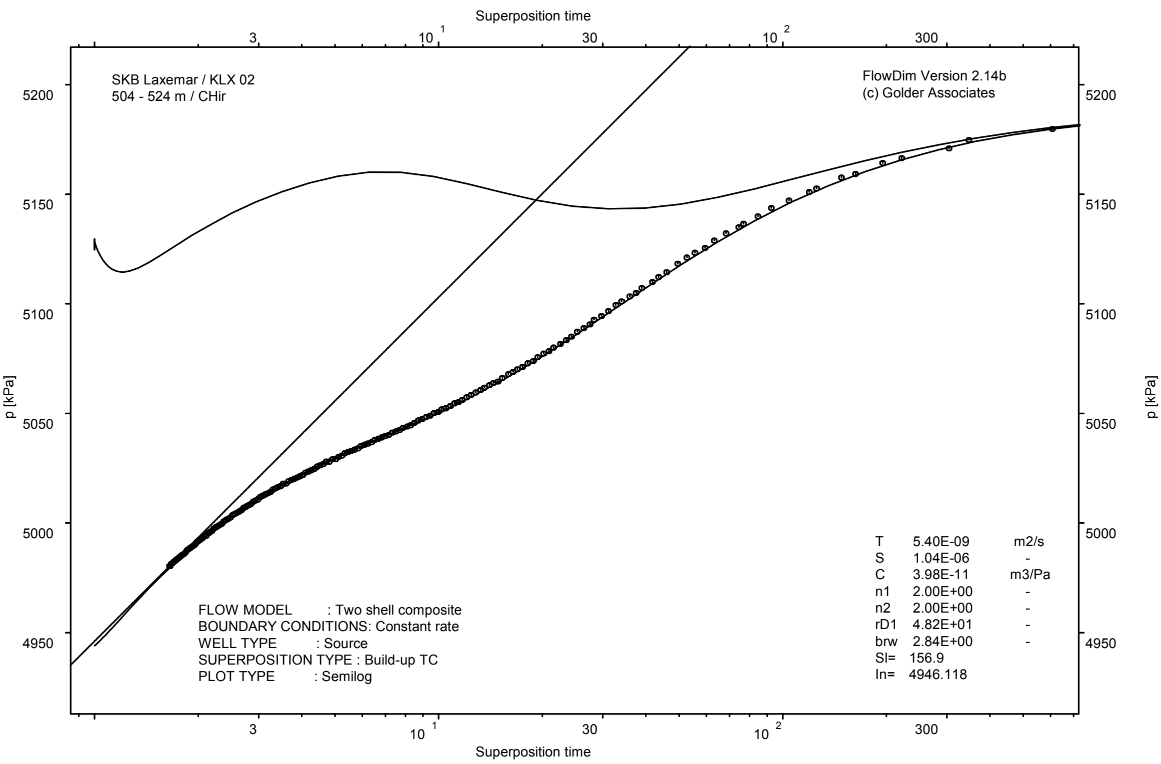
Pressure and temperature in the test section; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

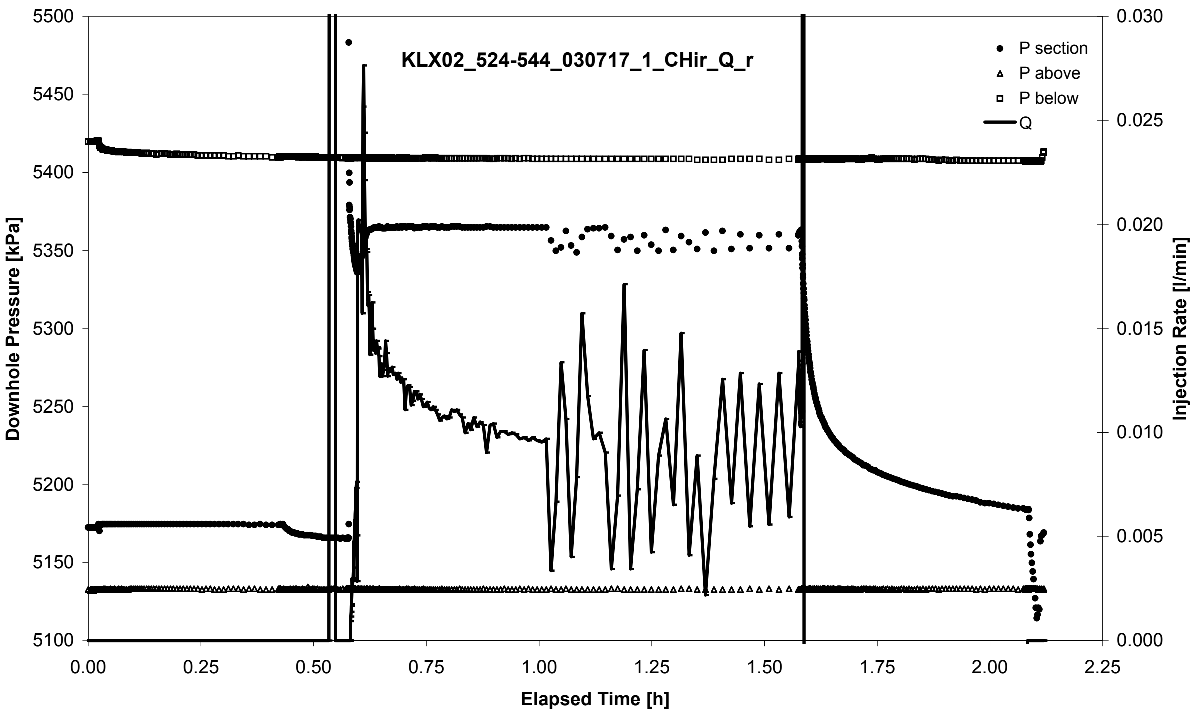


CHIR phase; HORNER match

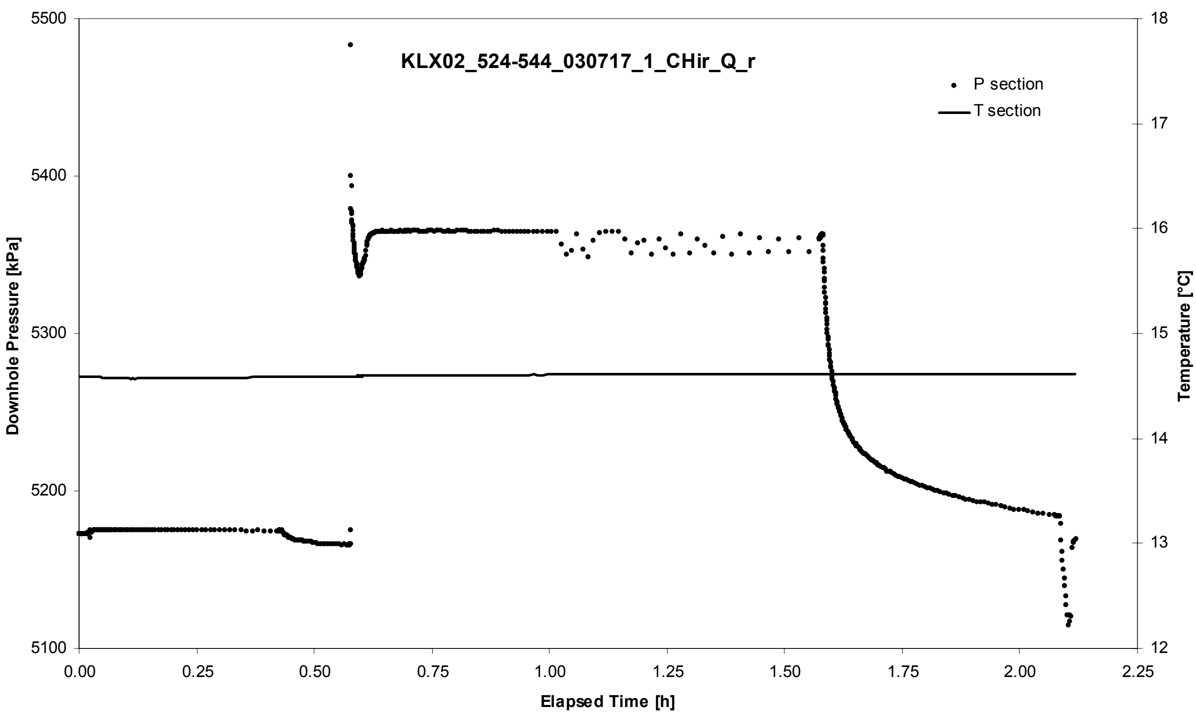
APPENDIX 2-26

Test 524 – 544 m

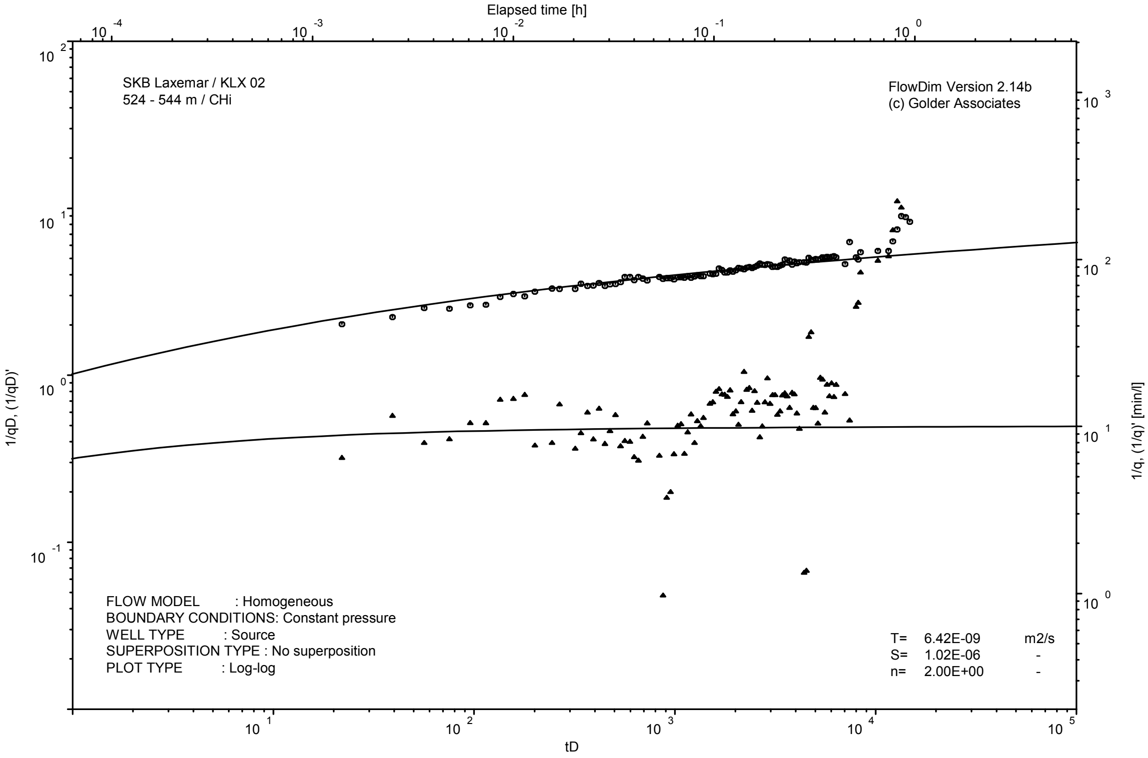
Analysis diagrams



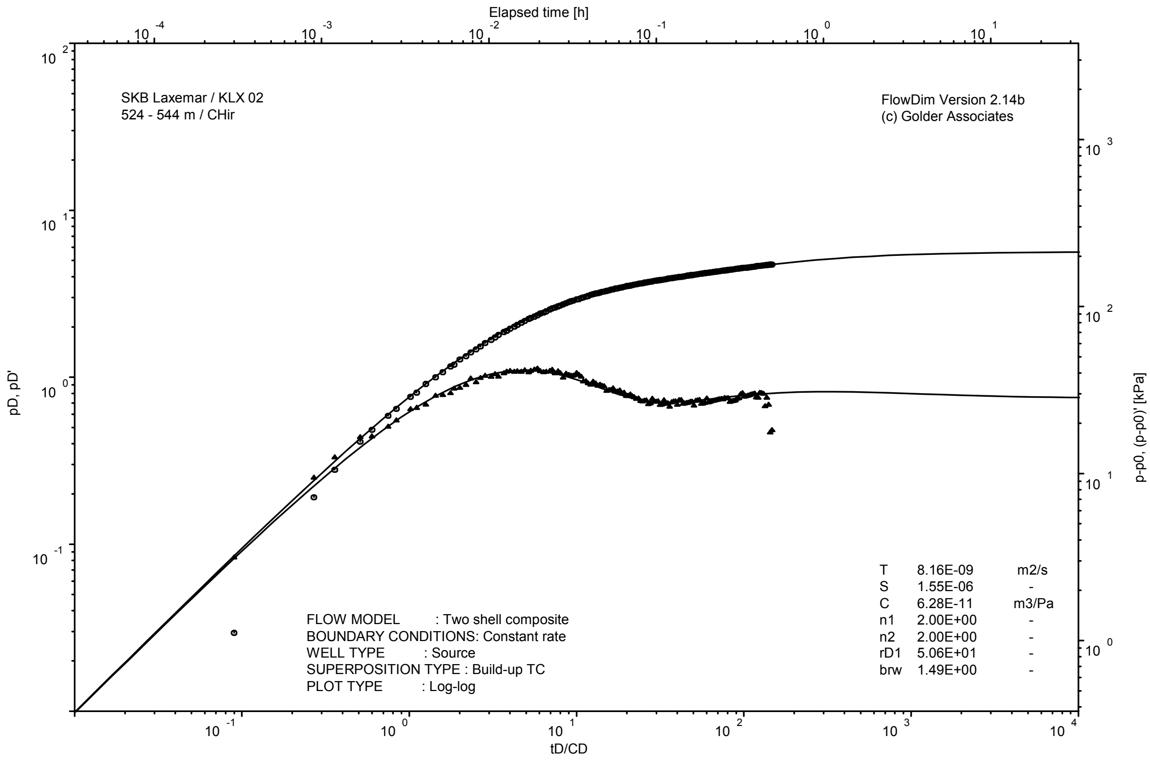
Pressure and flow rate vs. time; cartesian plot



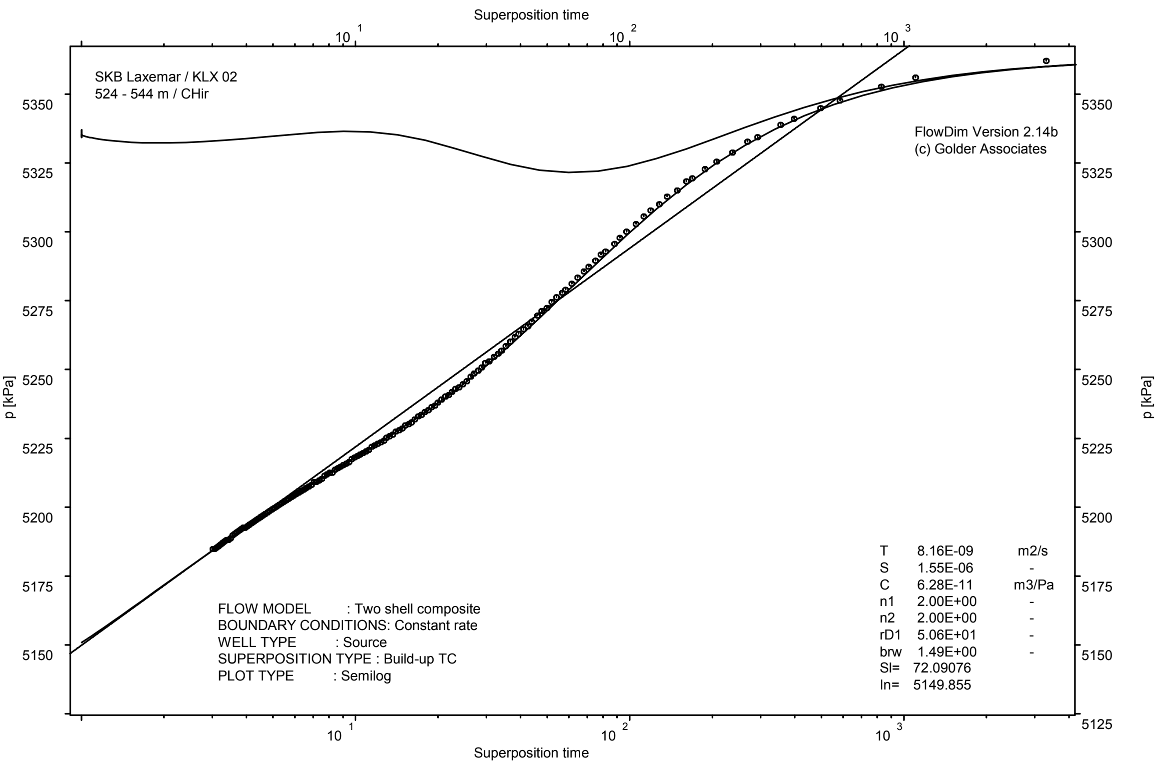
Pressure and temperature in the test section; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

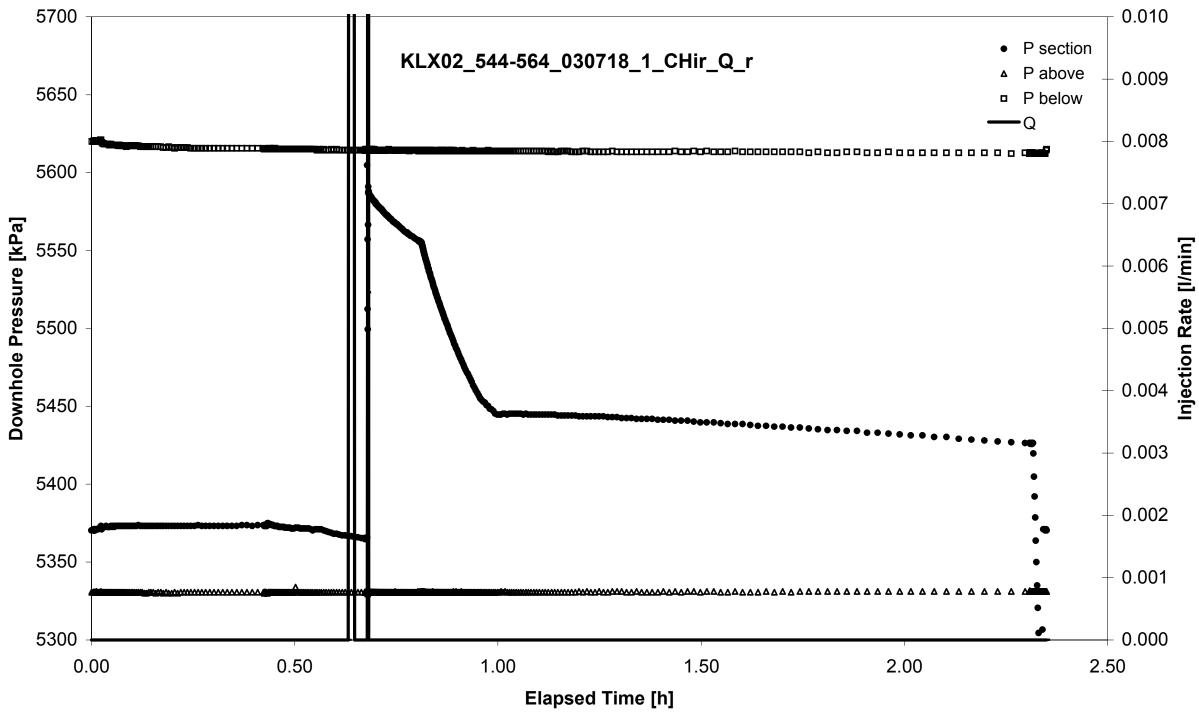


CHIR phase; HORNER match

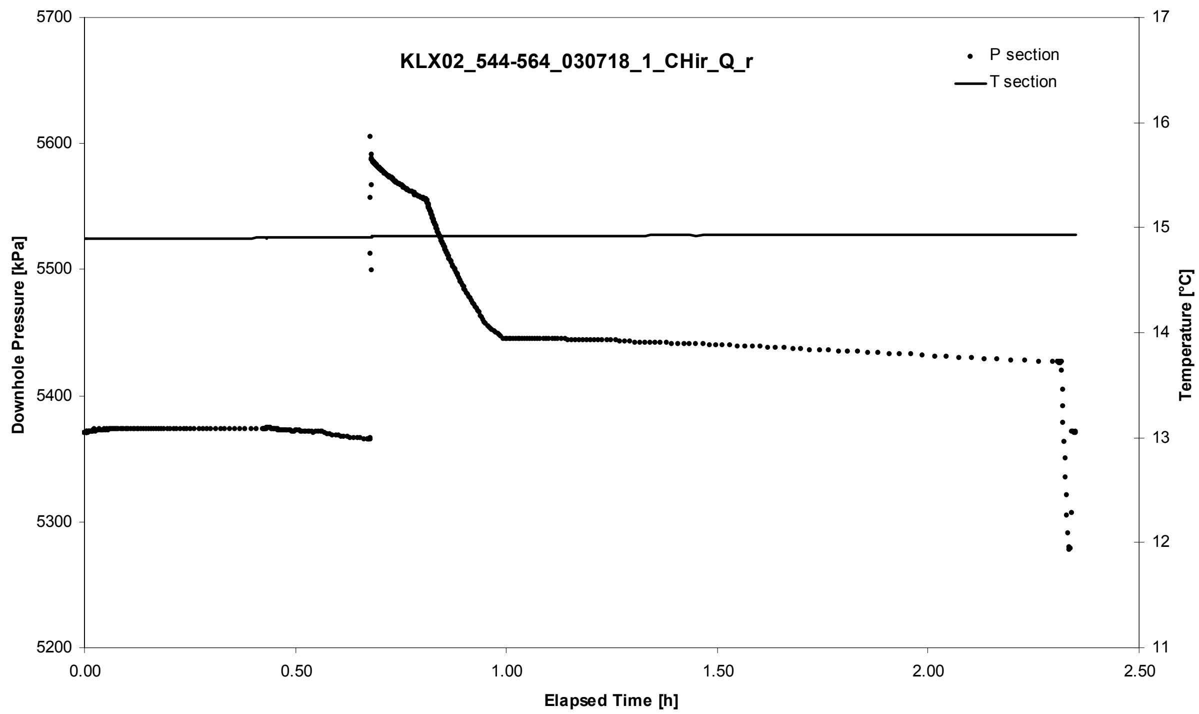
APPENDIX 2-27

Test 544 – 564 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

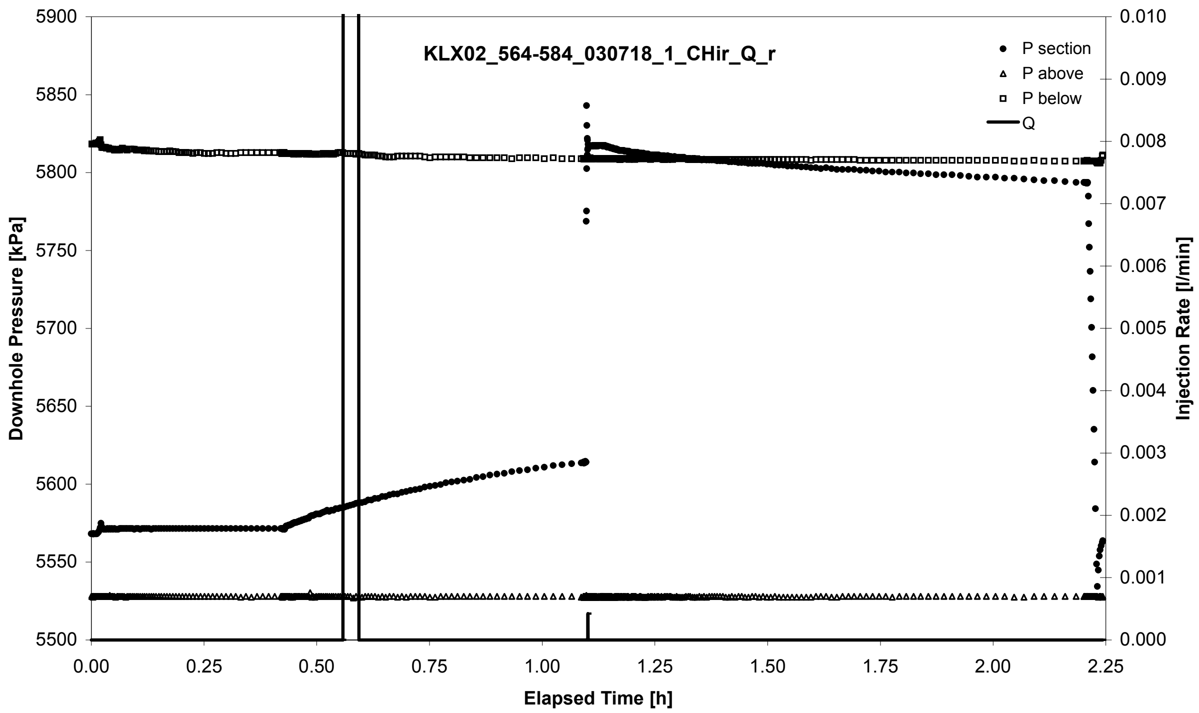
Not Analysed

CHIR phase; HORNER match

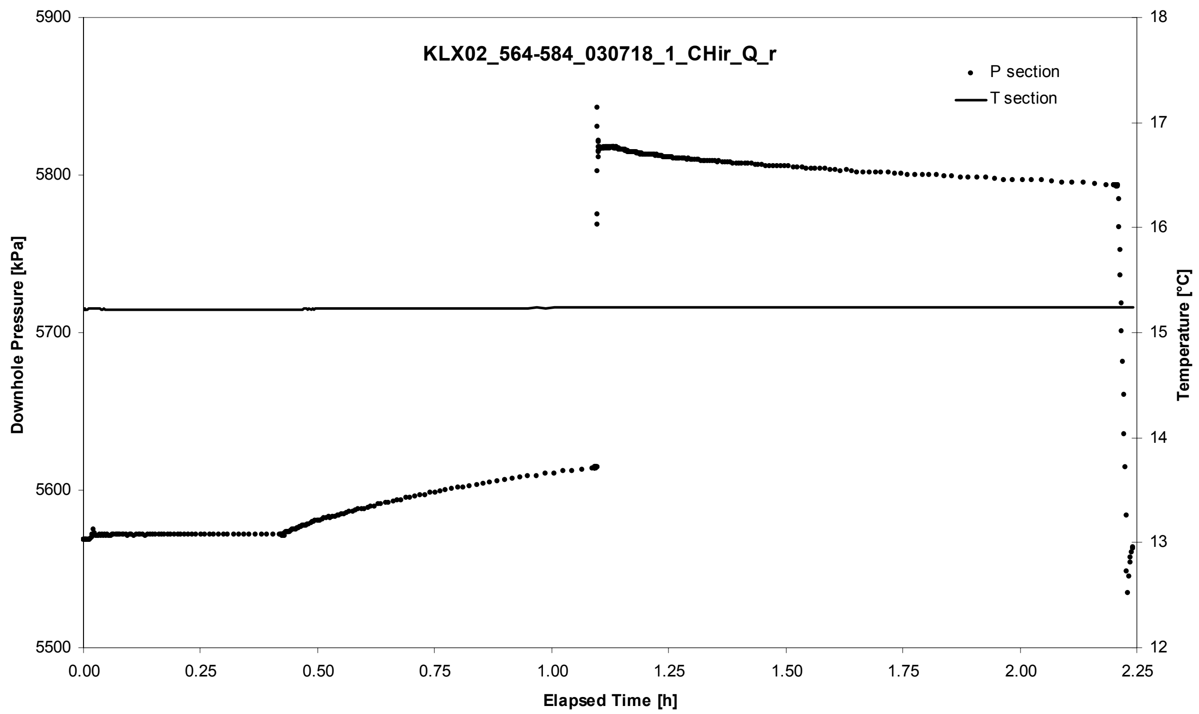
APPENDIX 2-28

Test 564 – 584 m

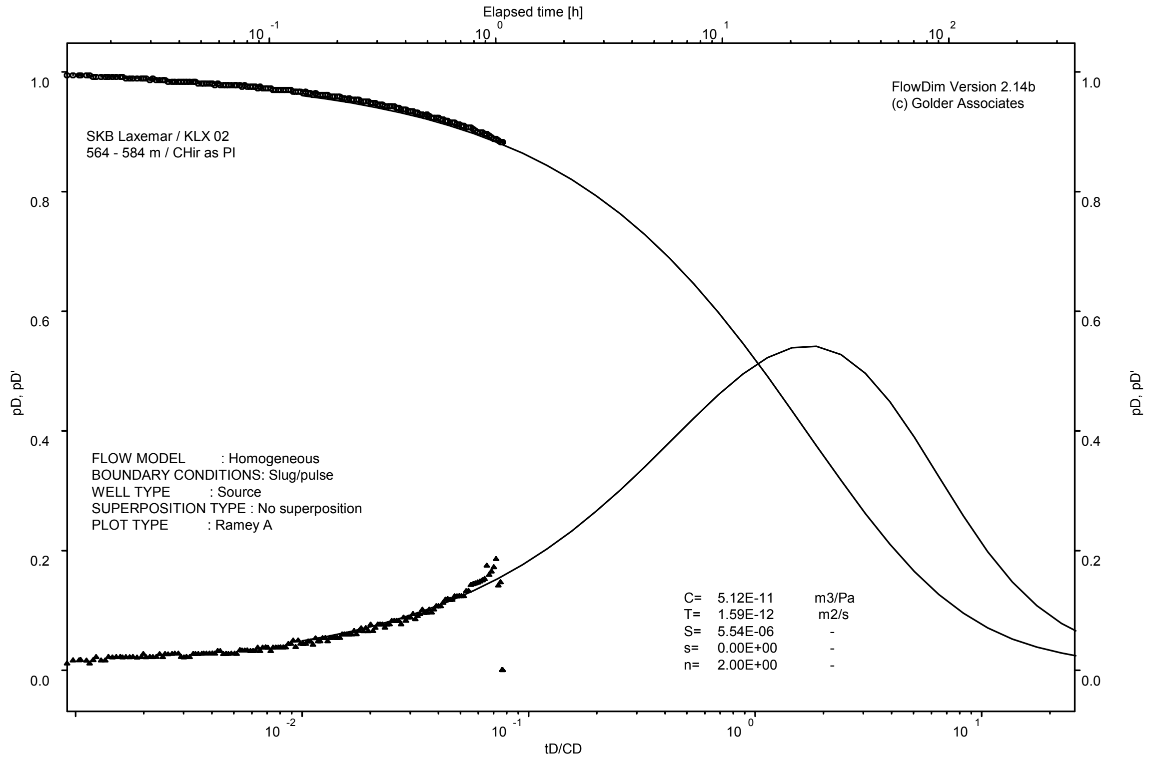
Analysis diagrams



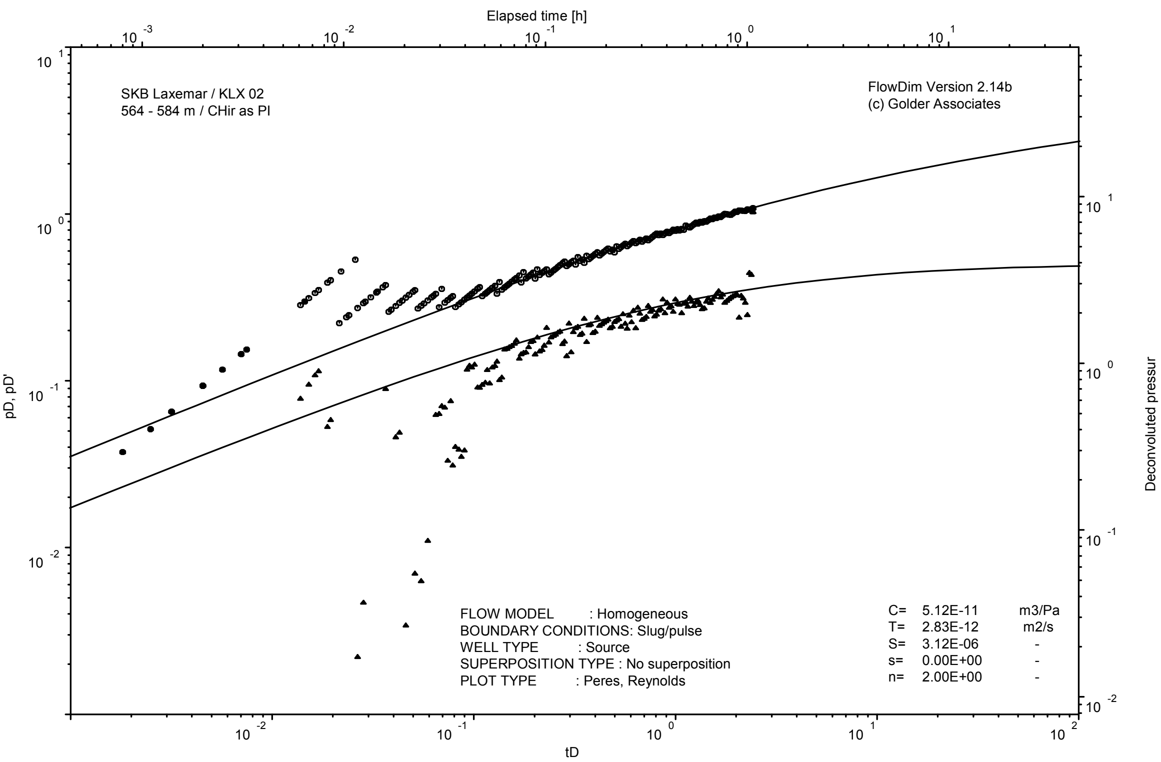
Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot



CHIR phase; RAMEY match

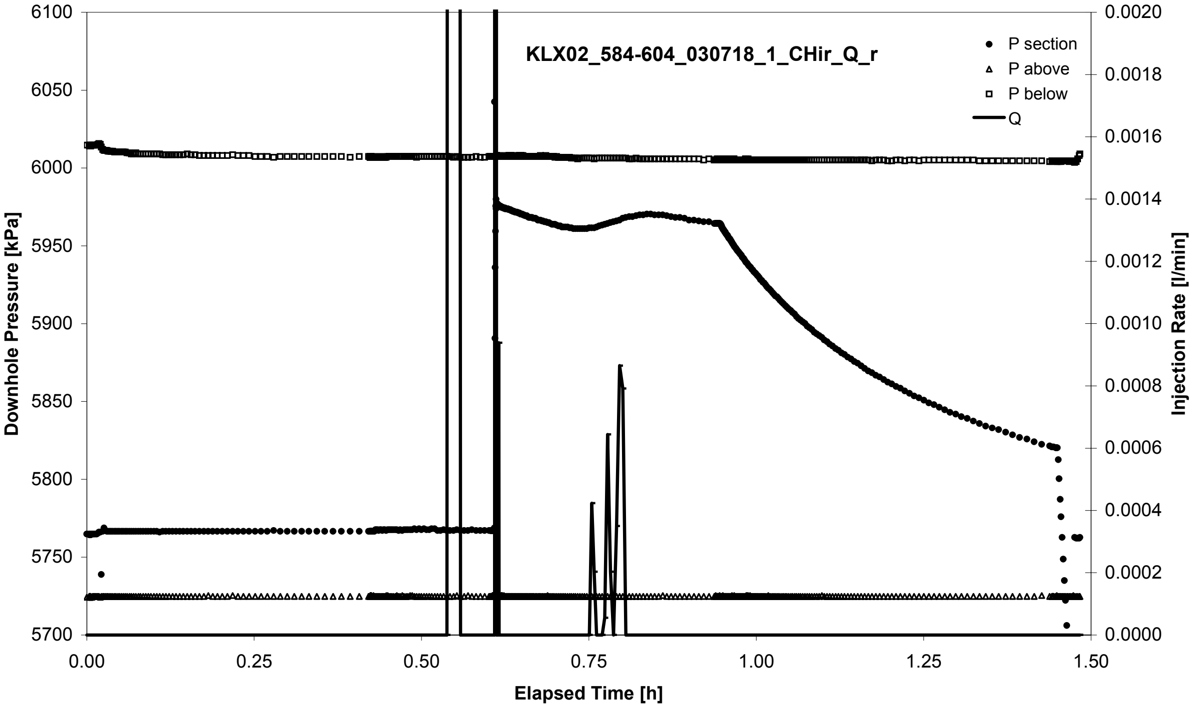


CHIR phase analysed as pulse injection; deconvolution match

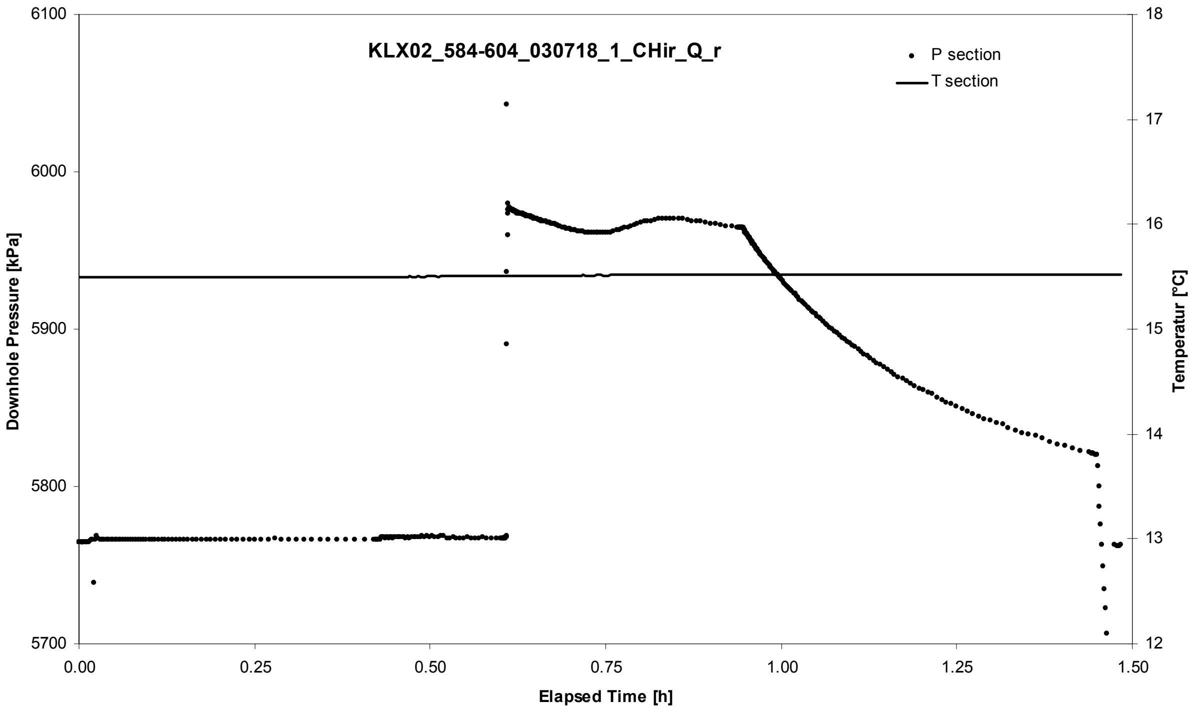
APPENDIX 2-29

Test 584 – 604 m

Analysis diagrams



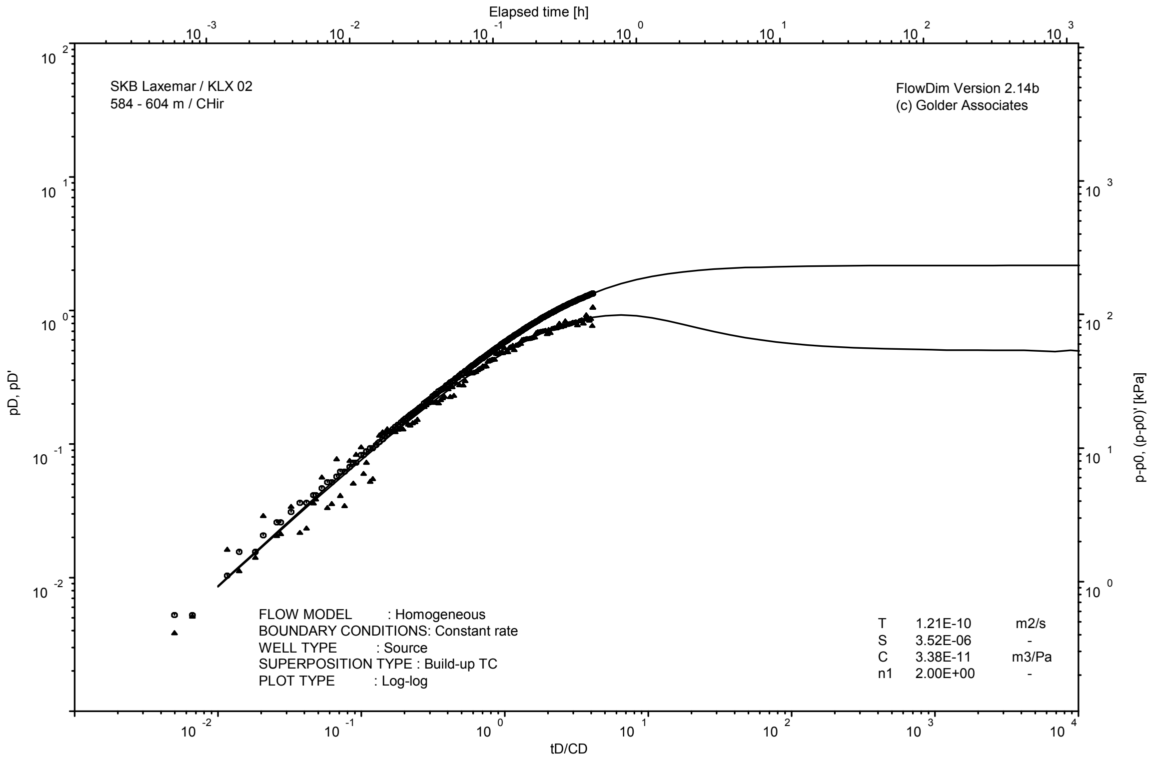
Pressure and flow rate vs. time; cartesian plot



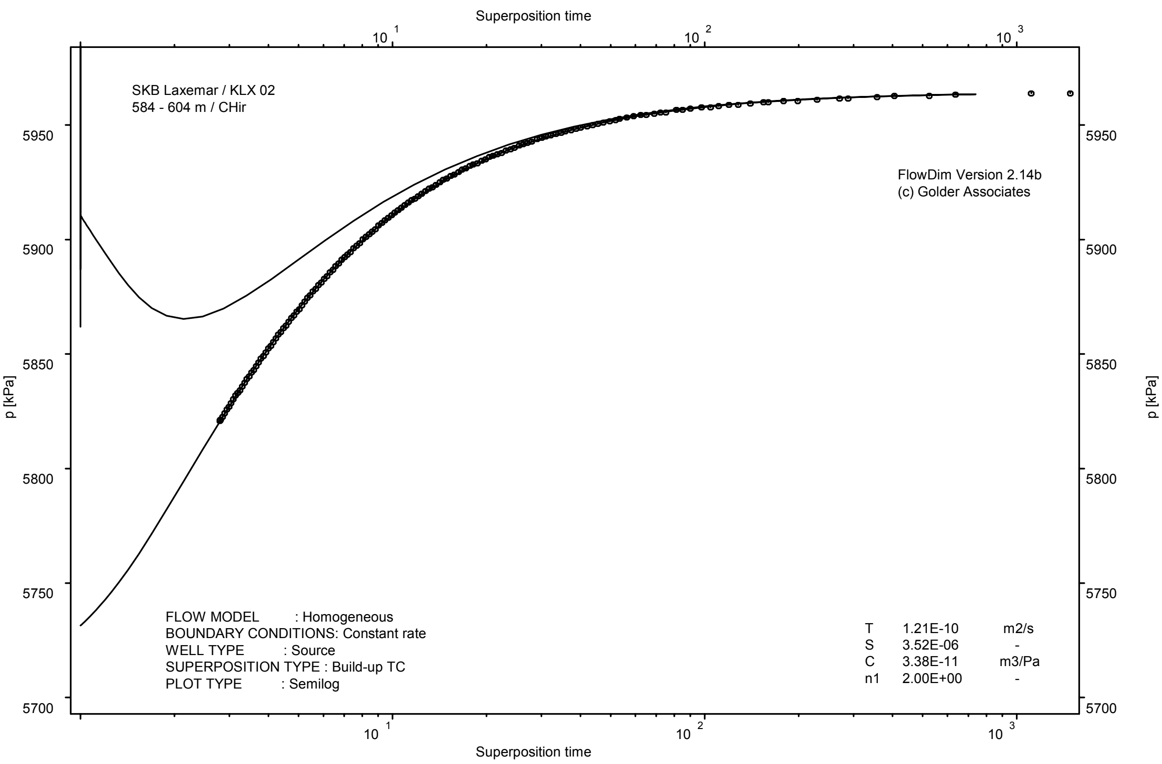
Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match



CHIR phase; log-log match

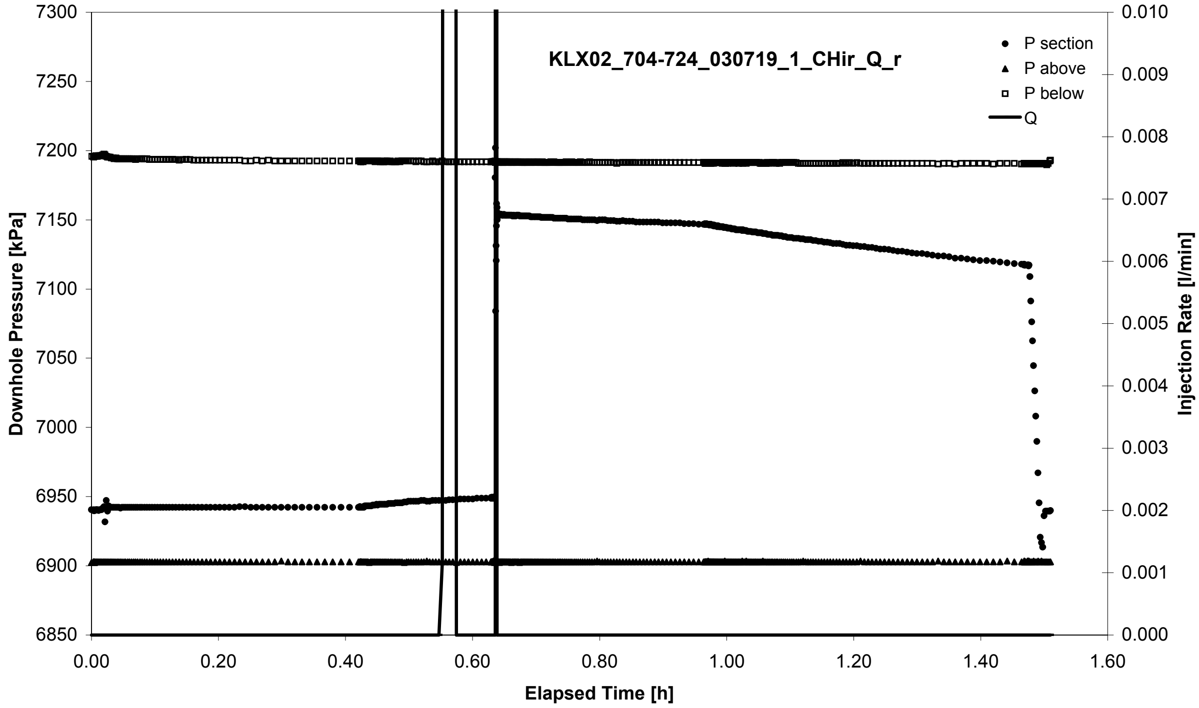


CHIR phase; HORNER match

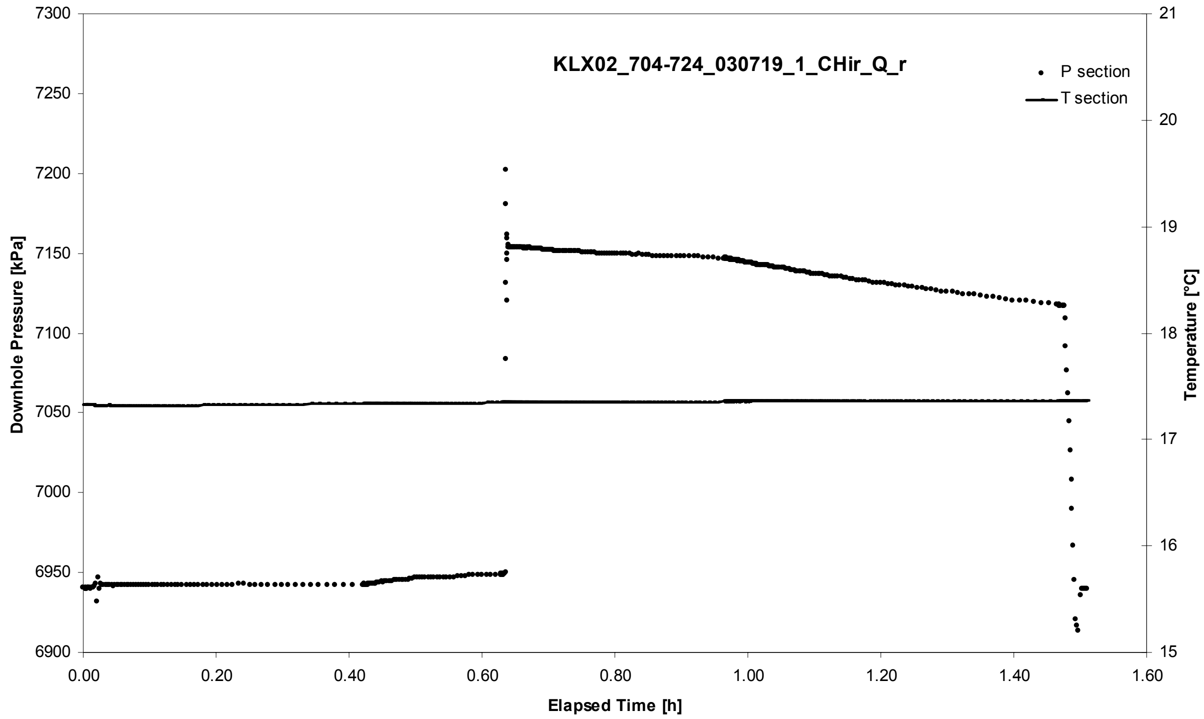
APPENDIX 2-30

Test 704 – 724 m

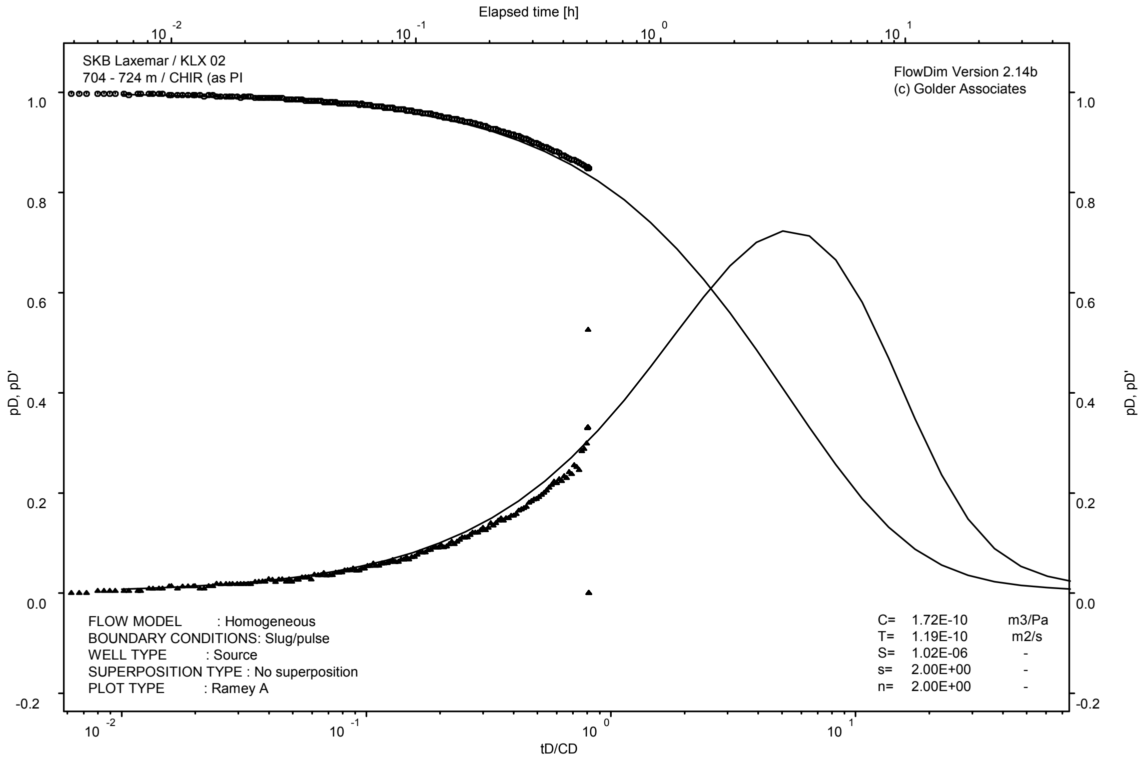
Analysis diagrams



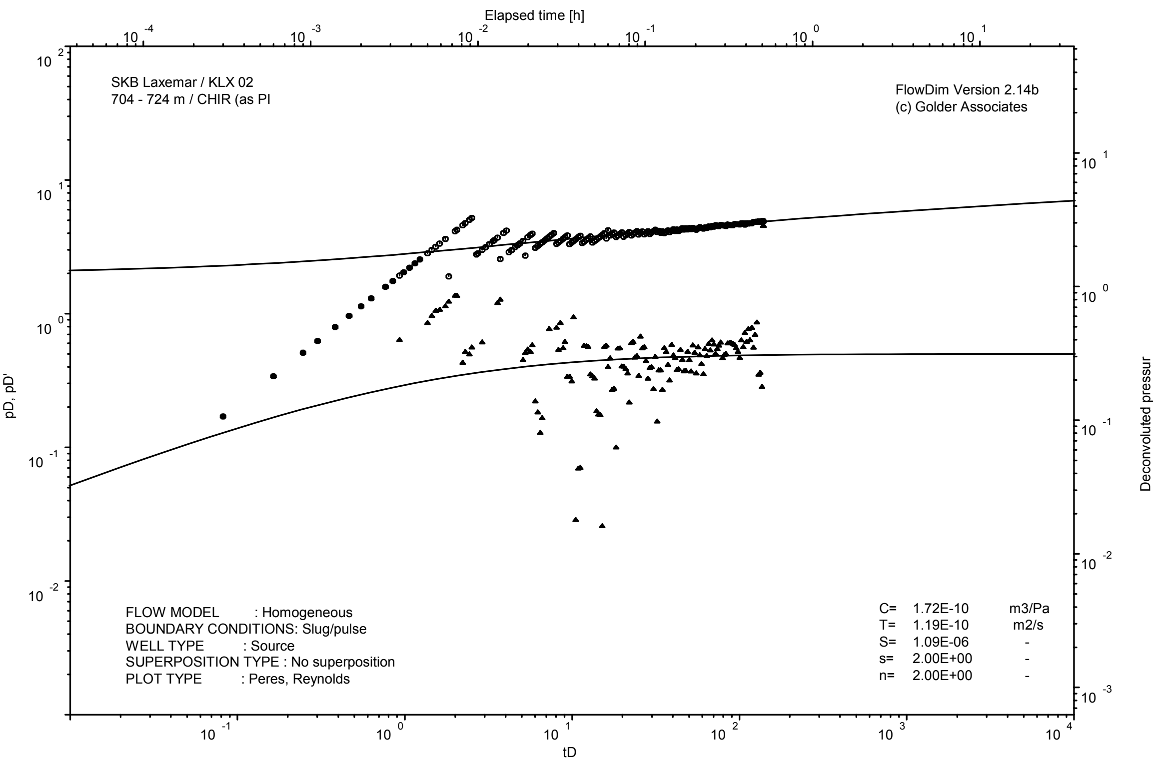
Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot



CHIR phase; RAMEY match

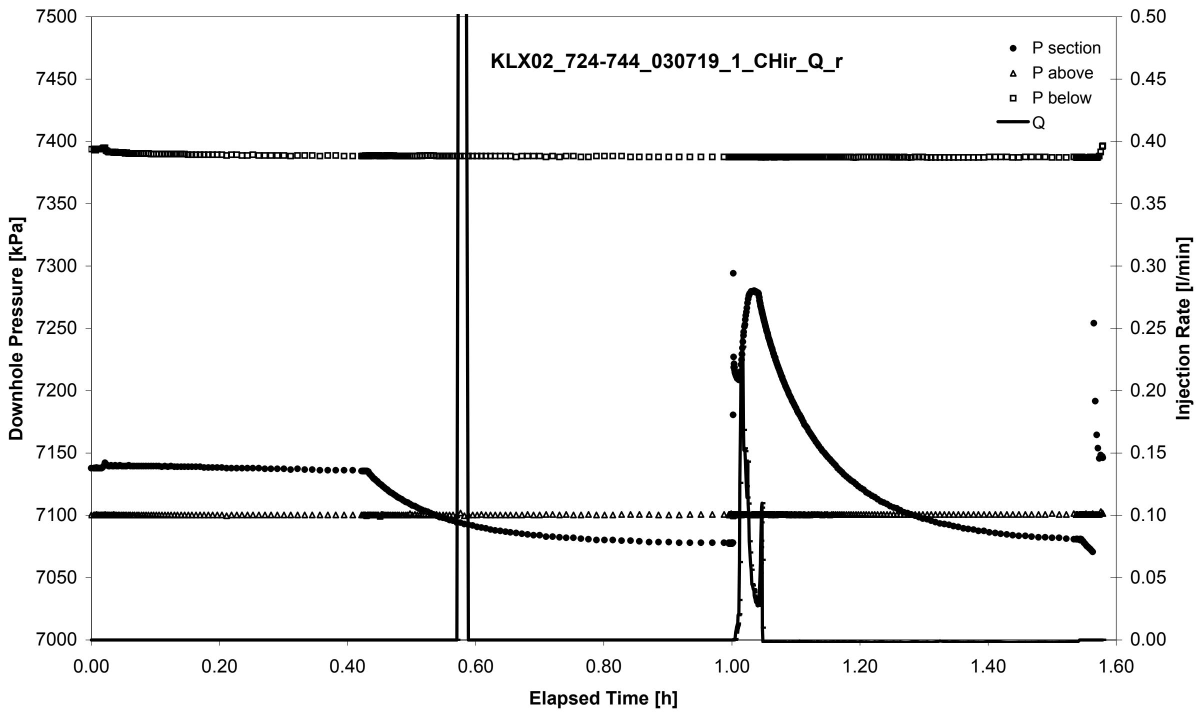


CHIR phase analysed as pulse injection; deconvolution match

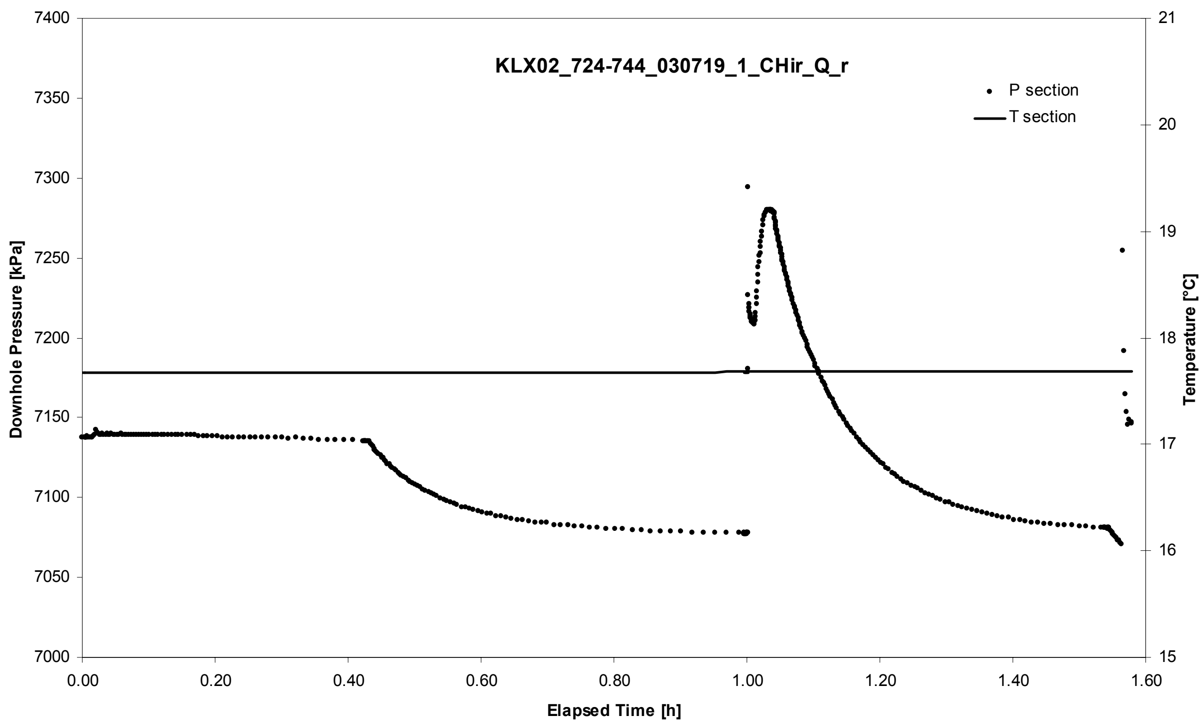
APPENDIX 2-31

Test 724 – 744 m

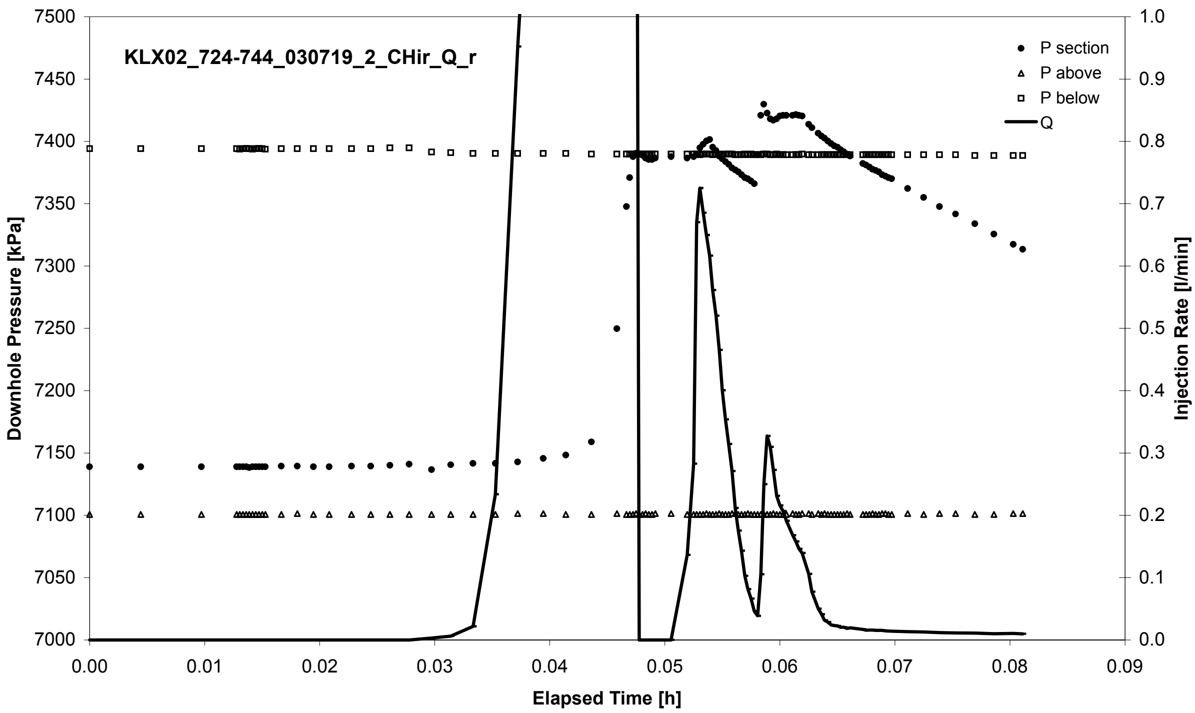
Analysis diagrams



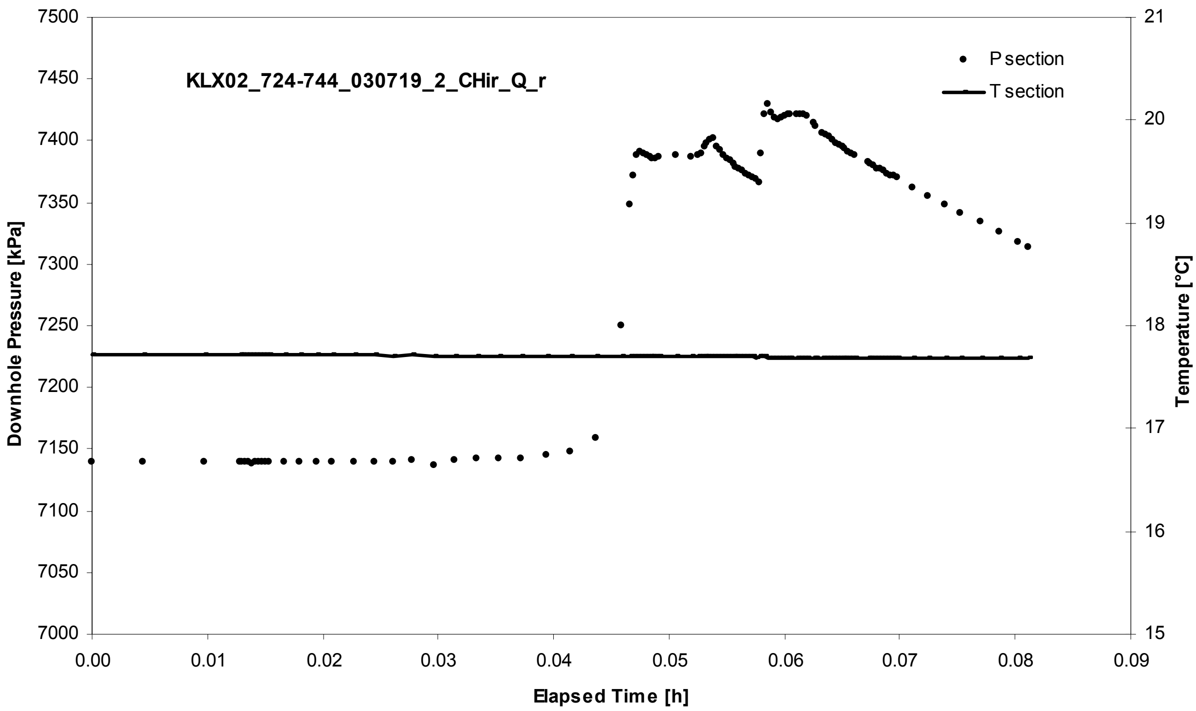
Pressure and flow rate vs. time; cartesian plot (test repeated)



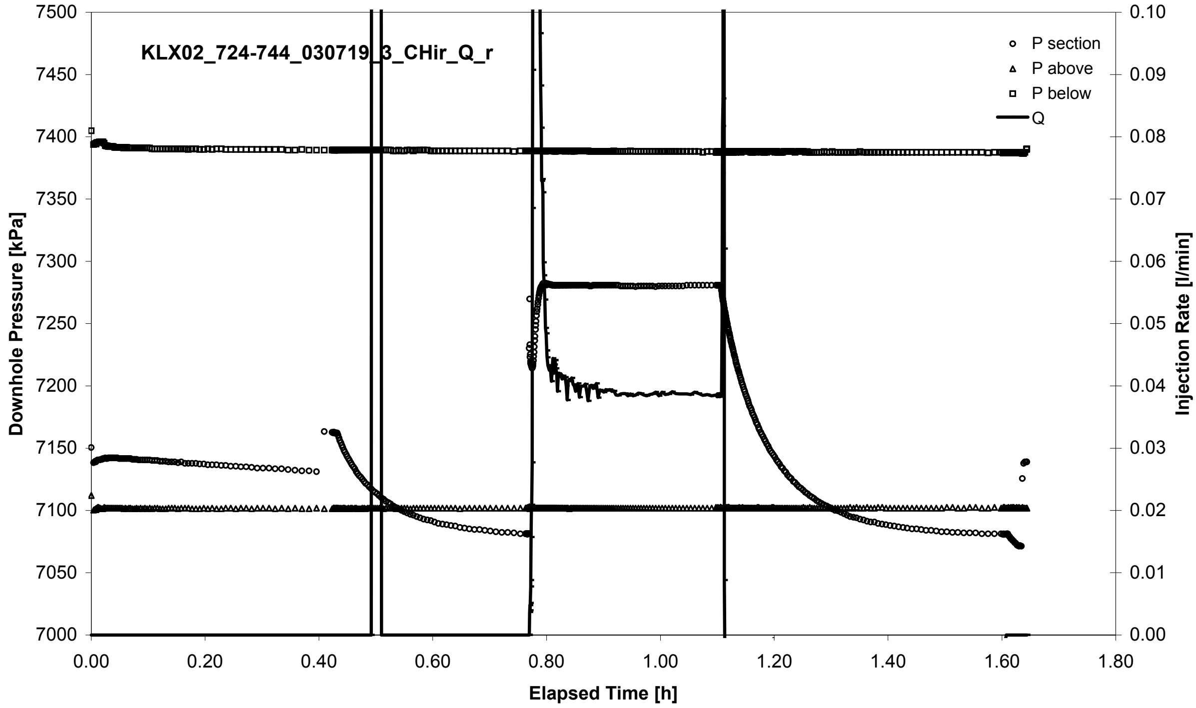
Pressure and temperature in the test section; cartesian plot (test repeated)



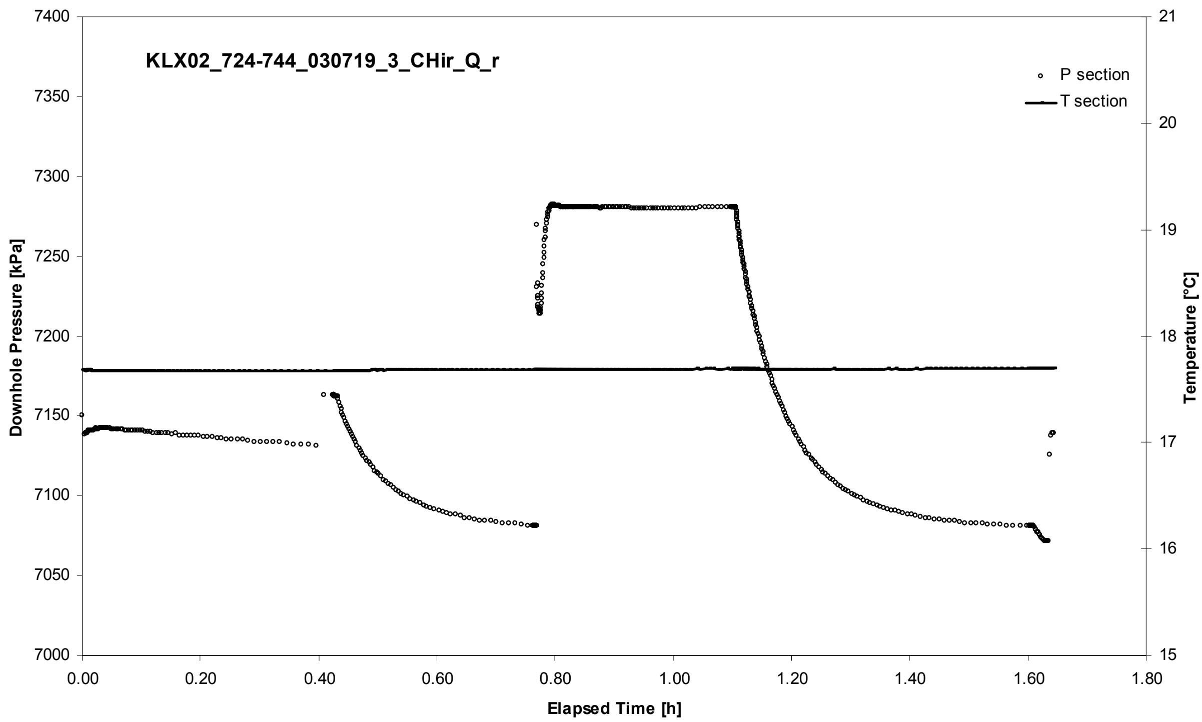
Pressure and flow rate vs. time; cartesian plot (test repeated)



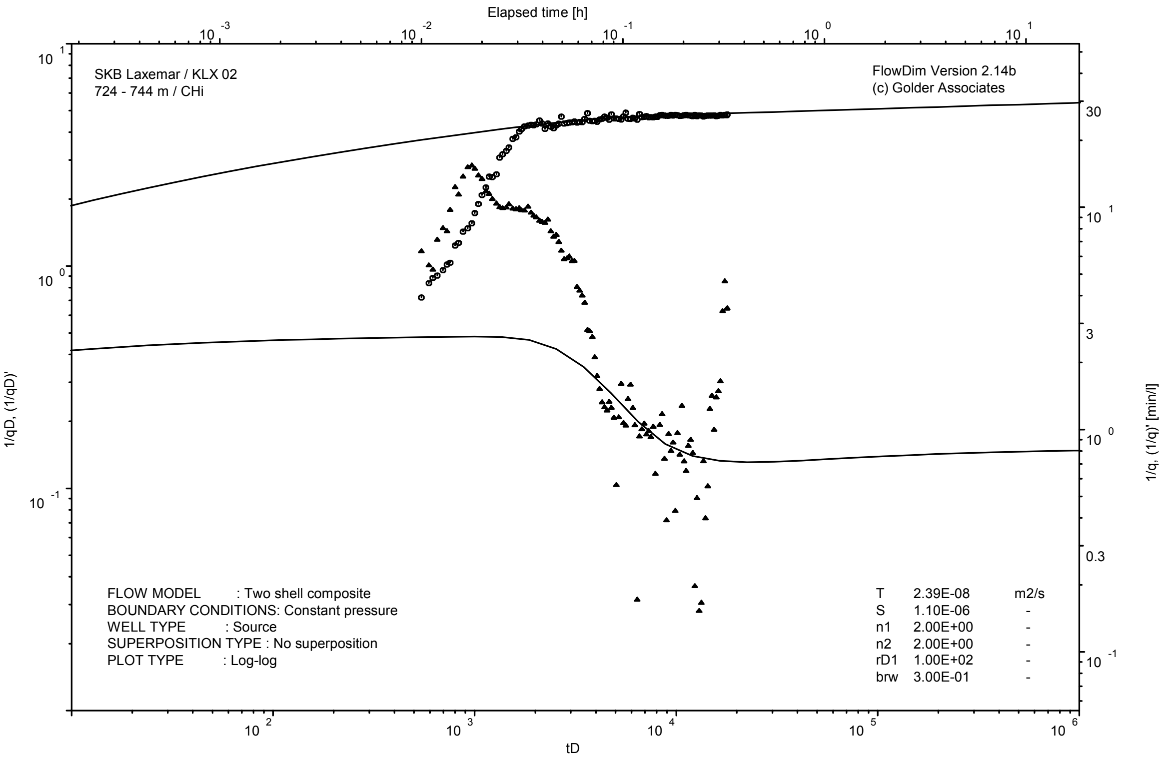
Pressure and temperature in the test section; cartesian plot (test repeated)



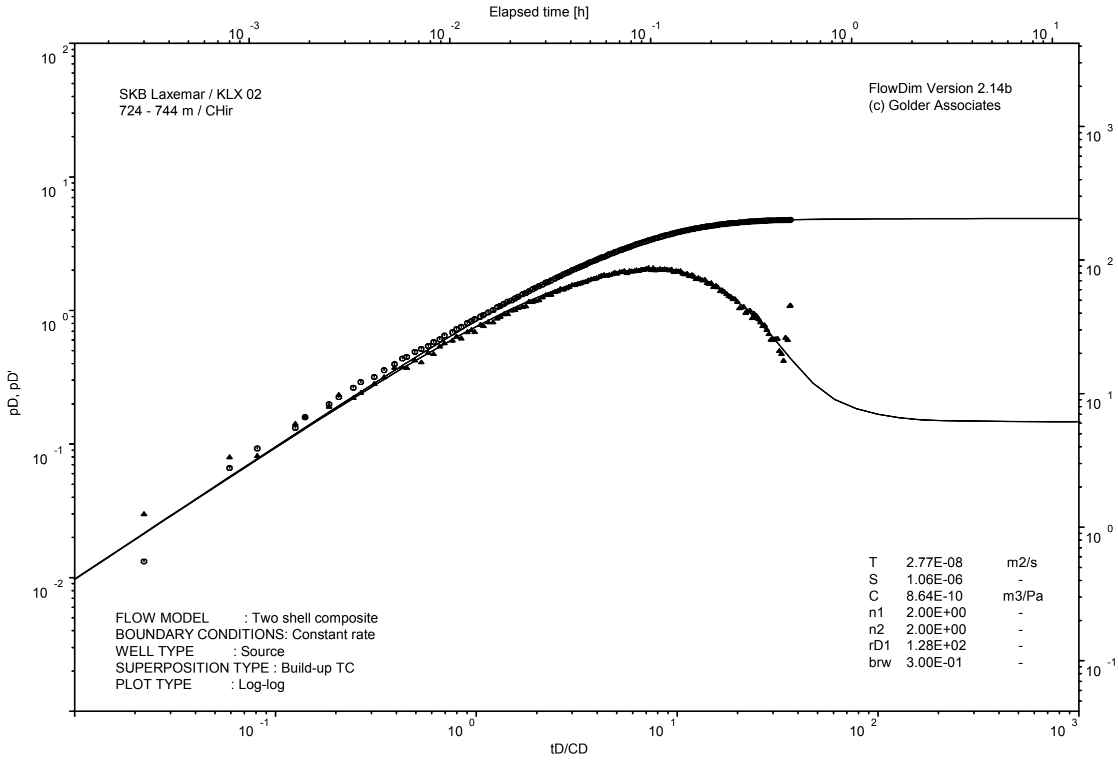
Pressure and flow rate vs. time; cartesian plot (analysed)



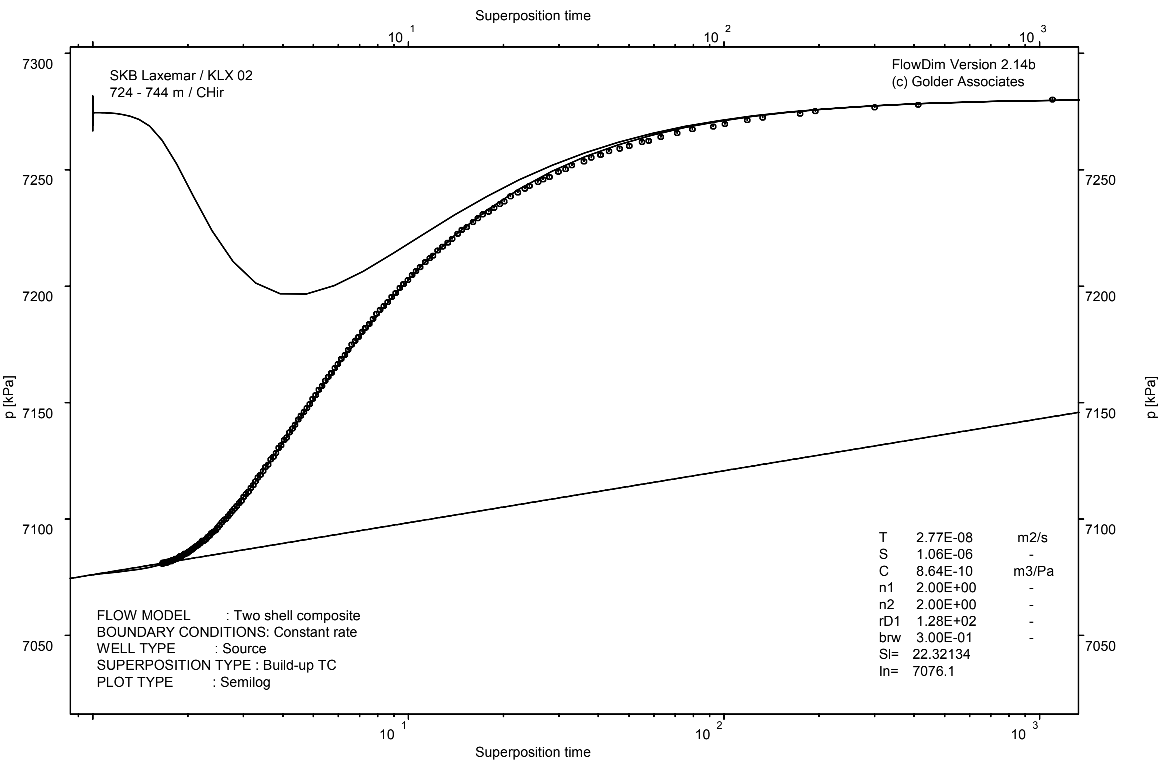
Pressure and temperature in the test section; cartesian plot (analysed)



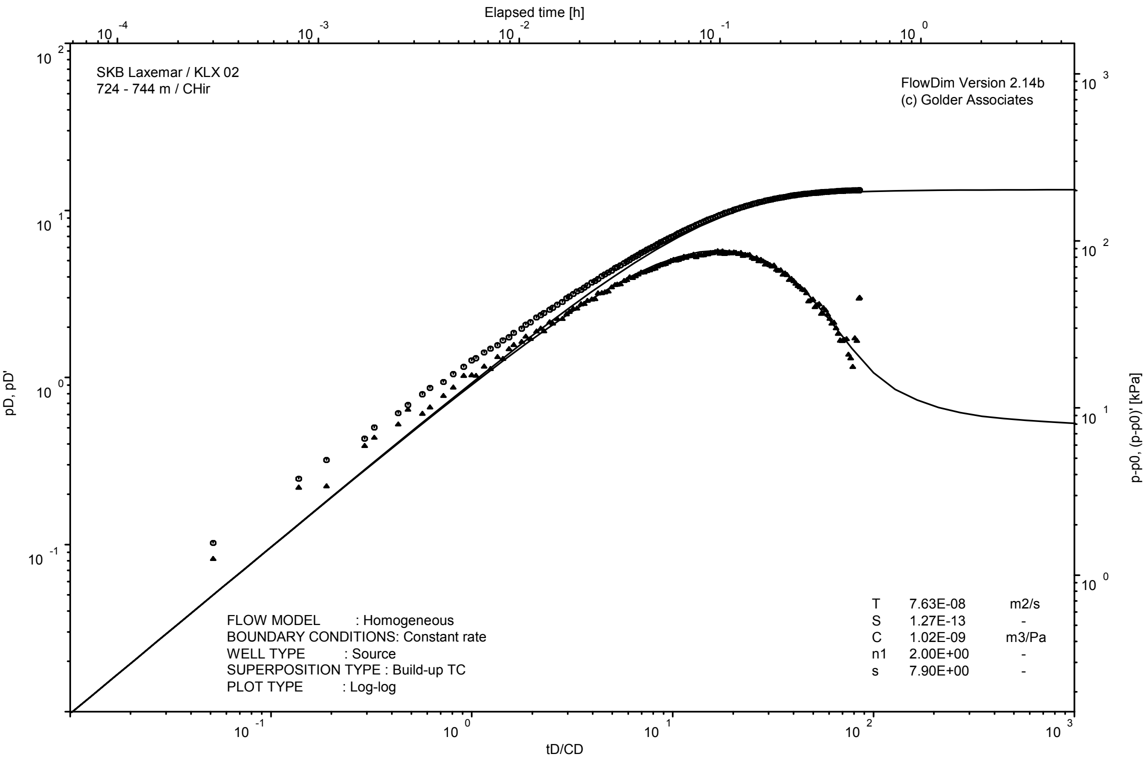
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

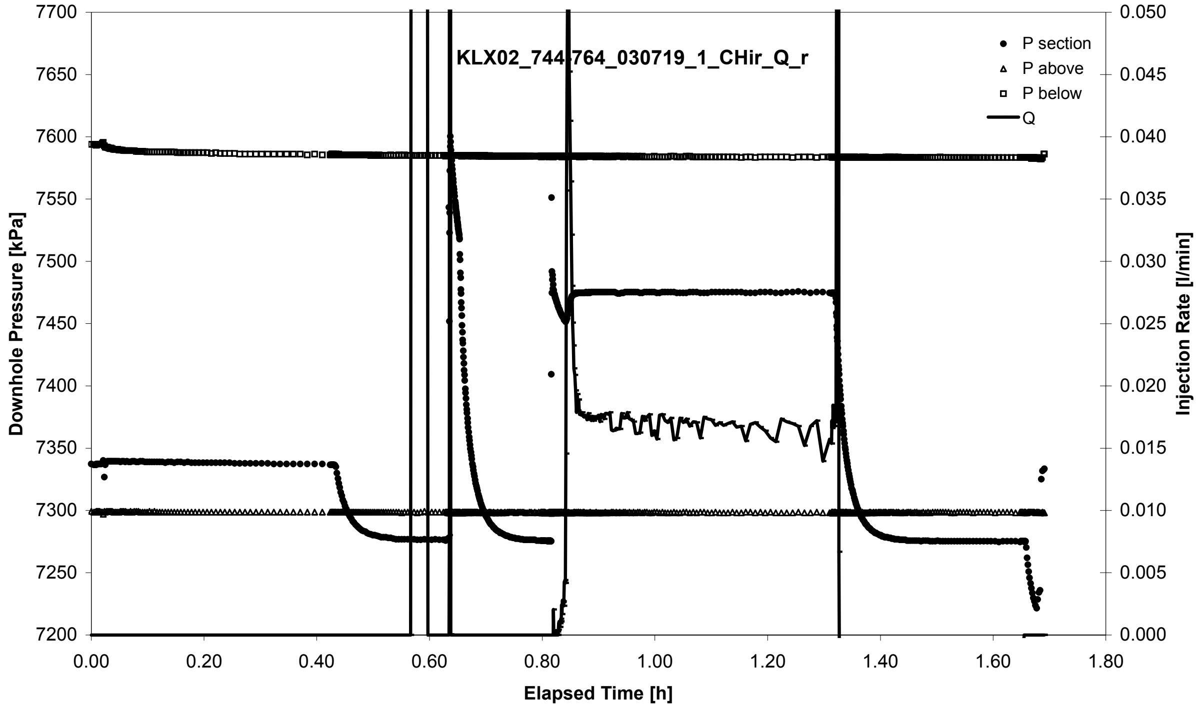


CHIR phase; Homogeneous model analyses, log-log match

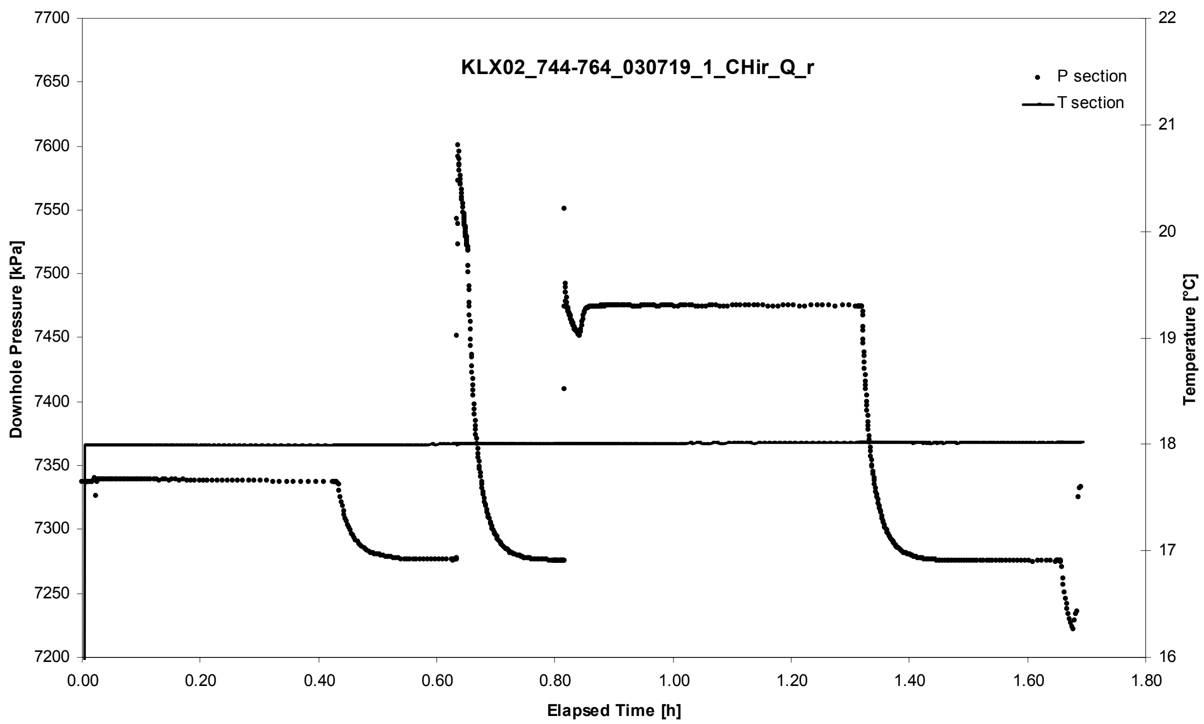
APPENDIX 2-32

Test 744 – 764 m

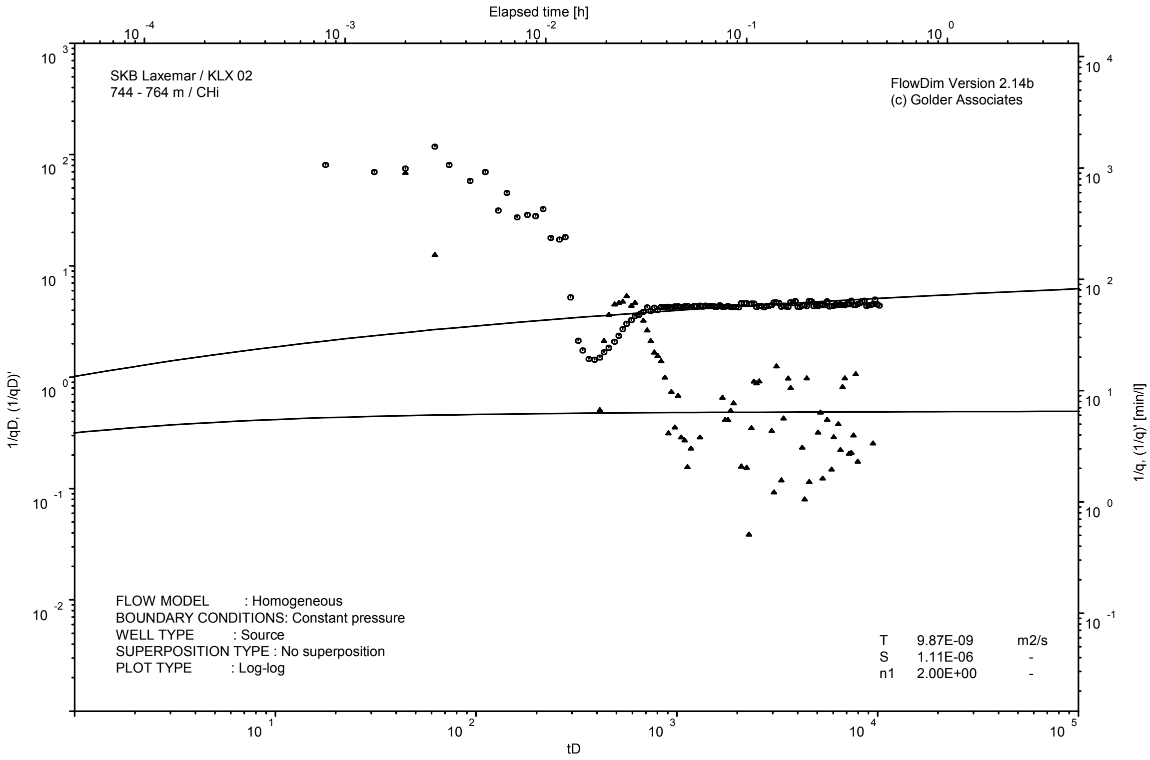
Analysis diagrams



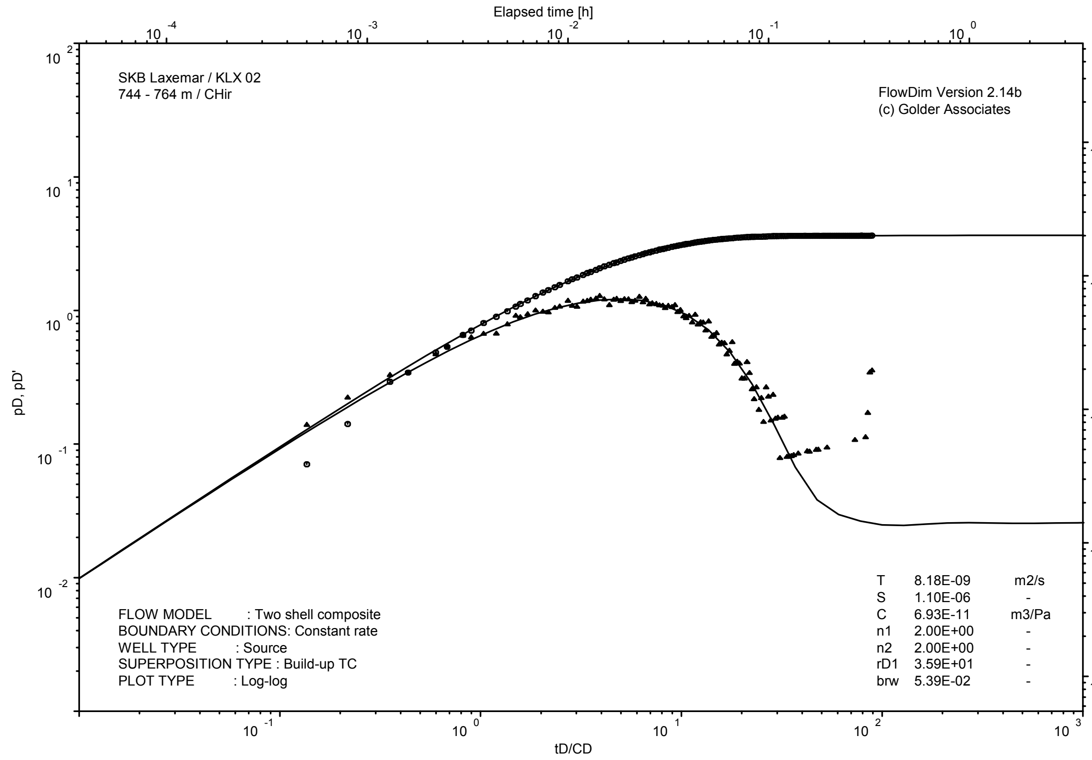
Pressure and flow rate vs. time; cartesian plot



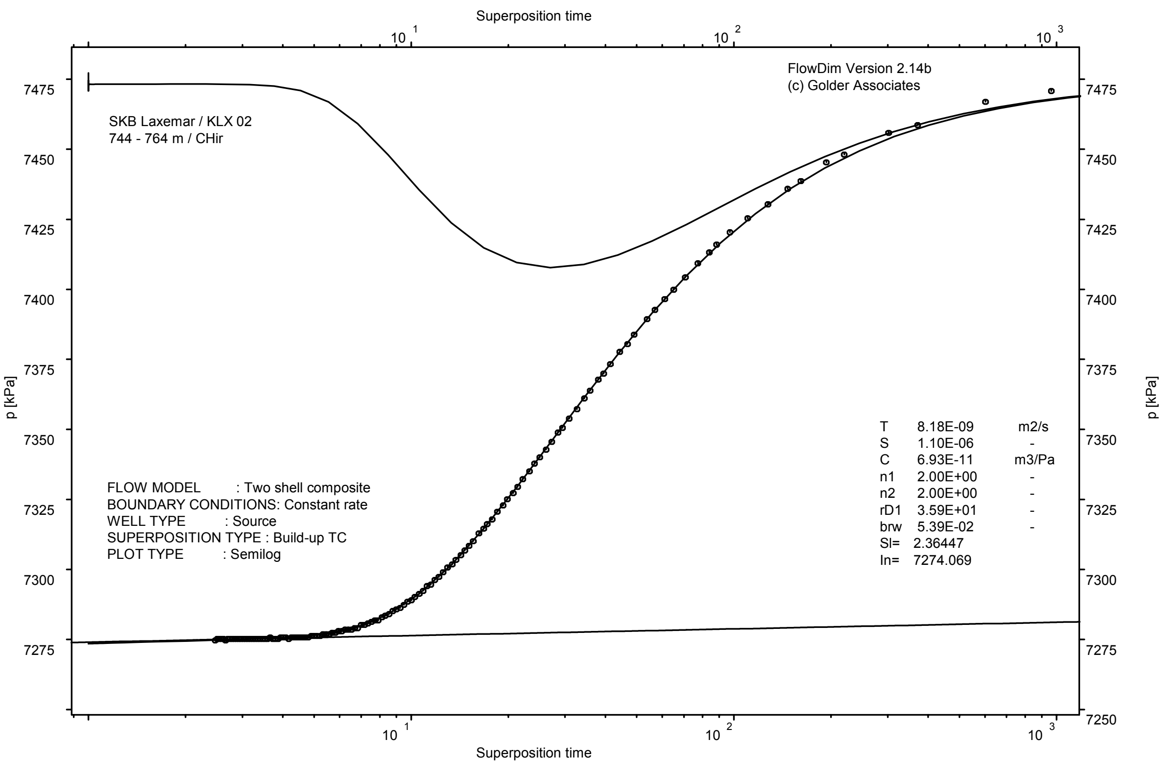
Pressure and temperature in the test section; cartesian plot



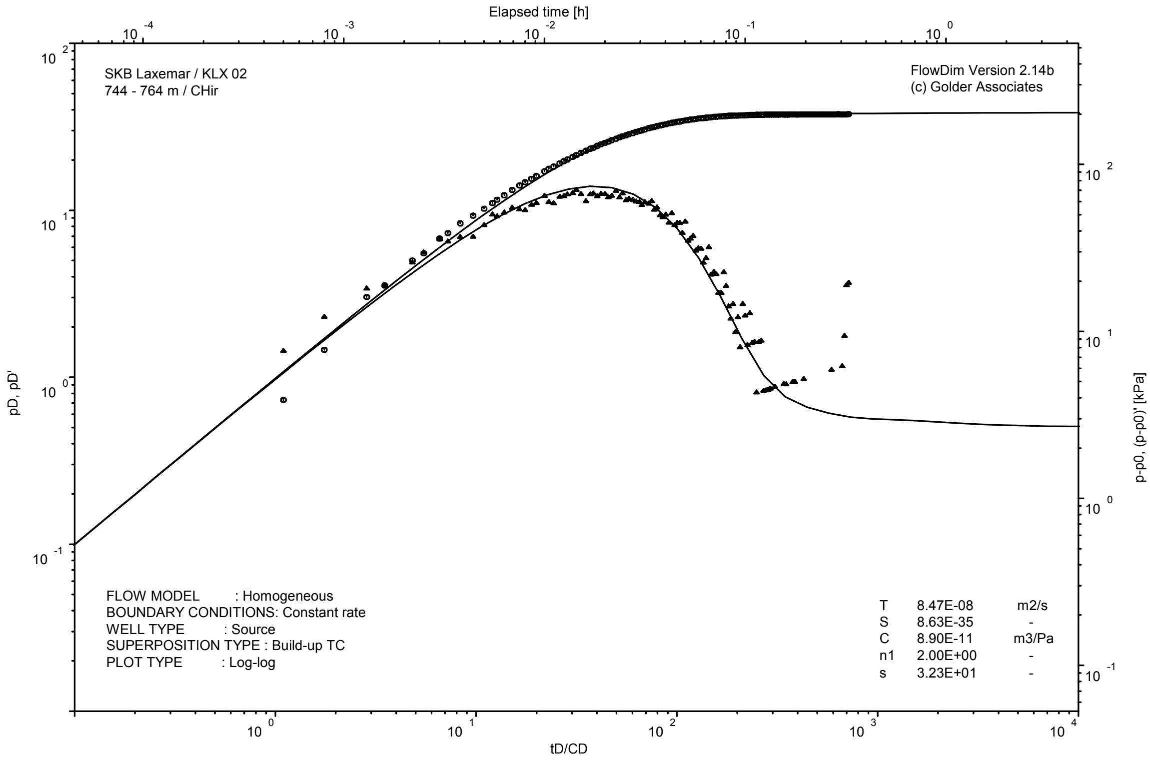
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

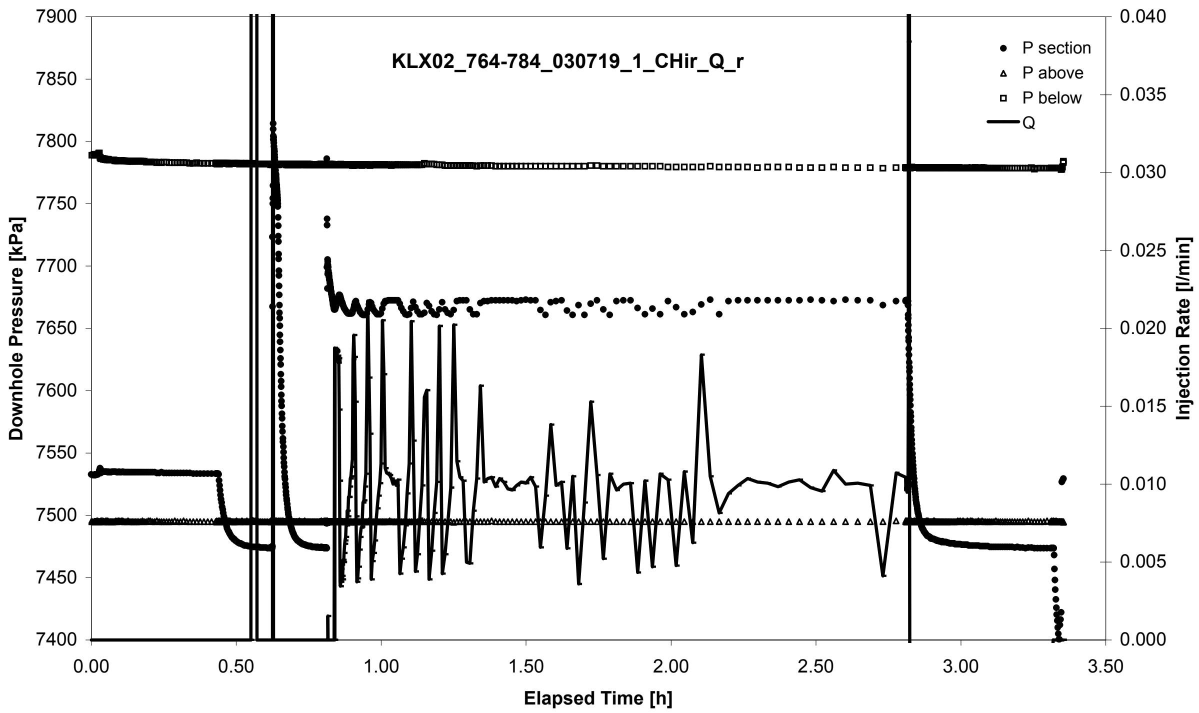


CHIR phase; Homogeneous model analyses, log-log match

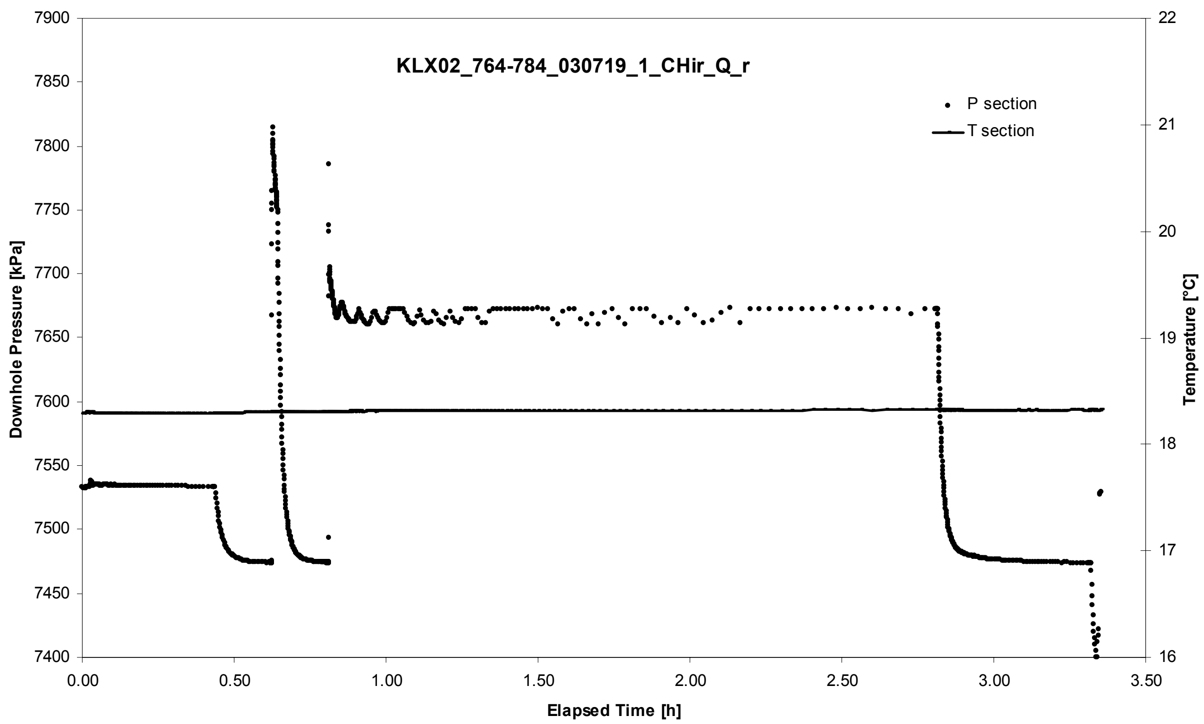
APPENDIX 2-33

Test 764 – 784 m

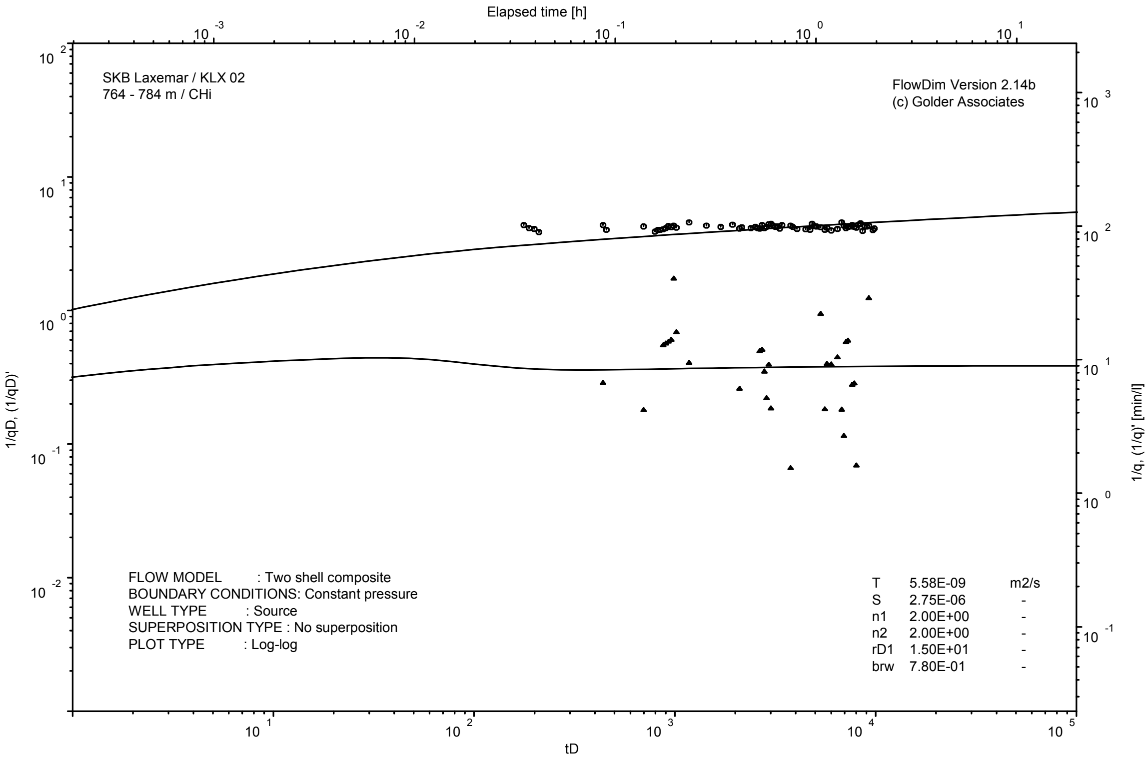
Analysis diagrams



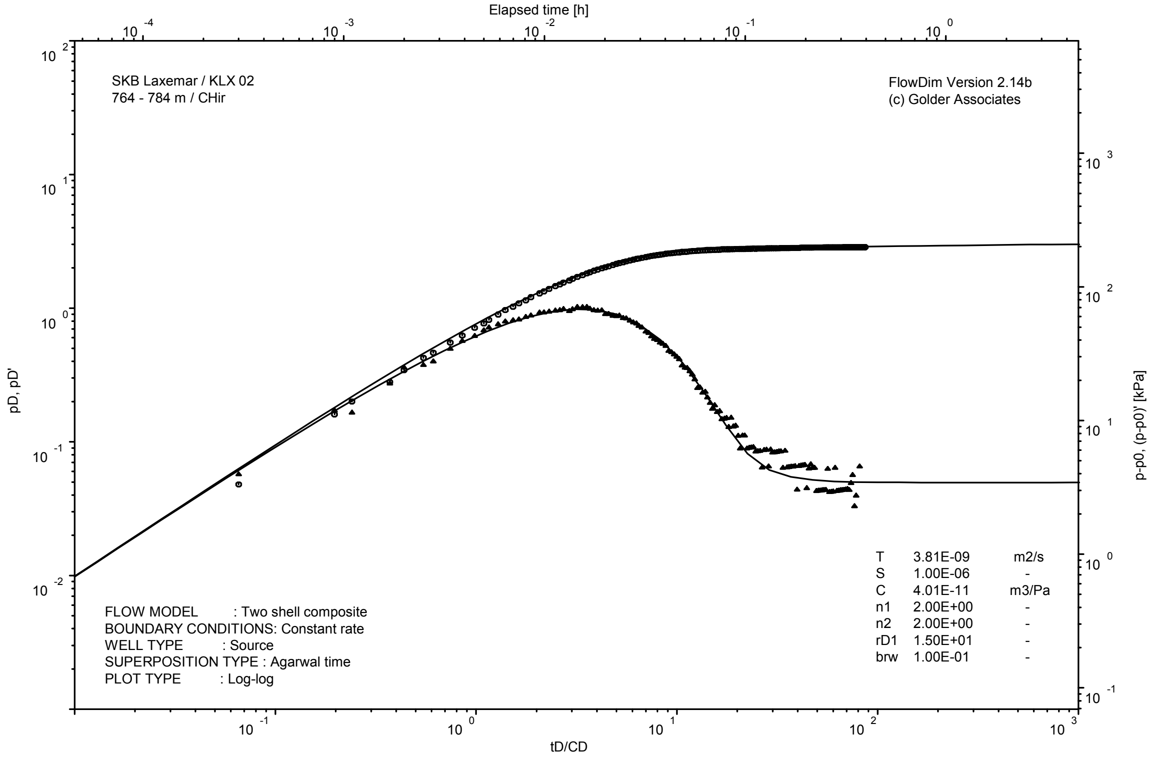
Pressure and flow rate vs. time; cartesian plot



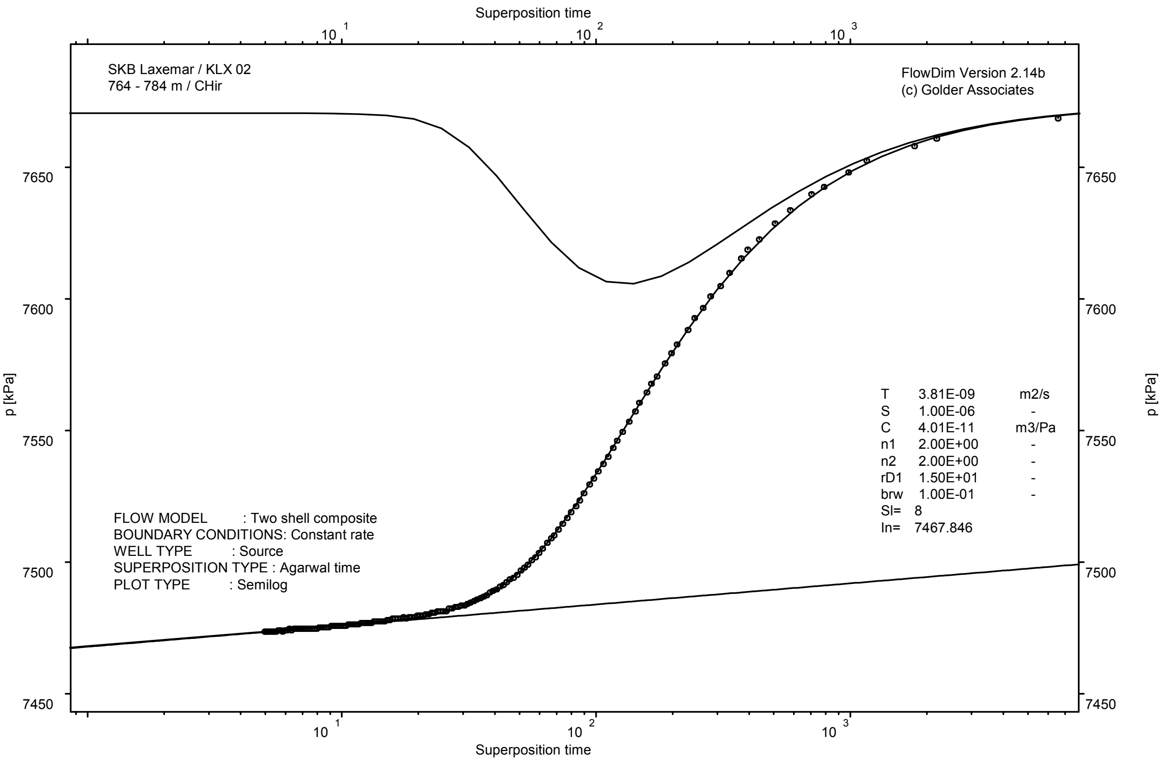
Pressure and temperature in the test section; cartesian plot



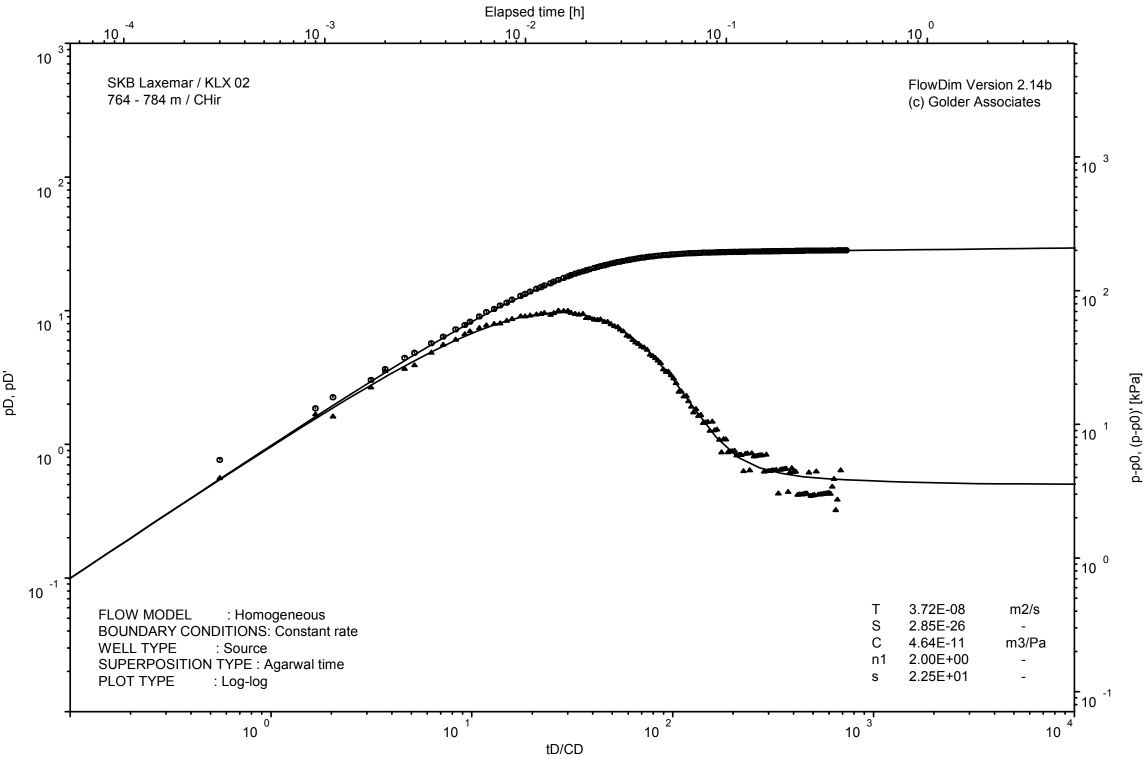
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

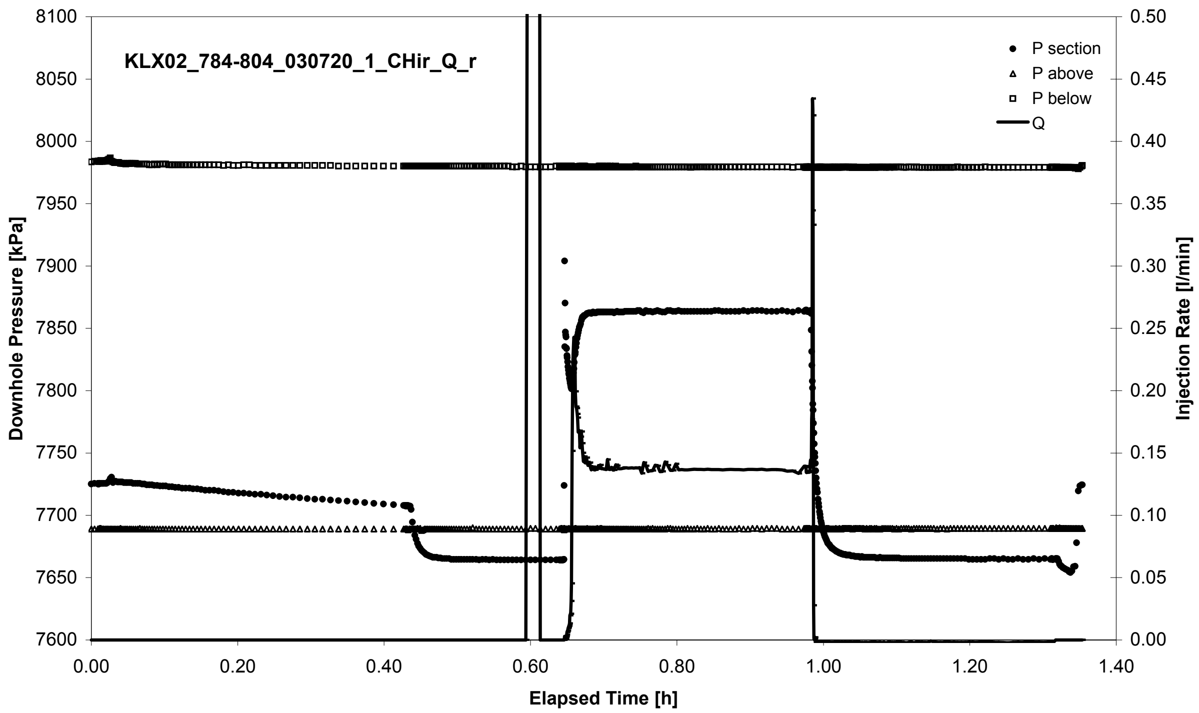


CHIR phase; Homogeneous model analyses, log-log match

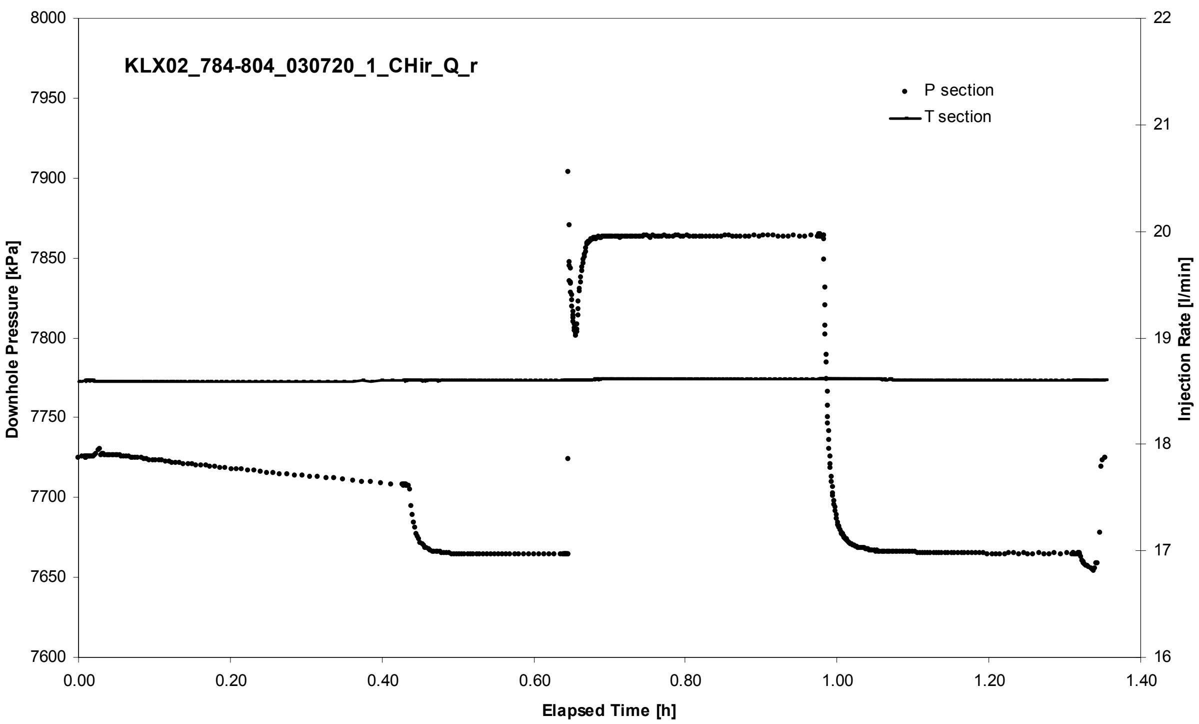
APPENDIX 2-34

Test 784 – 804 m

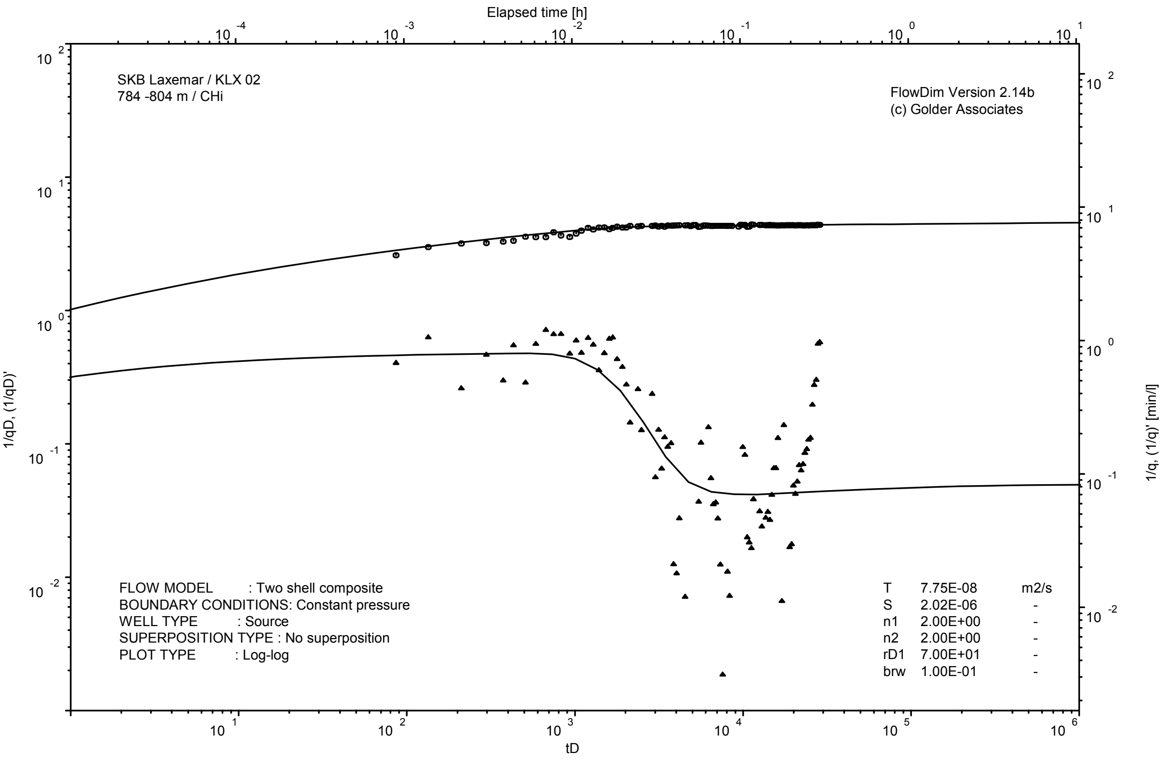
Analysis diagrams



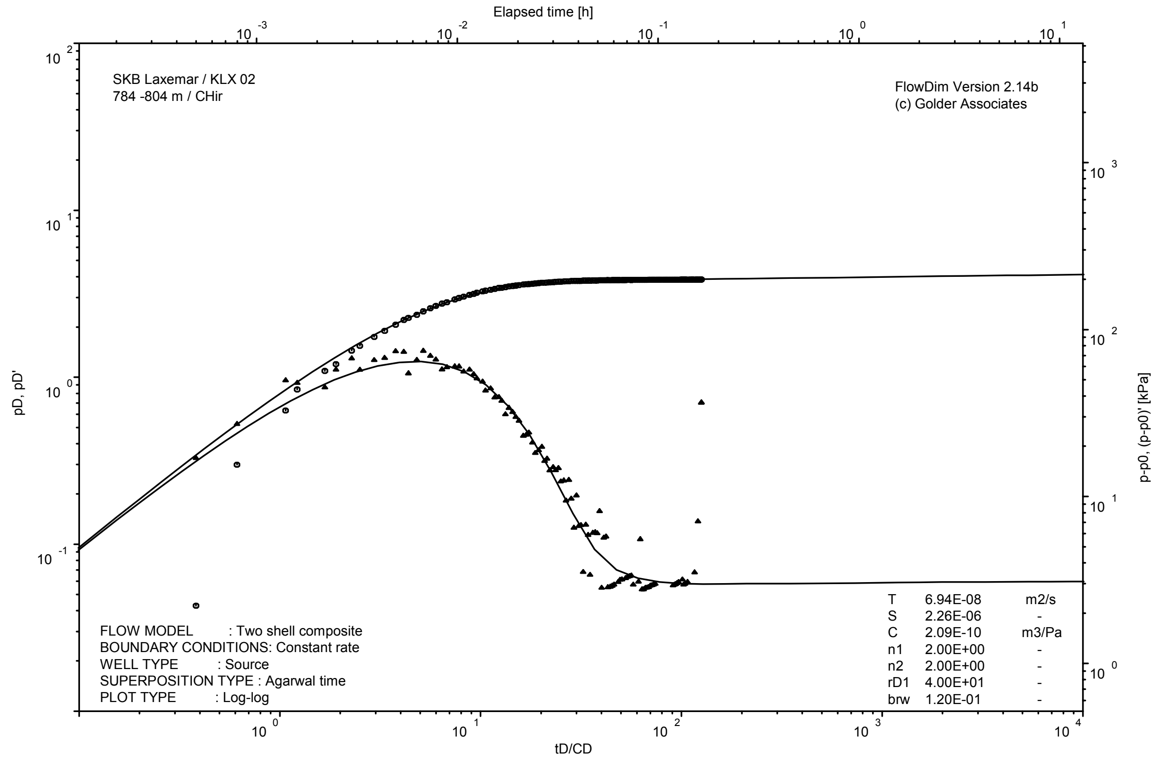
Pressure and flow rate vs. time; cartesian plot



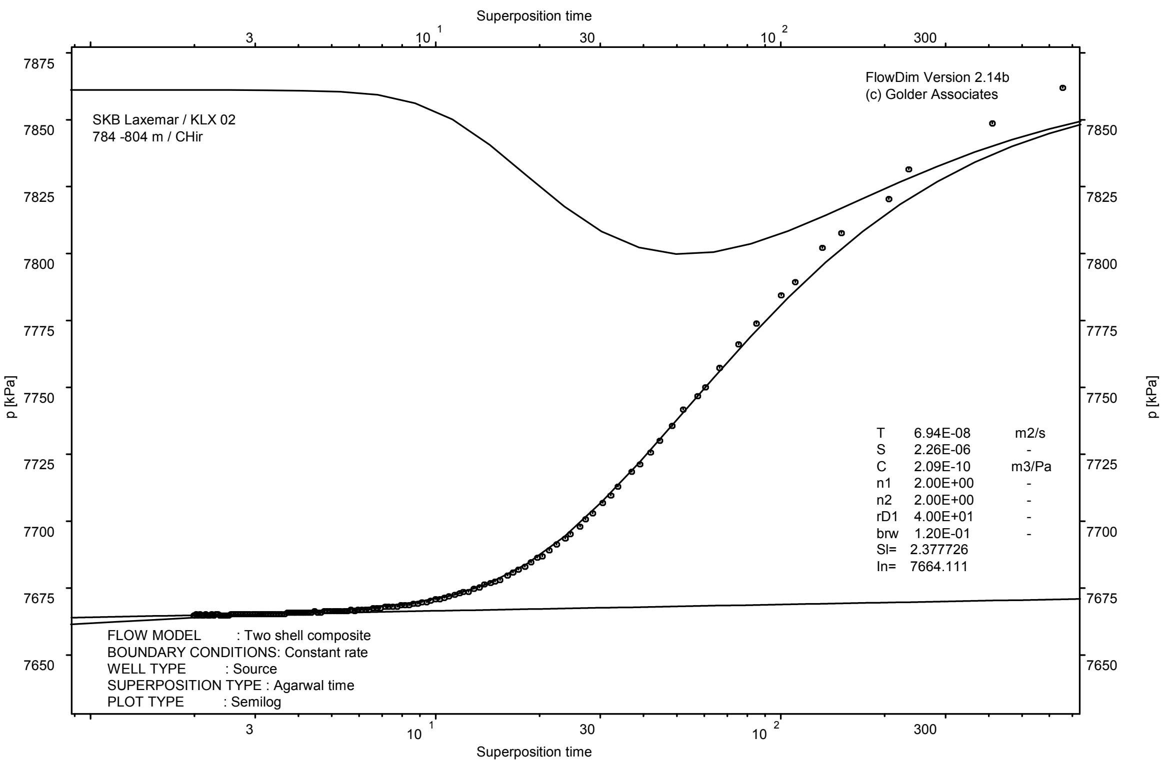
Pressure and temperature in the test section; cartesian plot



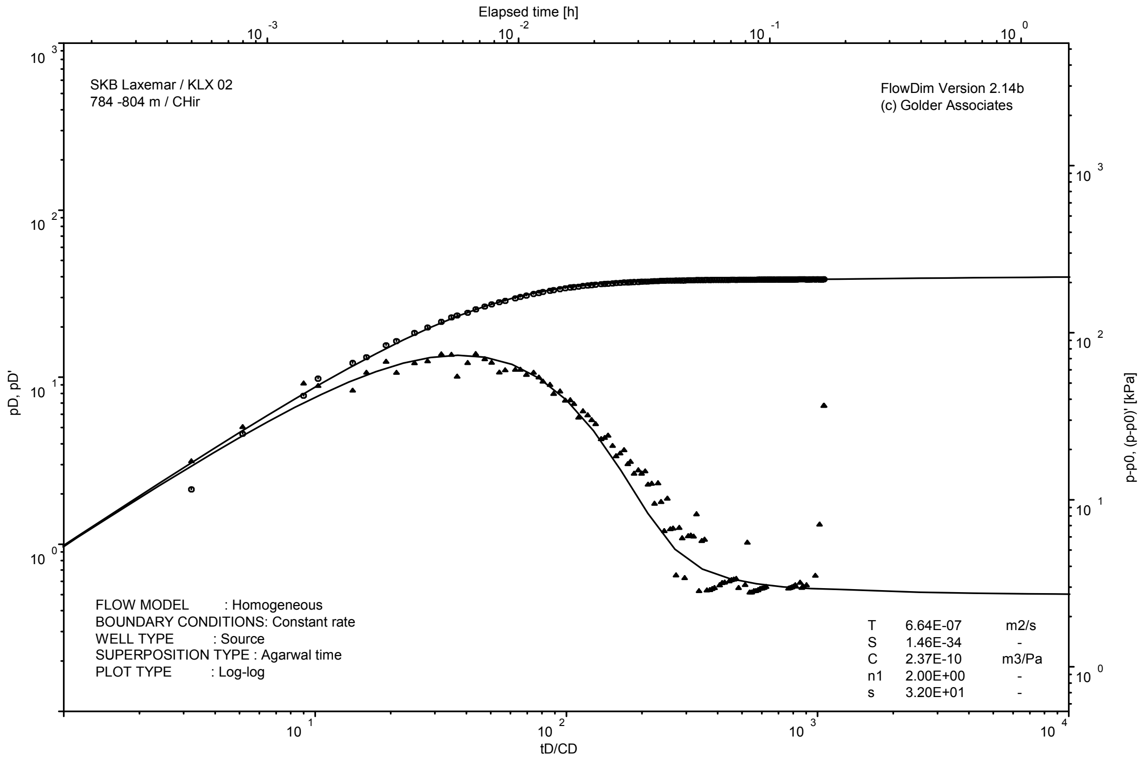
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

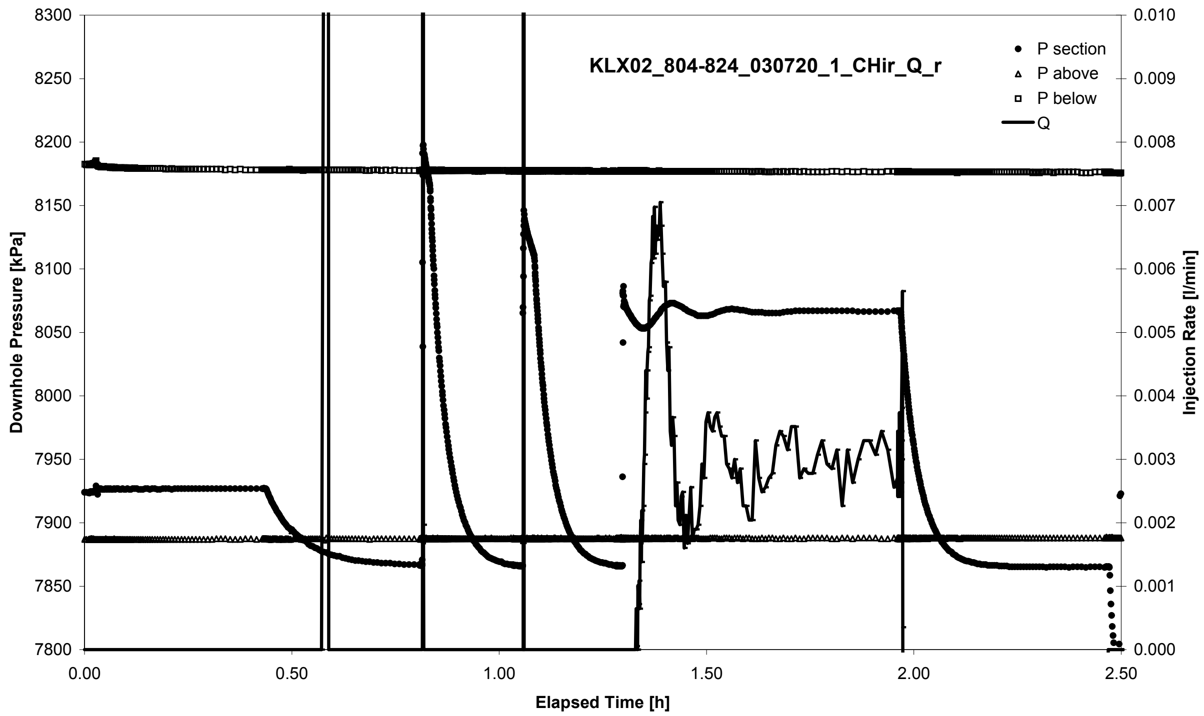


CHIR phase; Homogeneous model analyses, log-log match

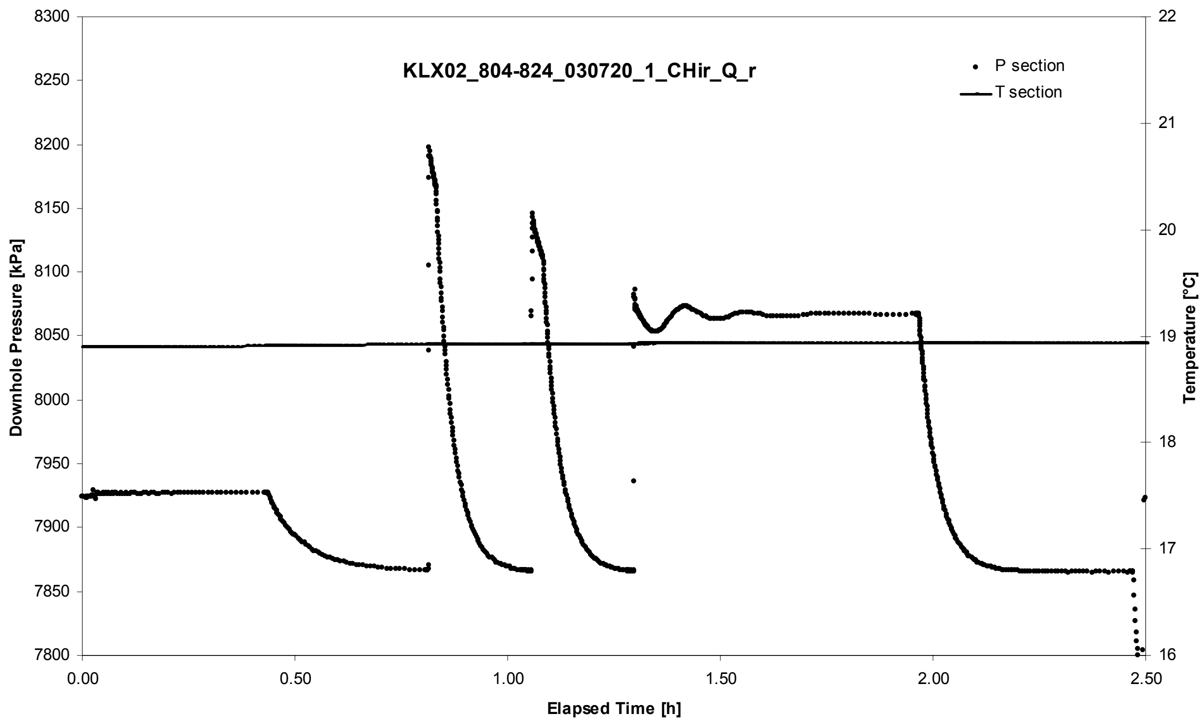
APPENDIX 2-35

Test 804 – 824 m

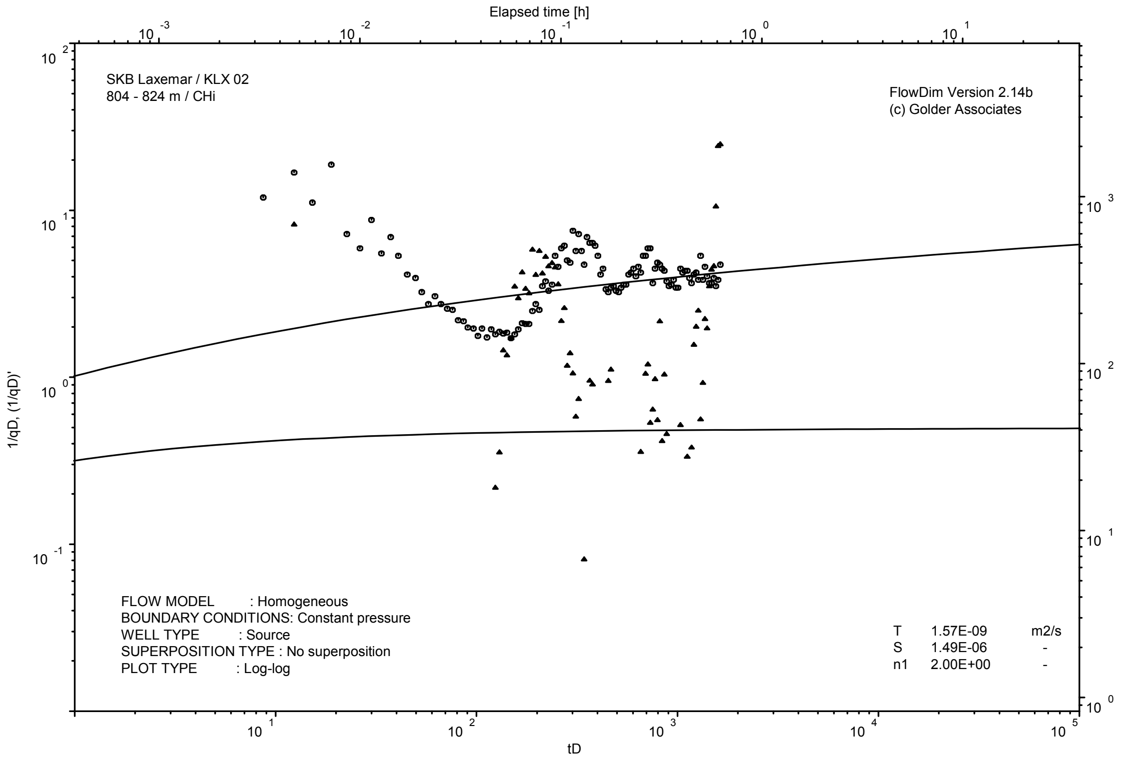
Analysis diagrams



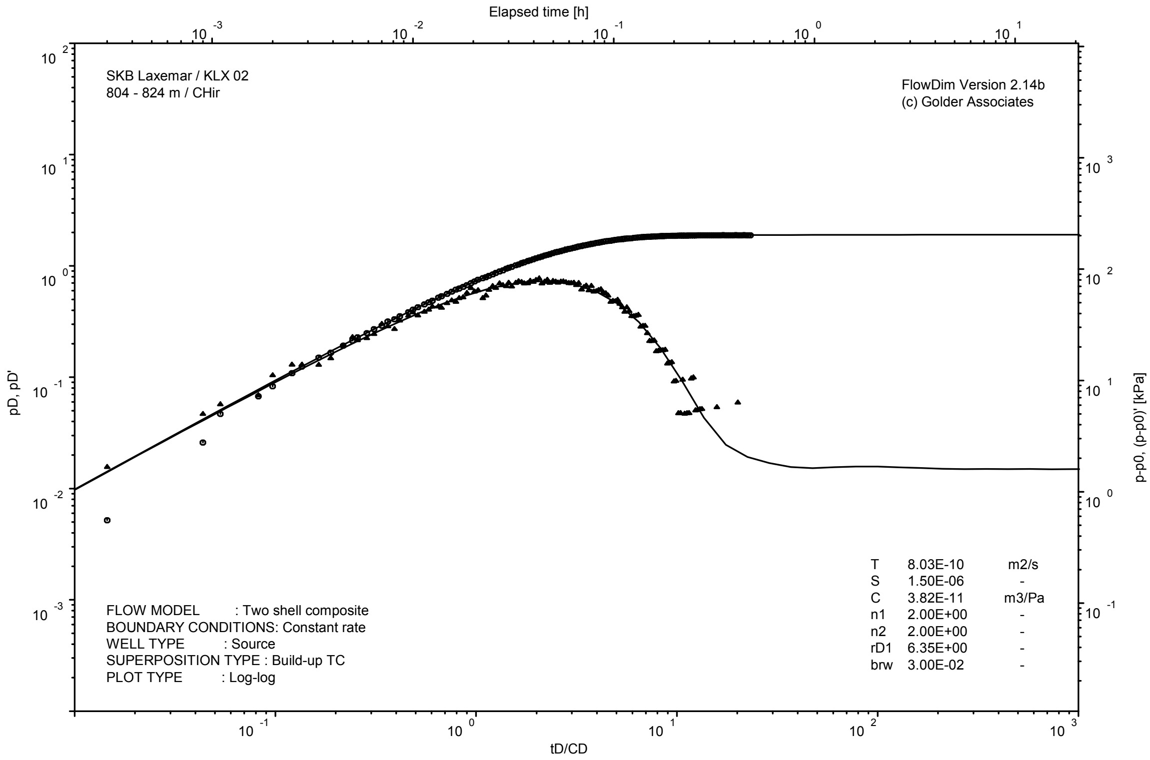
Pressure and flow rate vs. time; cartesian plot



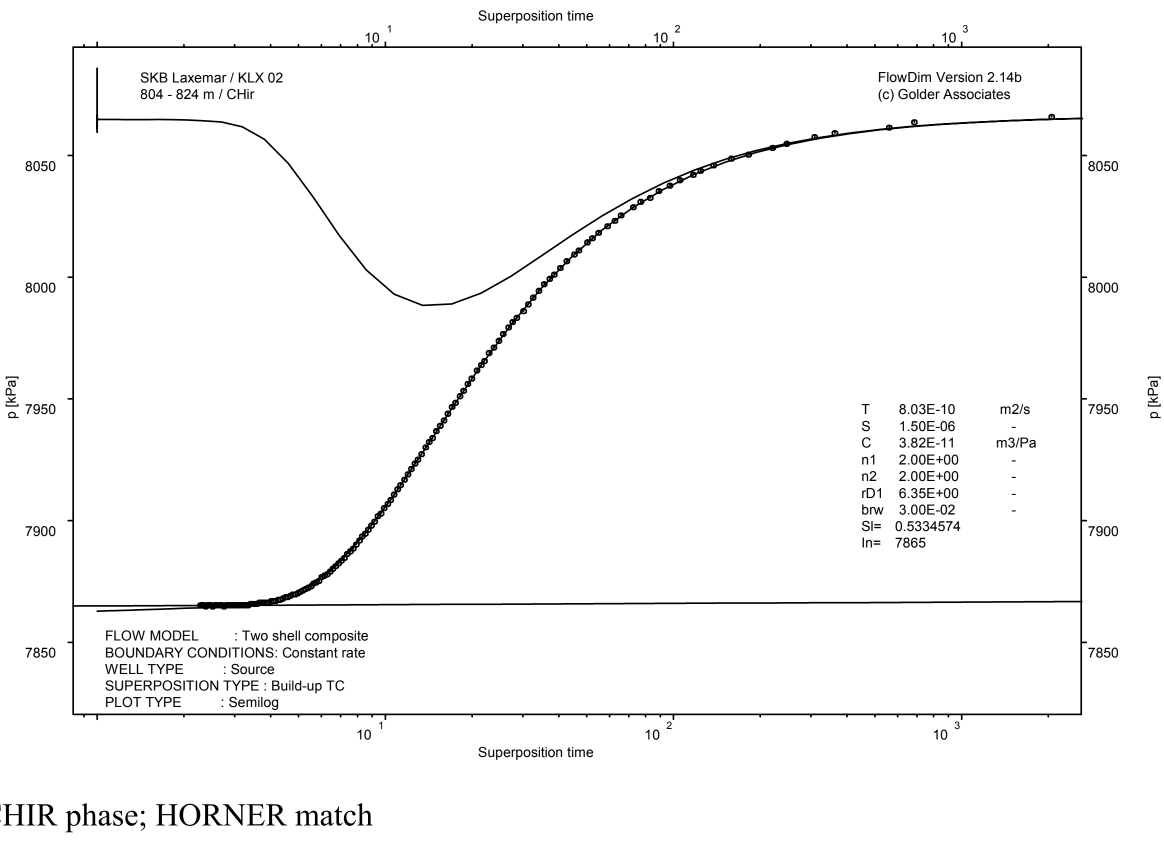
Pressure and temperature in the test section; cartesian plot



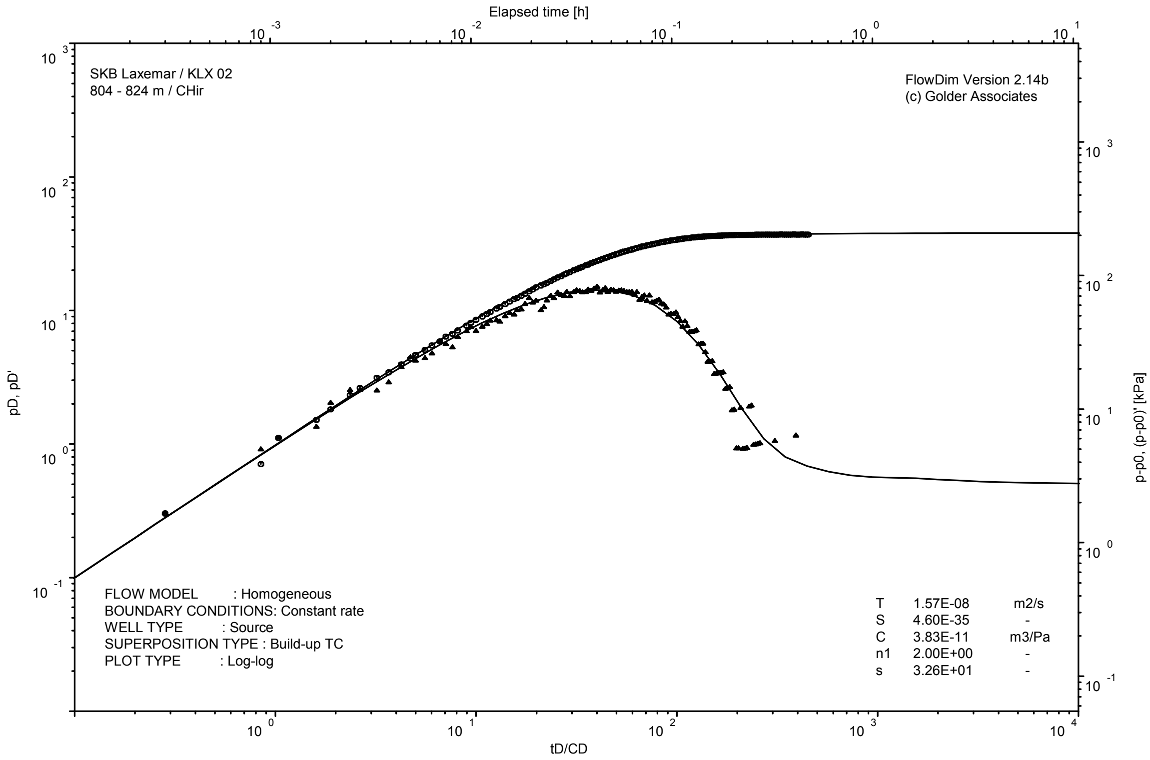
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

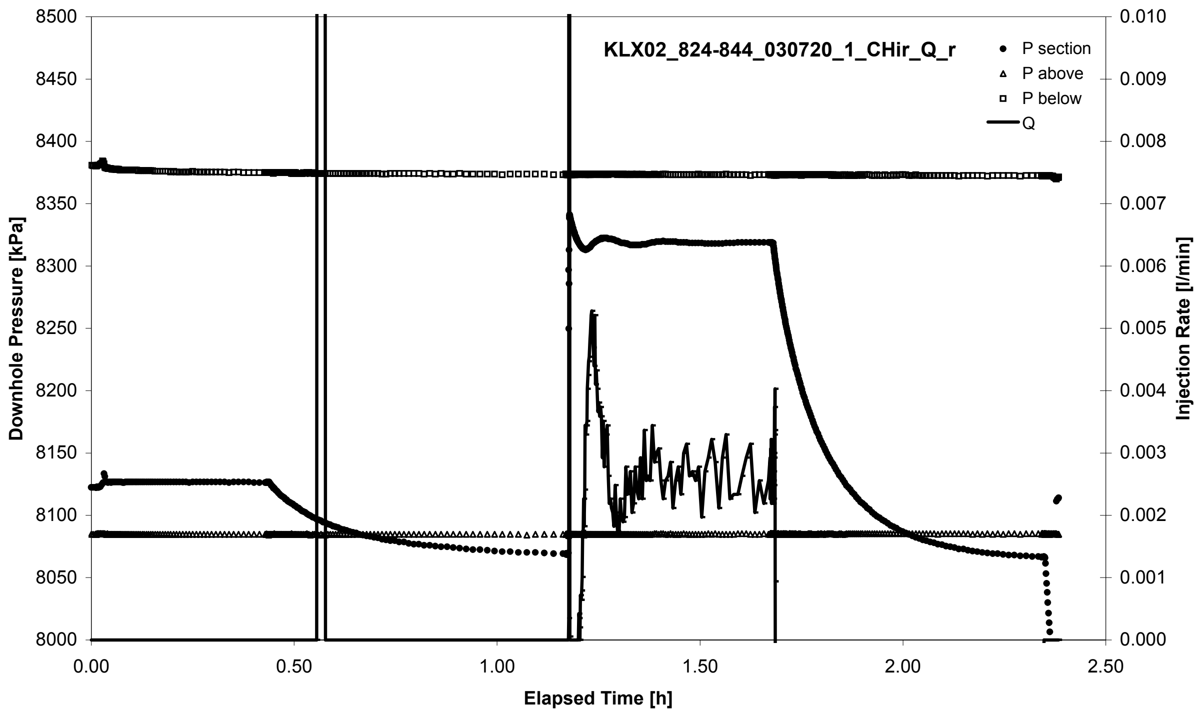


CHIR phase; Homogeneous model analyses, log-log match

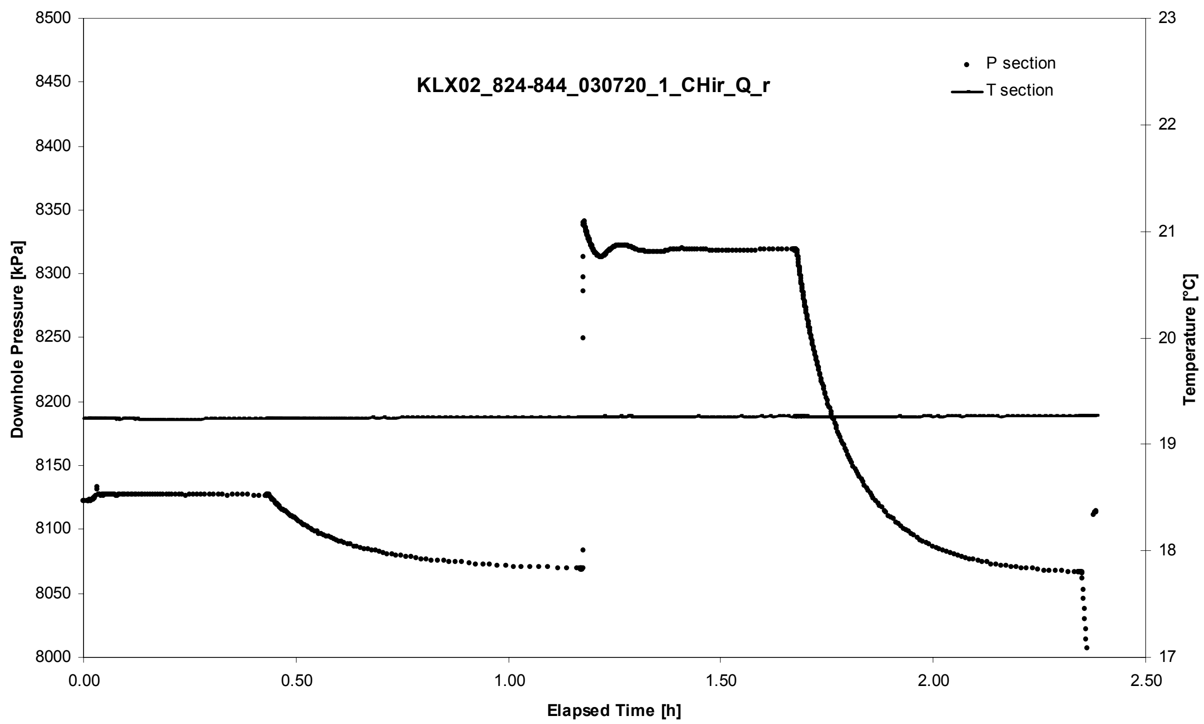
APPENDIX 2-36

Test 824 – 844 m

Analysis diagrams



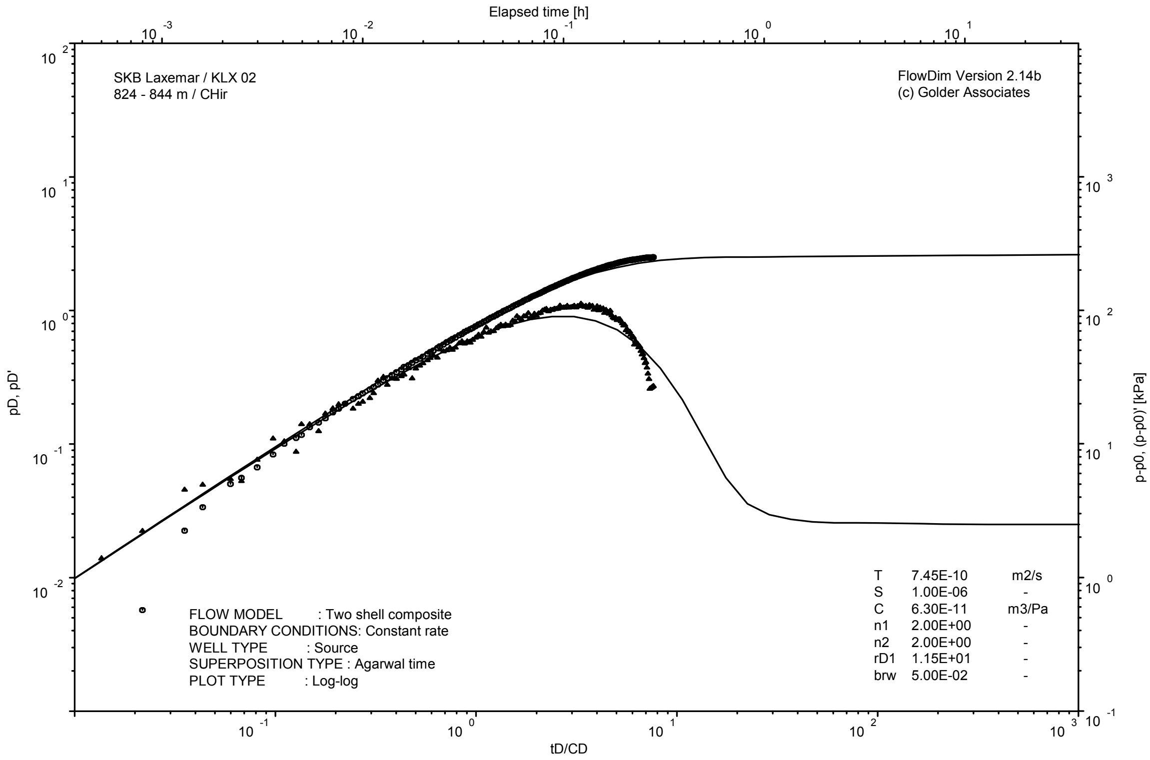
Pressure and flow rate vs. time; cartesian plot



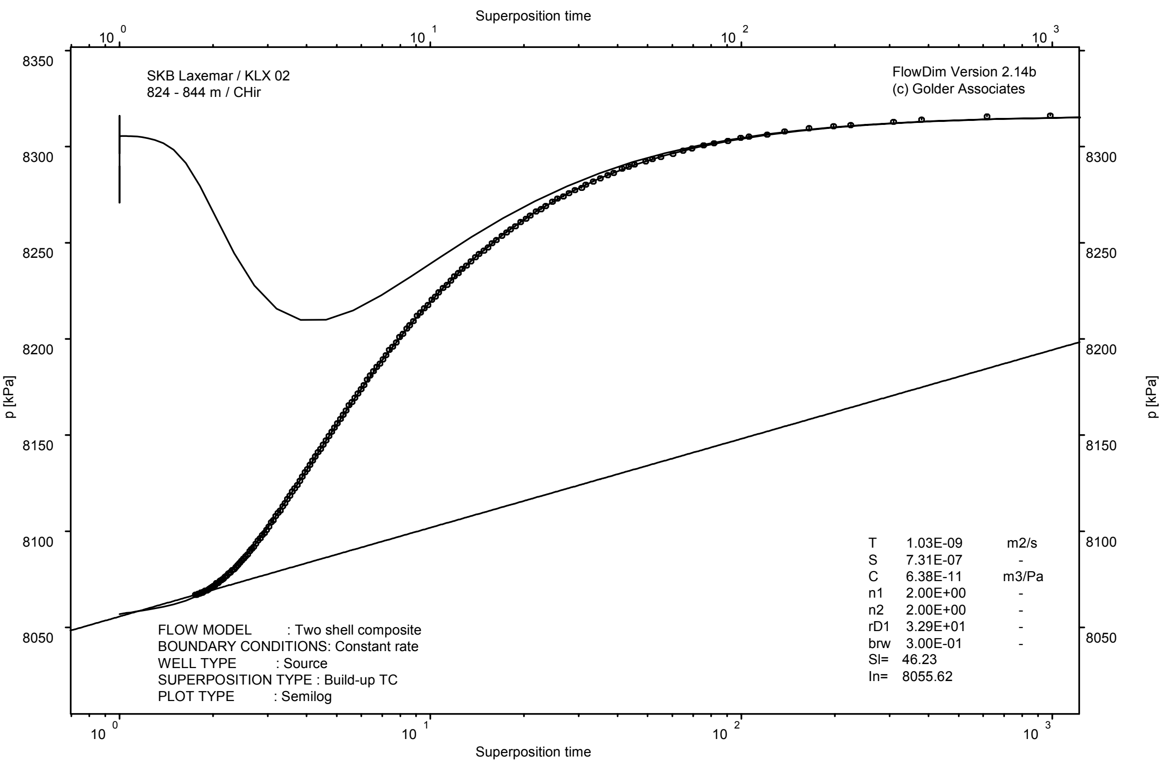
Pressure and temperature in the test section; cartesian plot

Not Analysed

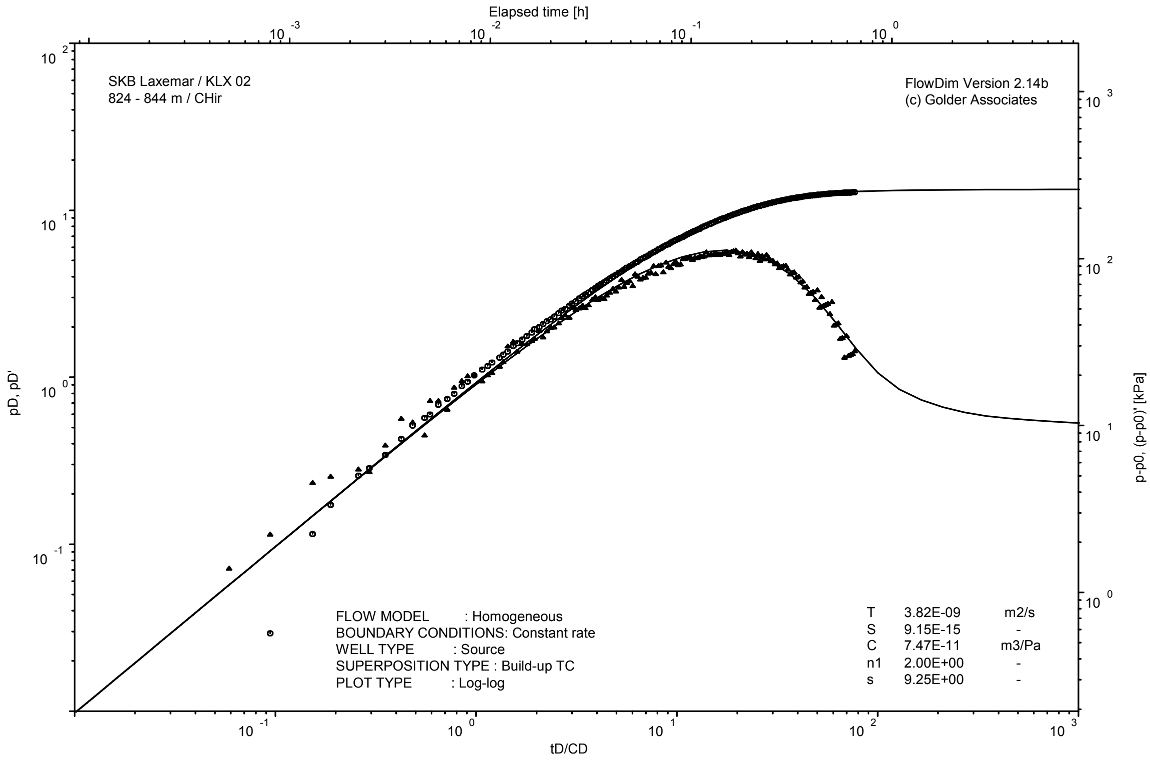
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

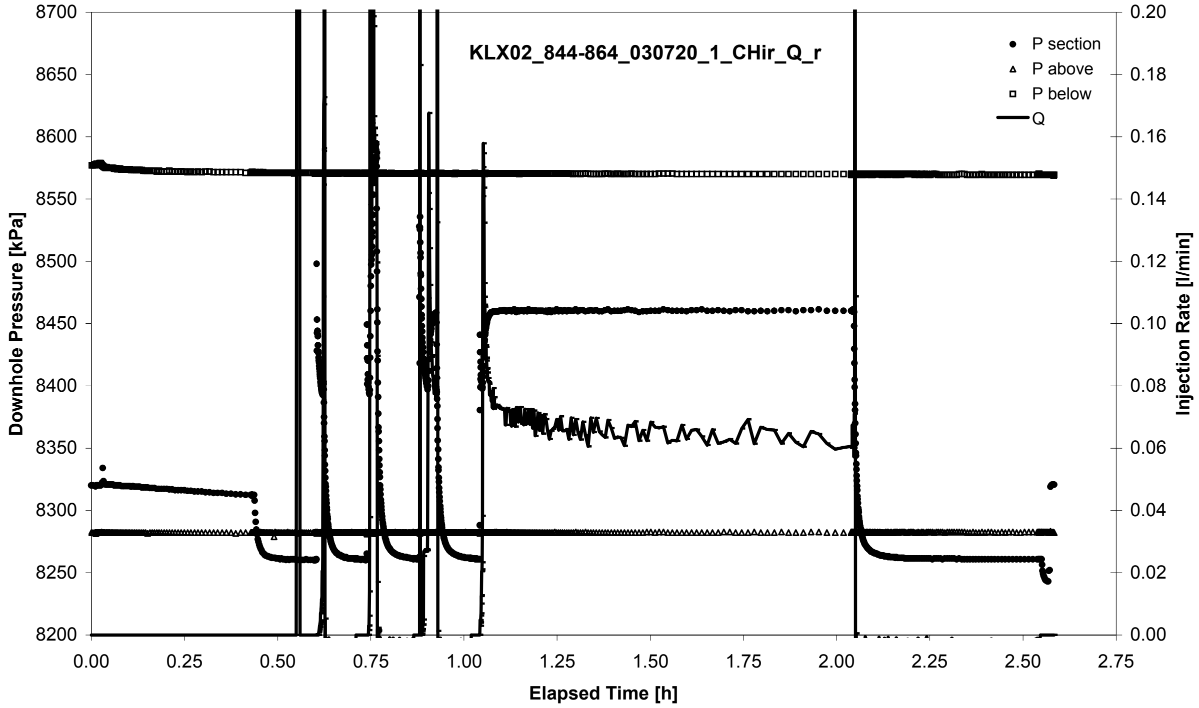


CHIR phase; Homogeneous model analyses, log-log match

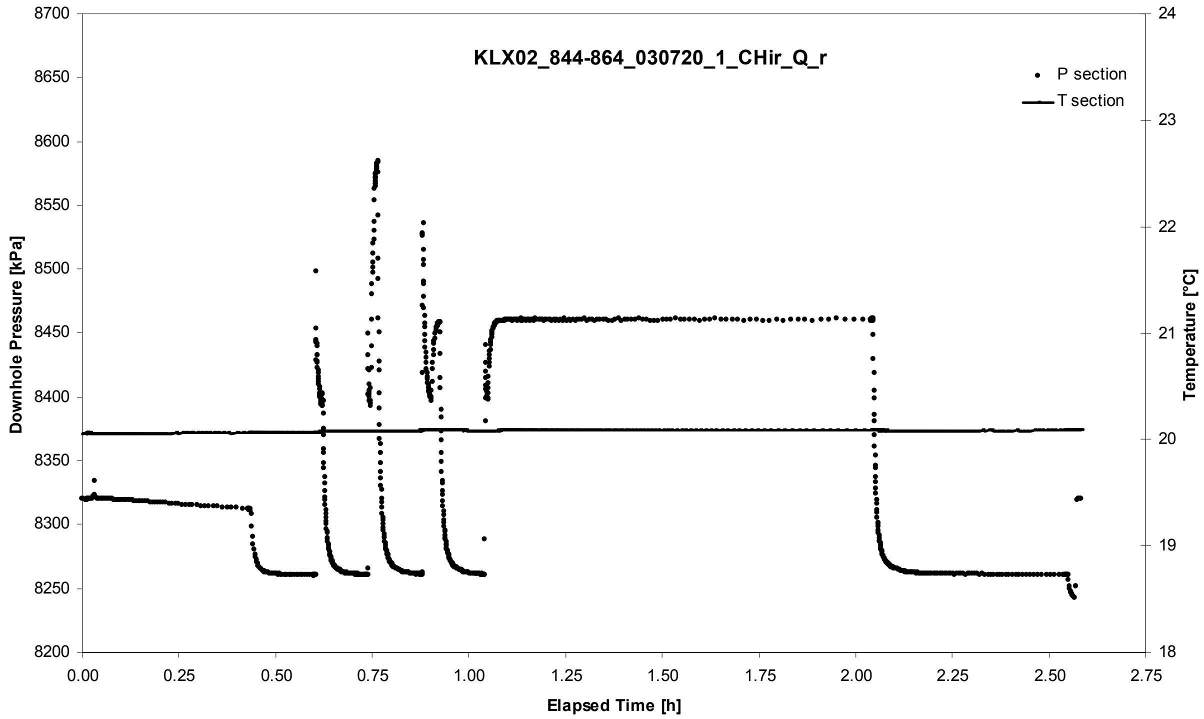
APPENDIX 2-37

Test 844 – 864 m

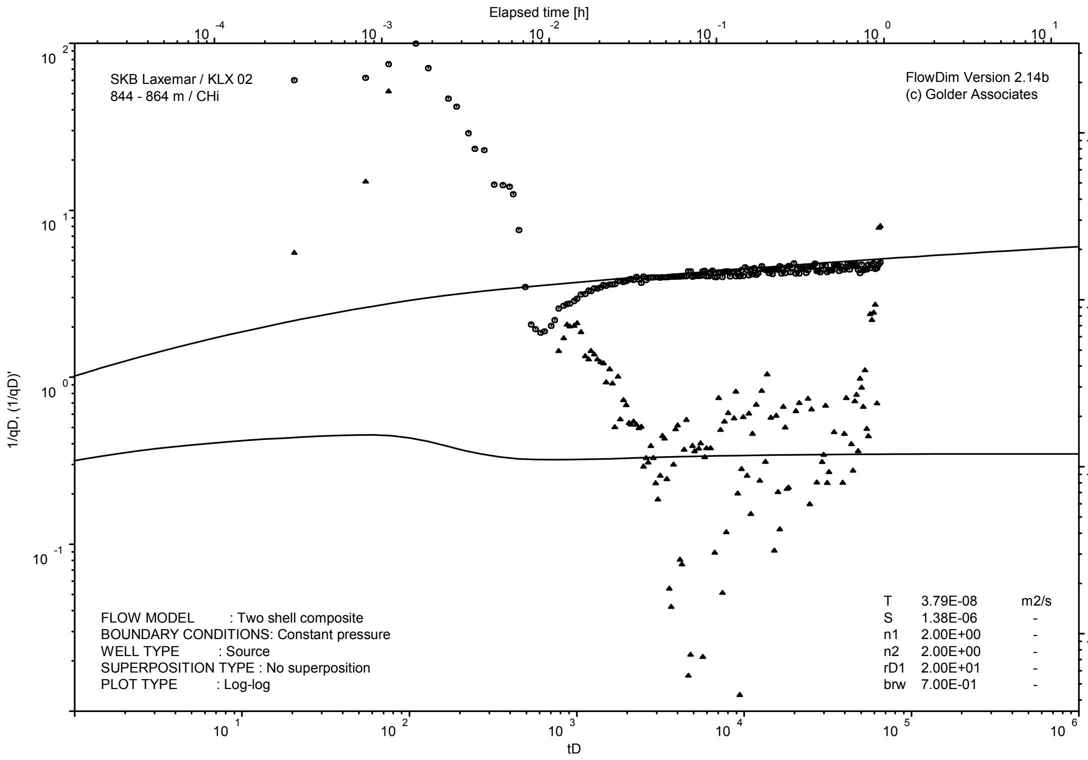
Analysis diagrams



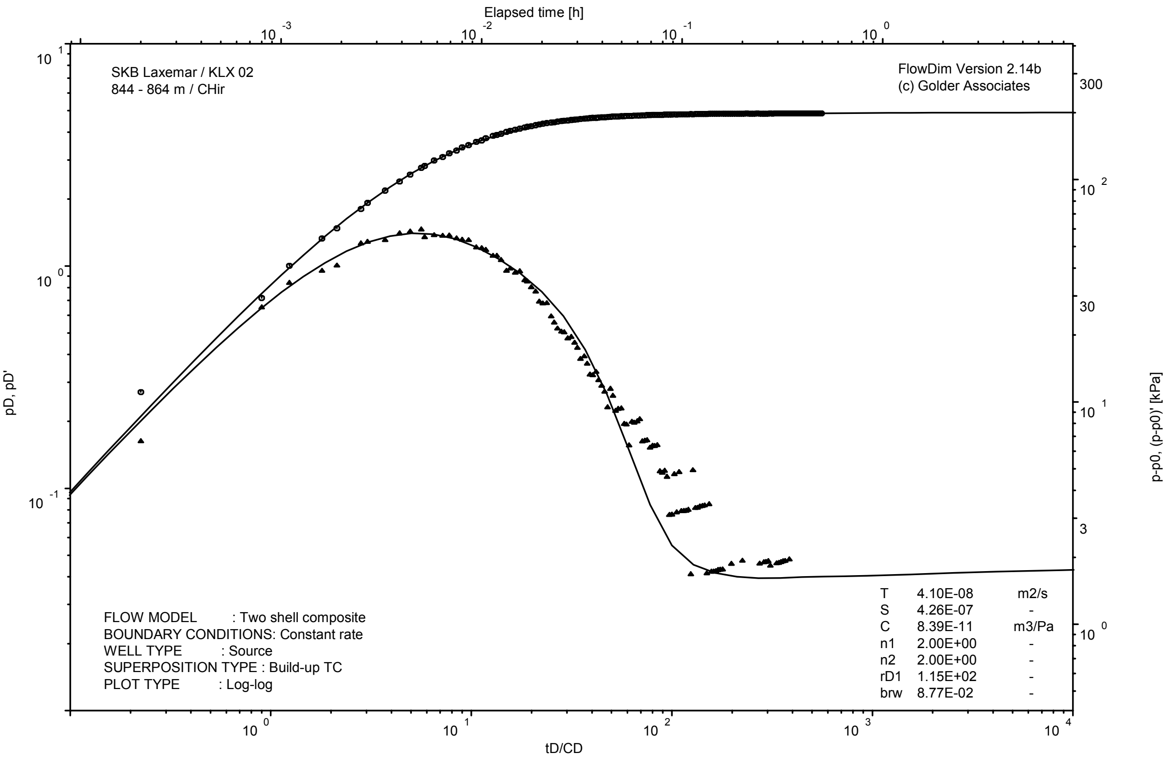
Pressure and flow rate vs. time; cartesian plot



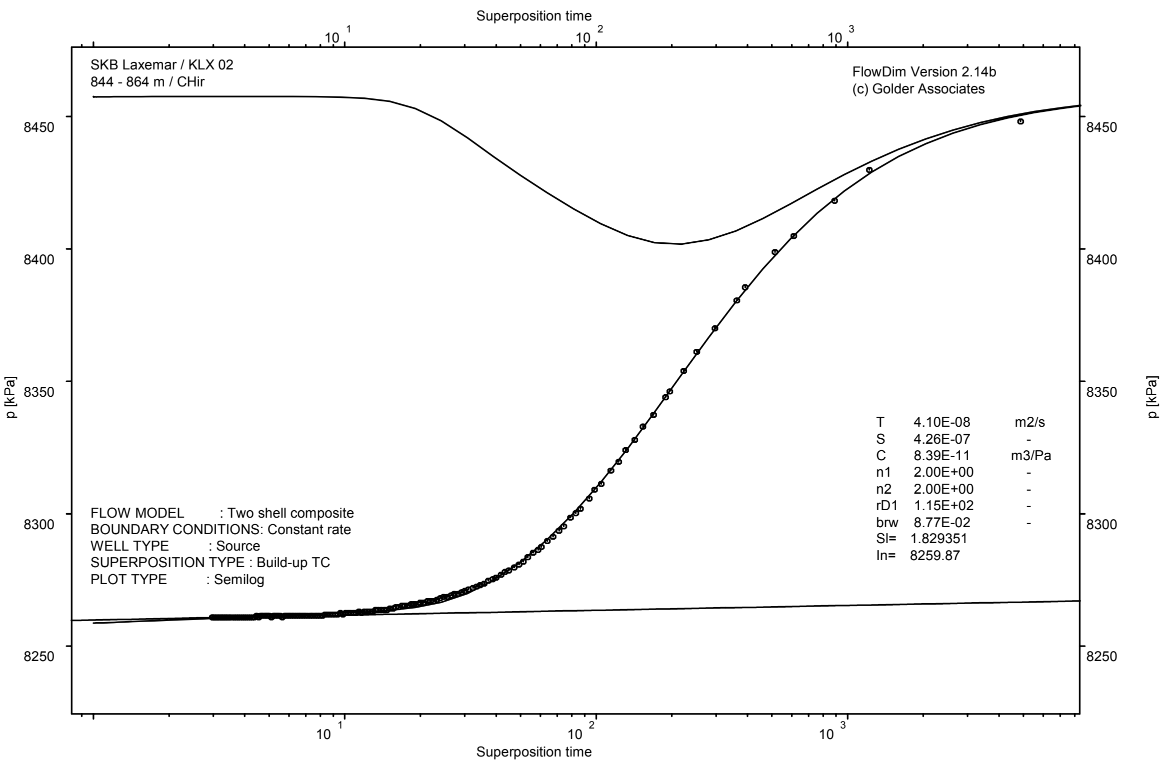
Pressure and temperature in the test section; cartesian plot



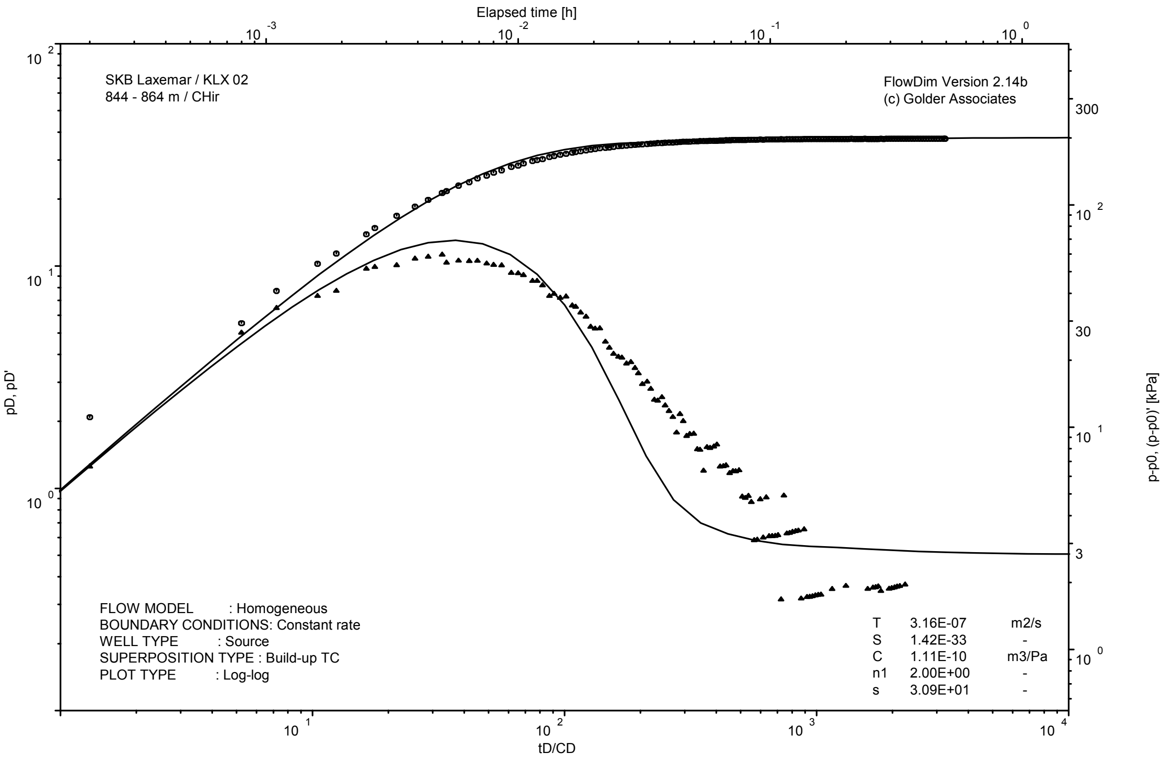
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

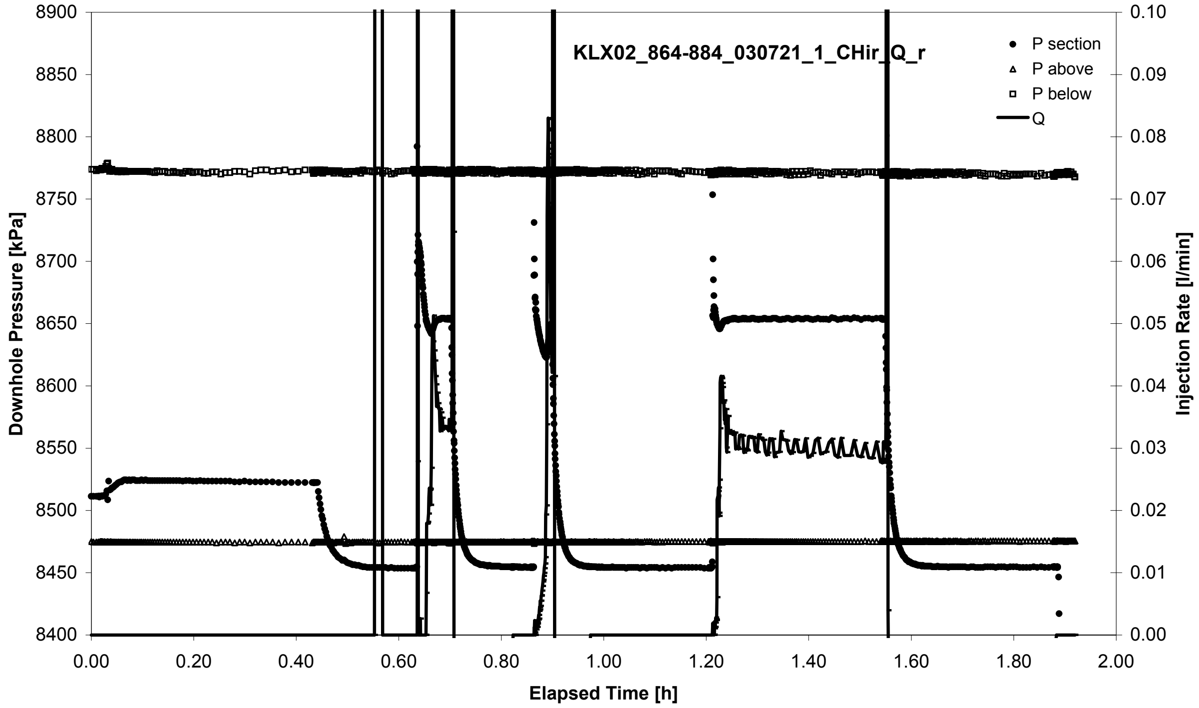


CHIR phase; Homogeneous model analyses, log-log match

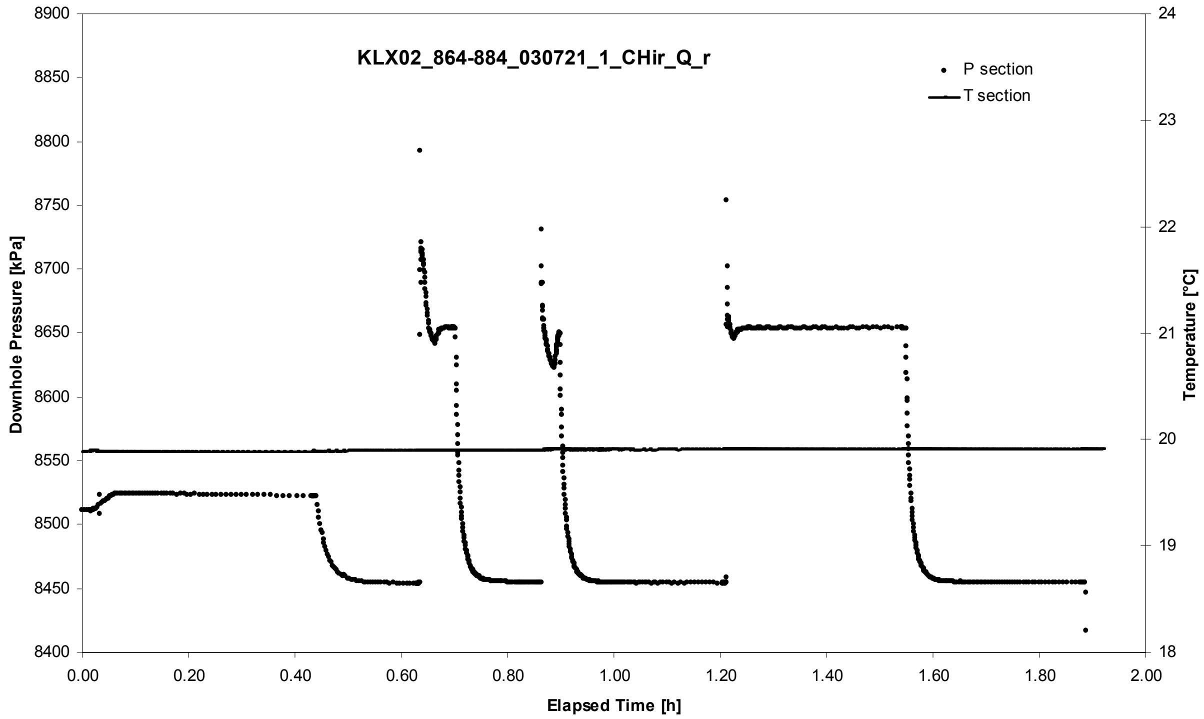
APPENDIX 2-38

Test 864 – 884 m

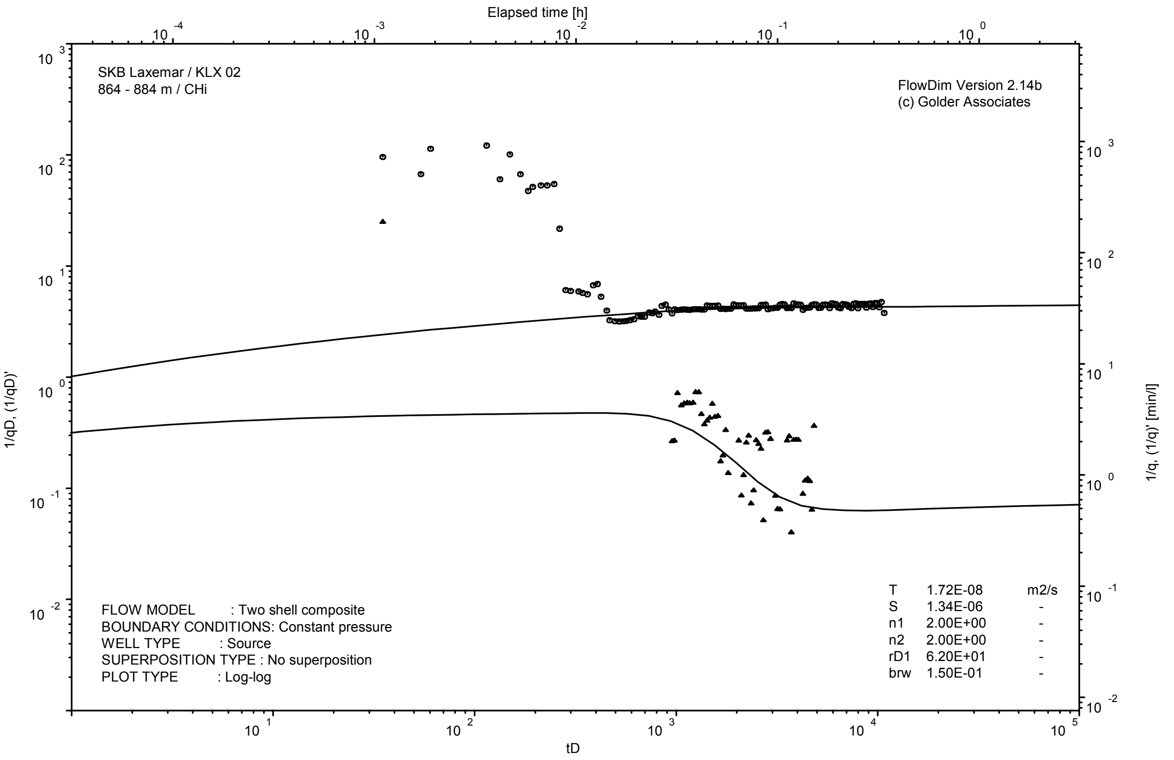
Analysis diagrams



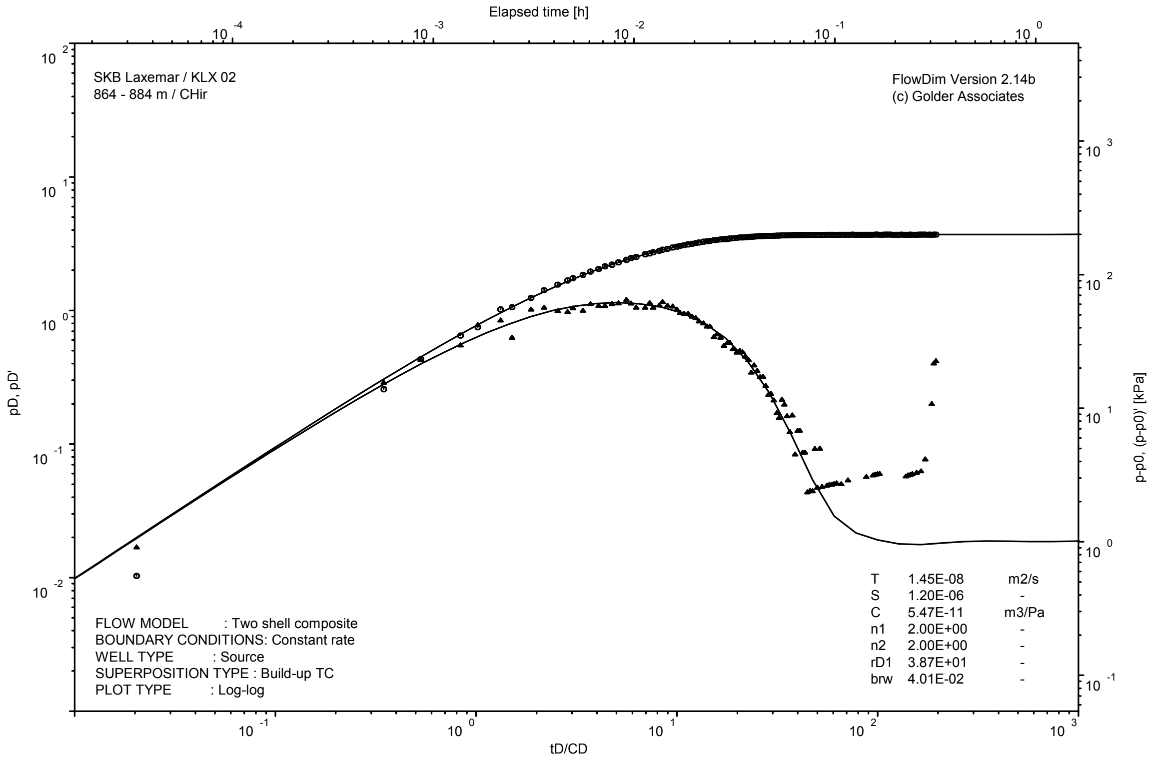
Pressure and flow rate vs. time; cartesian plot



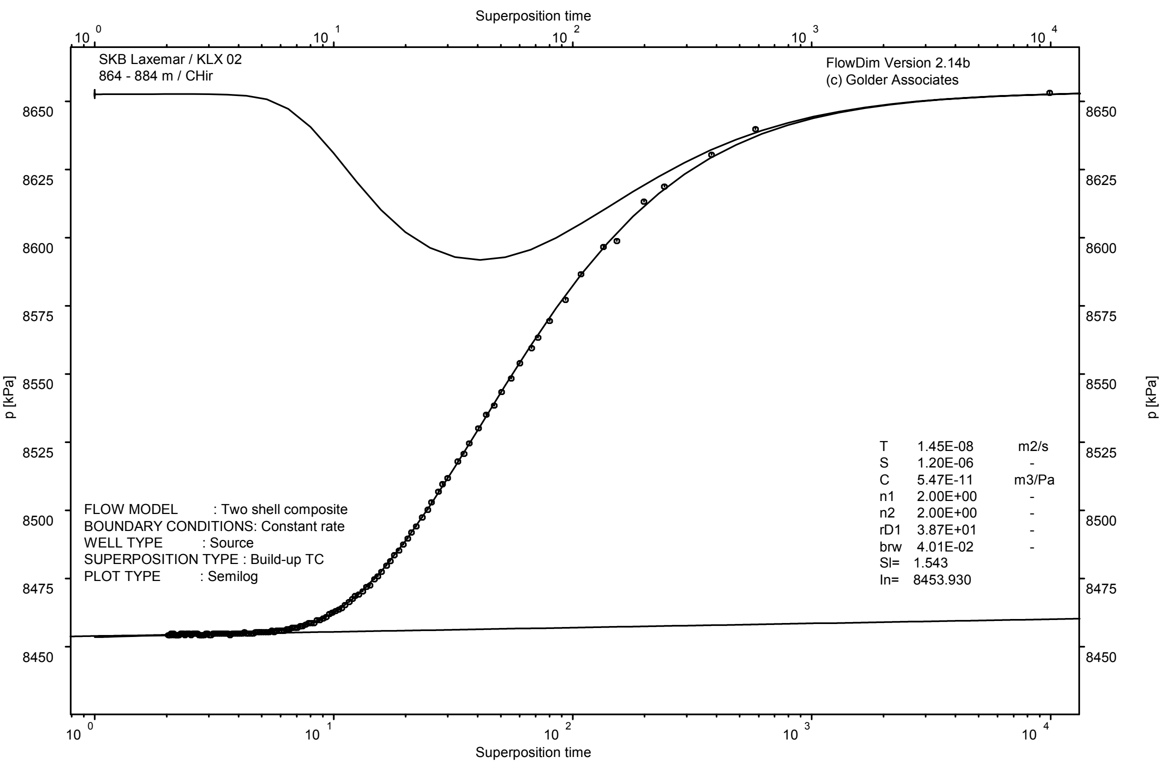
Pressure and temperature in the test section; cartesian plot



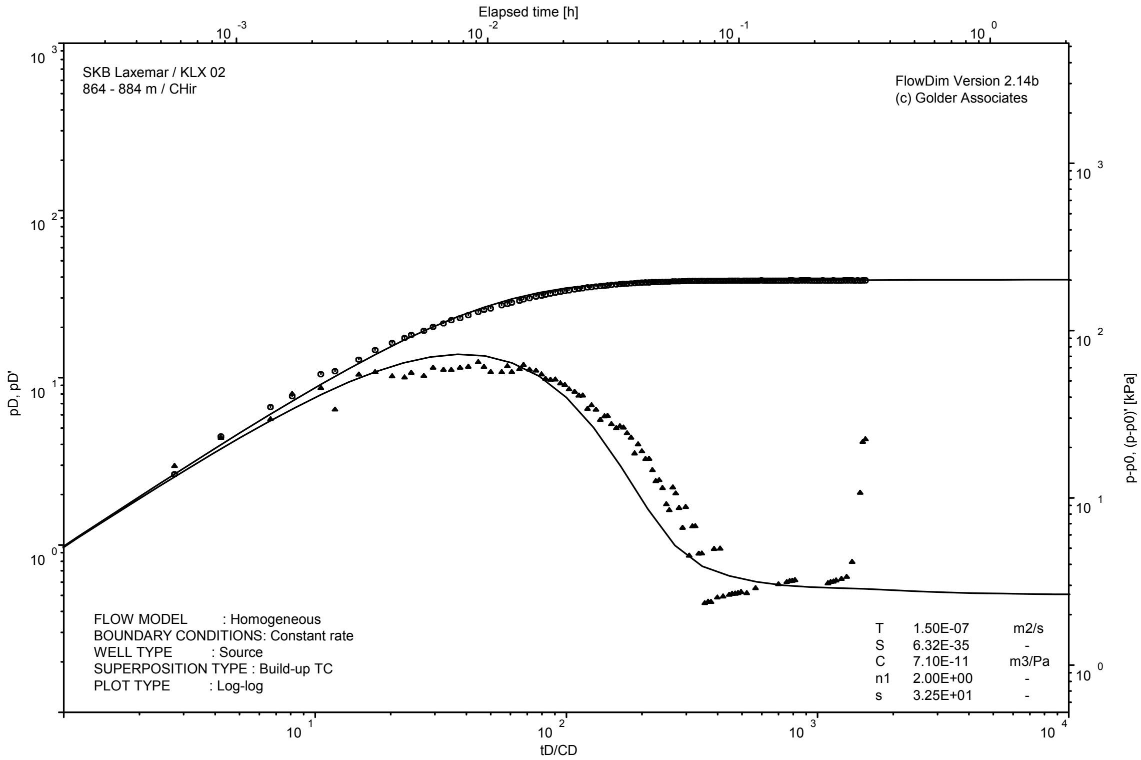
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

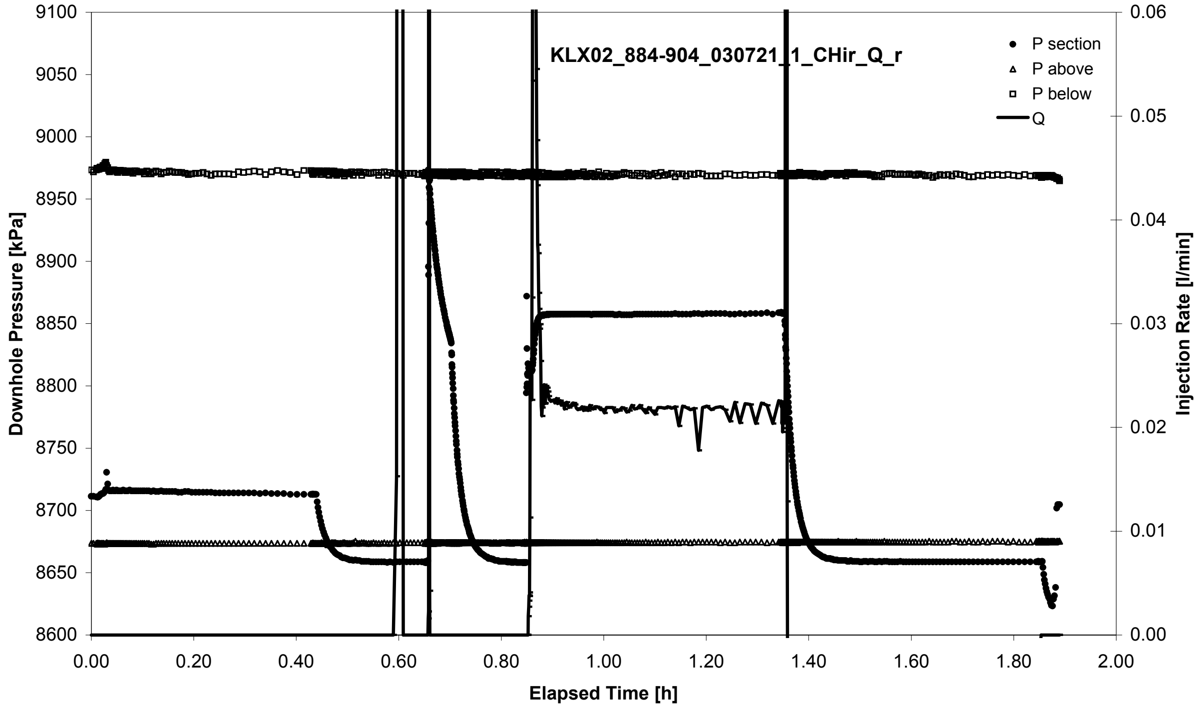


CHIR phase; Homogeneous model analyses, log-log match

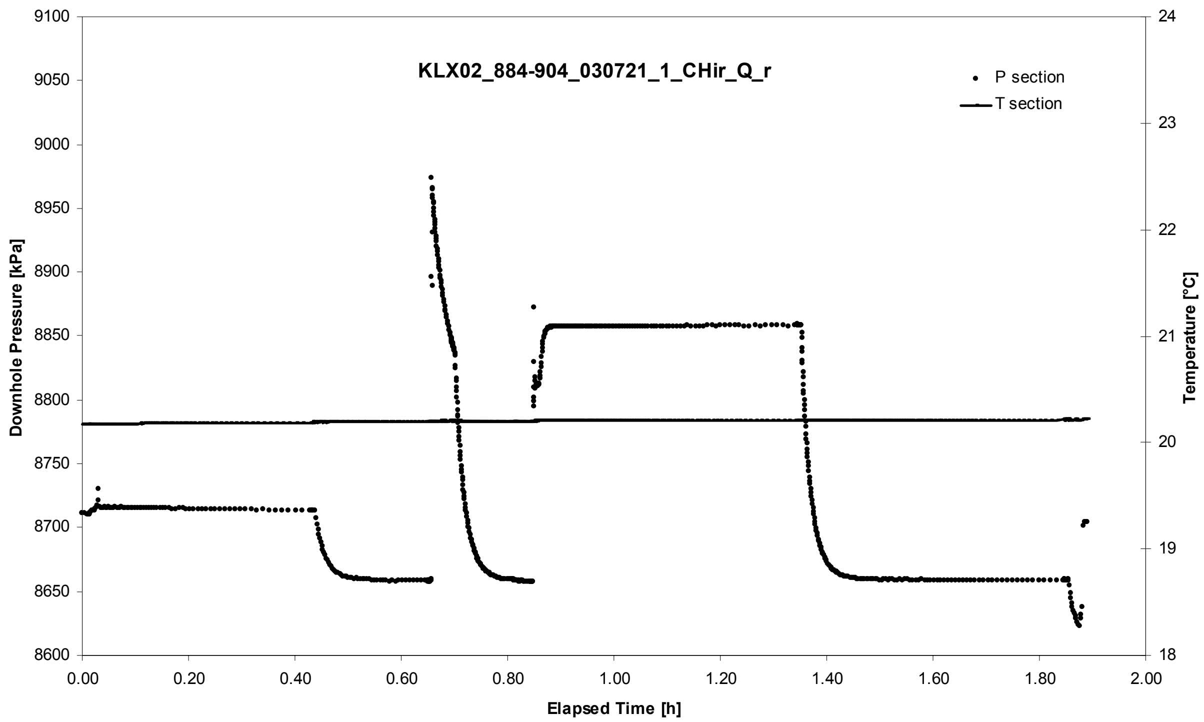
APPENDIX 2-39

Test 884 – 904 m

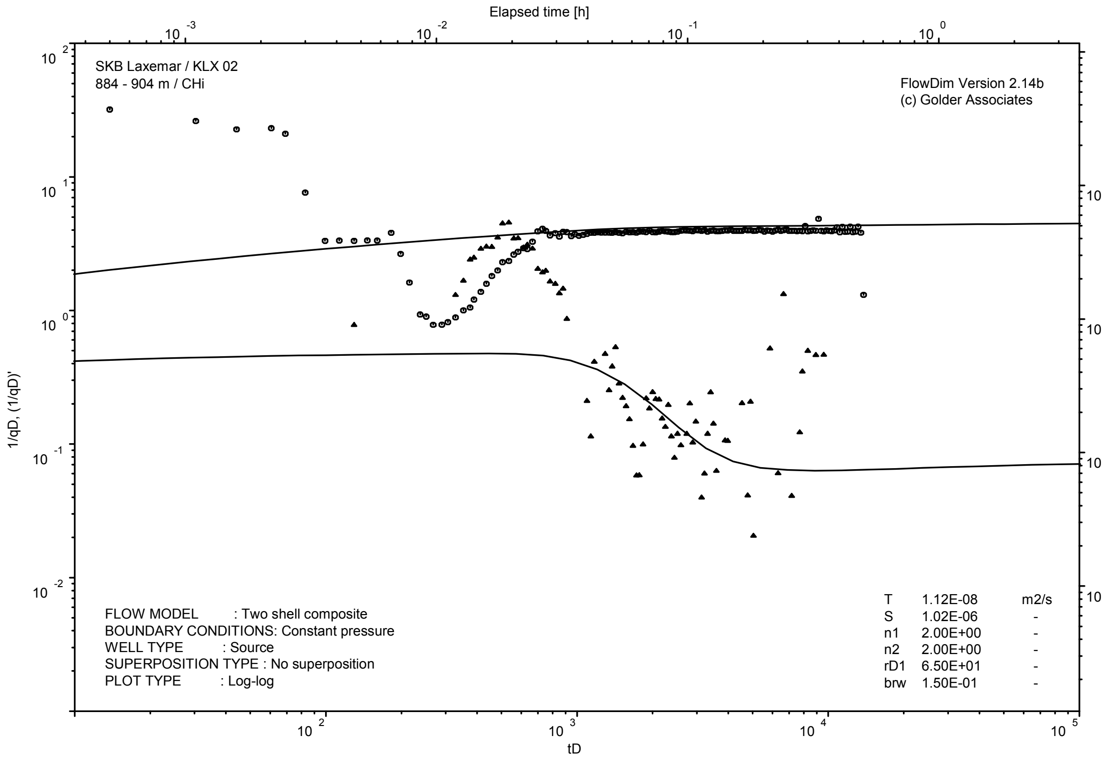
Analysis diagrams



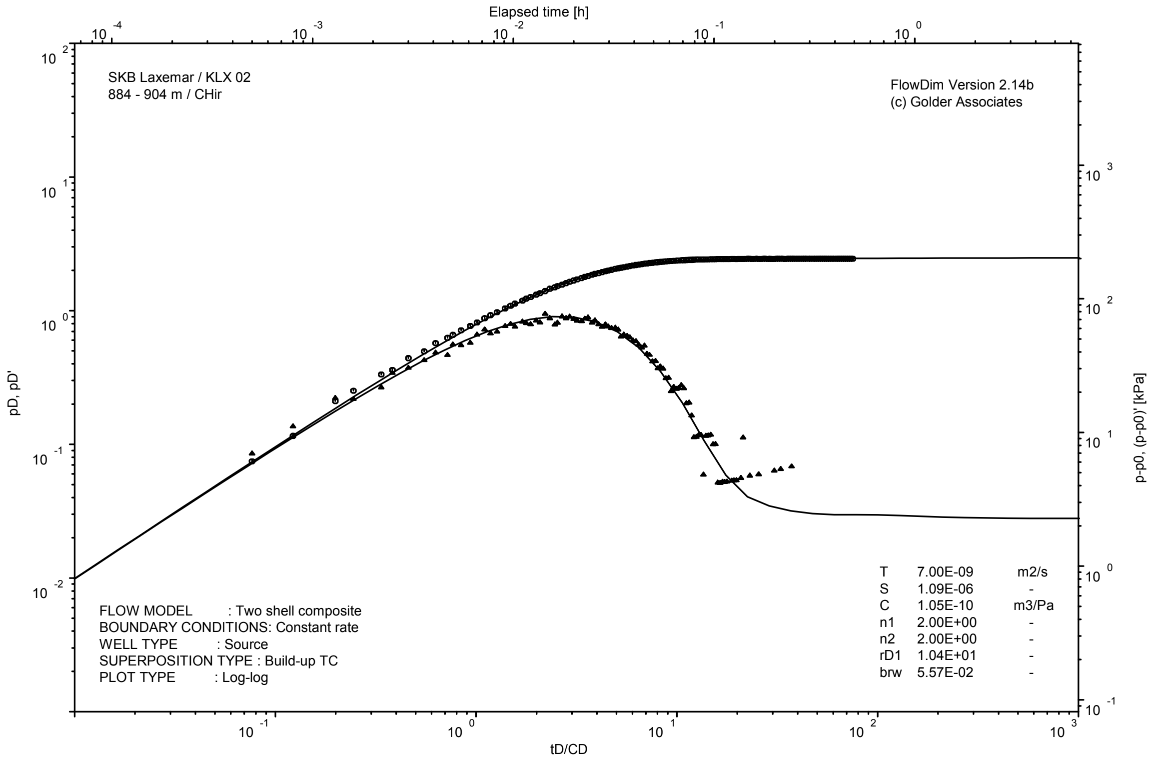
Pressure and flow rate vs. time; cartesian plot



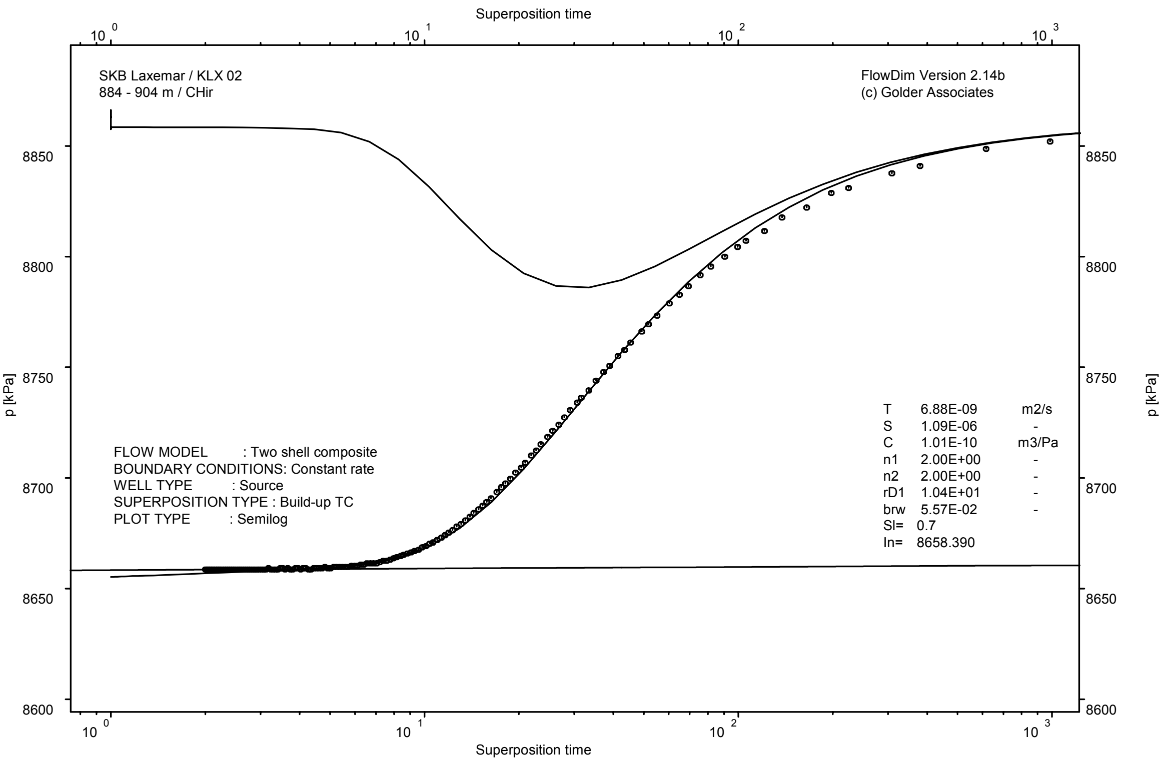
Pressure and temperature in the test section; cartesian plot



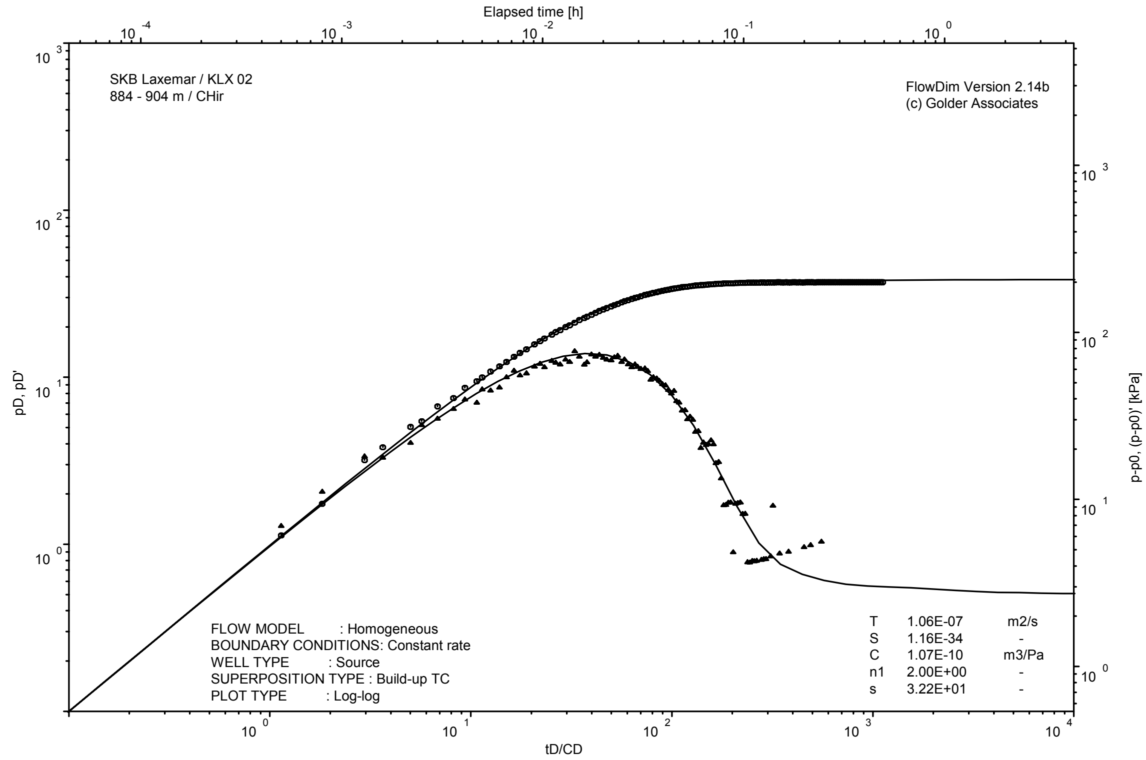
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

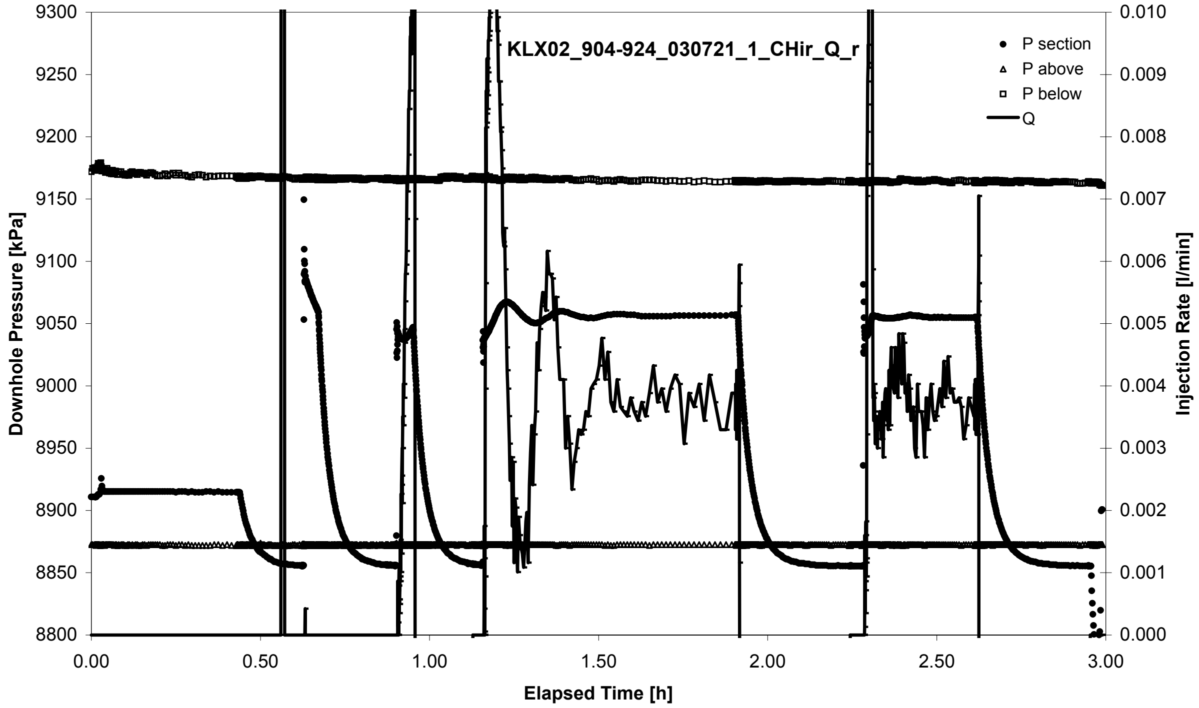


CHIR phase; Homogeneous model analyses, log-log match

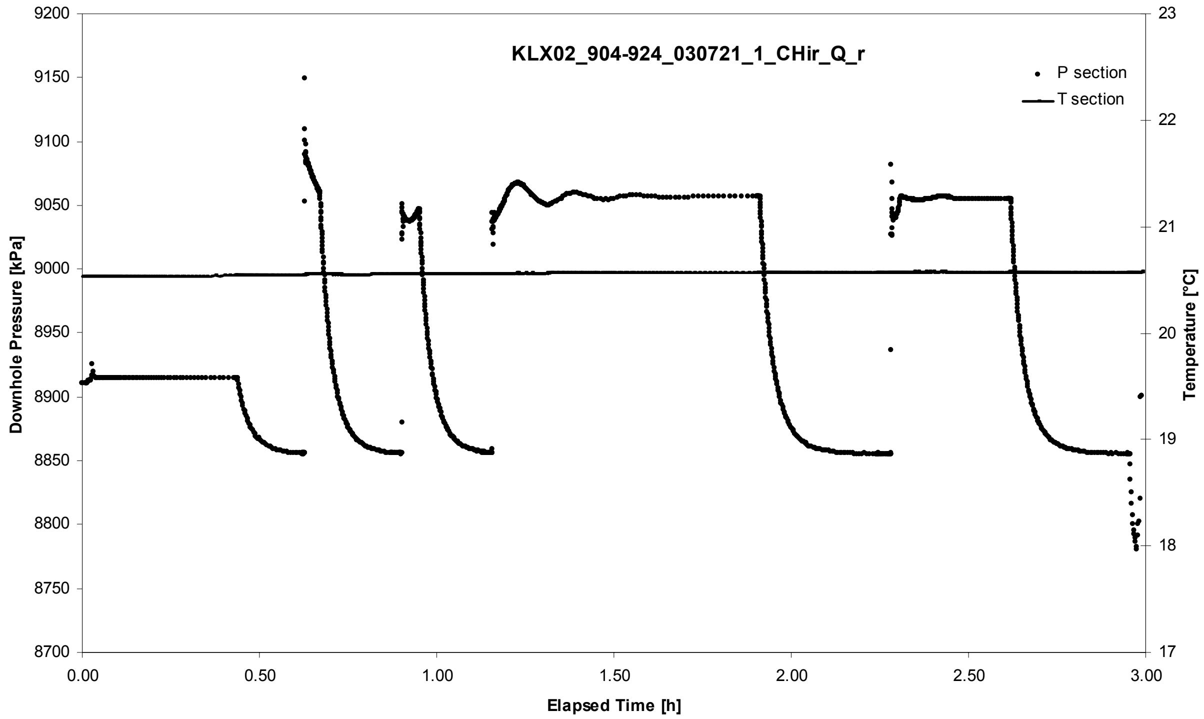
APPENDIX 2-40

Test 904 – 924 m

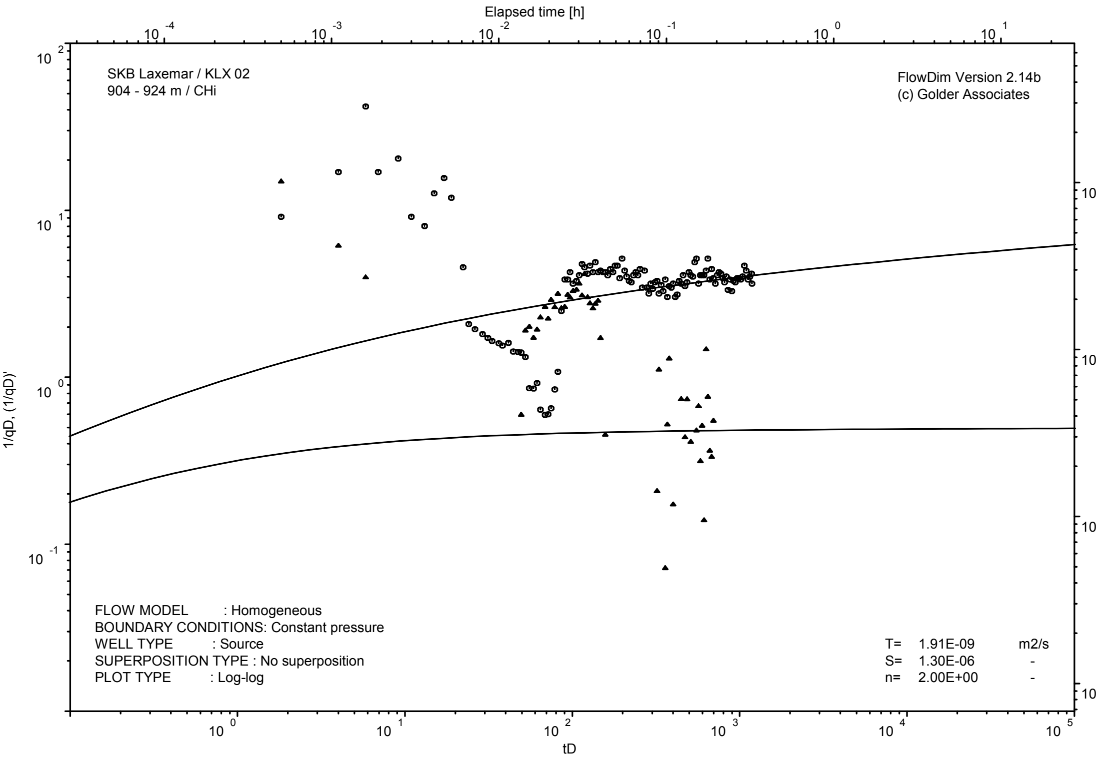
Analysis diagrams



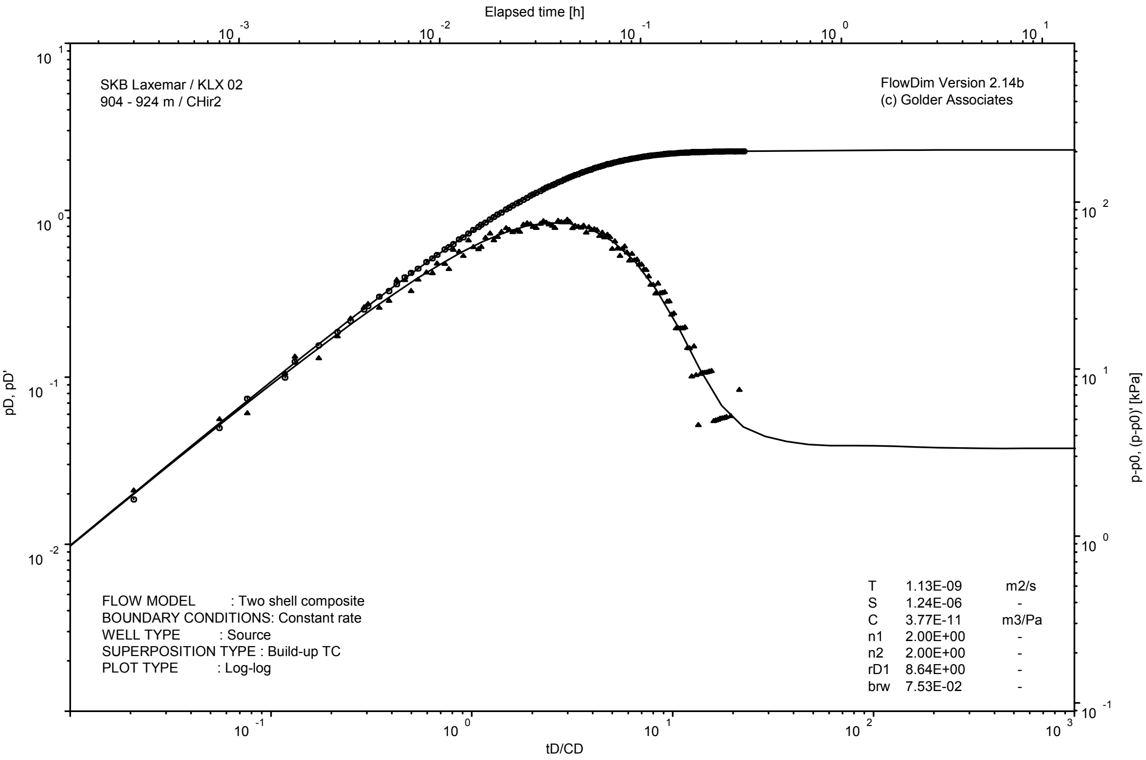
Pressure and flow rate vs. time; cartesian plot



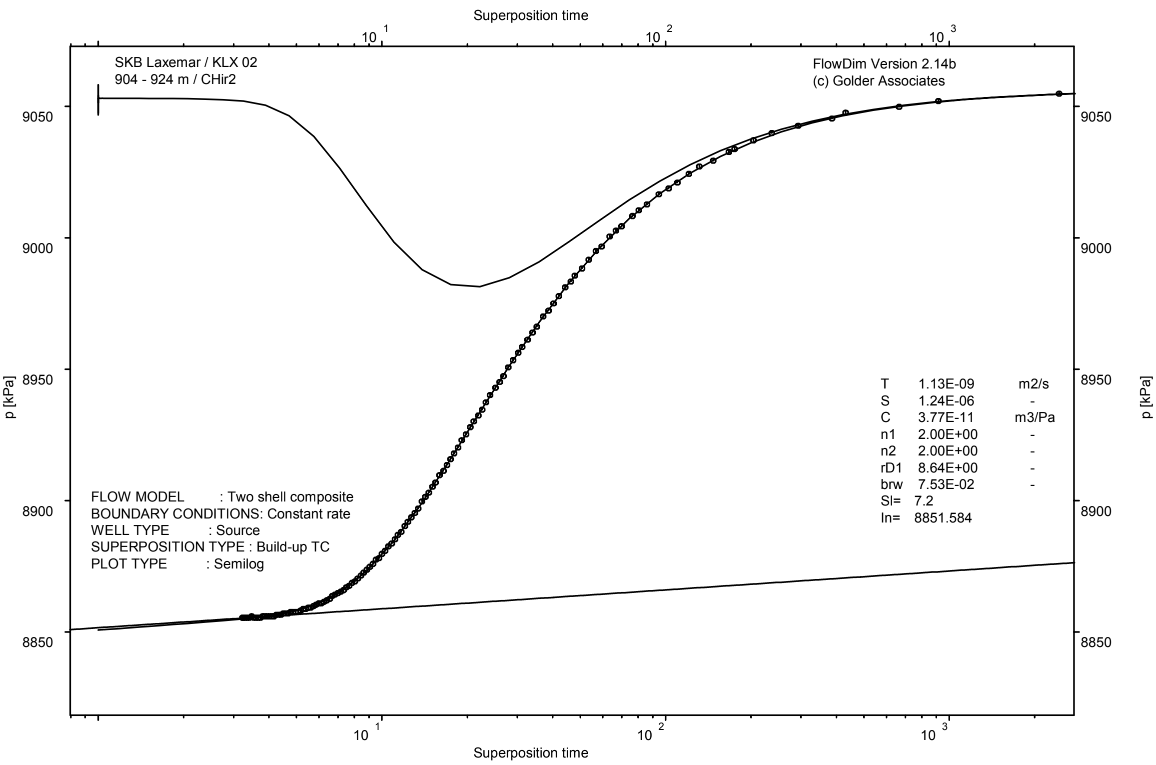
Pressure and temperature in the test section; cartesian plot



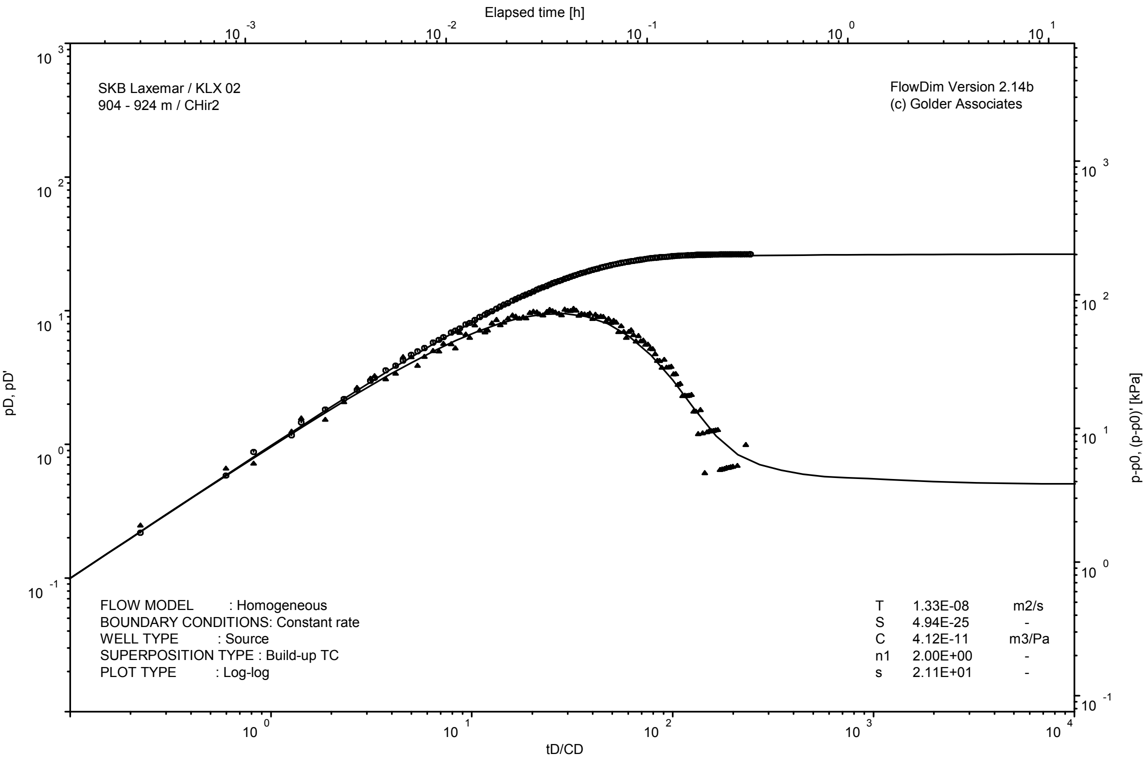
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

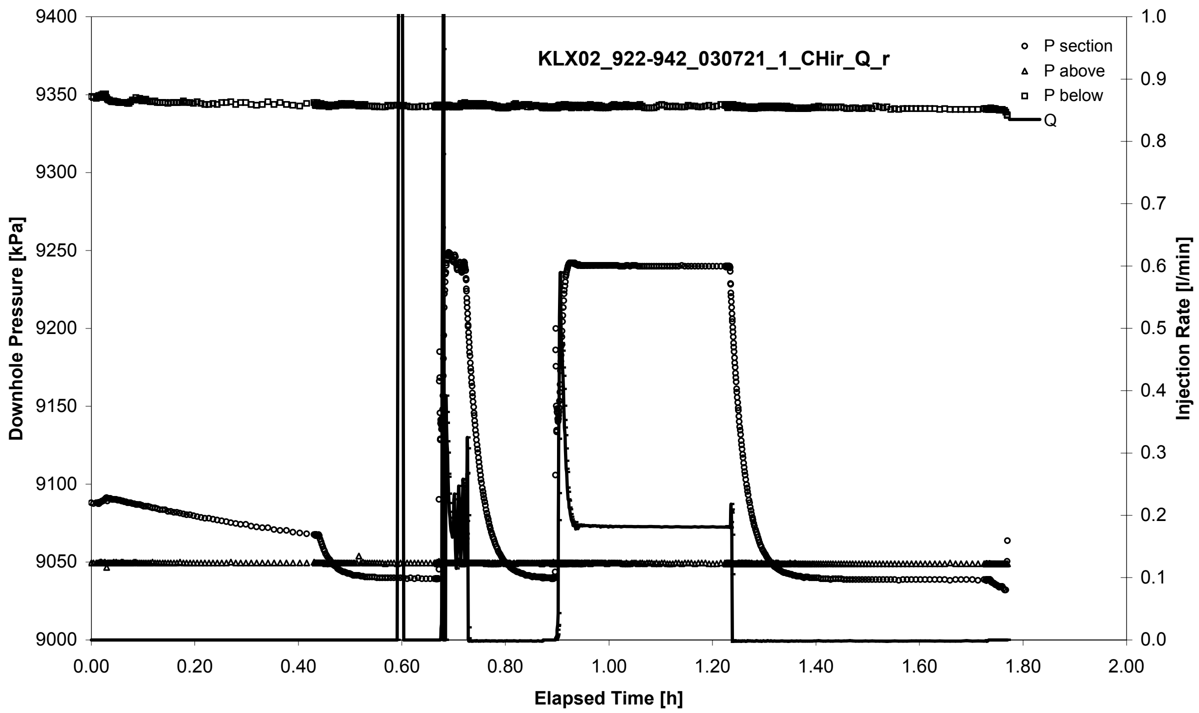


CHIR phase; Homogeneous model analyses, log-log match

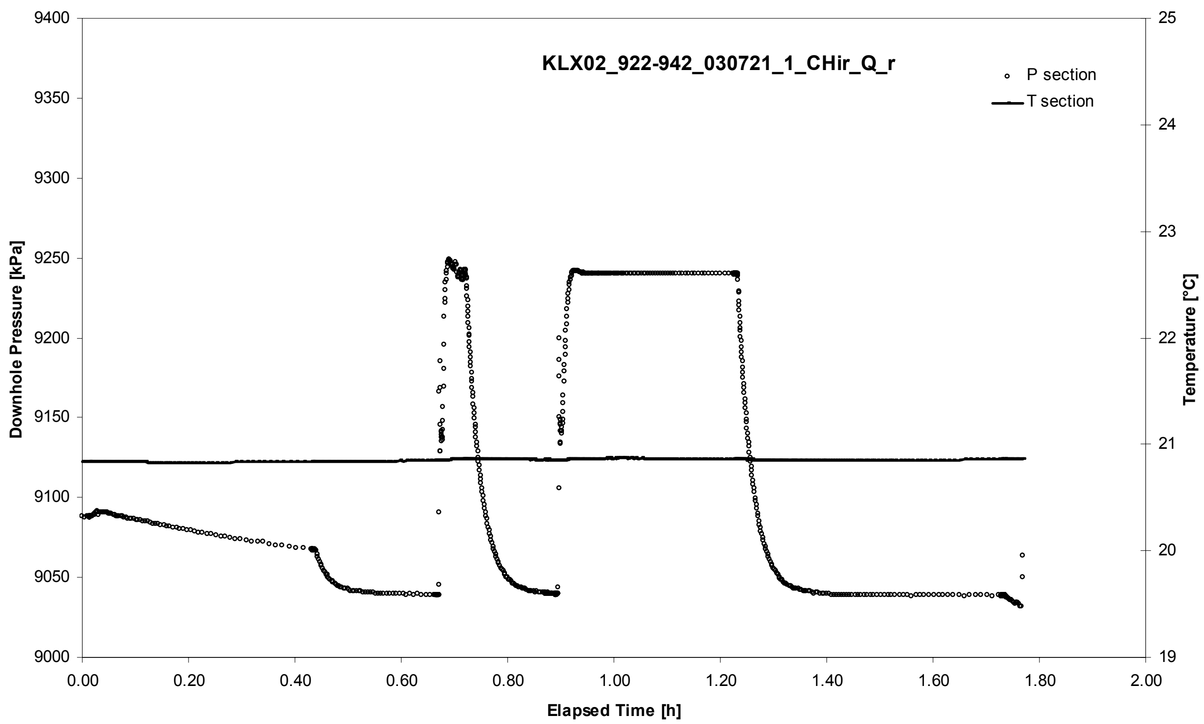
APPENDIX 2-41

Test 922 – 942 m

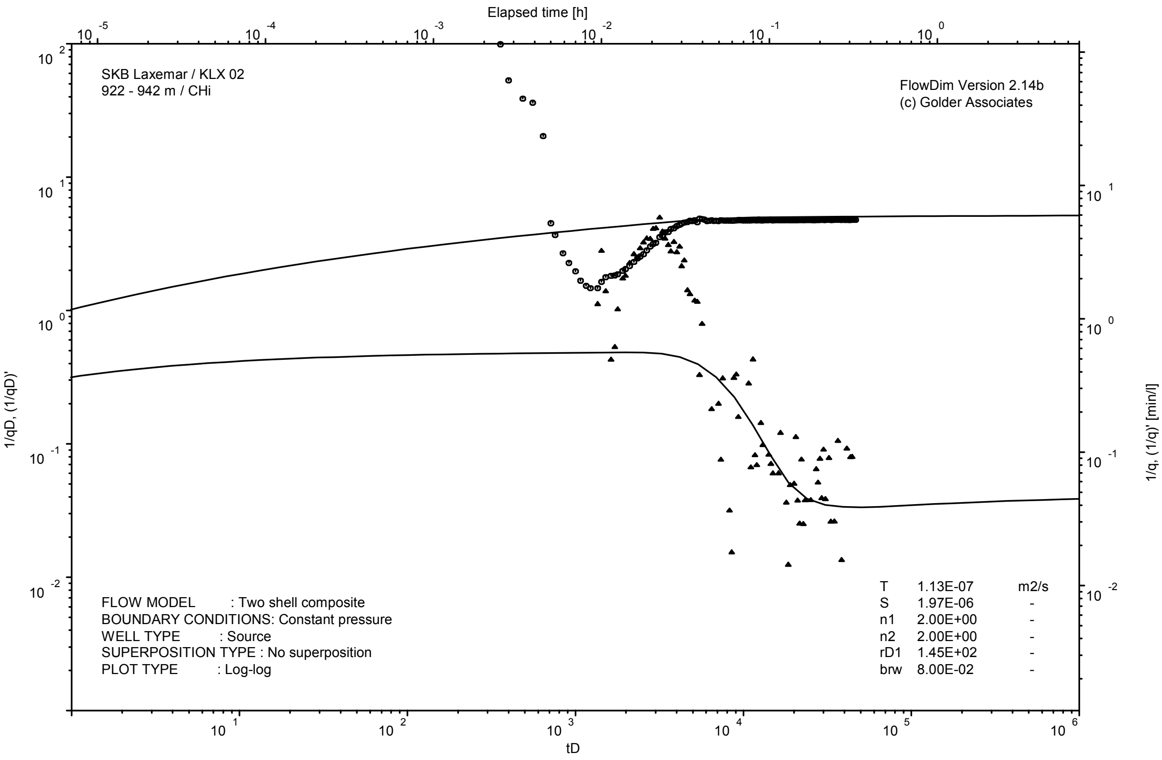
Analysis diagrams



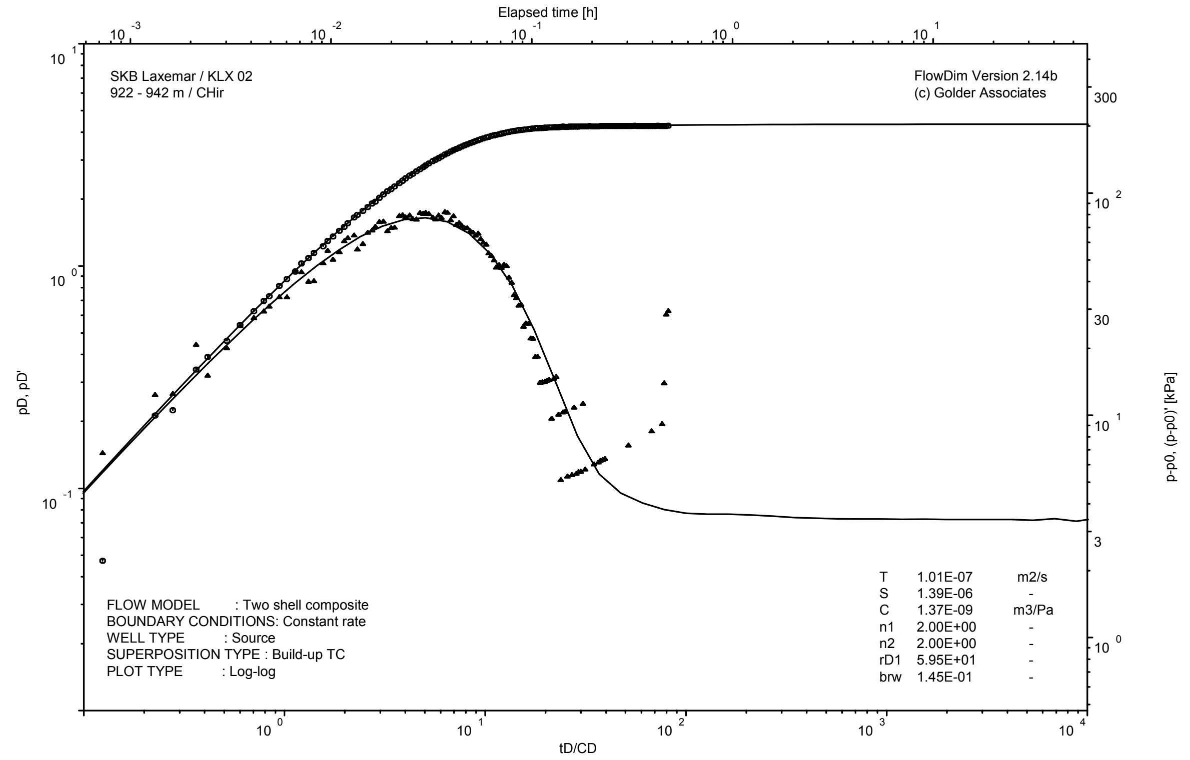
Pressure and flow rate vs. time; cartesian plot



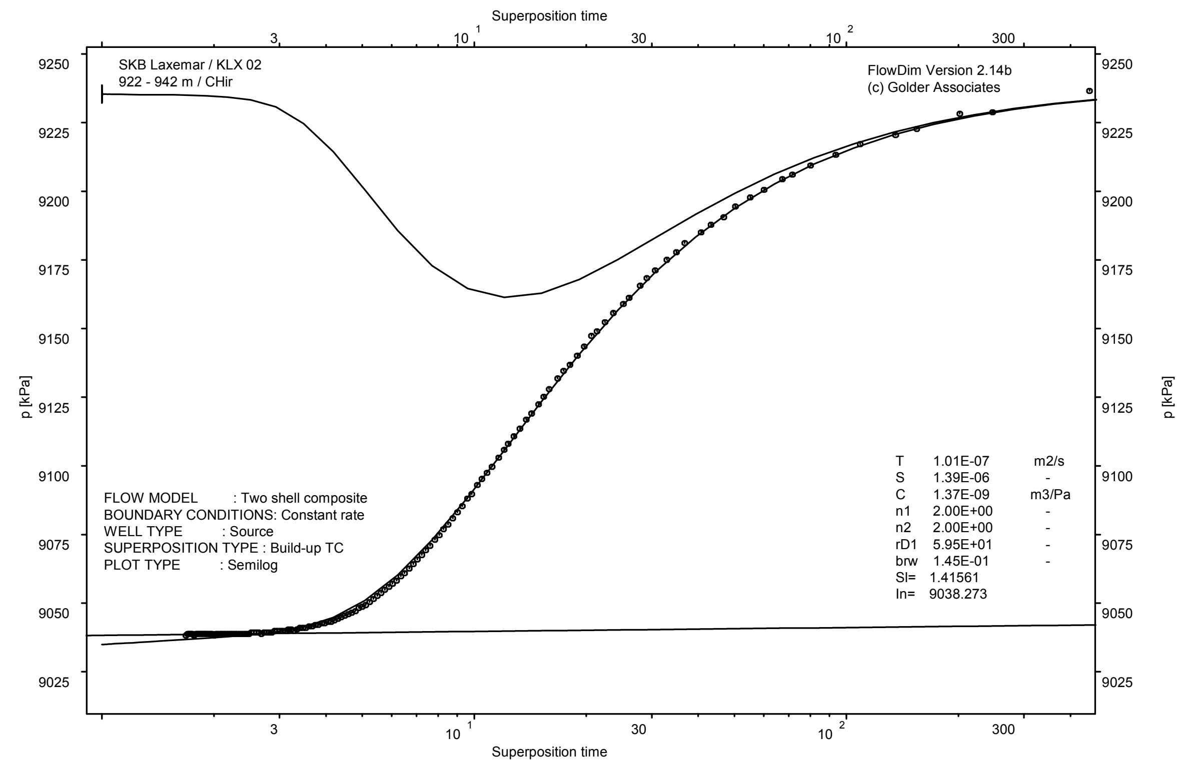
Pressure and temperature in the test section; cartesian plot



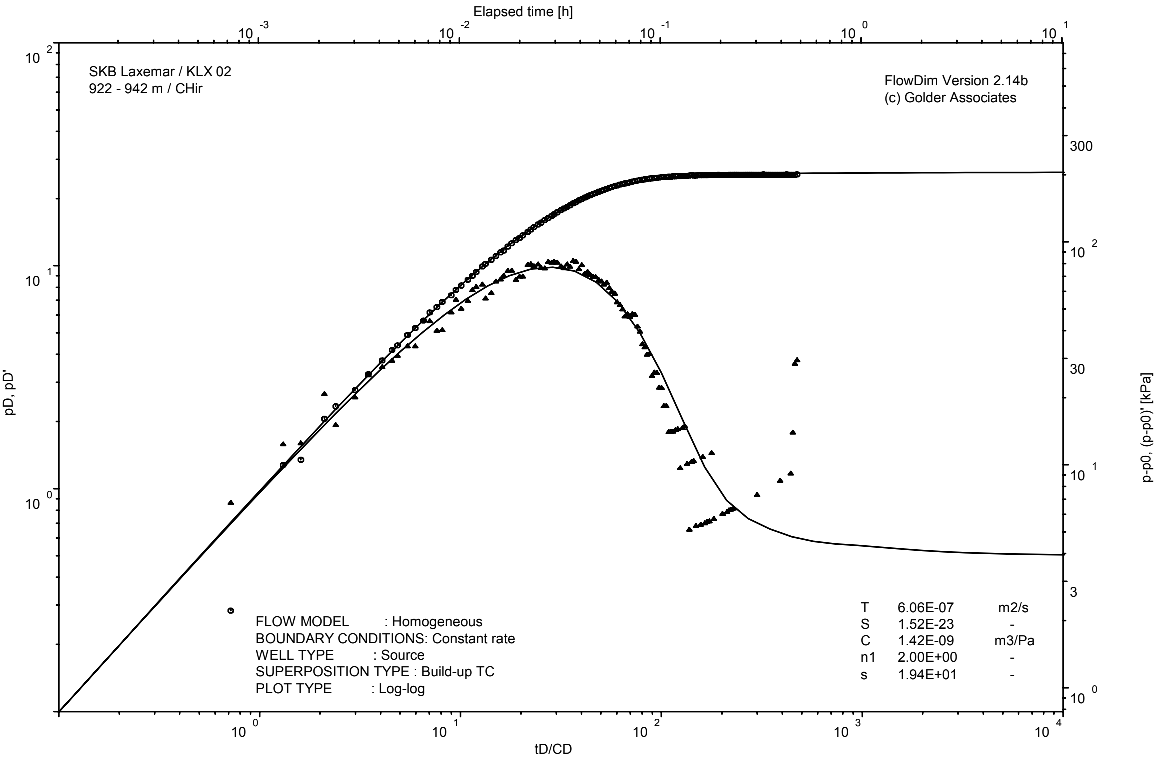
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

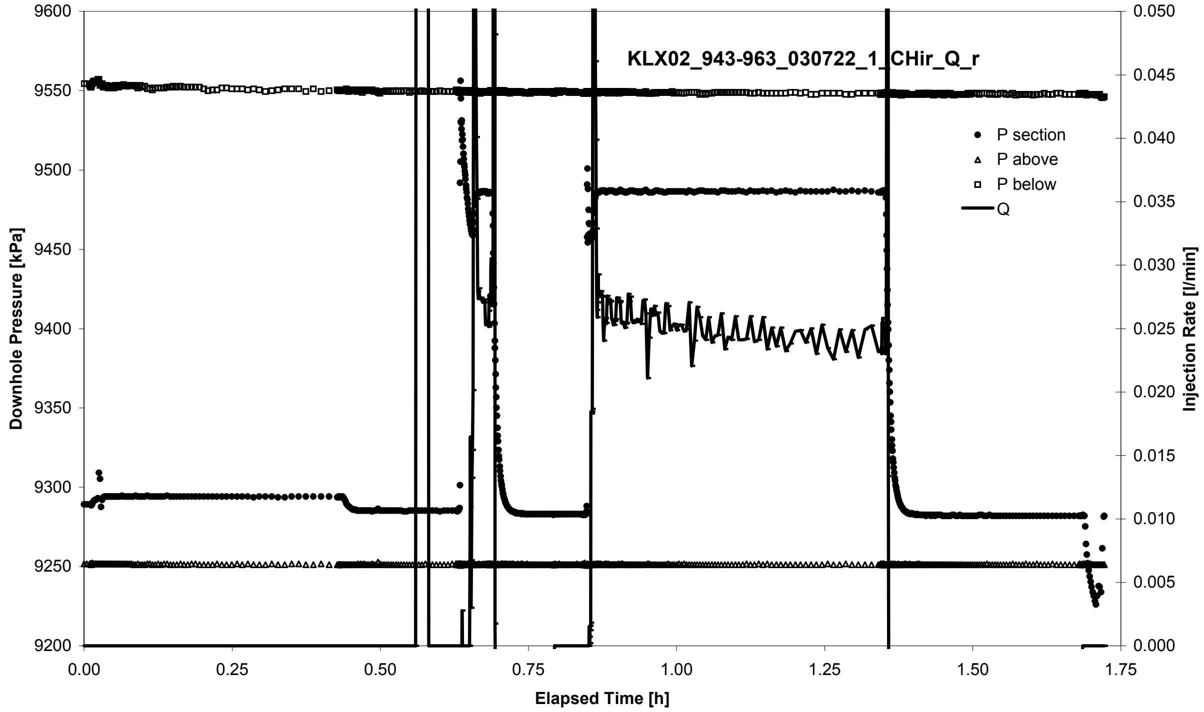


CHIR phase; Homogeneous model analyses, log-log match

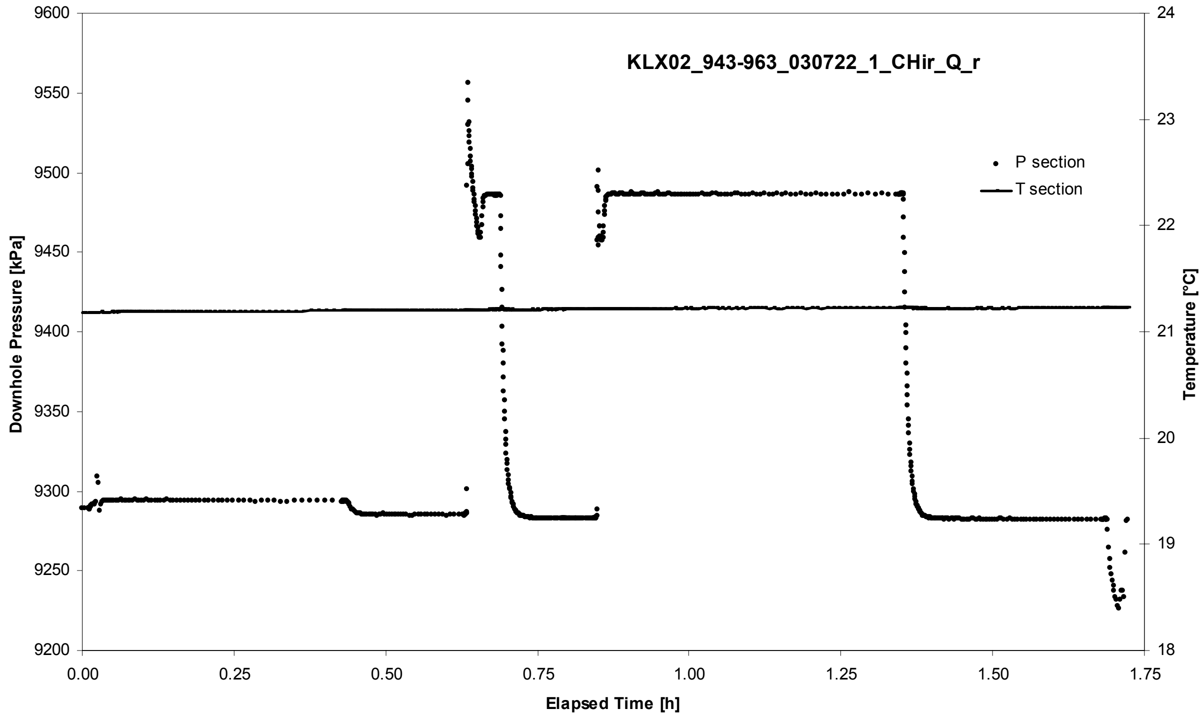
APPENDIX 2-42

Test 943 – 963 m

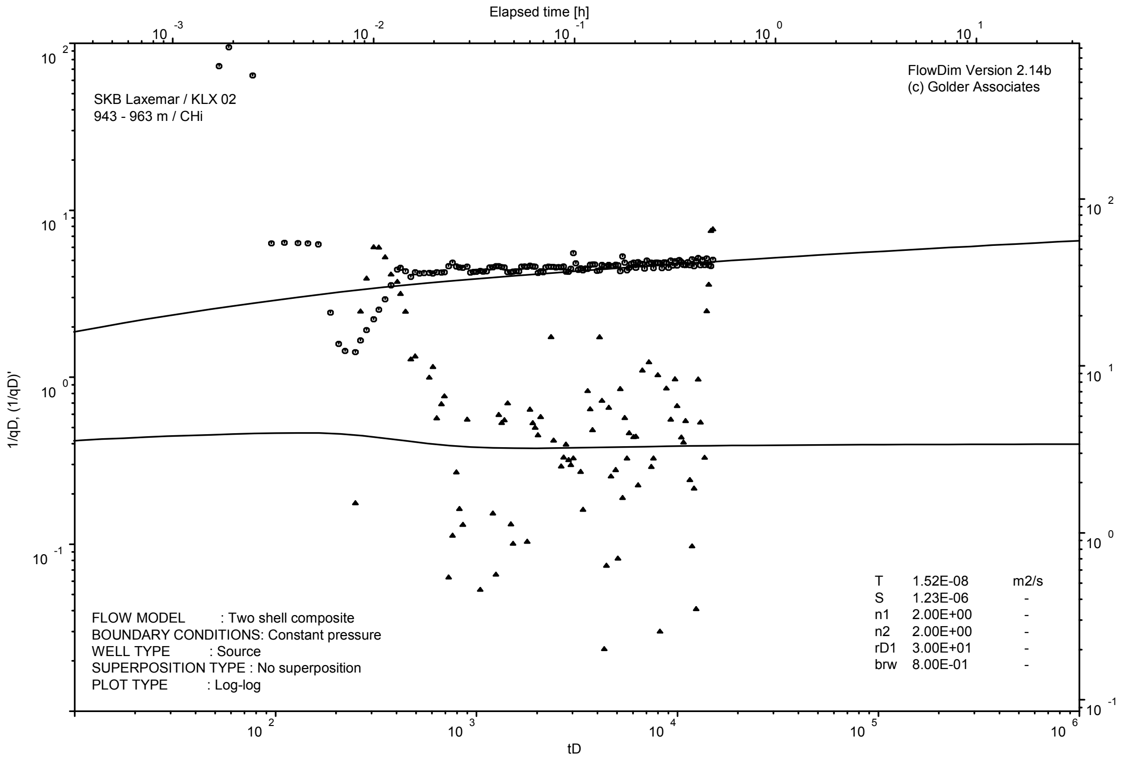
Analysis diagrams



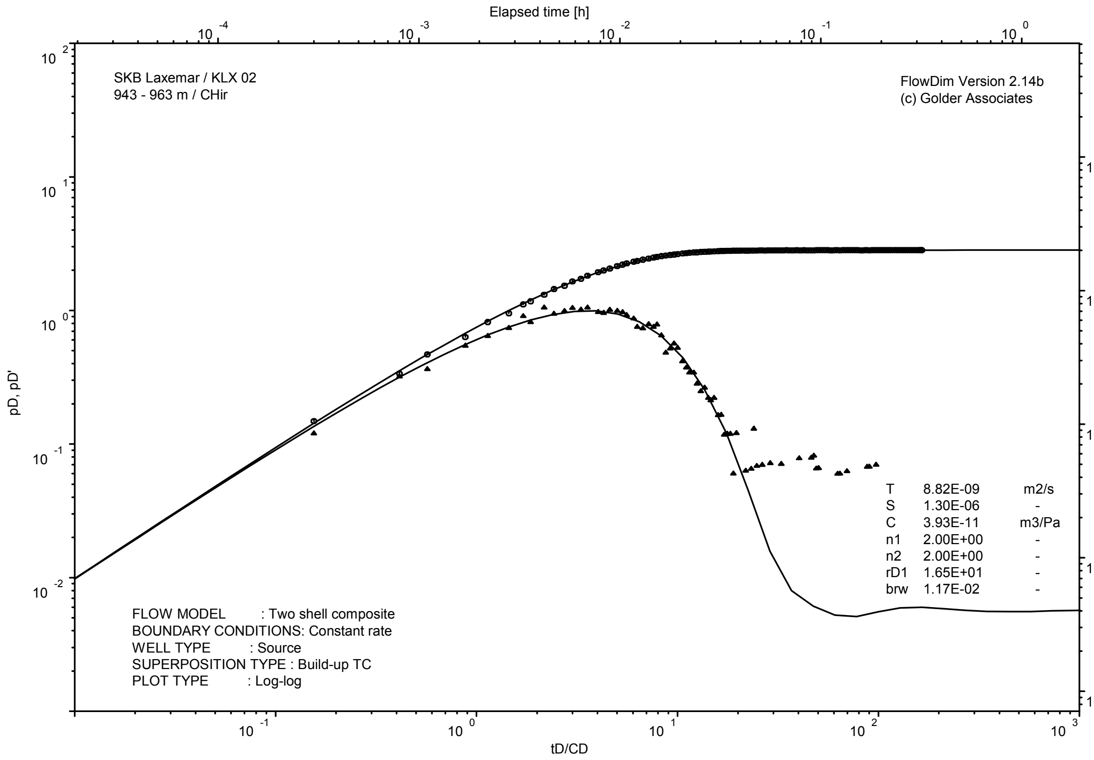
Pressure and flow rate vs. time; cartesian plot



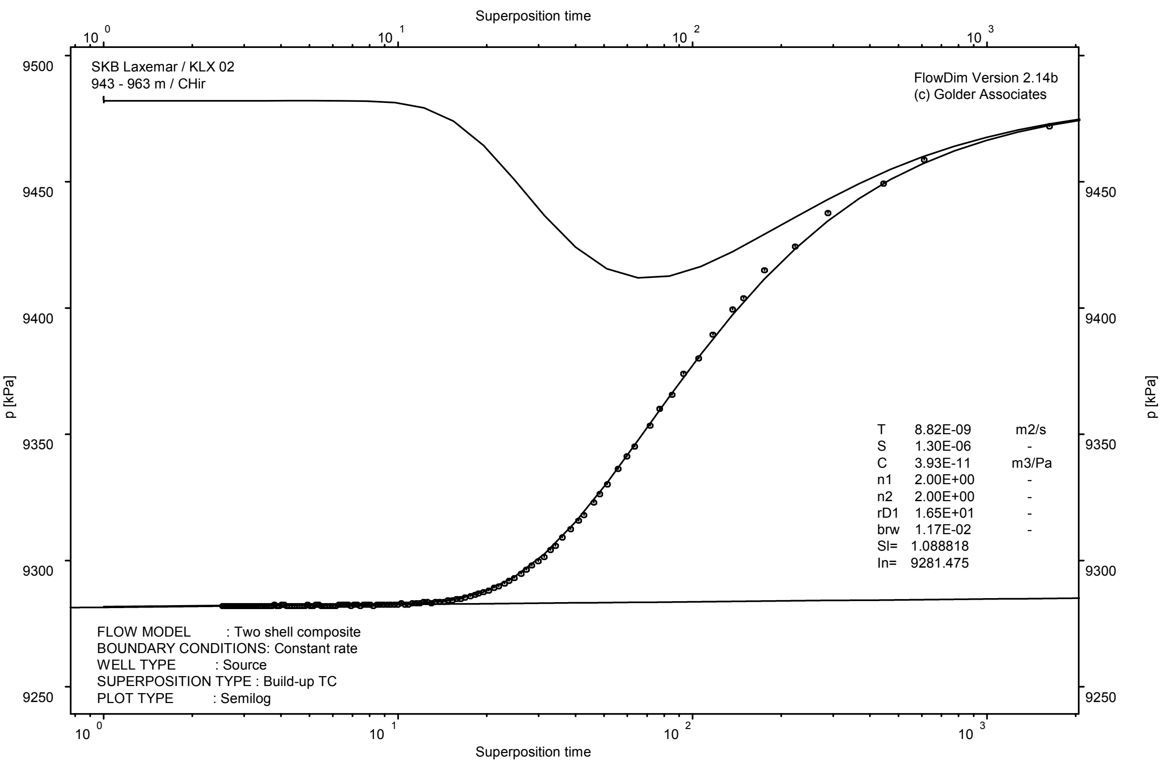
Pressure and temperature in the test section; cartesian plot



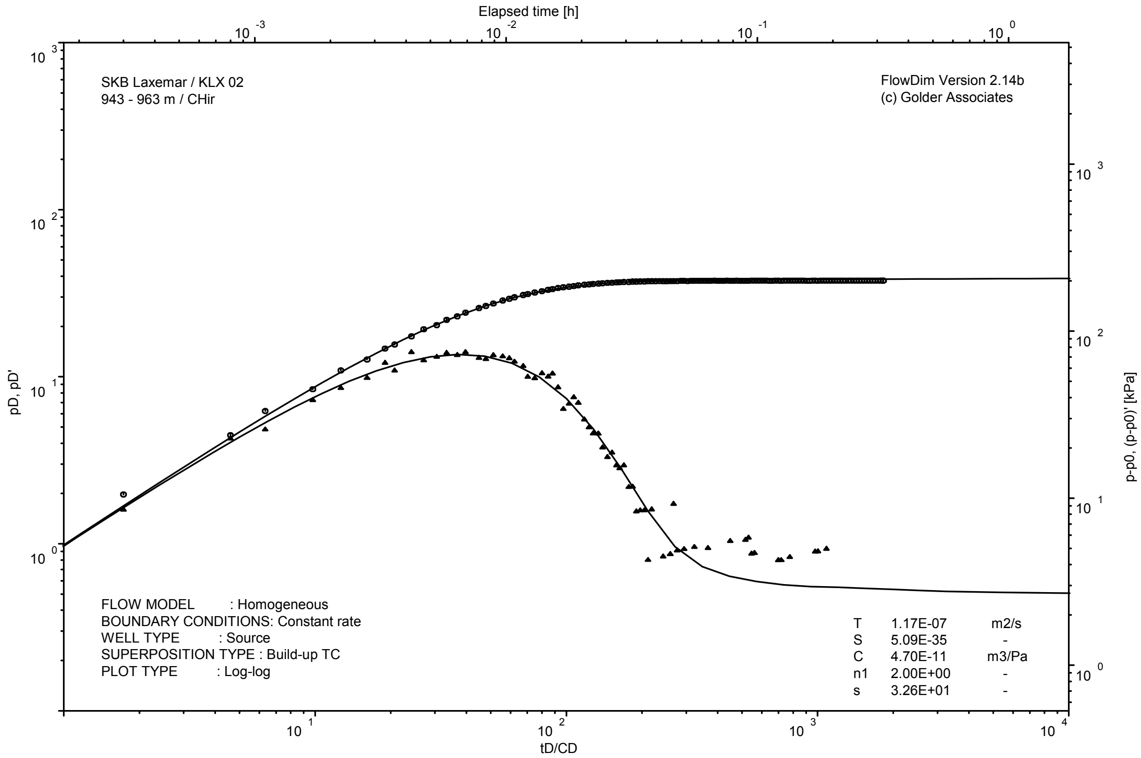
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

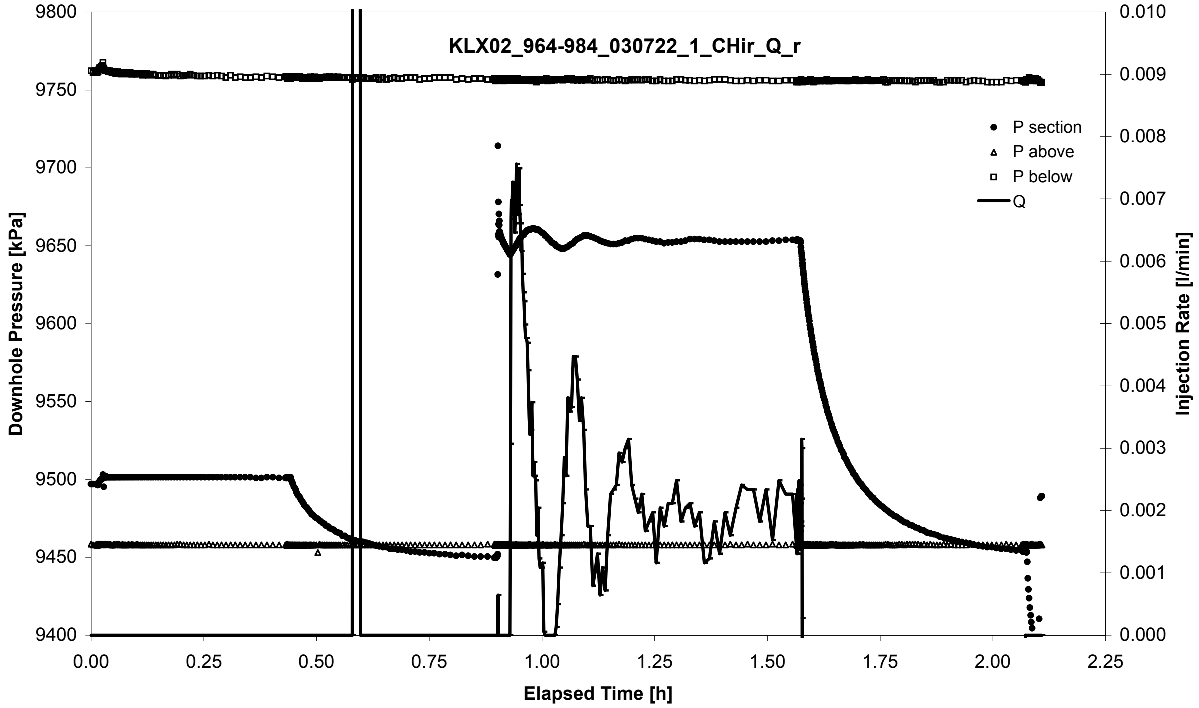


CHIR phase; Homogeneous model analyses, log-log match

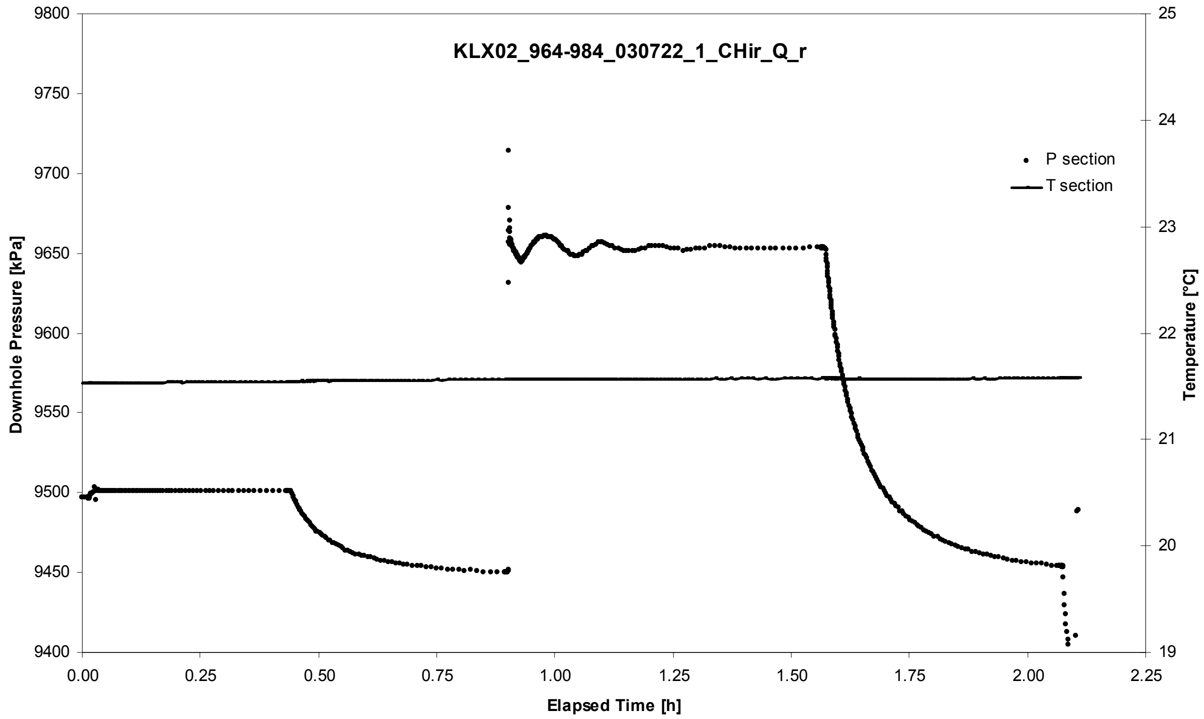
APPENDIX 2-43

Test 964 – 984 m

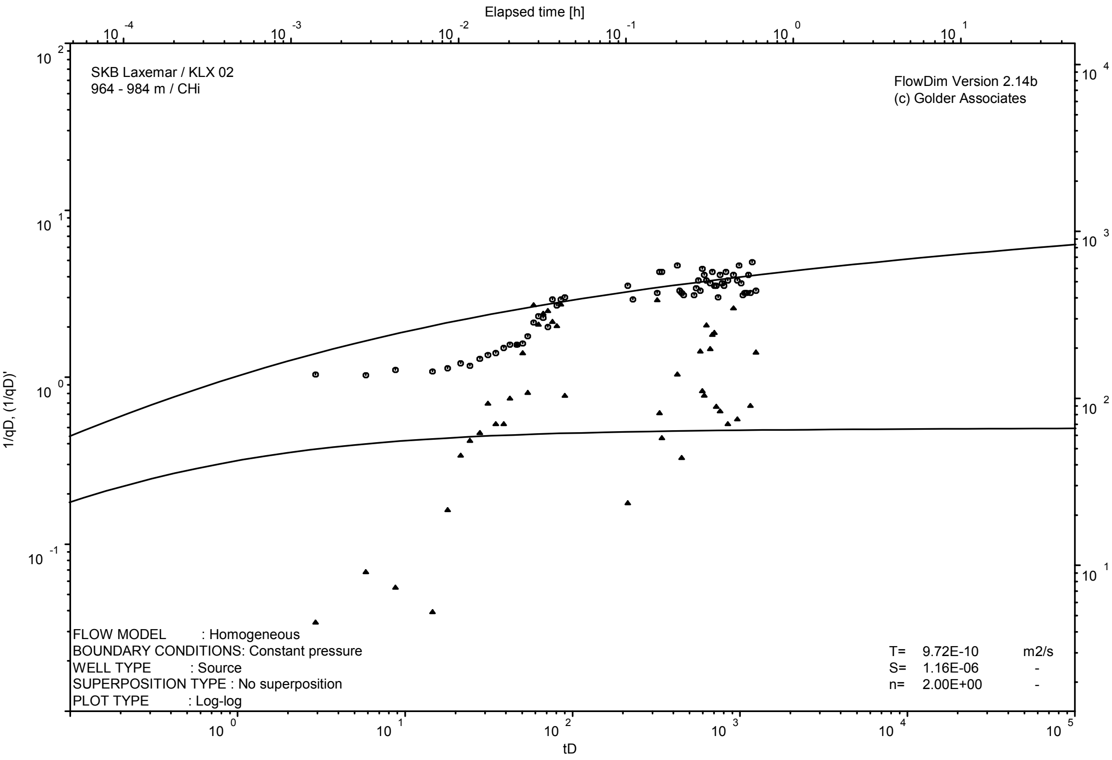
Analysis diagrams



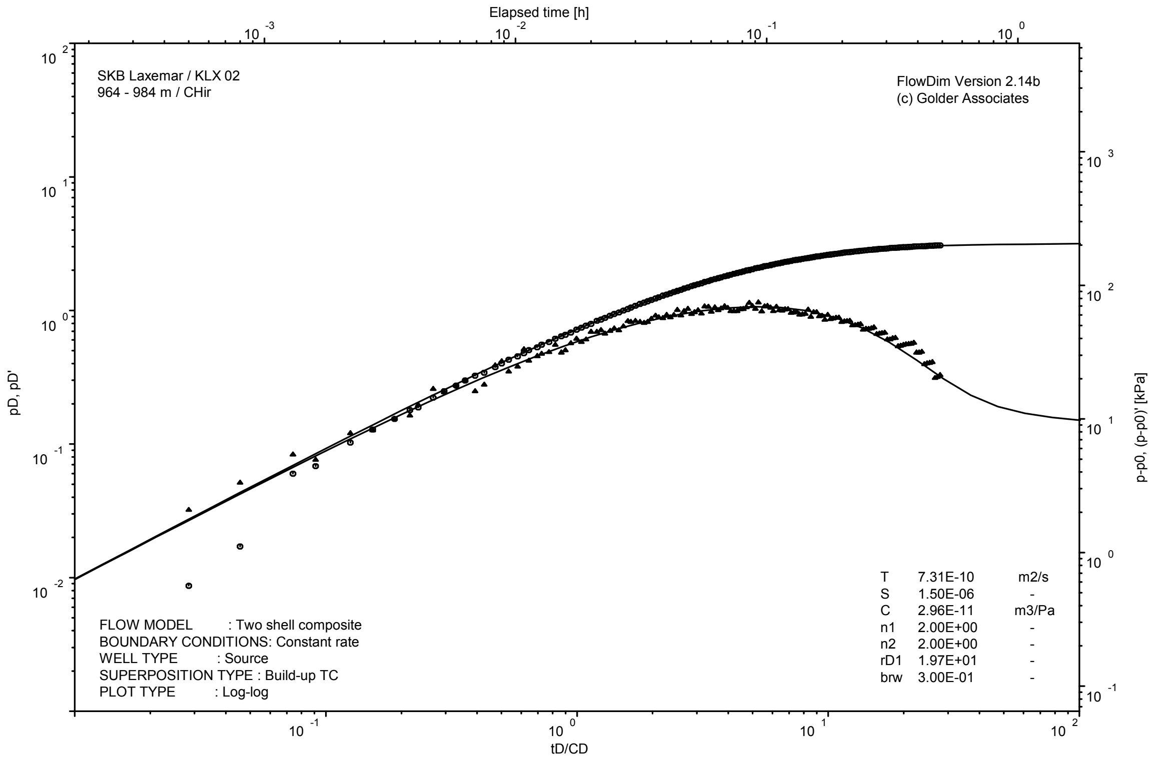
Pressure and flow rate vs. time; cartesian plot



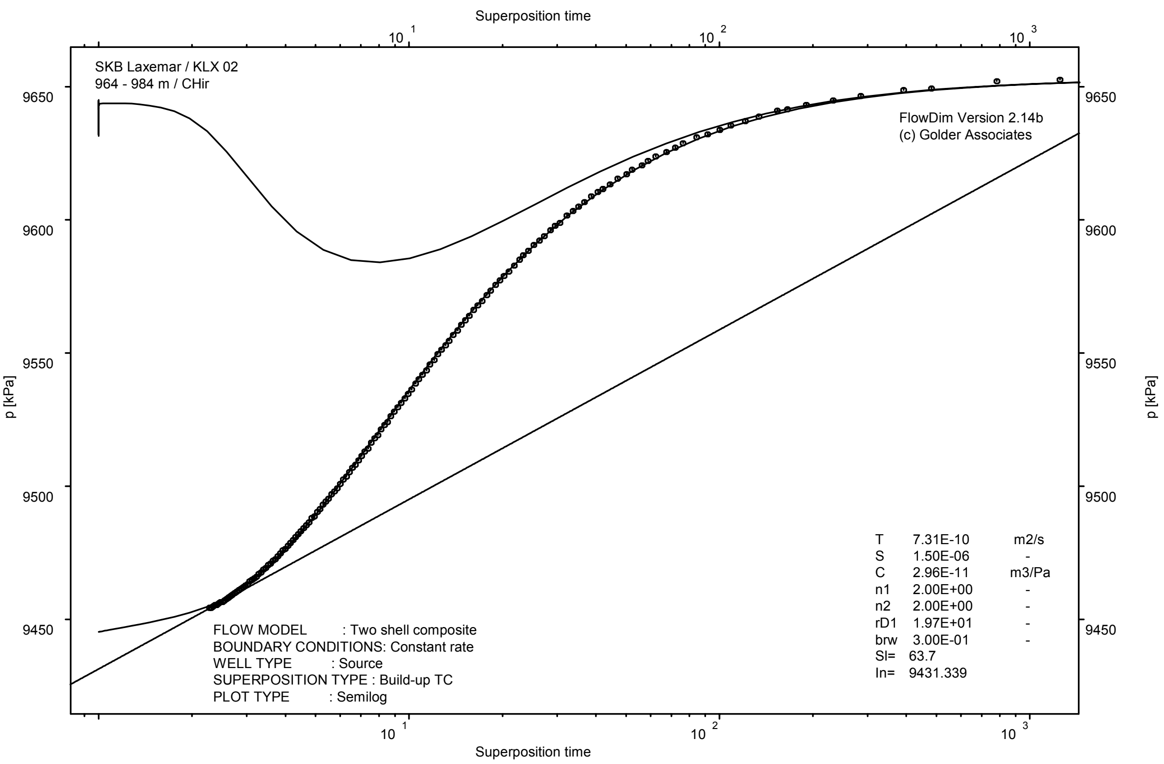
Pressure and temperature in the test section; cartesian plot



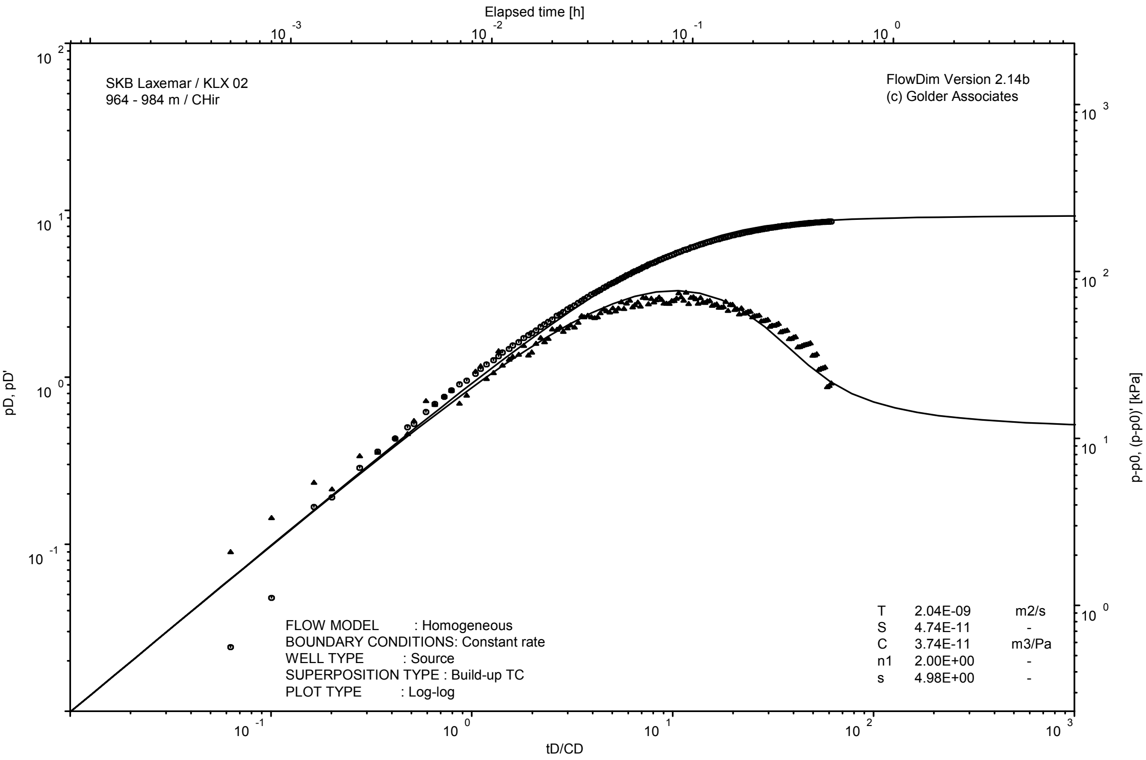
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

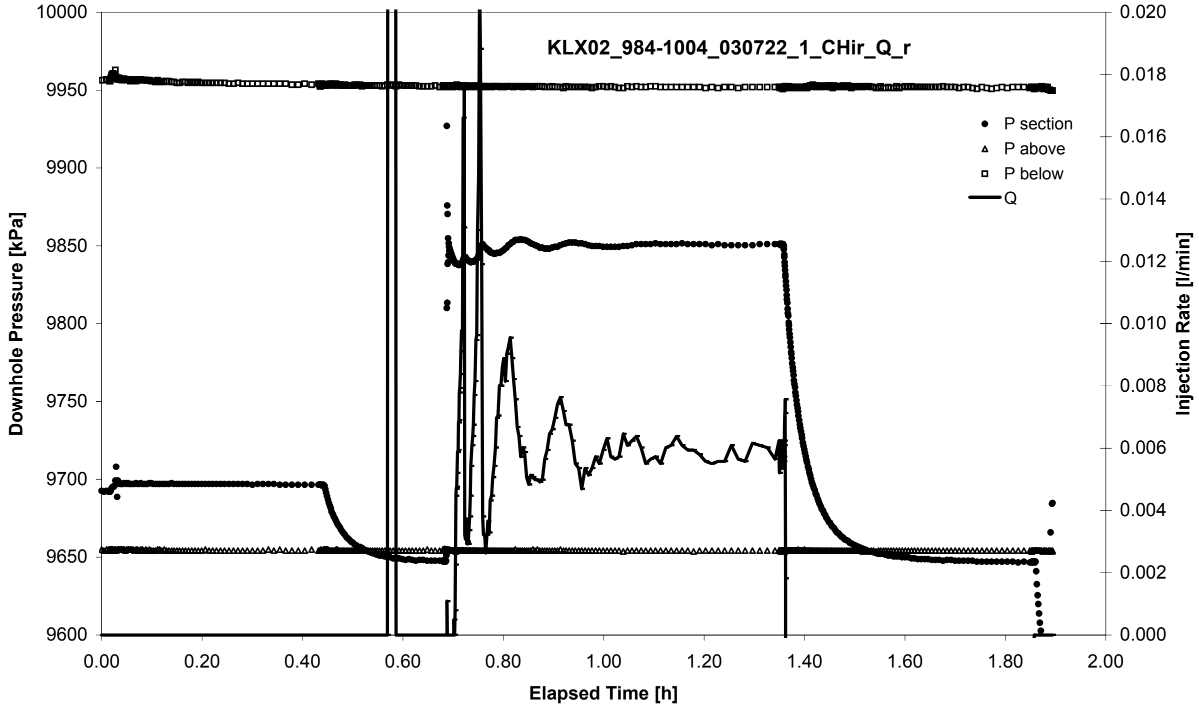


CHIR phase; Homogeneous model analyses, log-log match

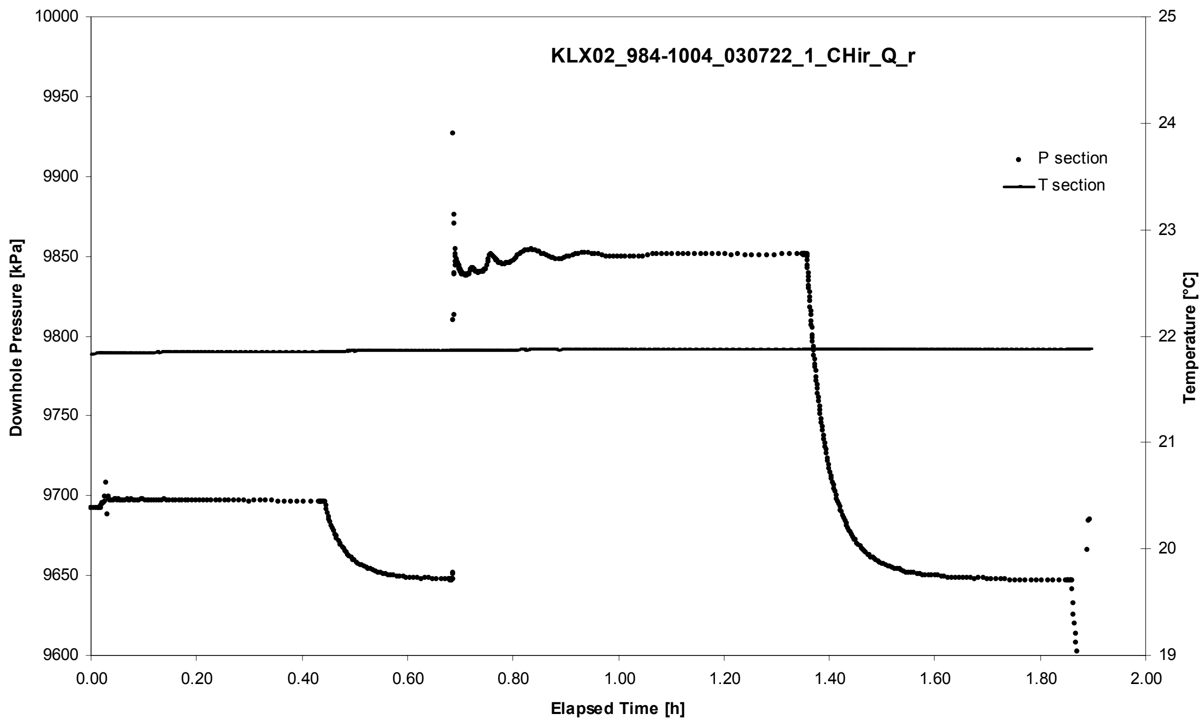
APPENDIX 2-44

Test 984 – 1004 m

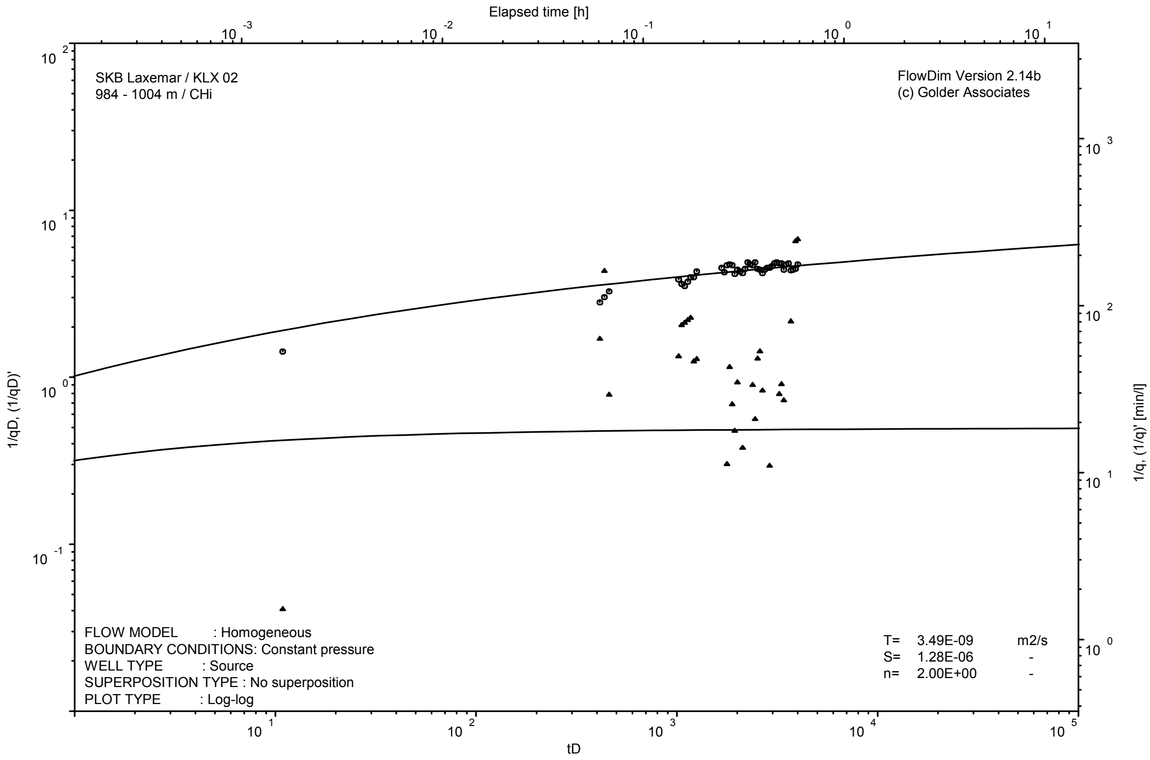
Analysis diagrams



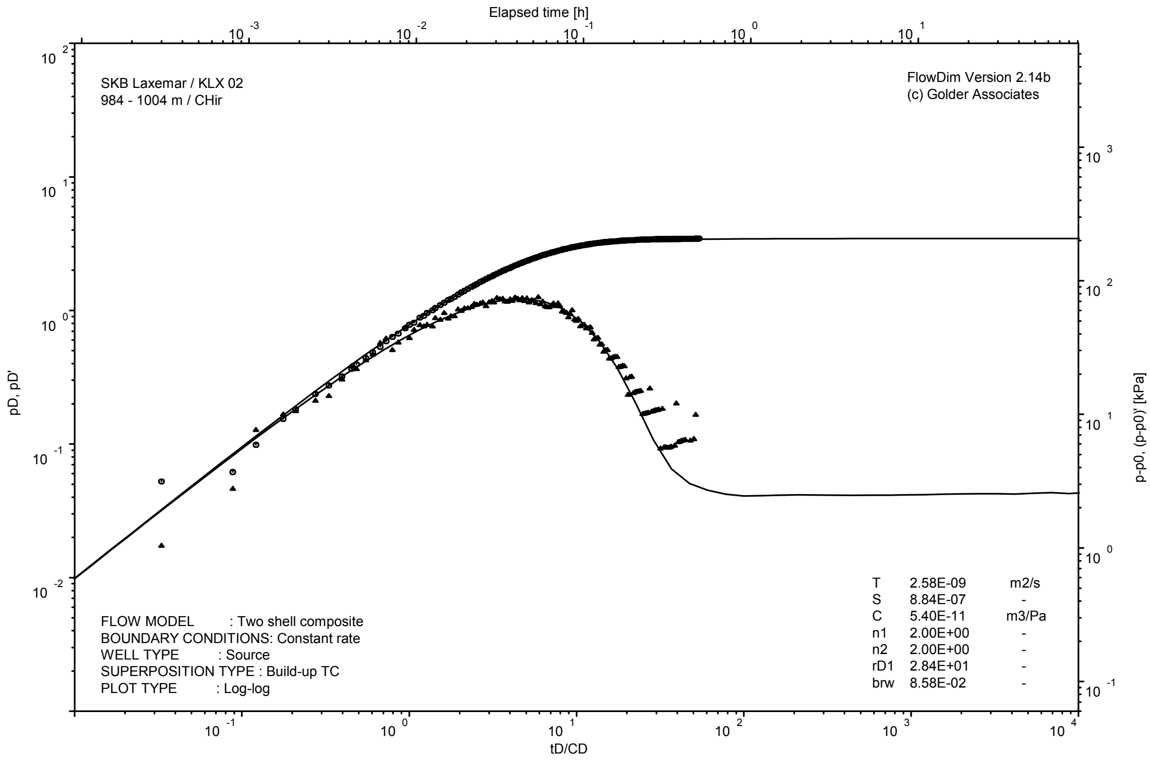
Pressure and flow rate vs. time; cartesian plot



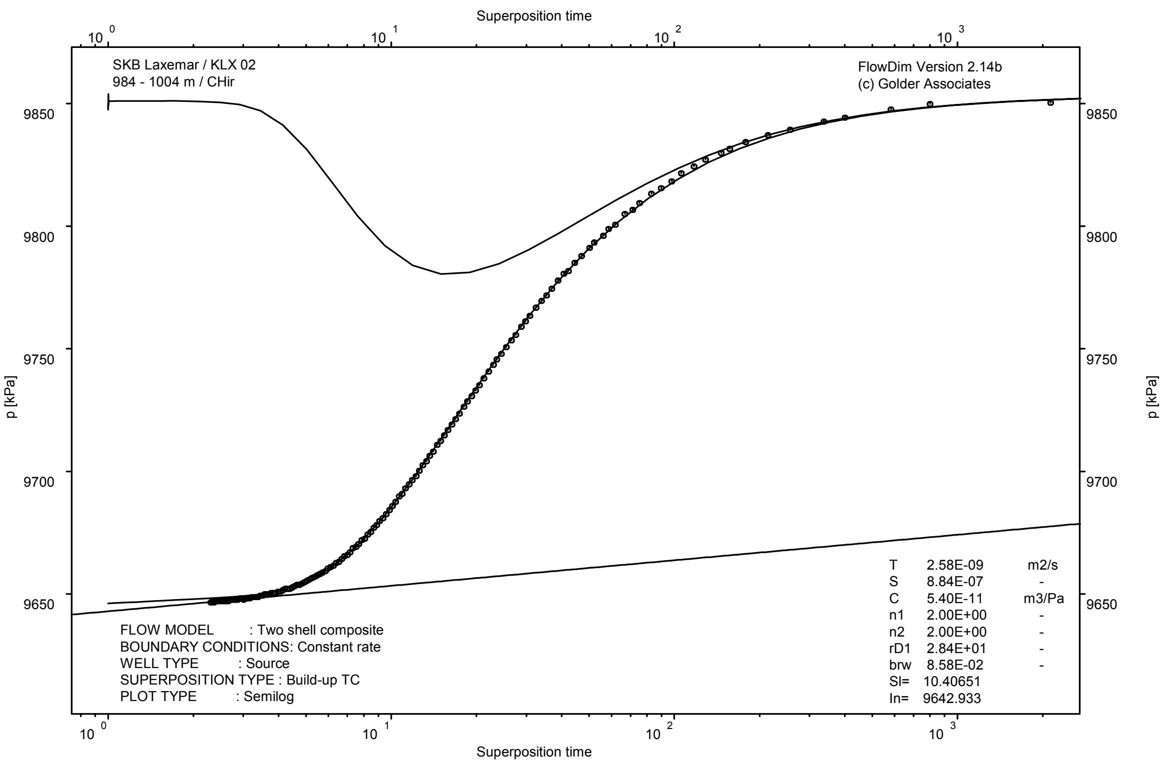
Pressure and temperature in the test section; cartesian plot



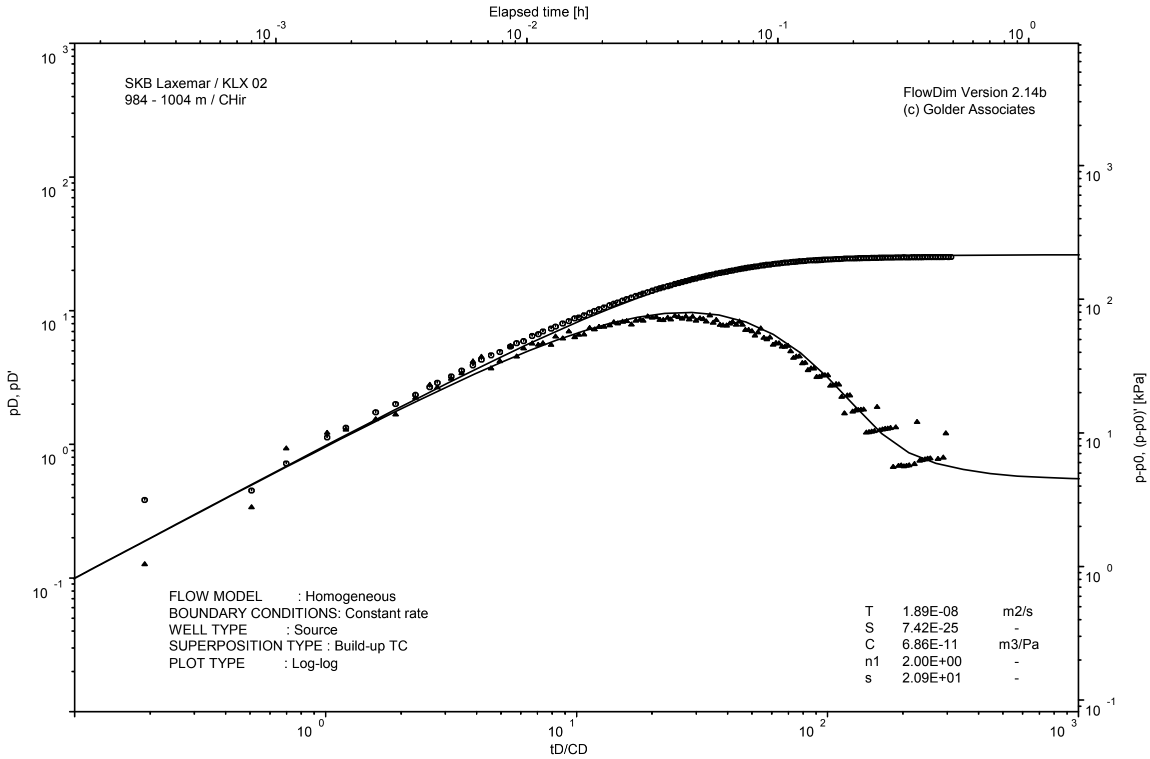
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

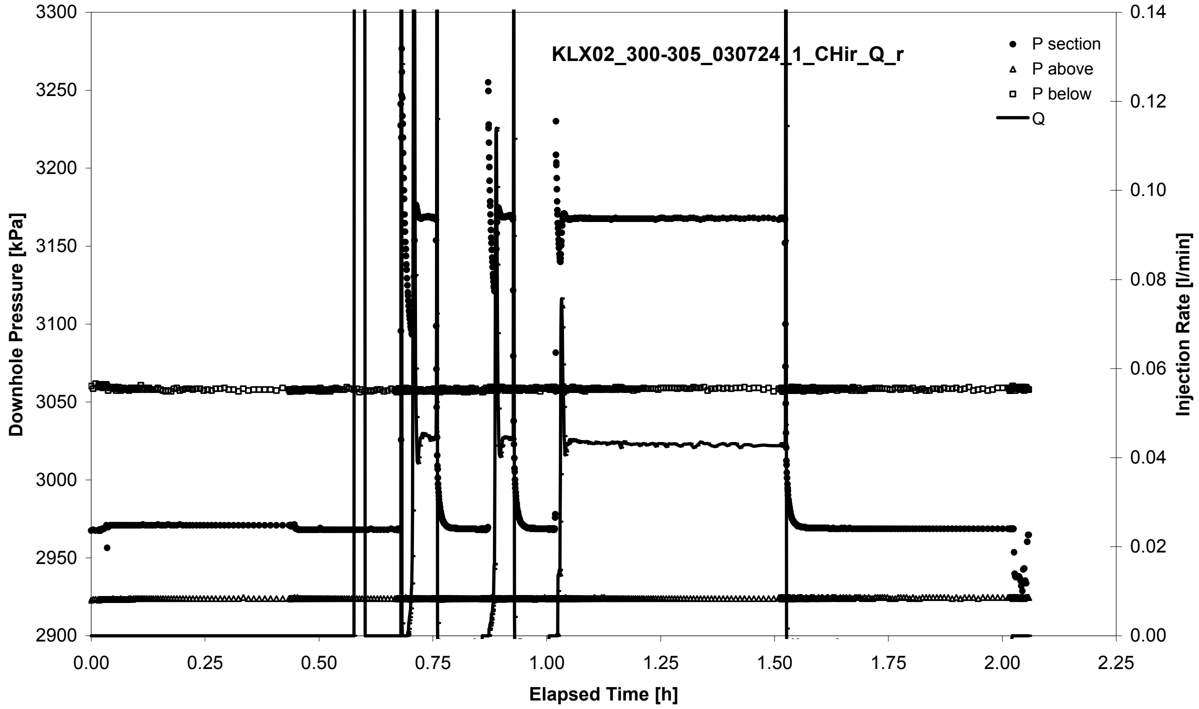


CHIR phase; Homogeneous model analyses, log-log match

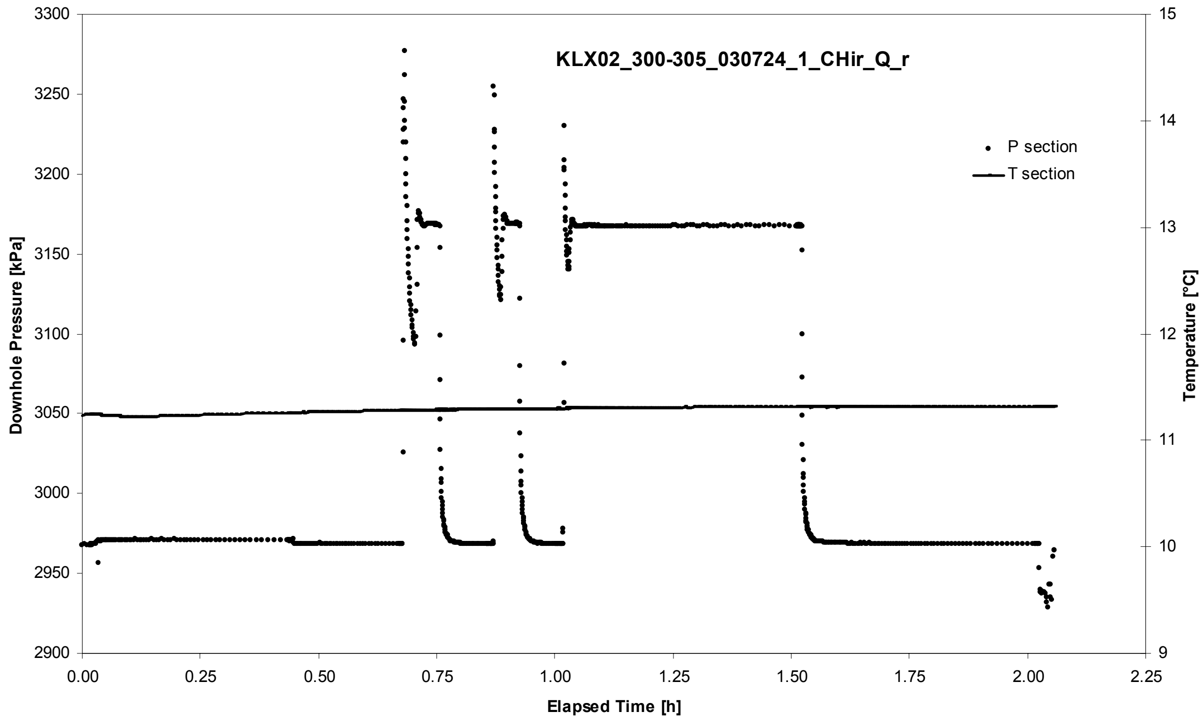
APPENDIX 2-45

Test 300 – 305 m

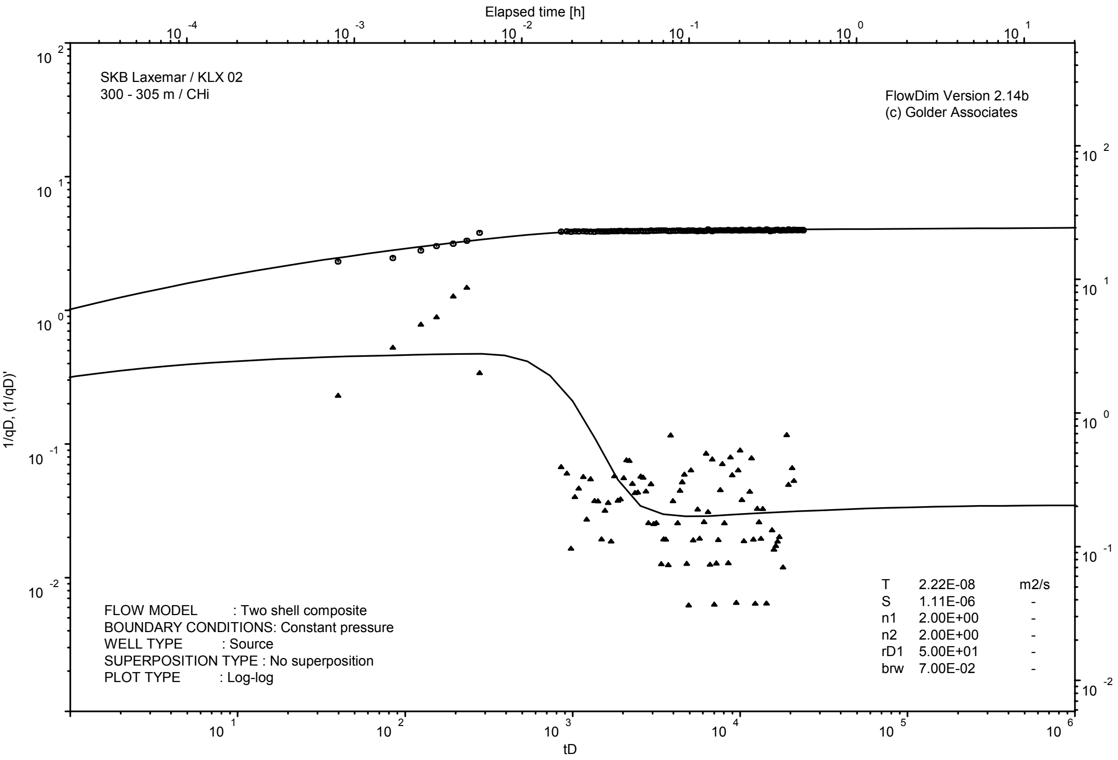
Analysis diagrams



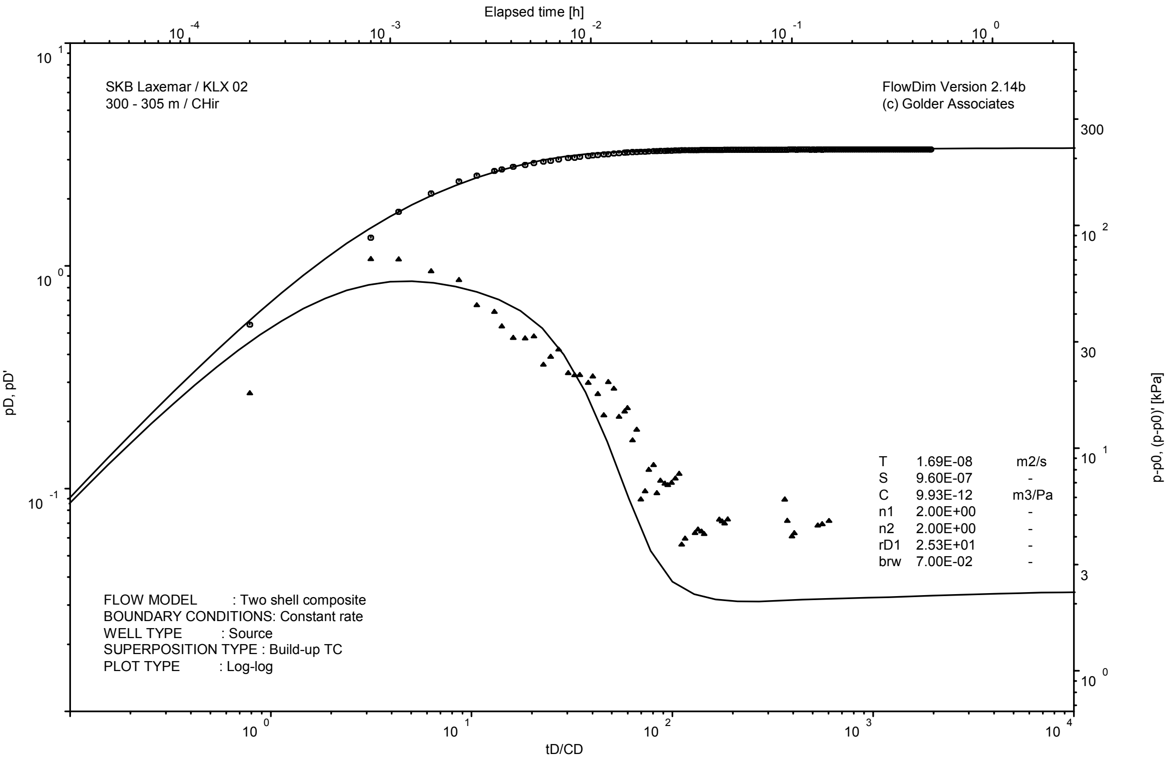
Pressure and flow rate vs. time; cartesian plot



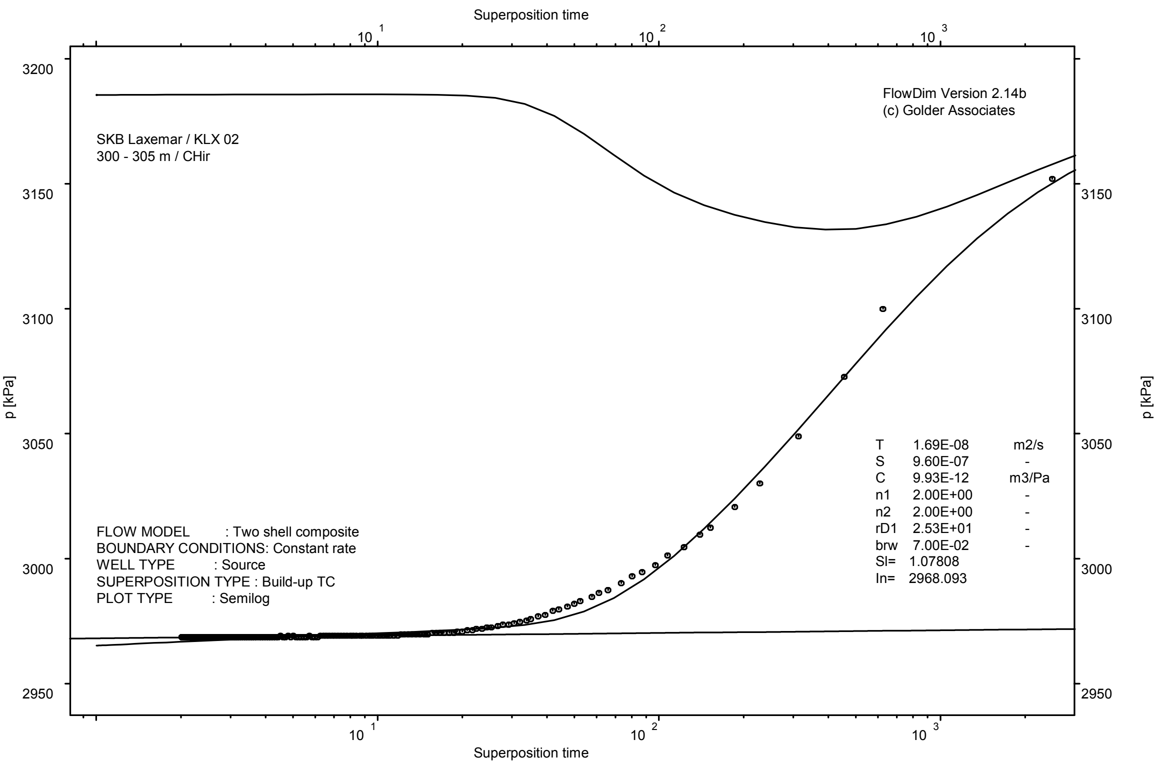
Pressure and temperature in the test section; cartesian plot



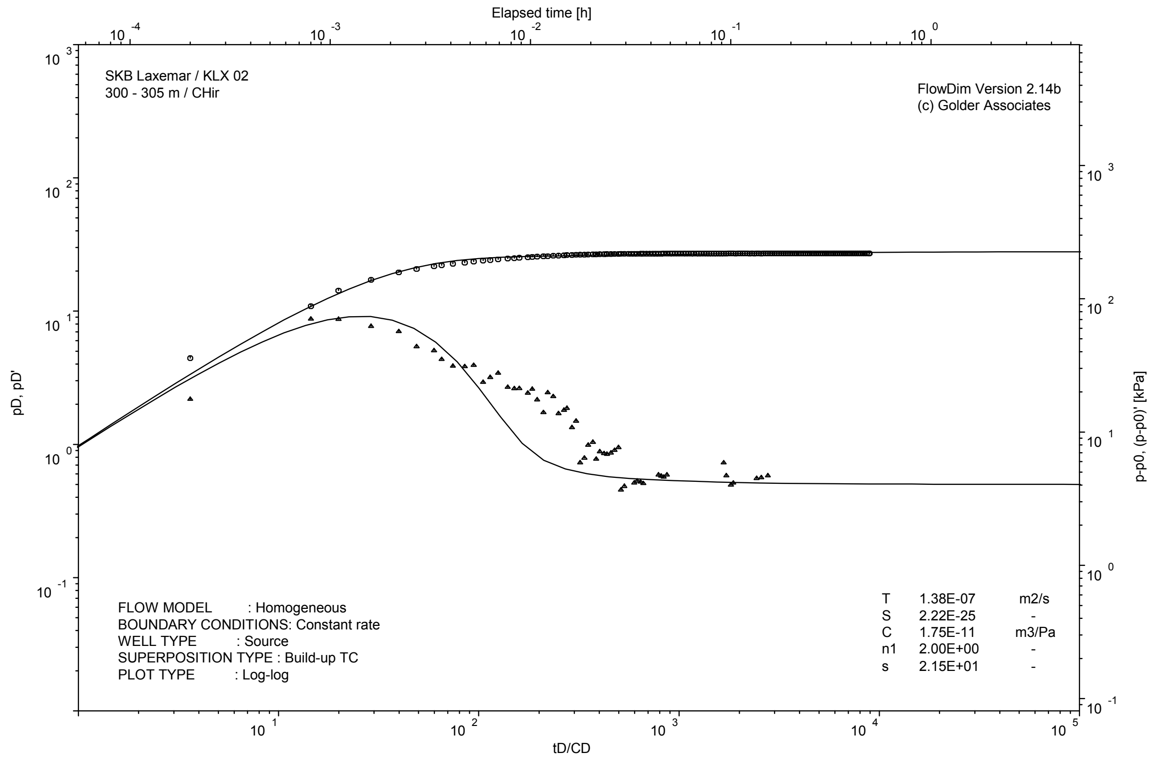
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

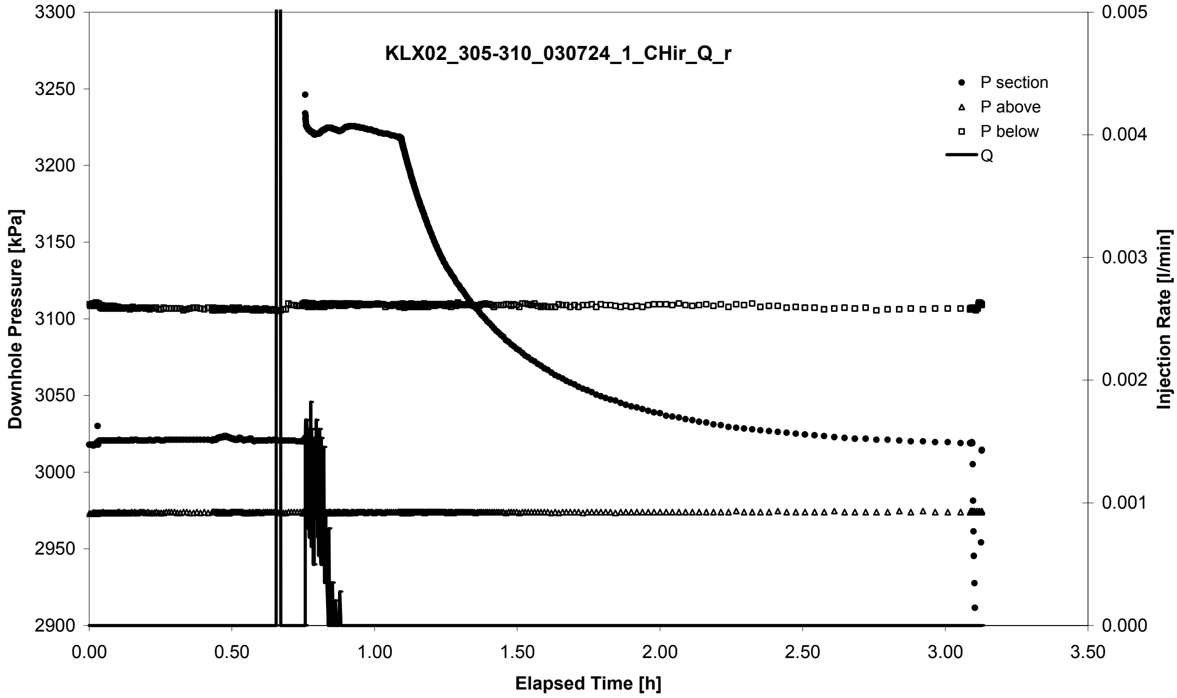


CHIR phase; Homogeneous model analyses, log-log match

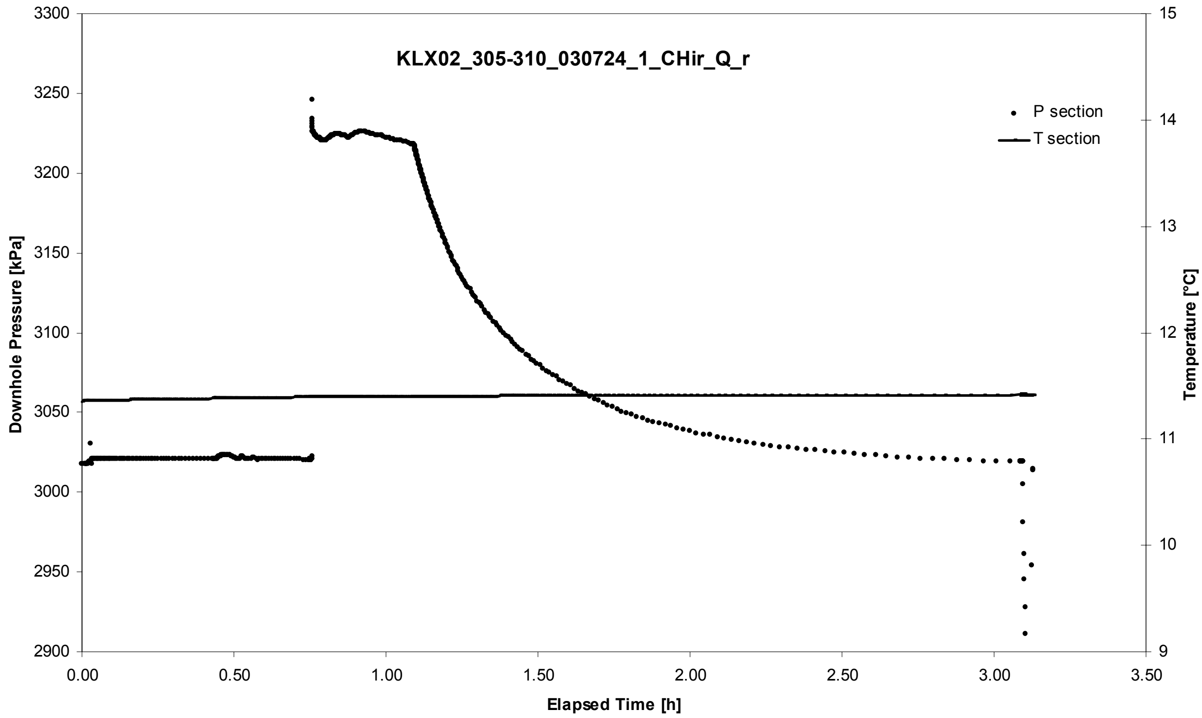
APPENDIX 2-46

Test 305 – 310 m

Analysis diagrams



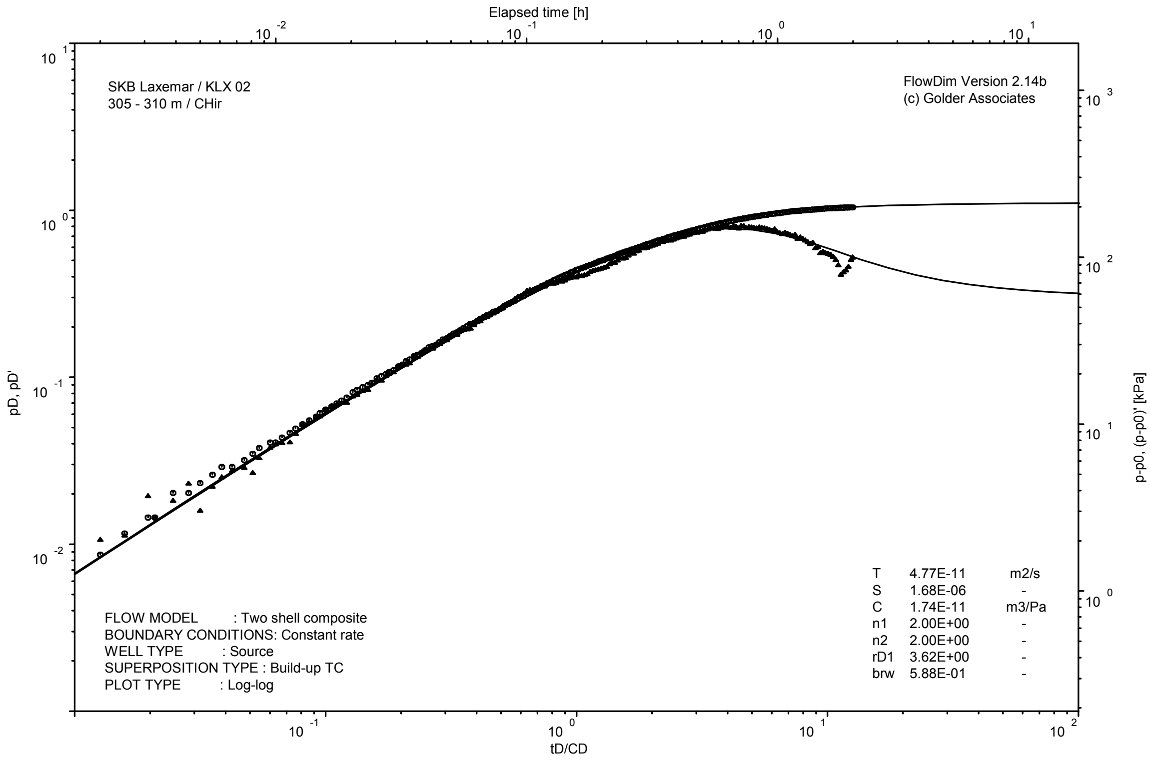
Pressure and flow rate vs. time; cartesian plot



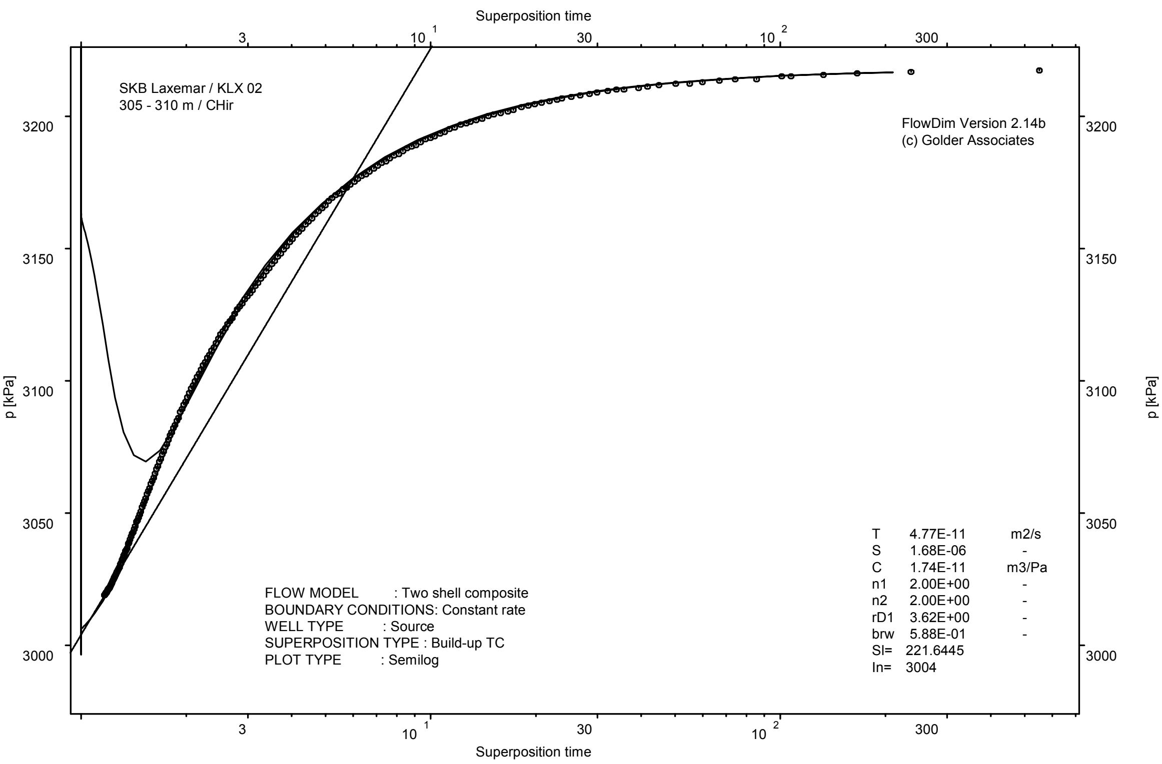
Pressure and temperature in the test section; cartesian plot

Not Analysed

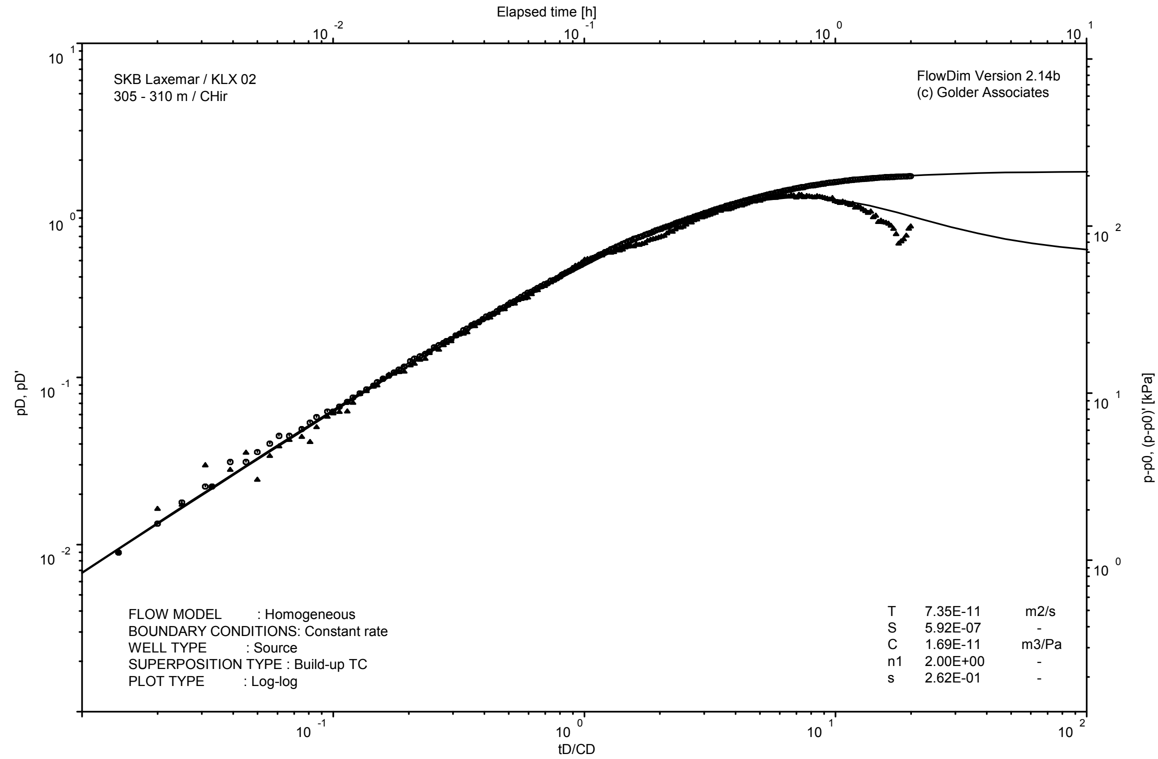
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

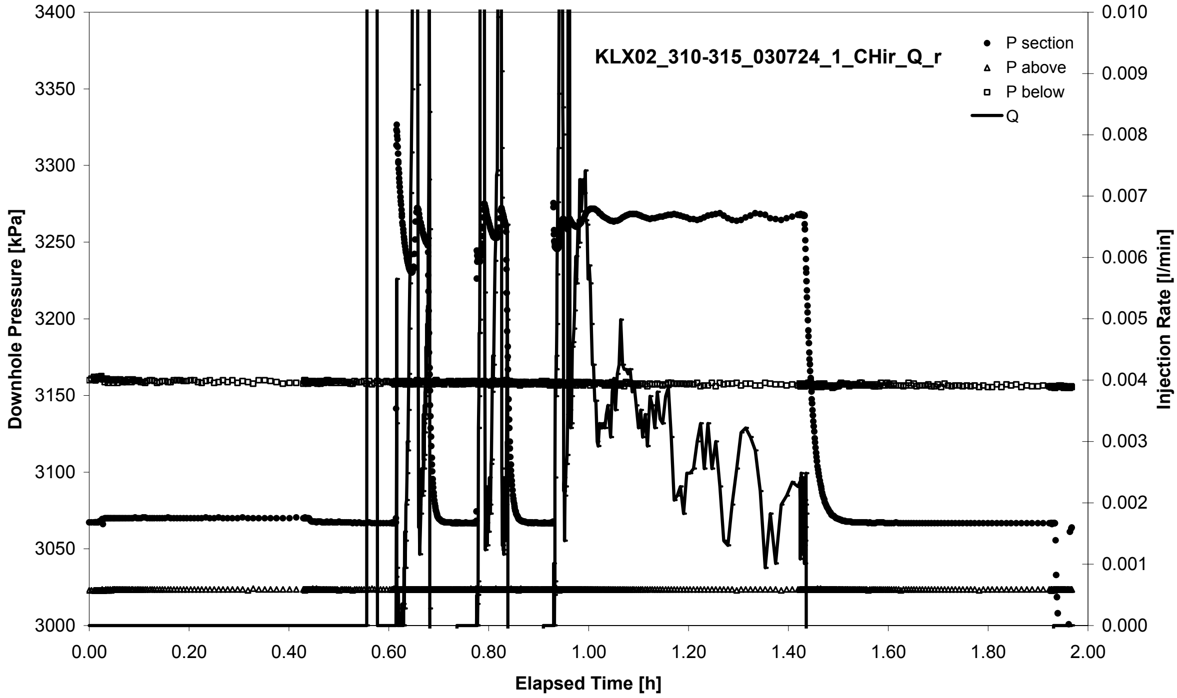


CHIR phase; Homogeneous model analyses, log-log match

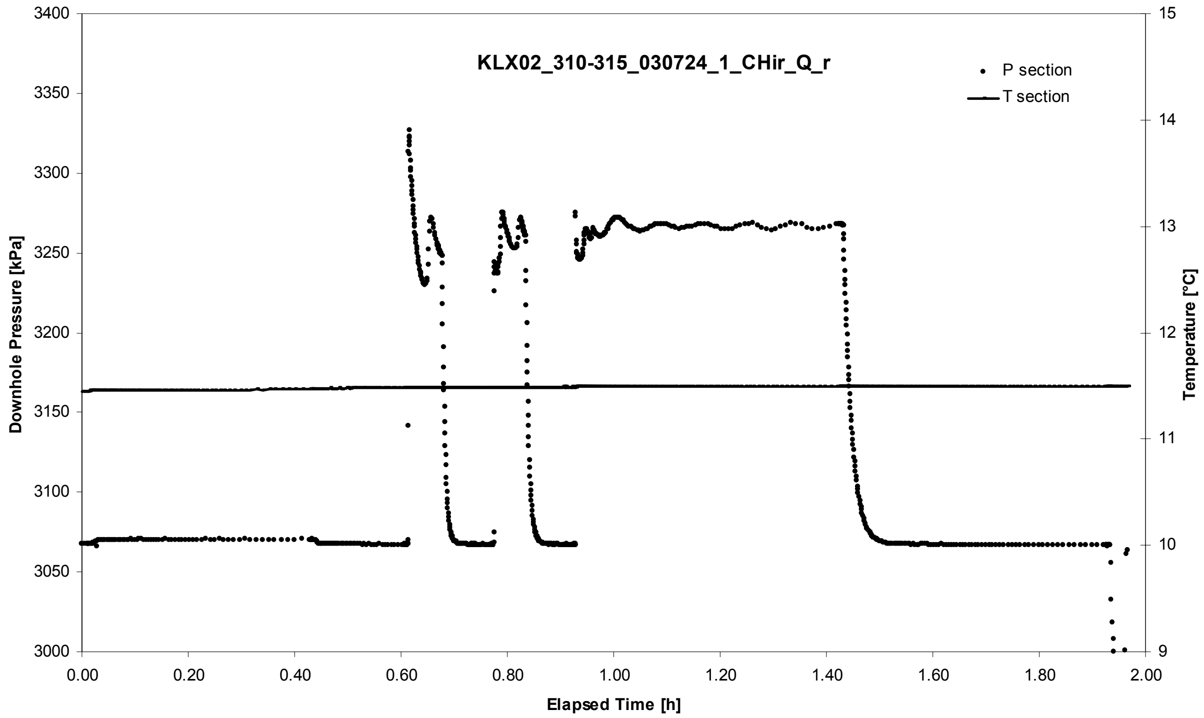
APPENDIX 2-47

Test 310 – 315 m

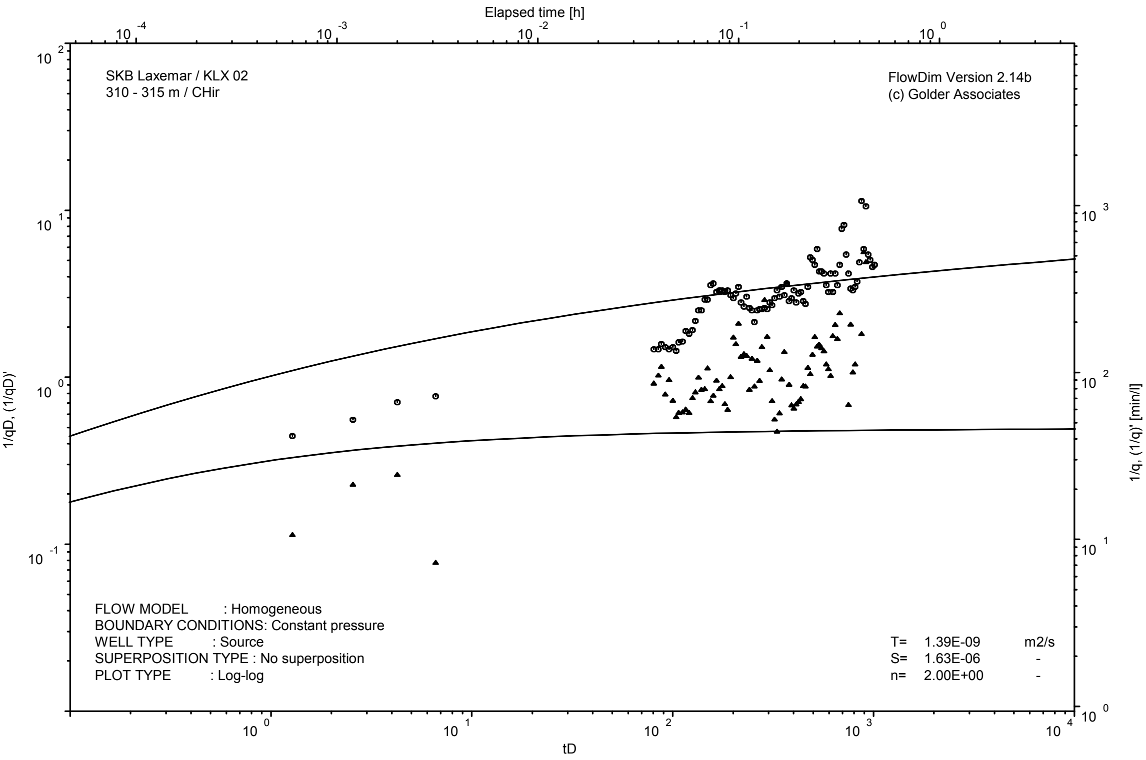
Analysis diagrams



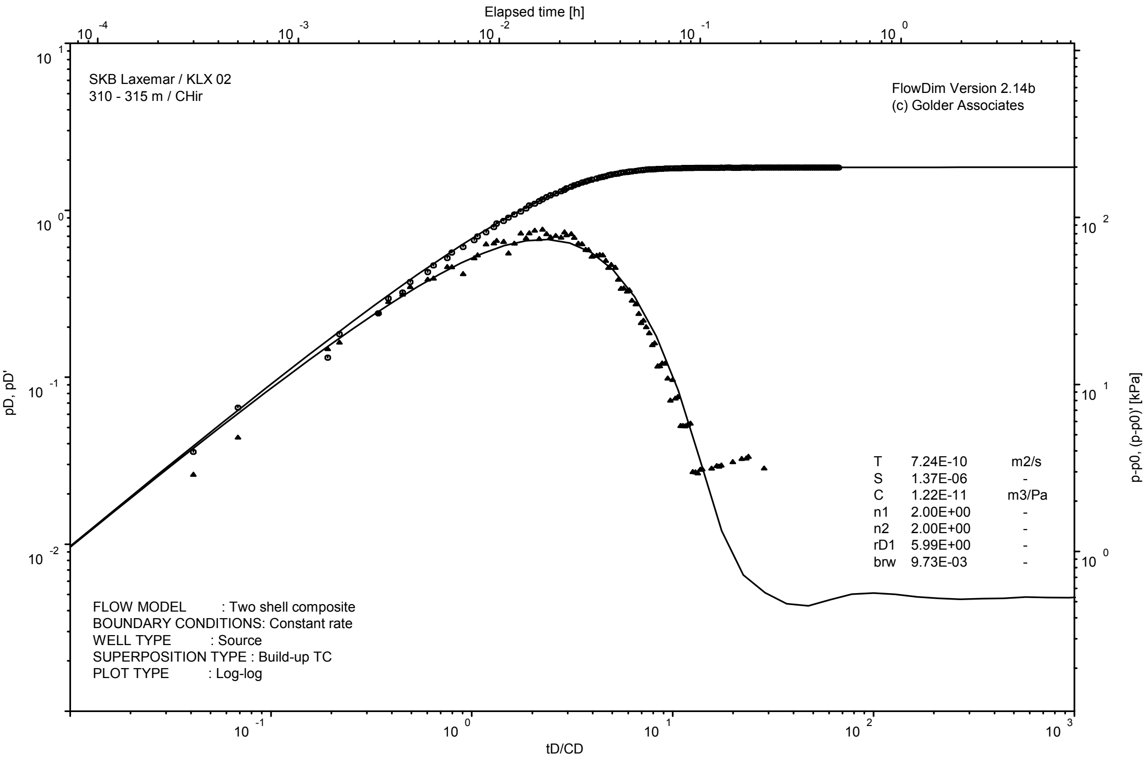
Pressure and flow rate vs. time; cartesian plot



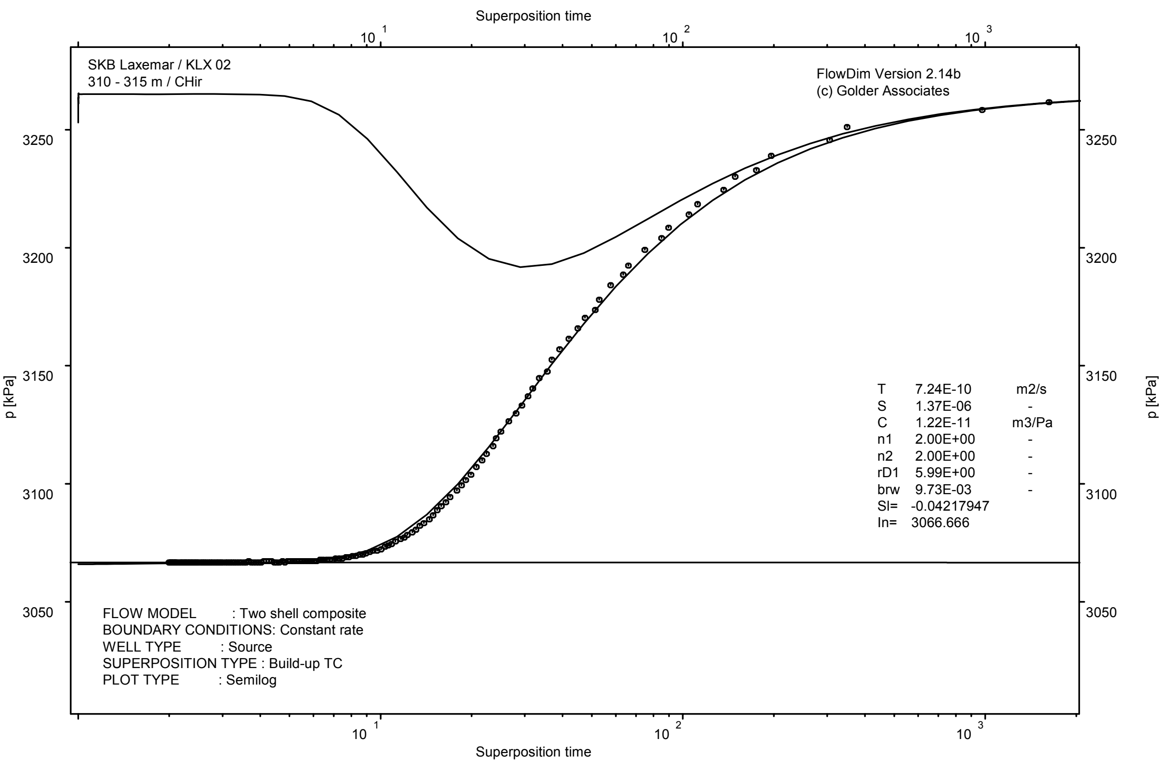
Pressure and temperature in the test section; cartesian plot



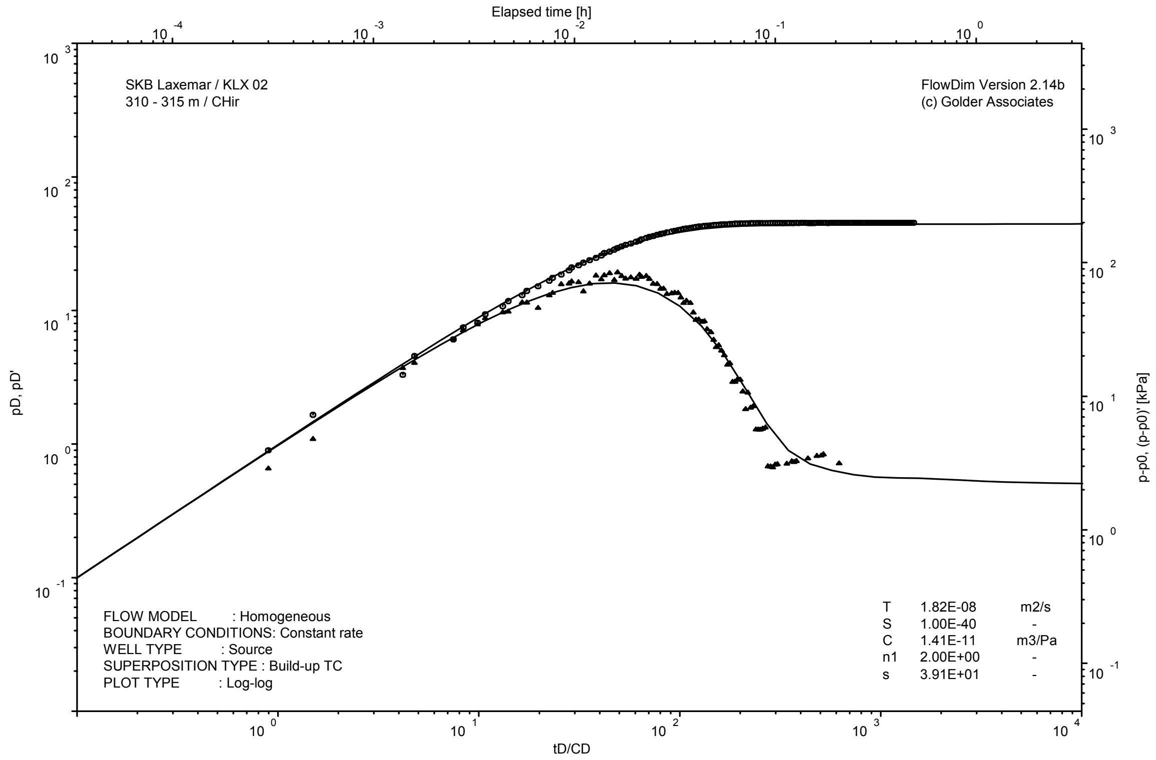
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

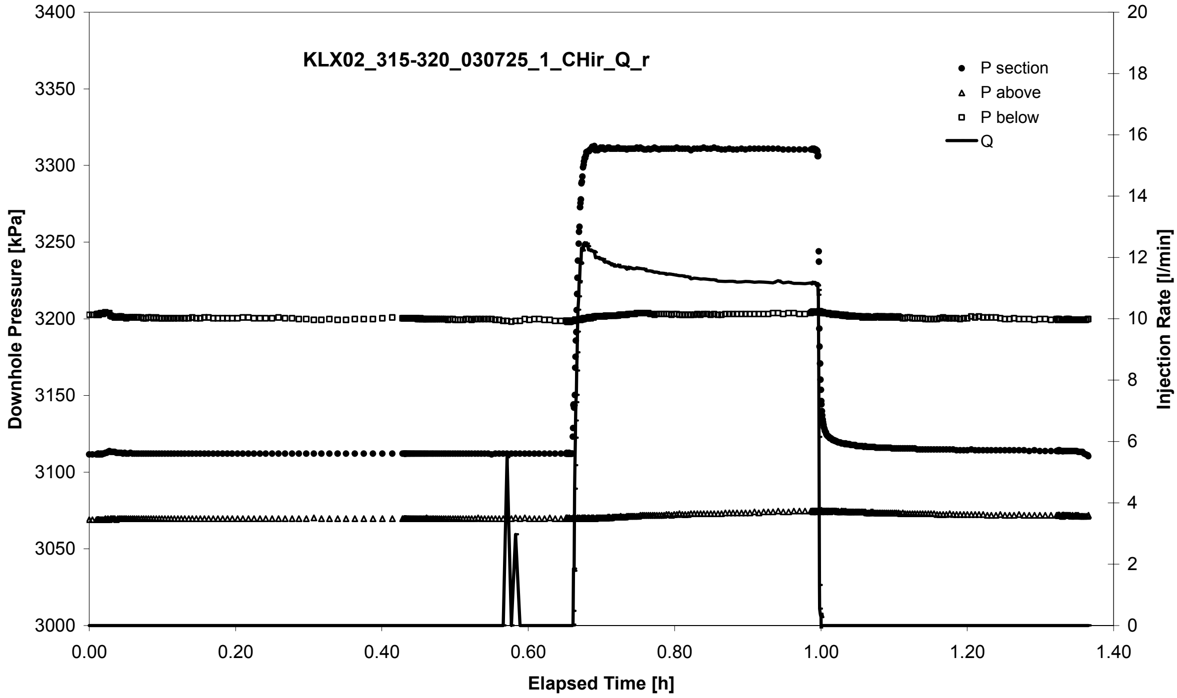


CHIR phase; Homogeneous model analyses, log-log match

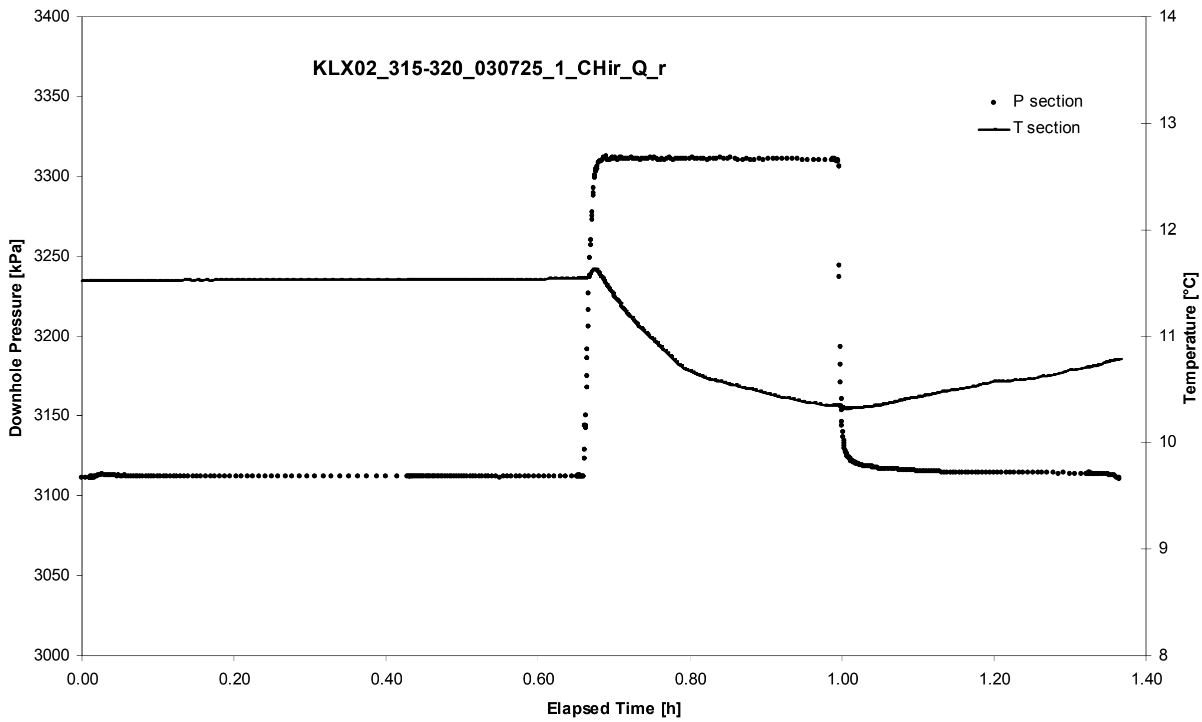
APPENDIX 2-48

Test 315 – 320 m

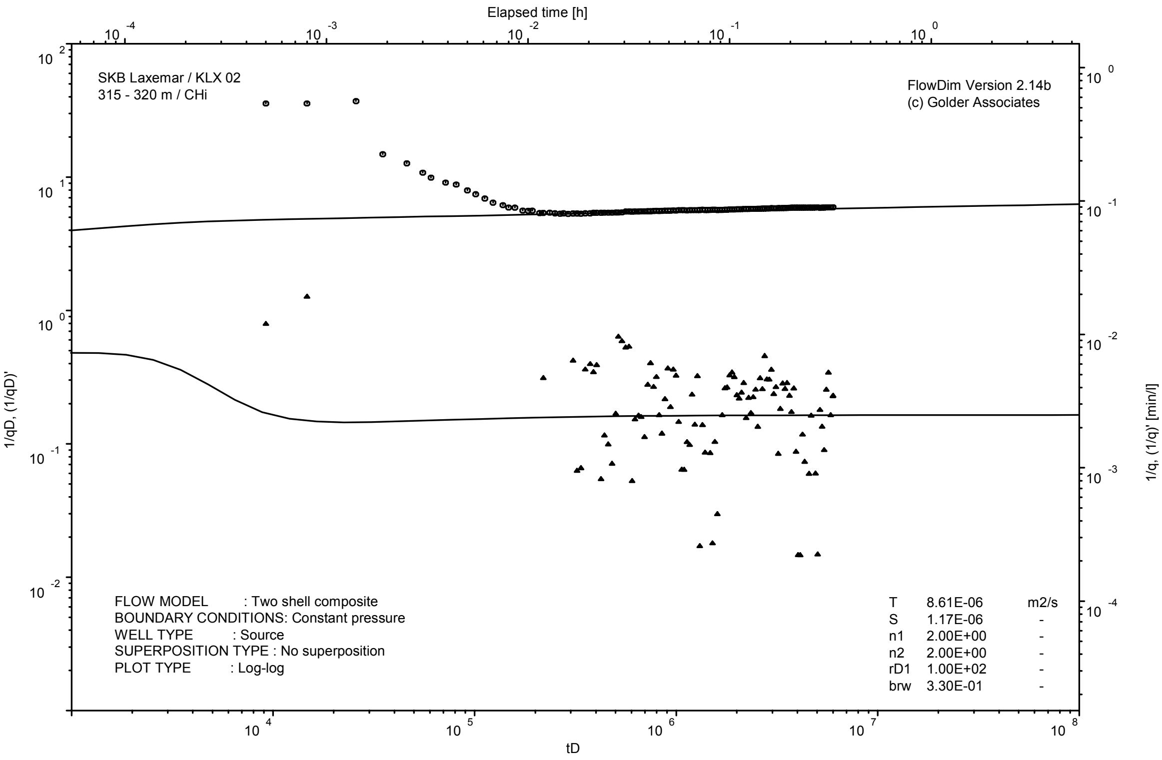
Analysis diagrams



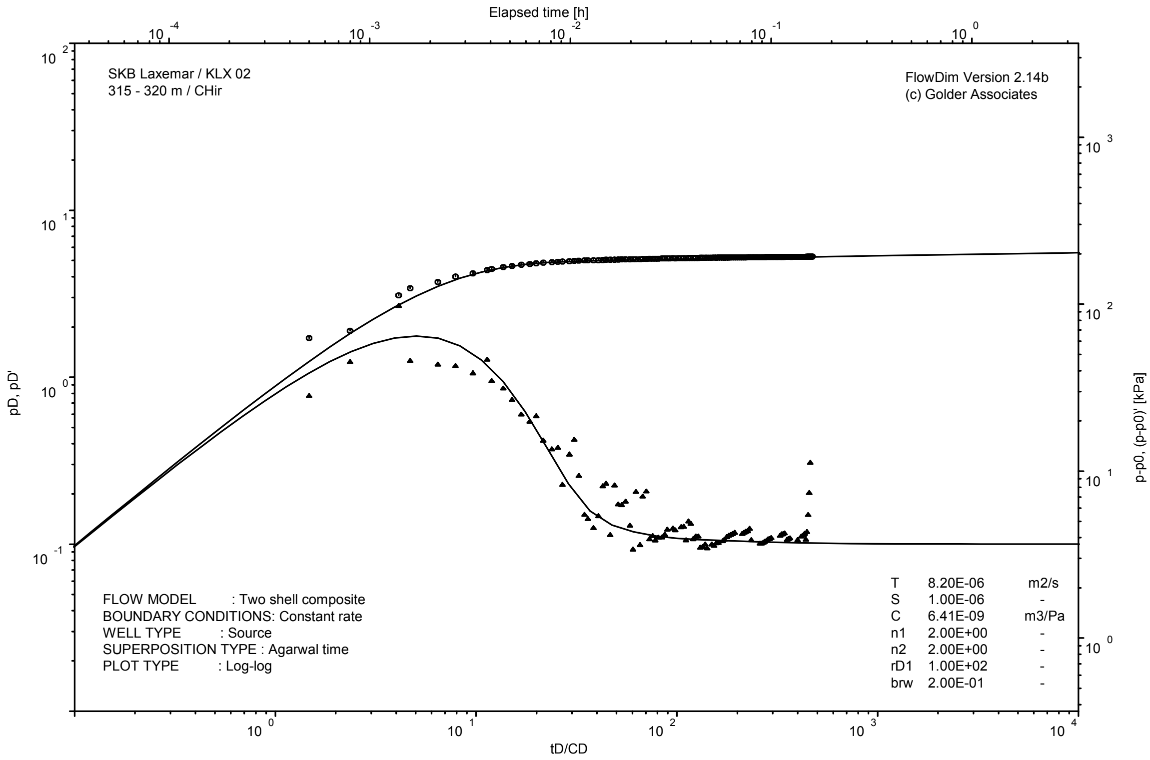
Pressure and flow rate vs. time; cartesian plot



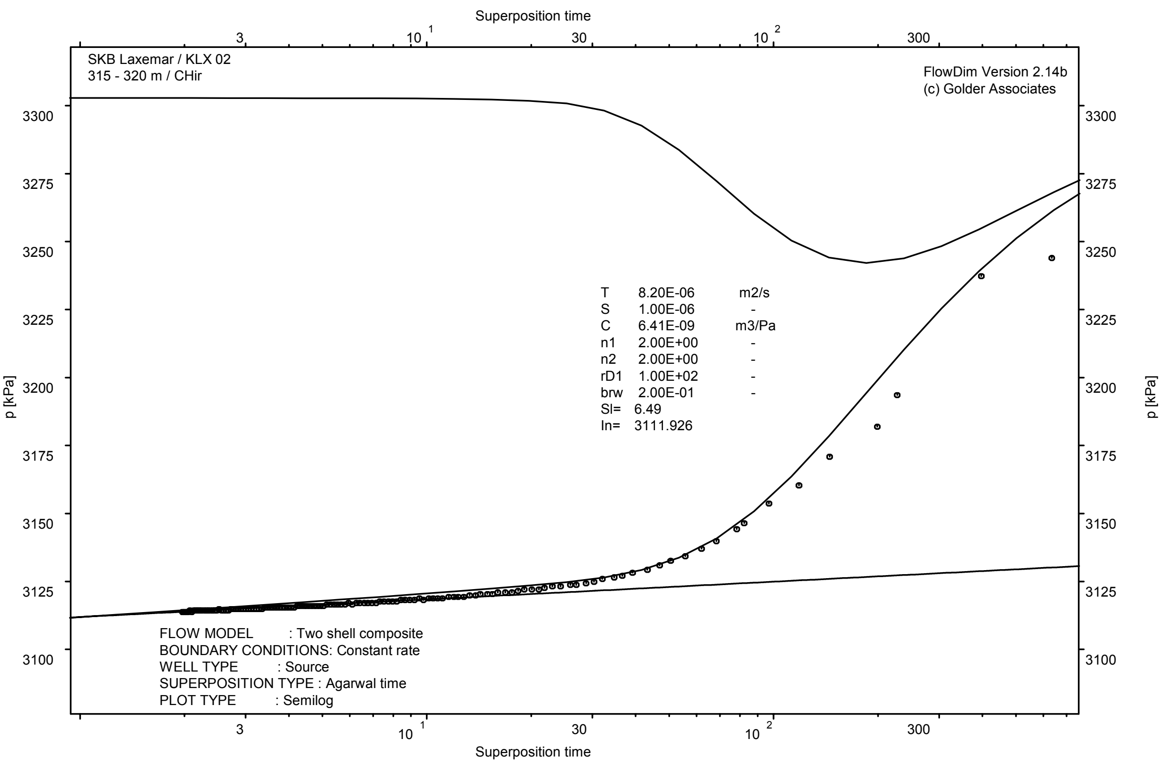
Pressure and temperature in the test section; cartesian plot



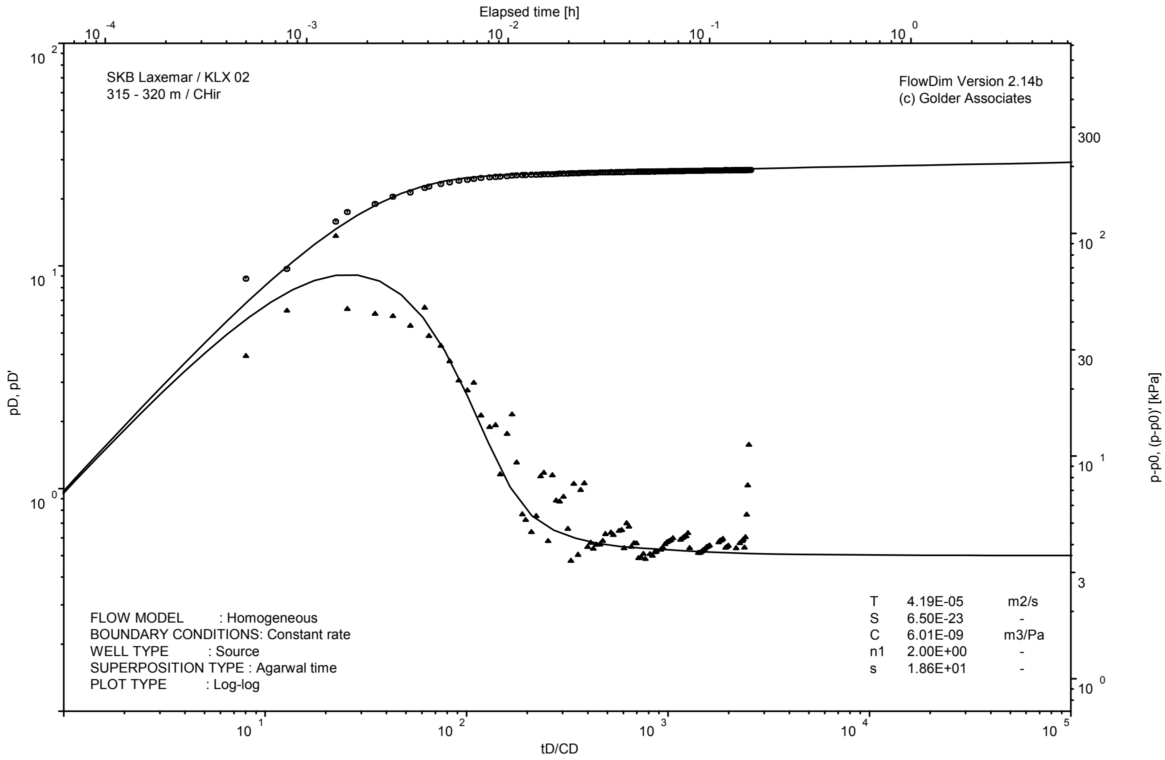
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

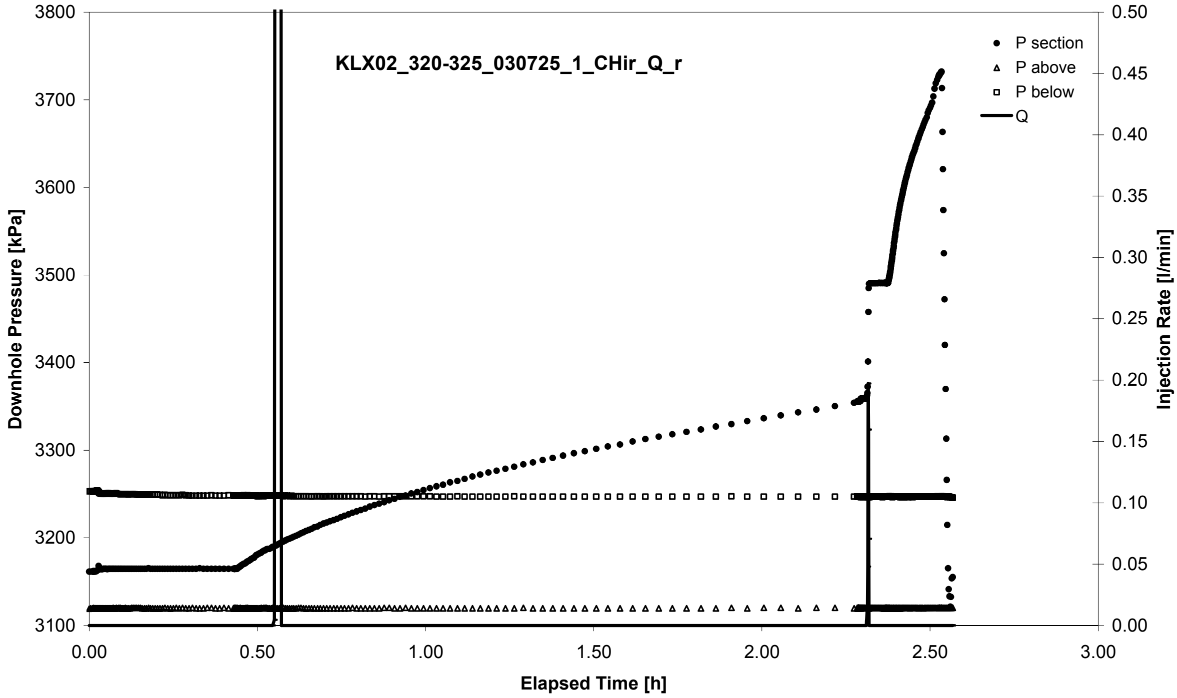


CHIR phase; Homogeneous model analyses, log-log match

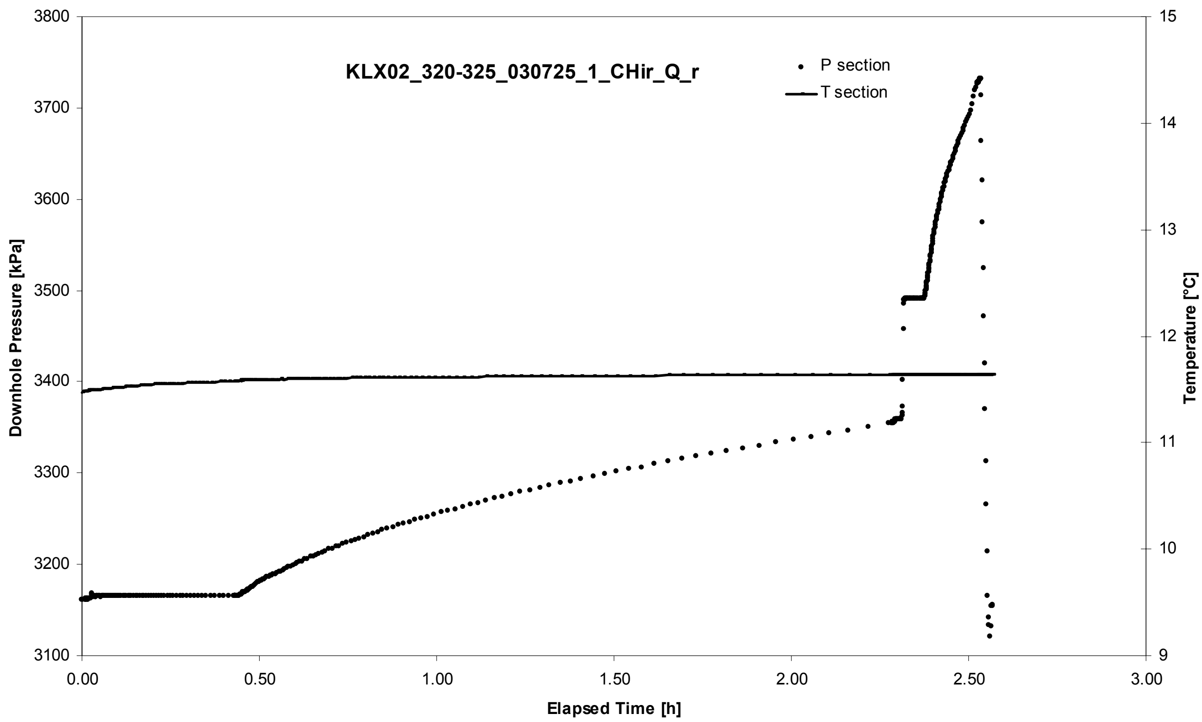
APPENDIX 2-49

Test 320 – 325 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

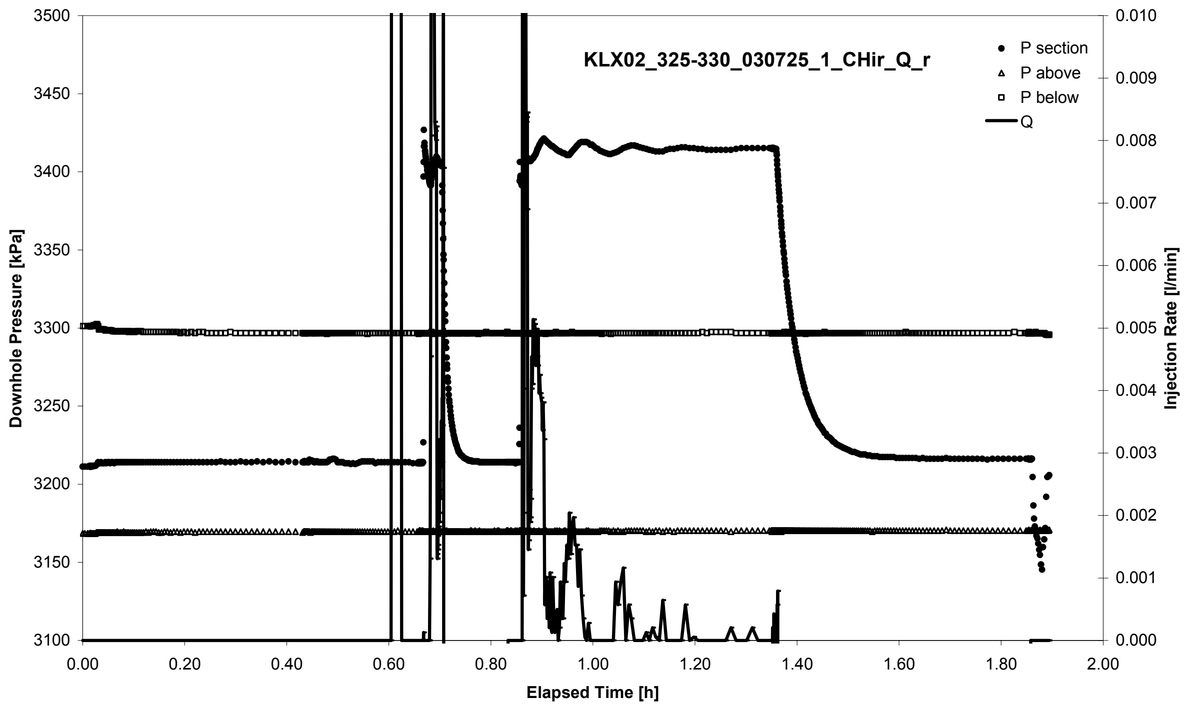
Not Analysed

CHIR phase; HORNER match

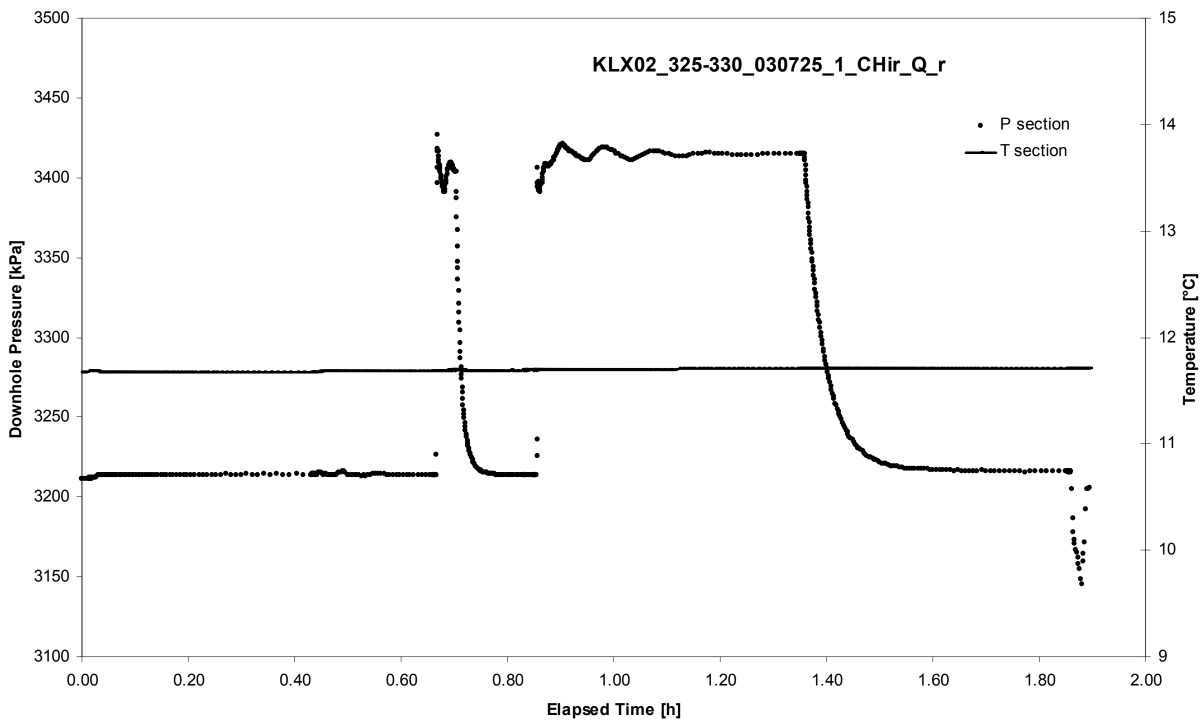
APPENDIX 2-50

Test 325 – 330 m

Analysis diagrams



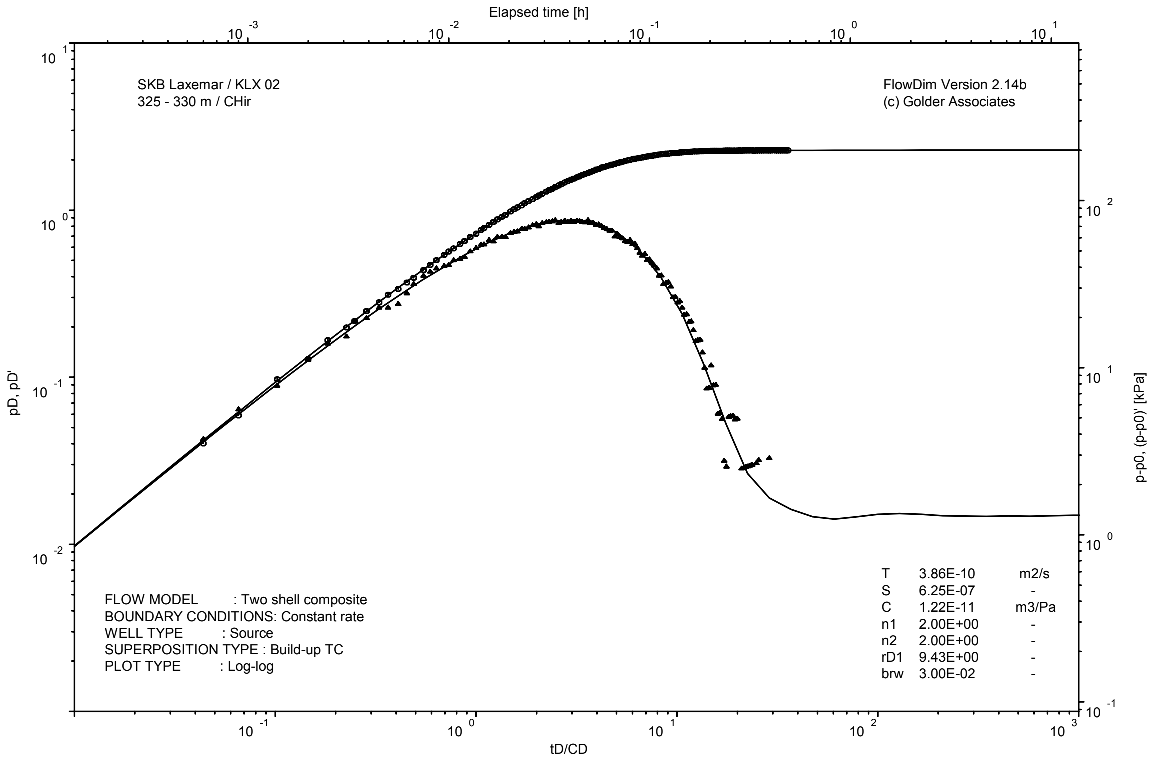
Pressure and flow rate vs. time; cartesian plot



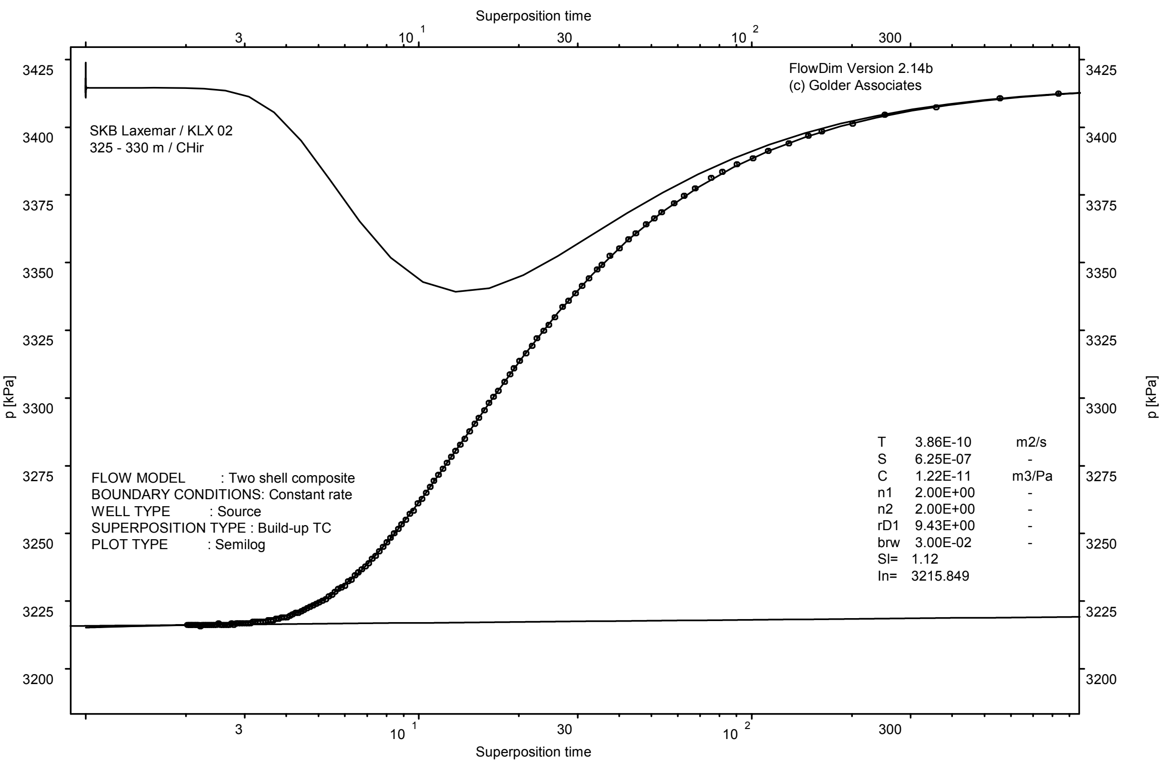
Pressure and temperature in the test section; cartesian plot

Not Analysed

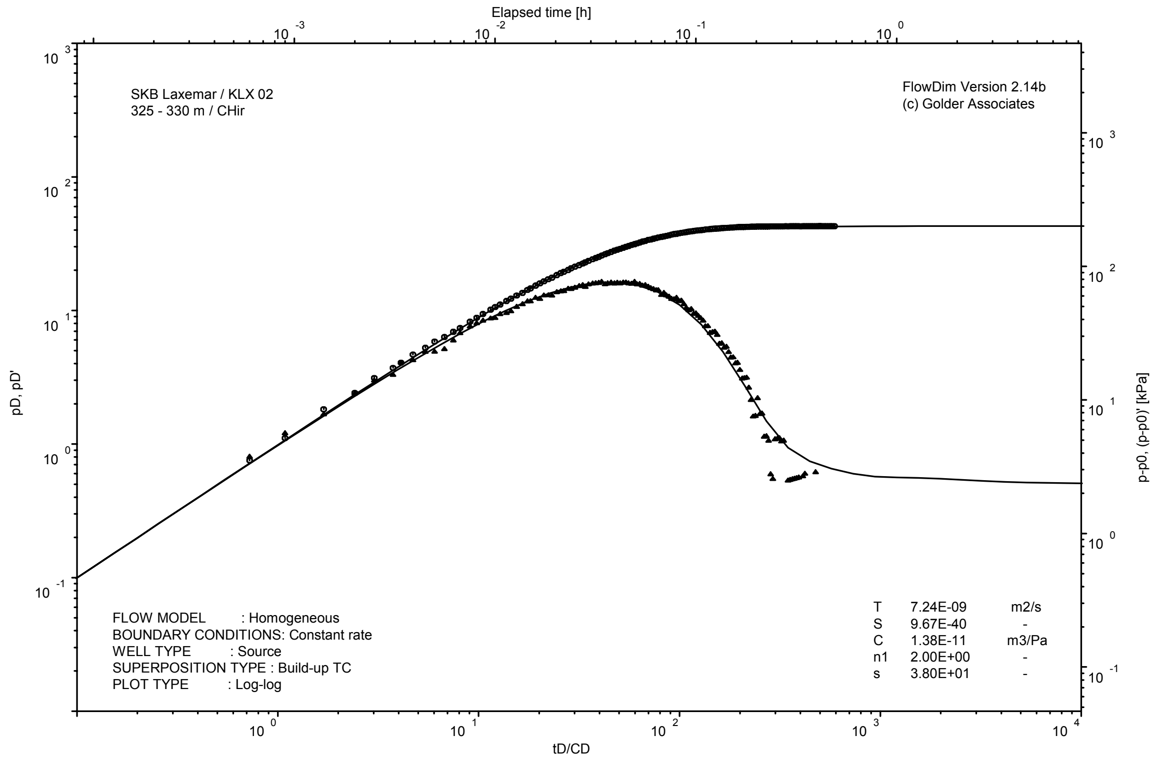
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

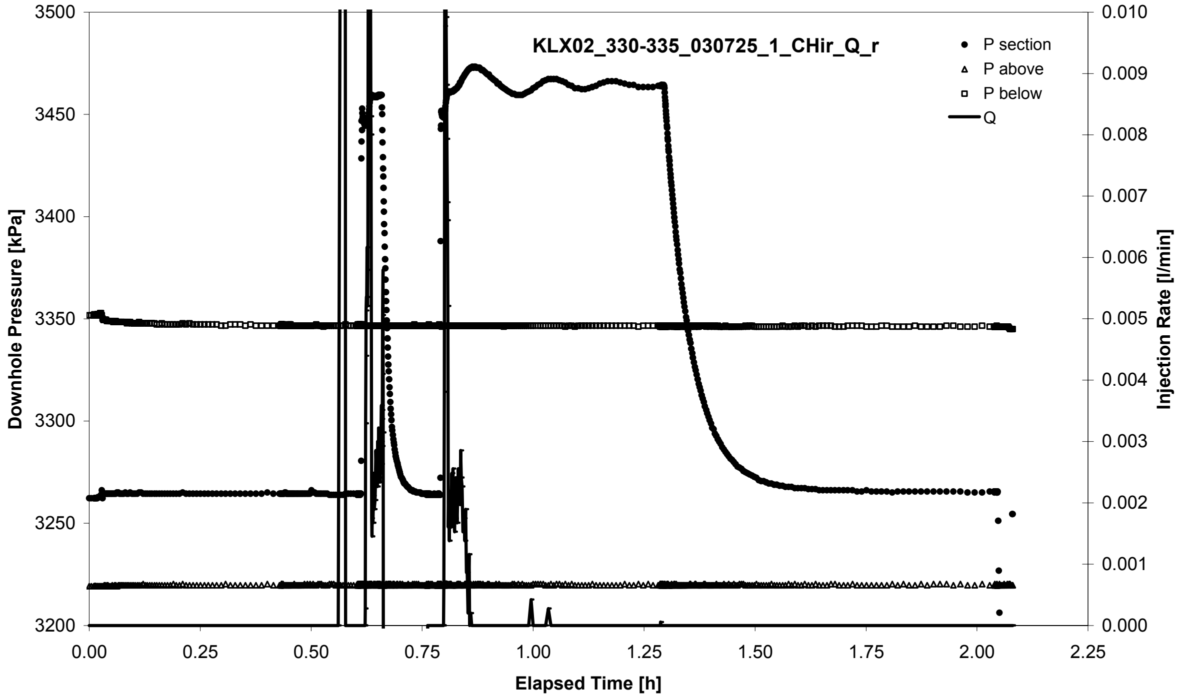


CHIR phase; Homogeneous model analyses, log-log match

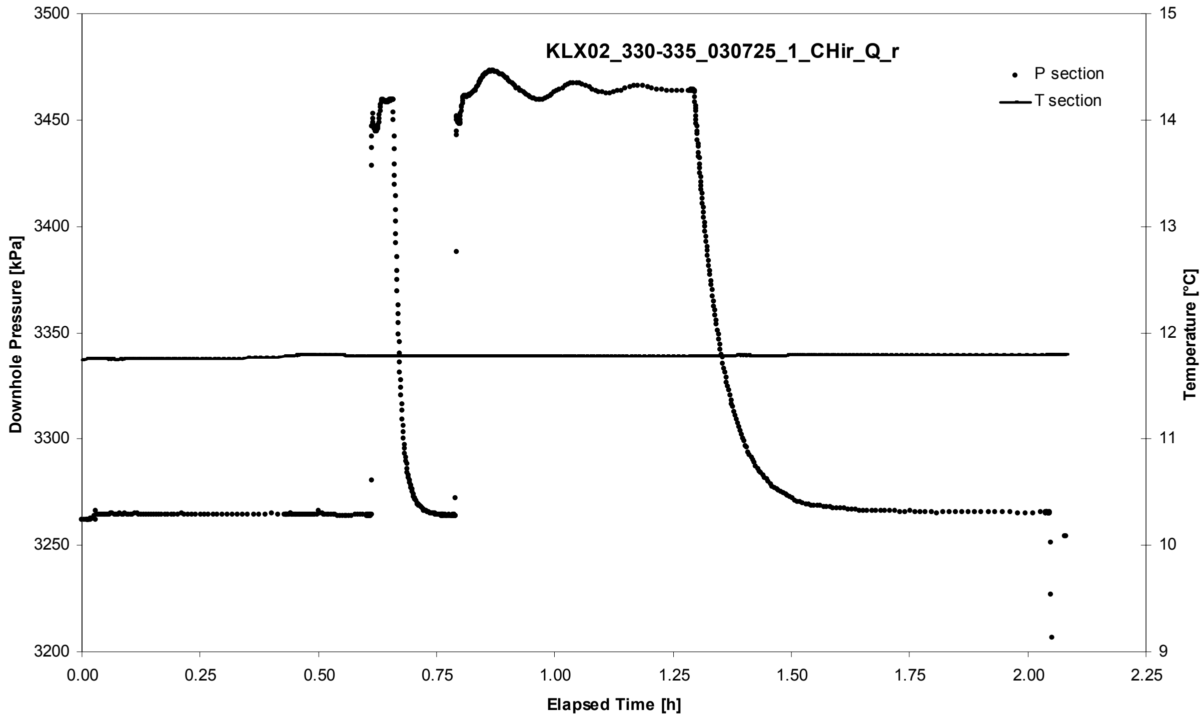
APPENDIX 2-51

Test 330 – 335 m

Analysis diagrams



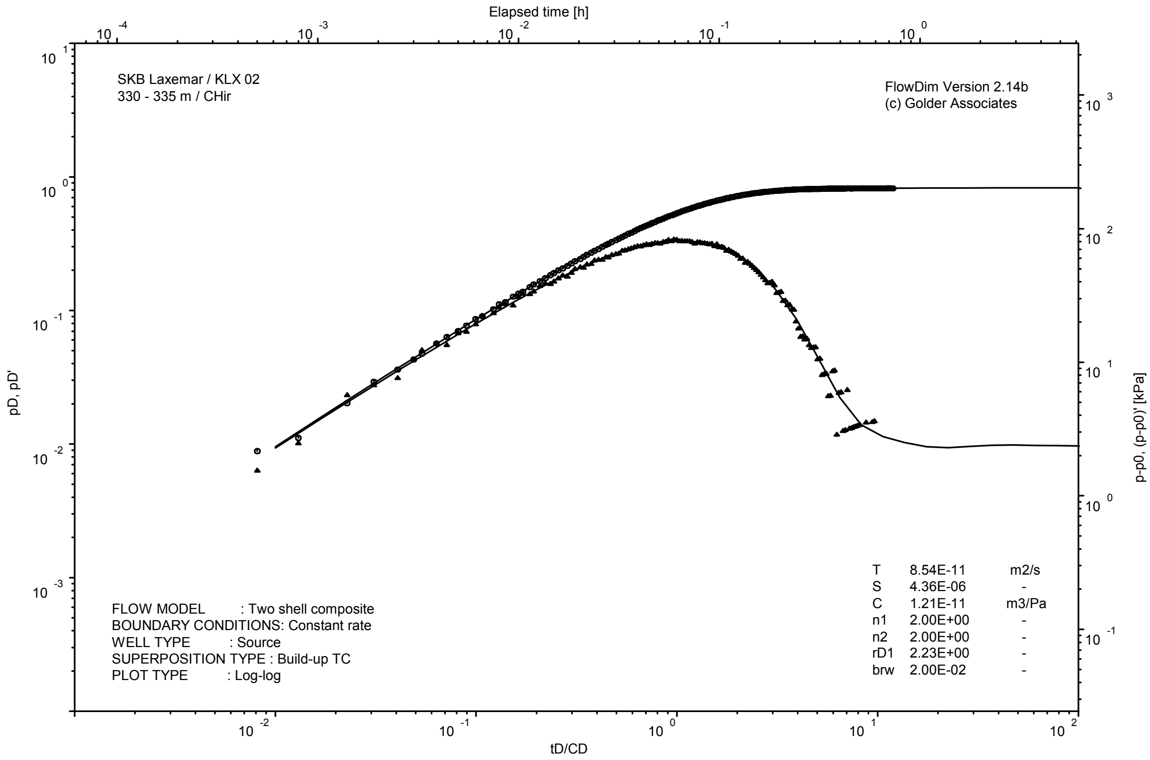
Pressure and flow rate vs. time; cartesian plot



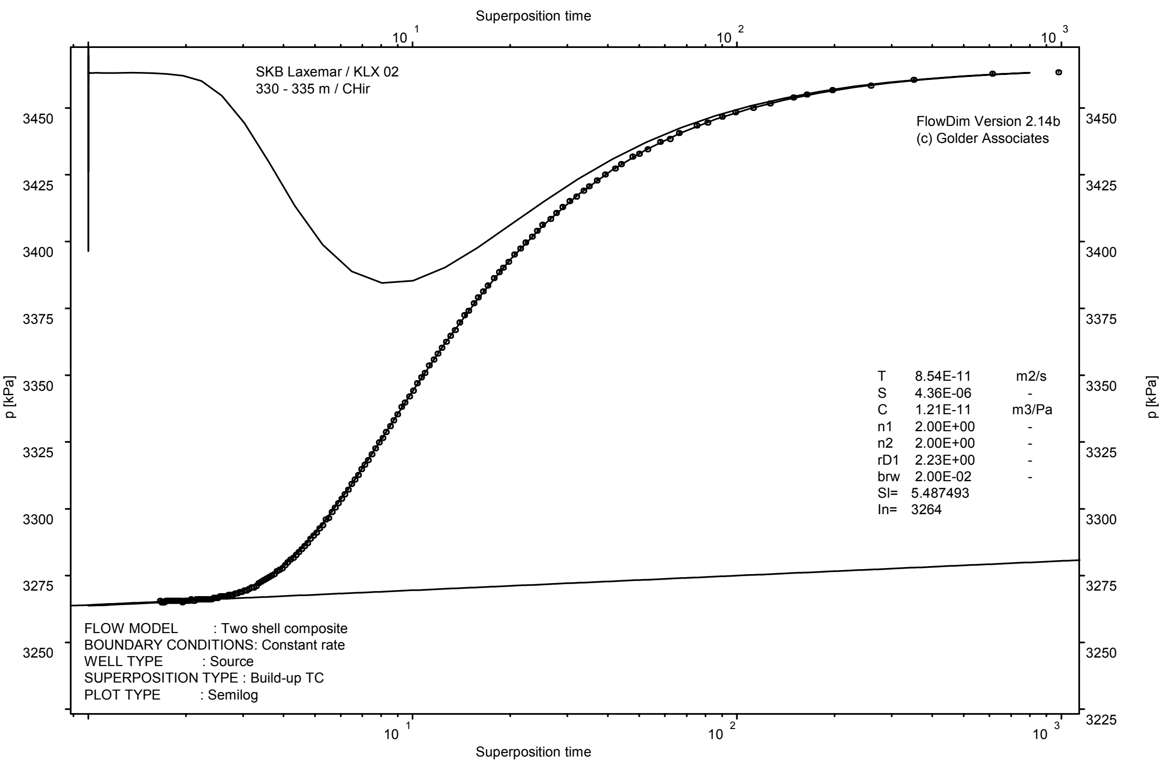
Pressure and temperature in the test section; cartesian plot

Not Analysed

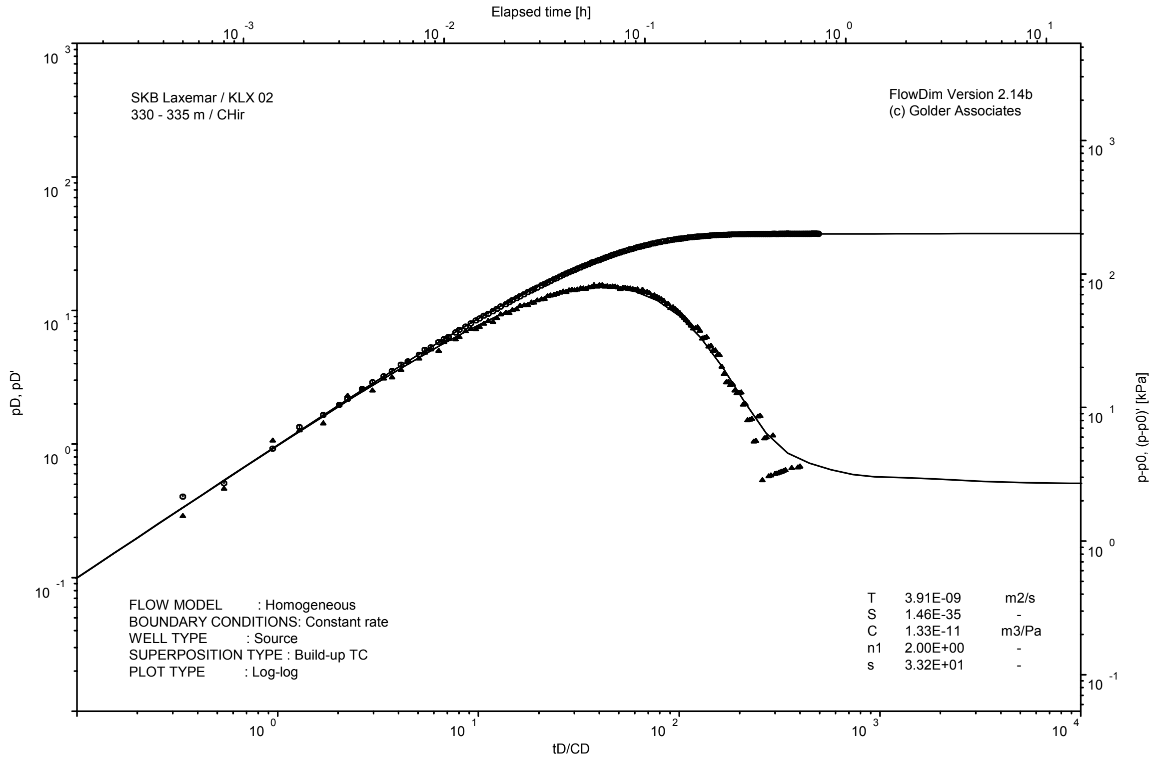
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

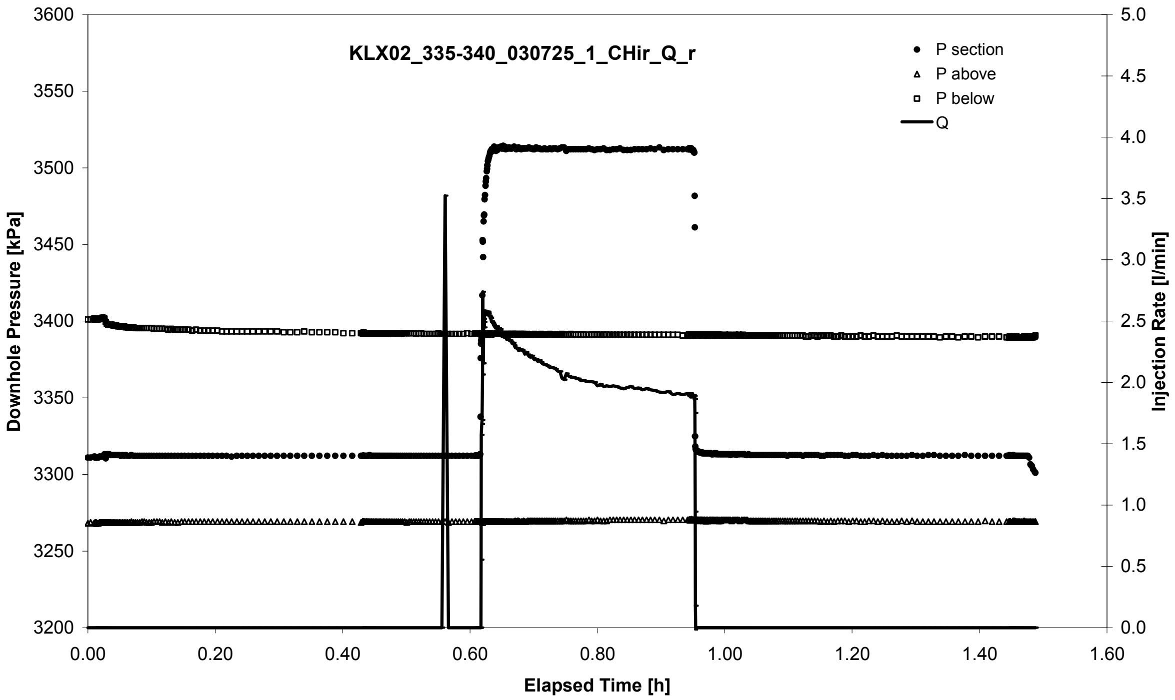


CHIR phase; Homogeneous model analyses, log-log match

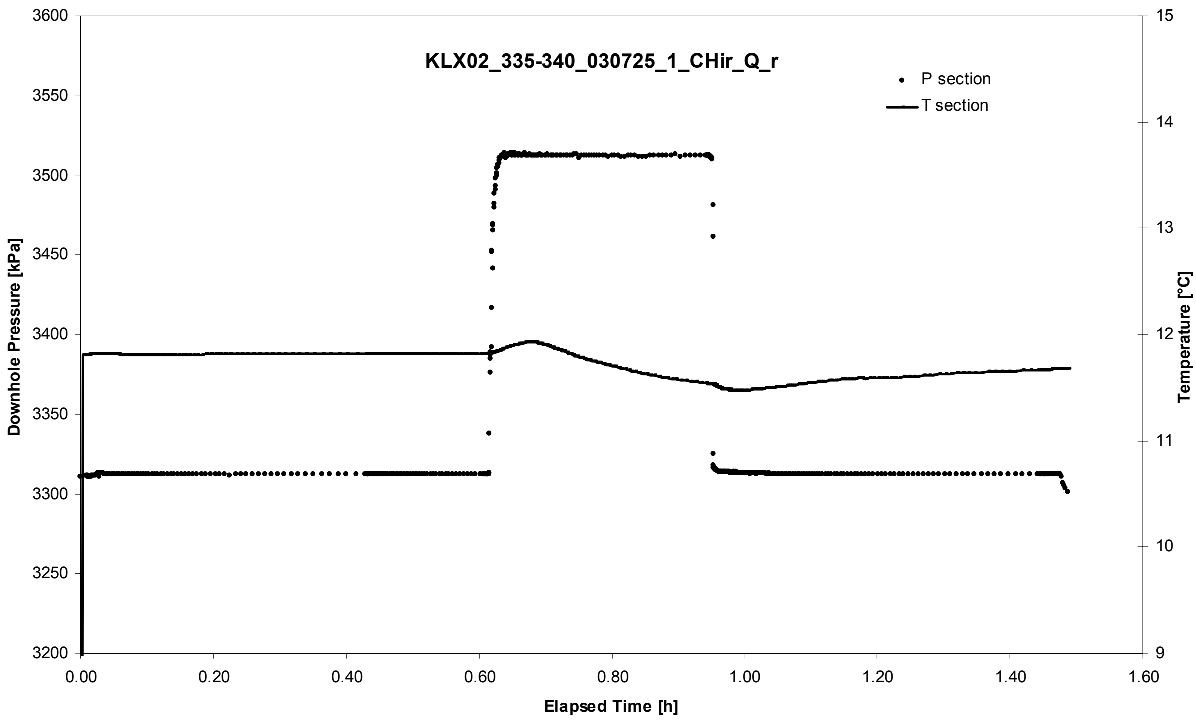
APPENDIX 2-52

Test 335 – 340 m

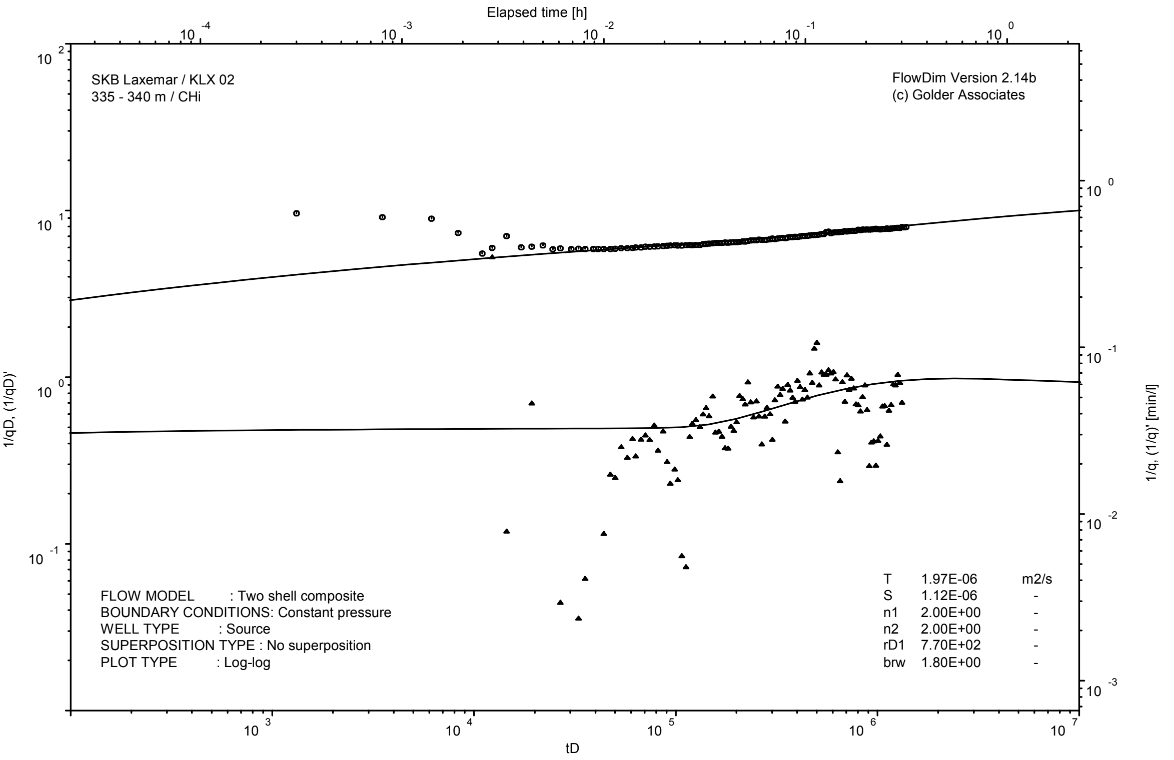
Analysis diagrams



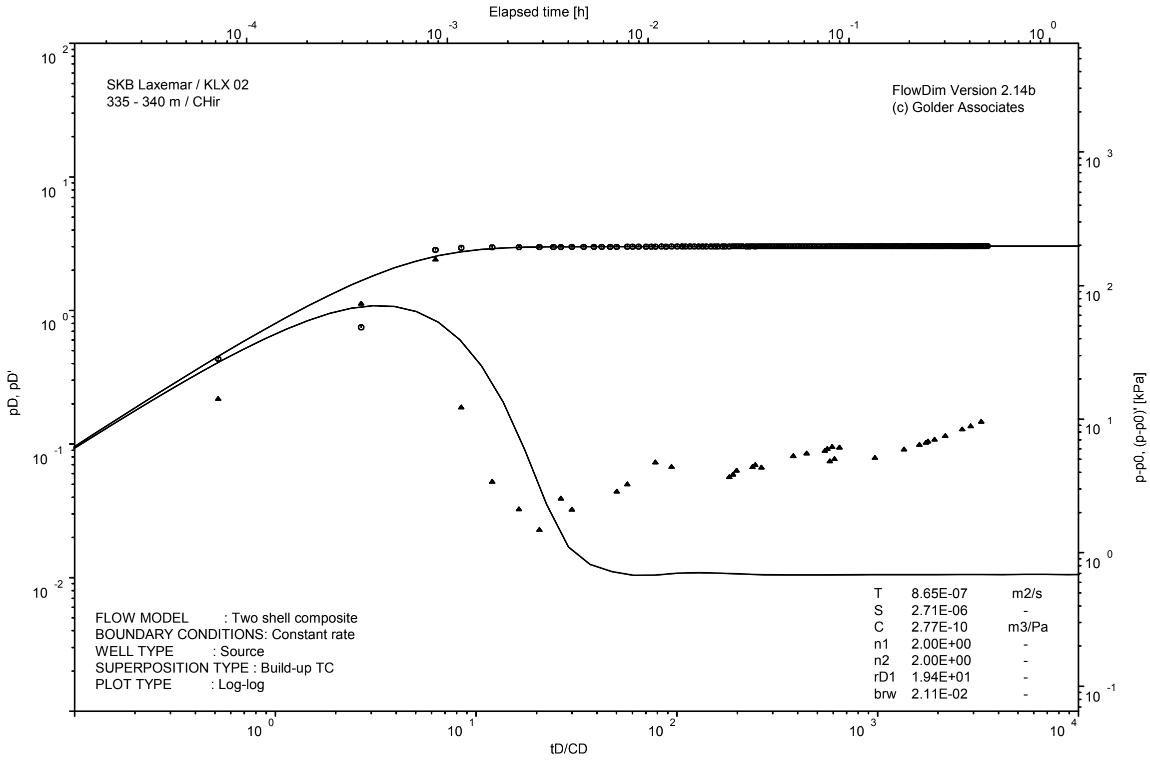
Pressure and flow rate vs. time; cartesian plot



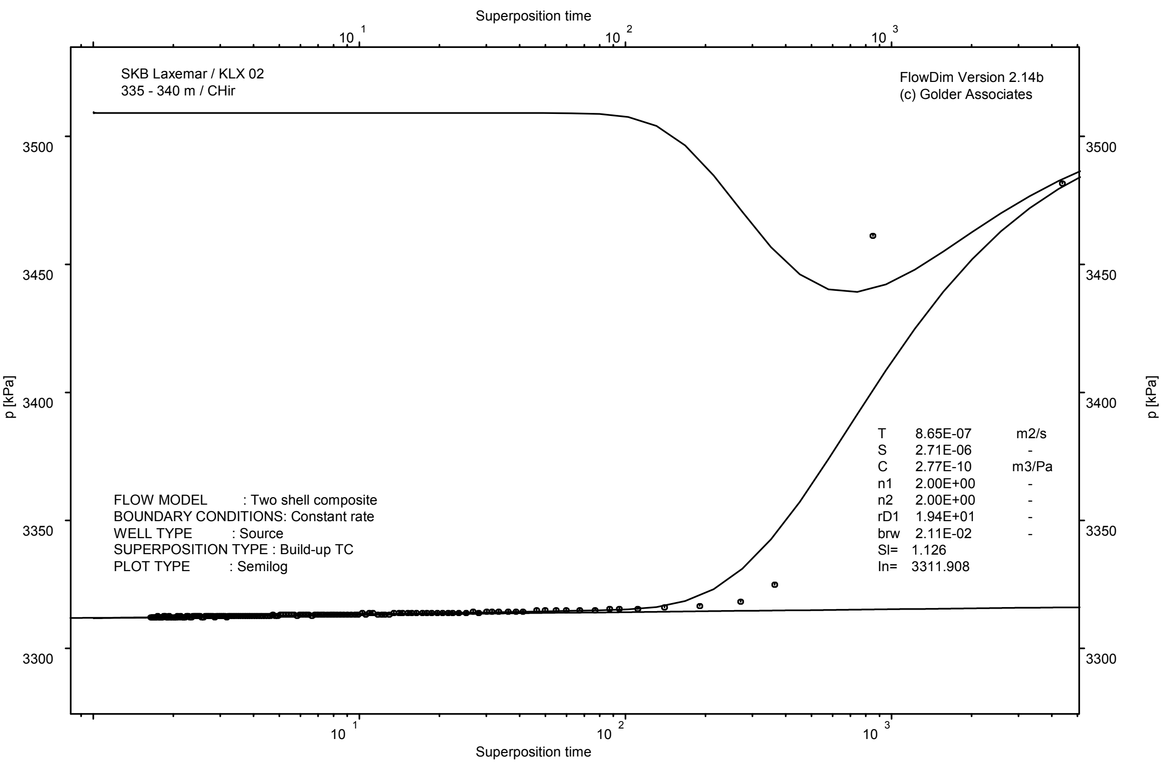
Pressure and temperature in the test section; cartesian plot



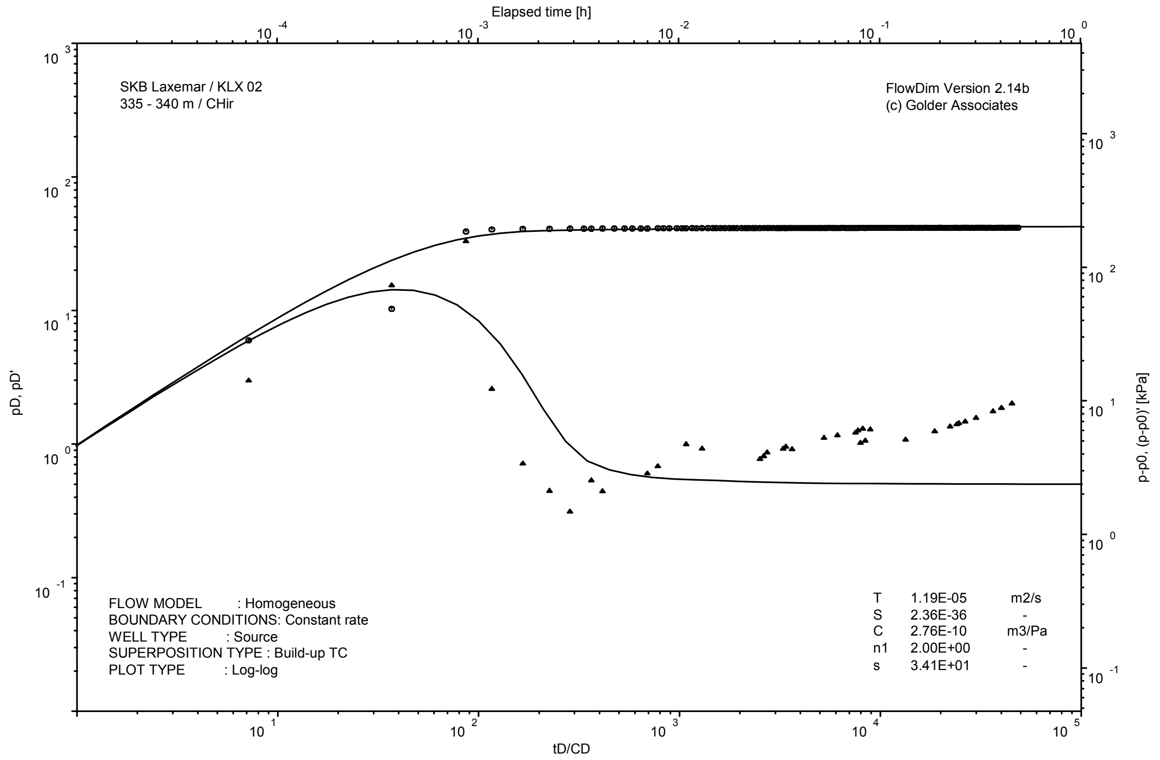
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

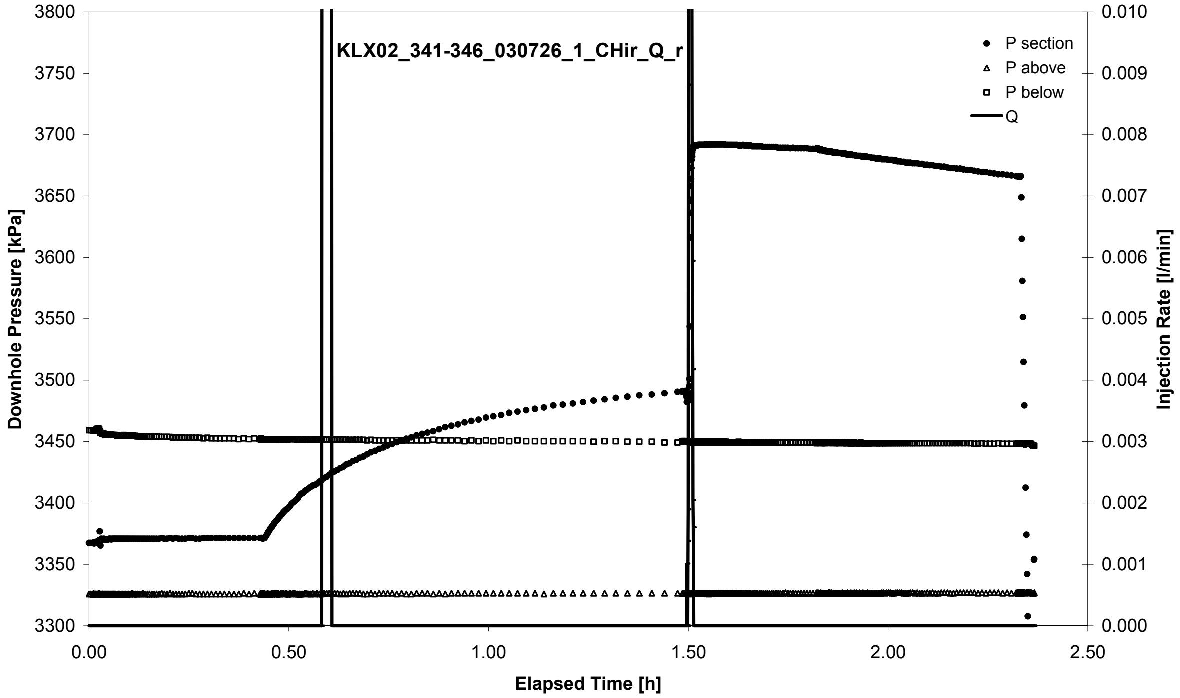


CHIR phase; Homogeneous model analyses, log-log match

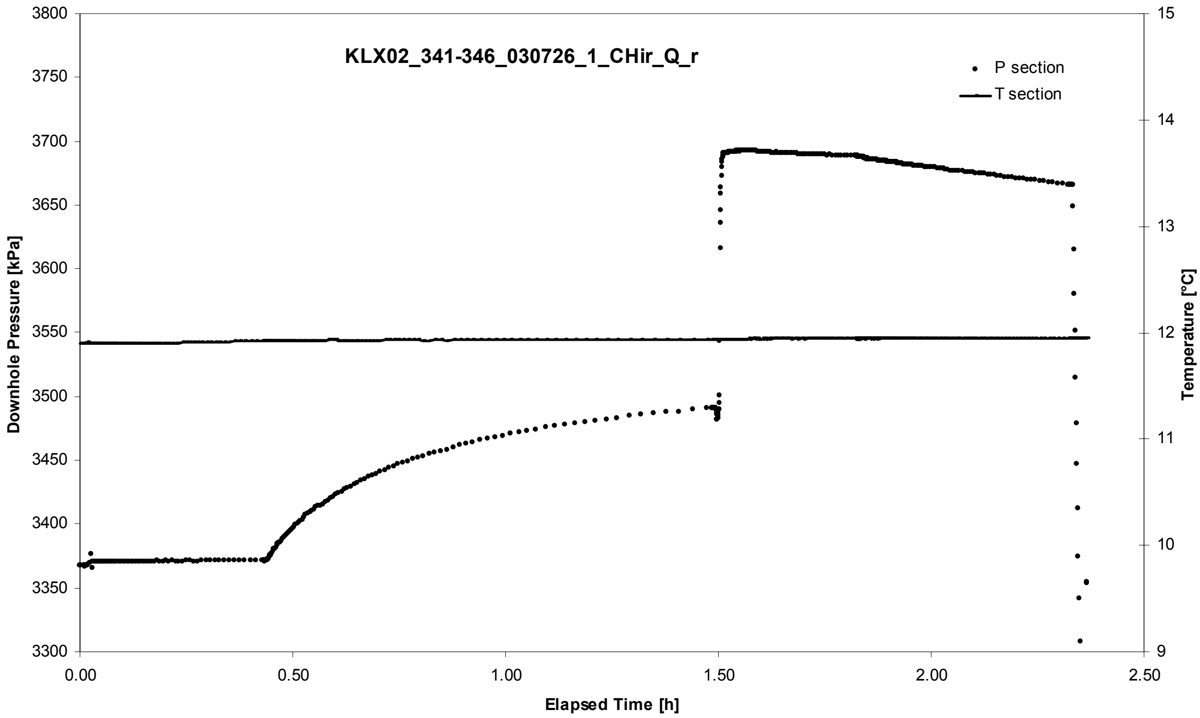
APPENDIX 2-53

Test 341 – 346 m

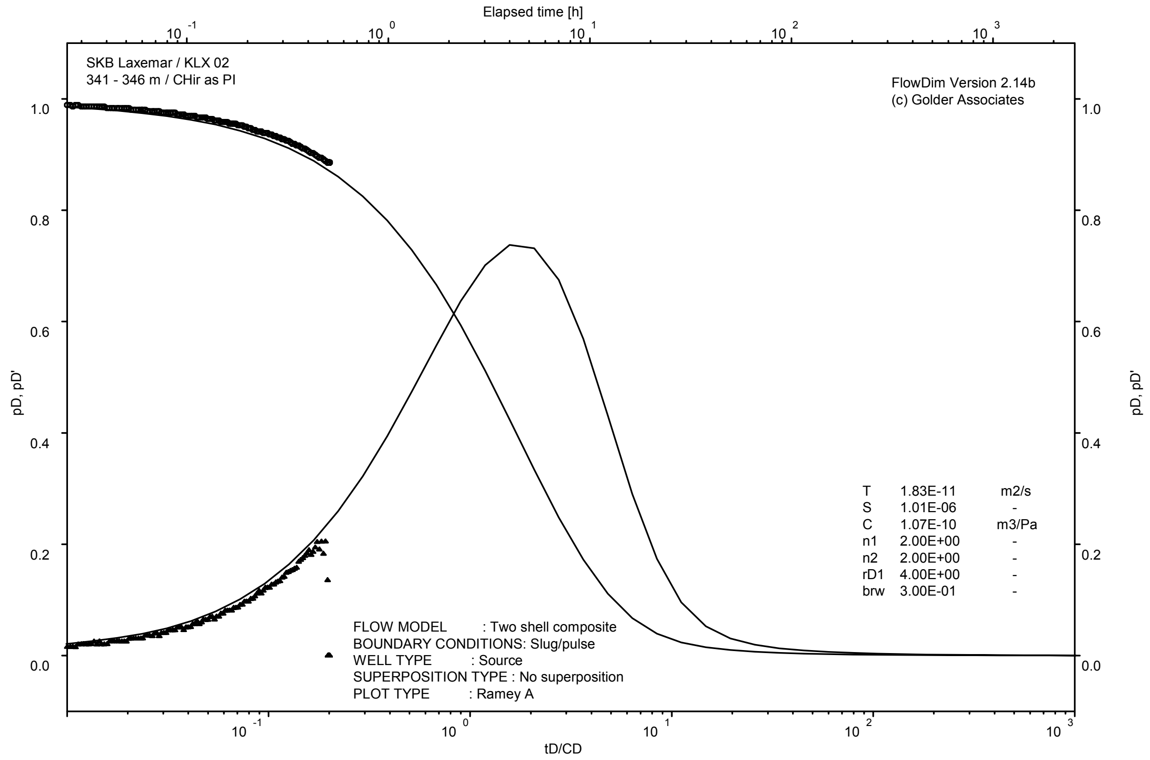
Analysis diagrams



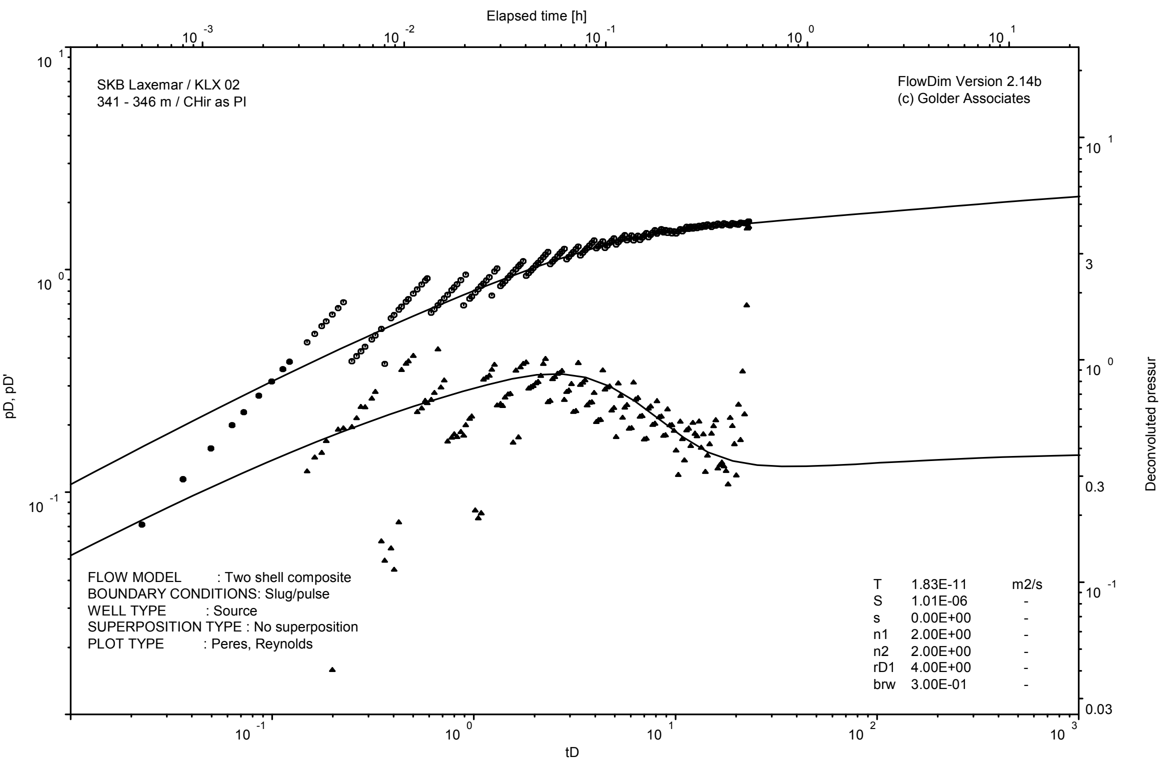
Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot



CHIR phase; RAMEY match

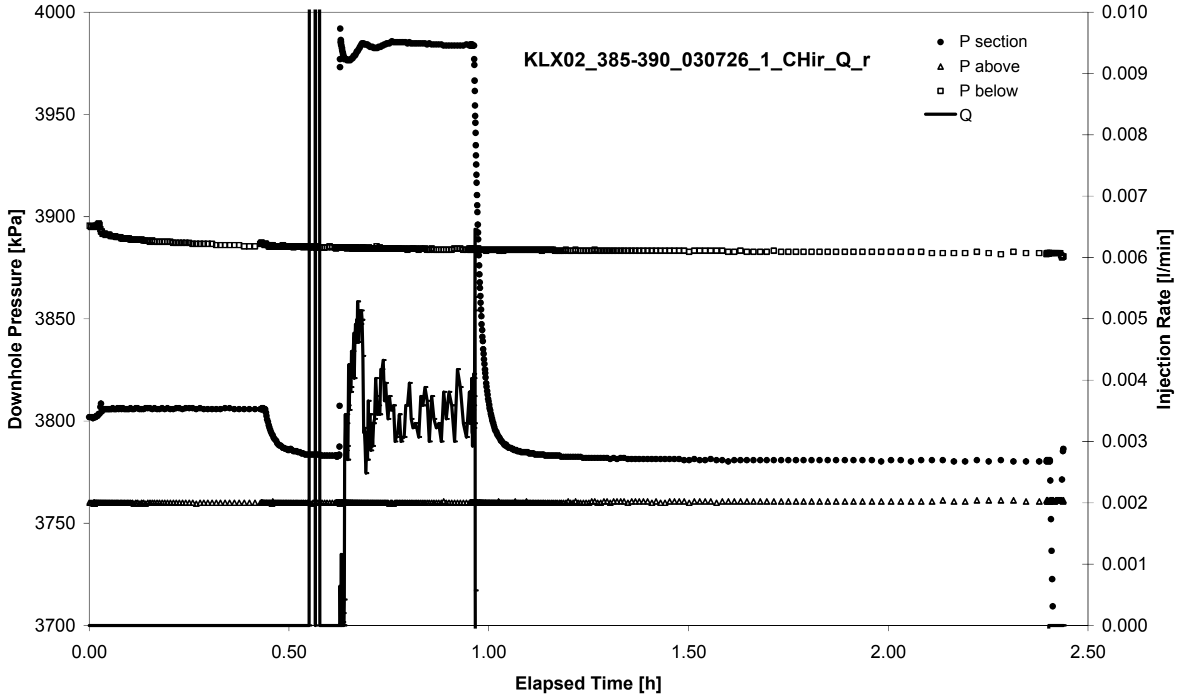


CHIR phase analysed as pulse injection; deconvolution match

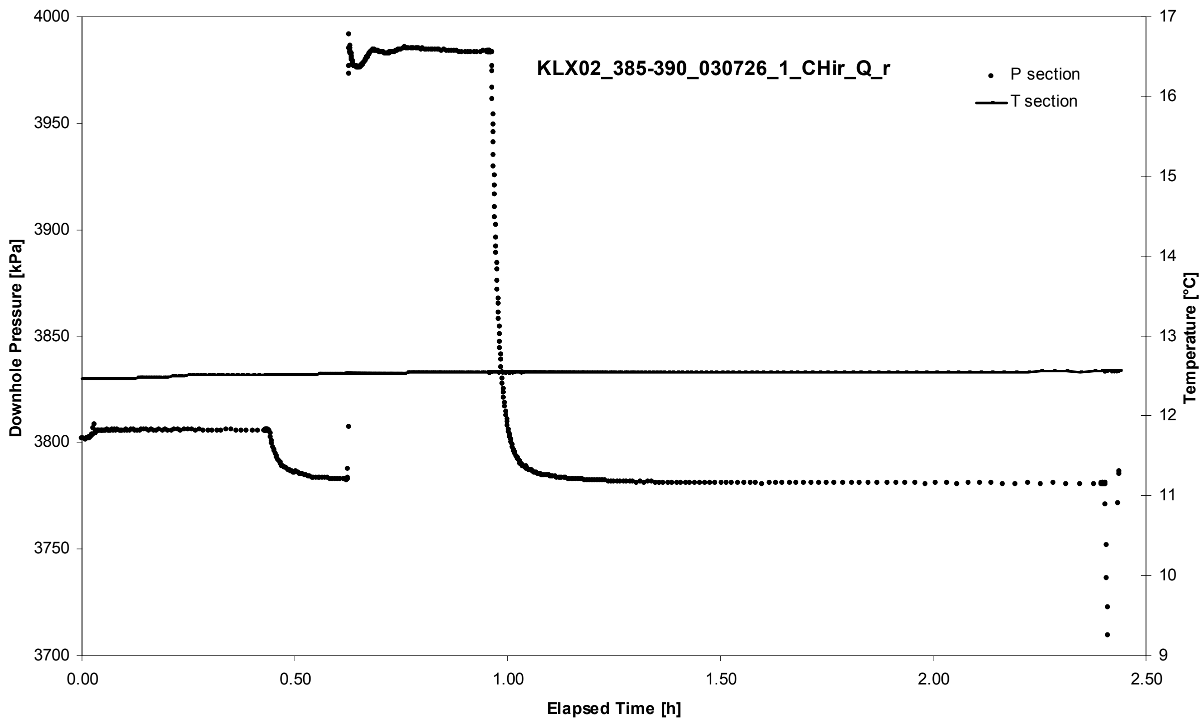
APPENDIX 2-54

Test 385 – 390 m

Analysis diagrams



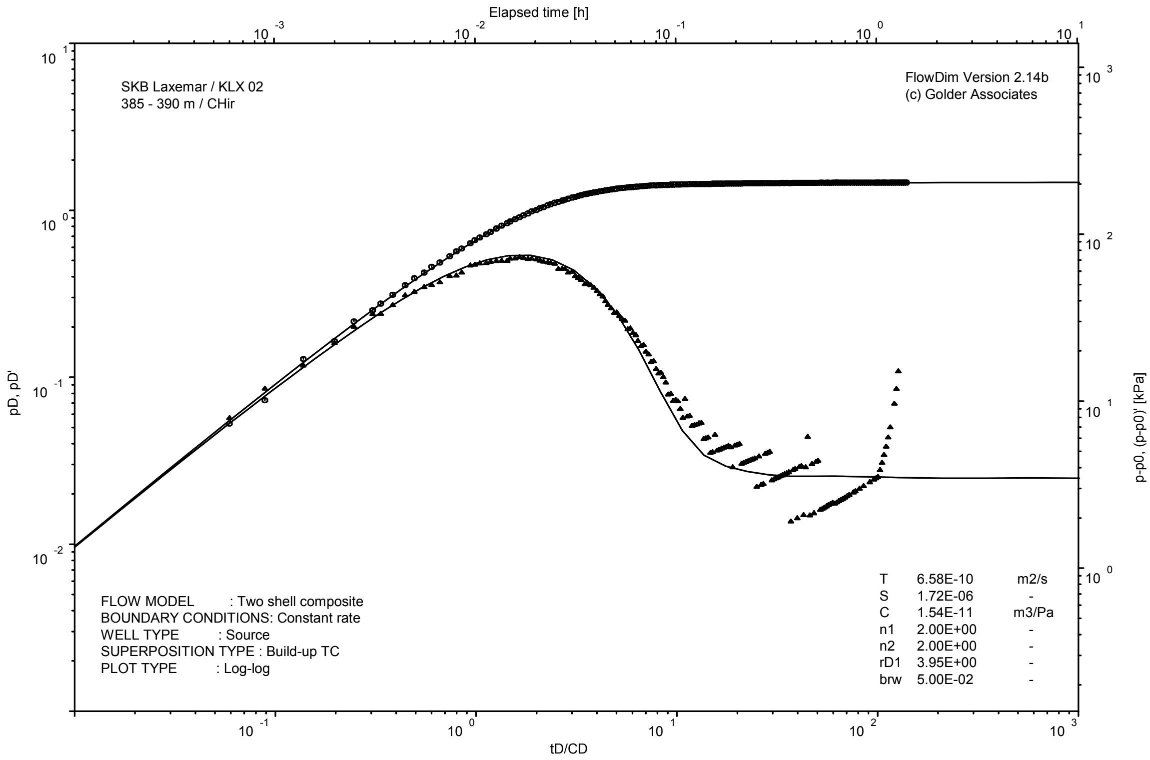
Pressure and flow rate vs. time; cartesian plot



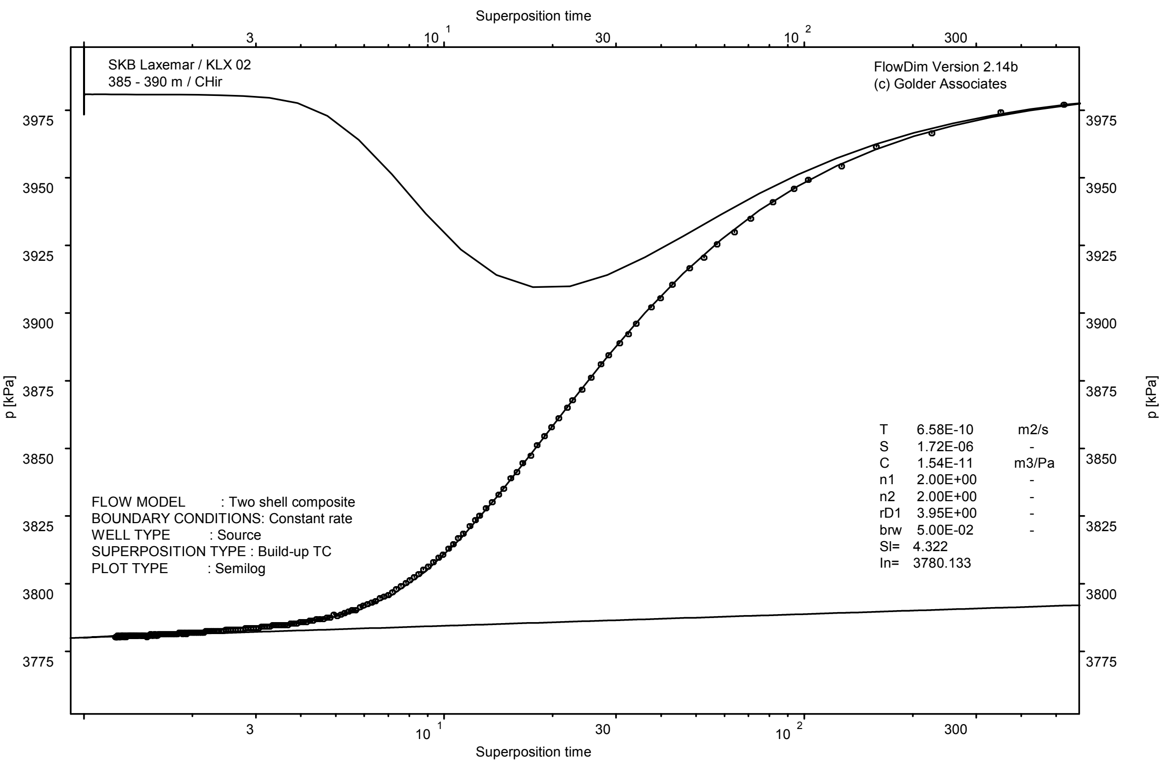
Pressure and temperature in the test section; cartesian plot

Not Analysed

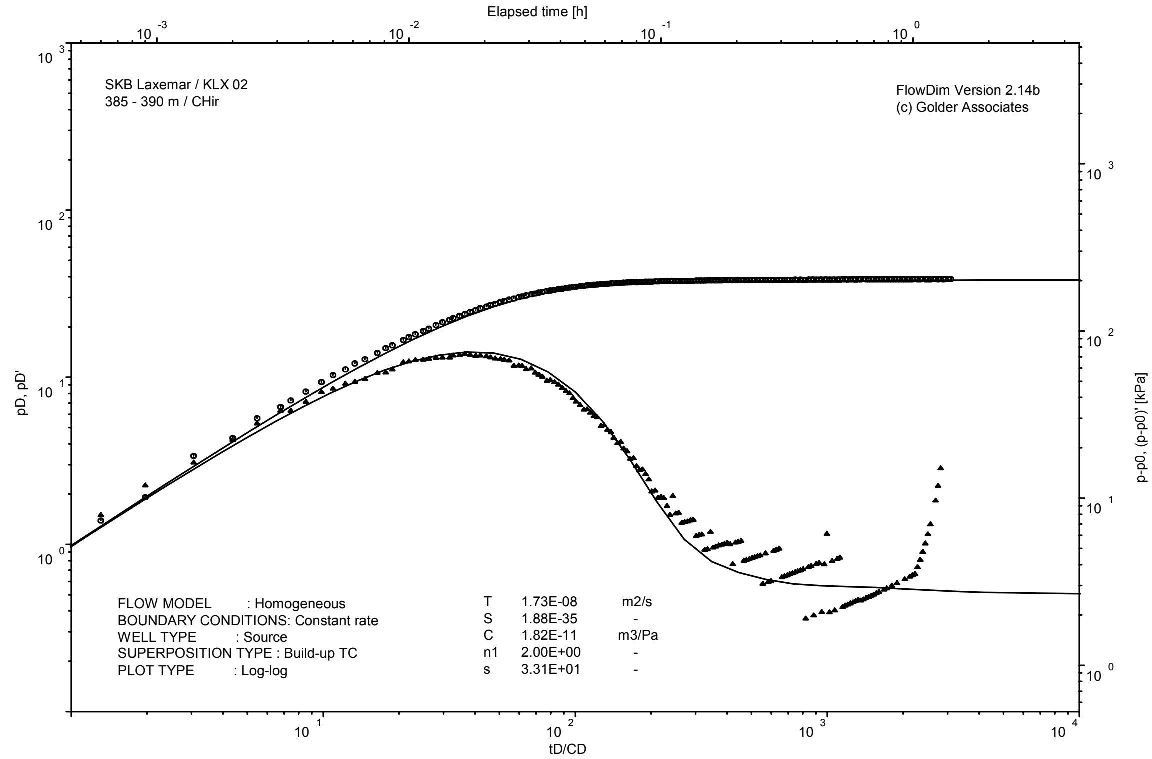
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

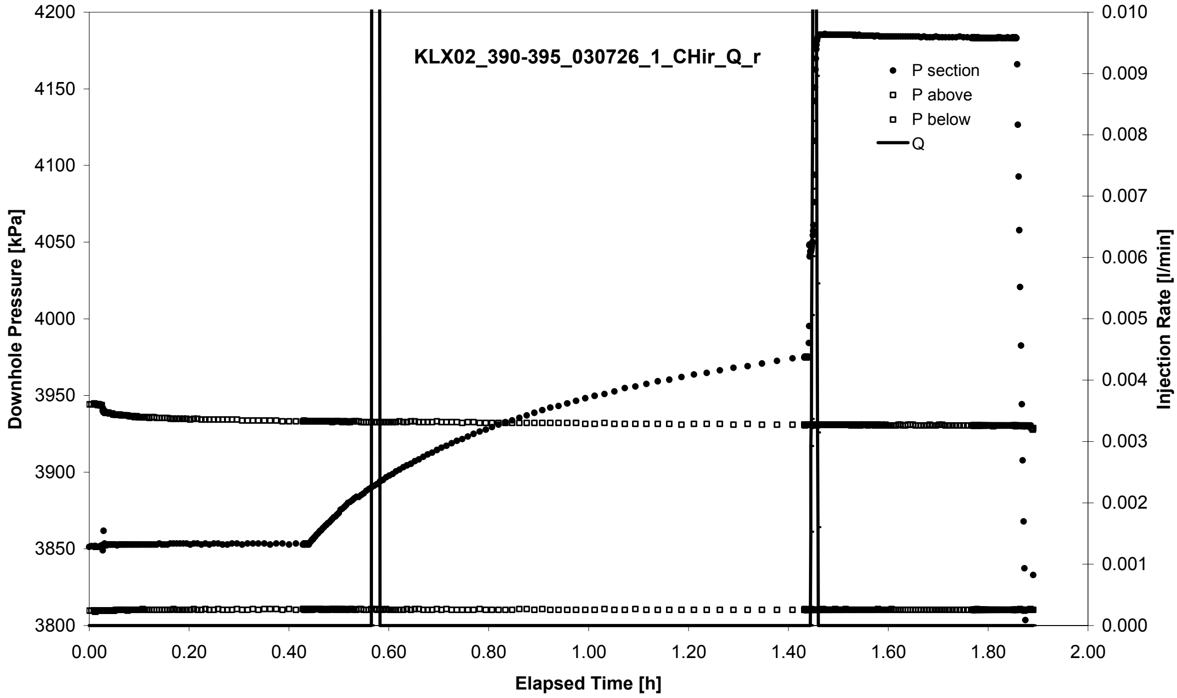


CHIR phase; Homogeneous model analyses, log-log match

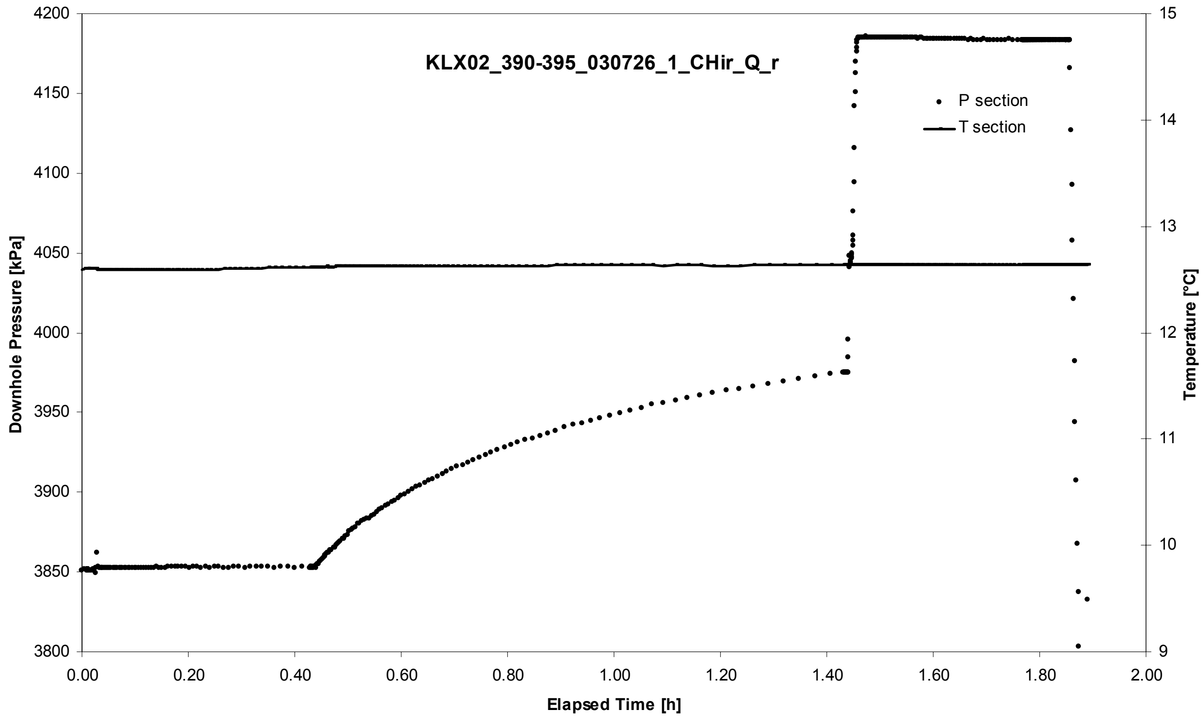
APPENDIX 2-55

Test 390 – 395 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

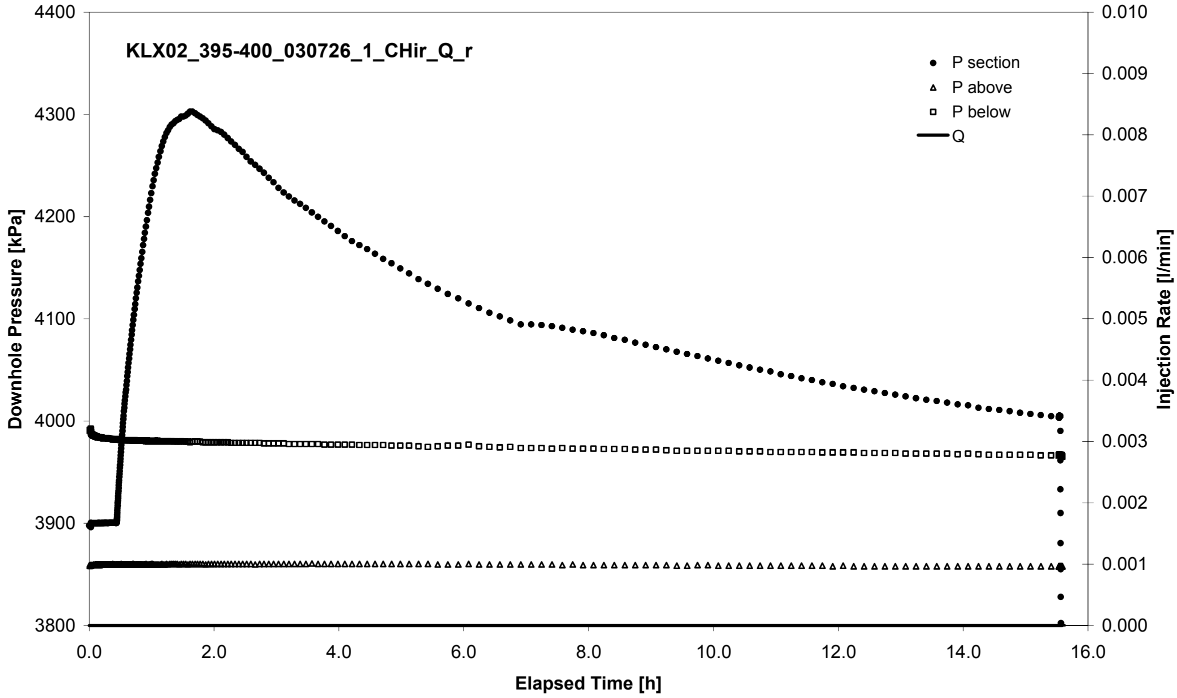
Not Analysed

CHIR phase; HORNER match

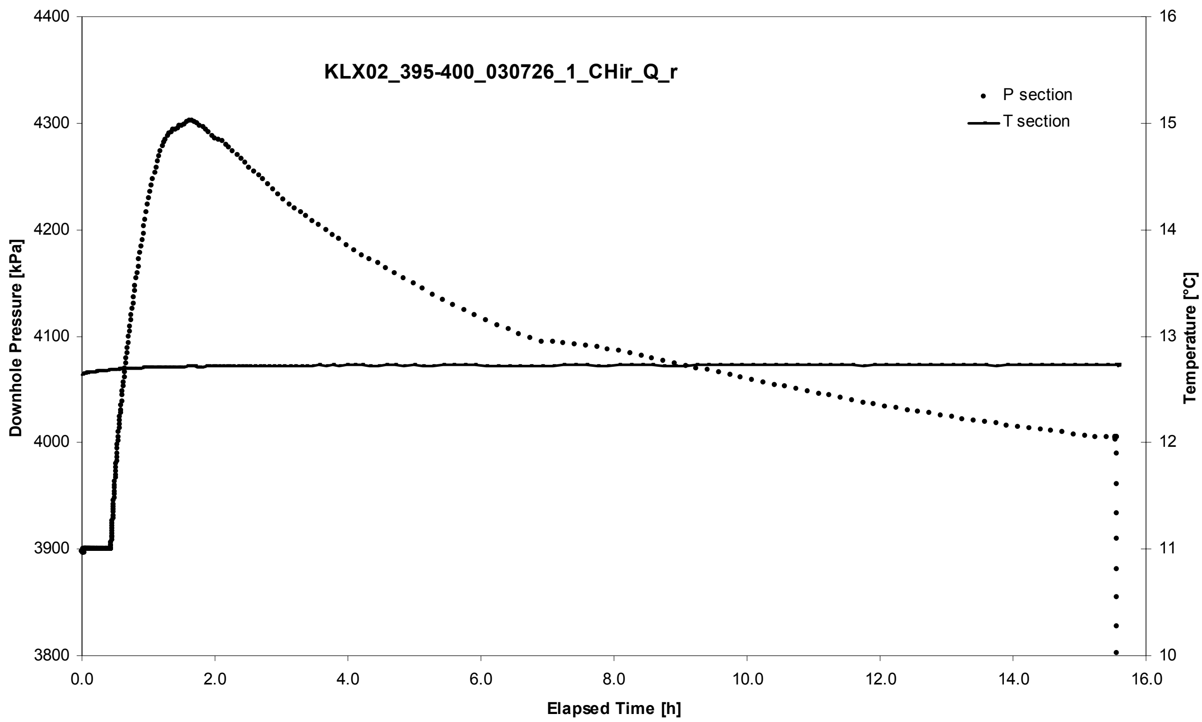
APPENDIX 2-56

Test 395 – 400 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

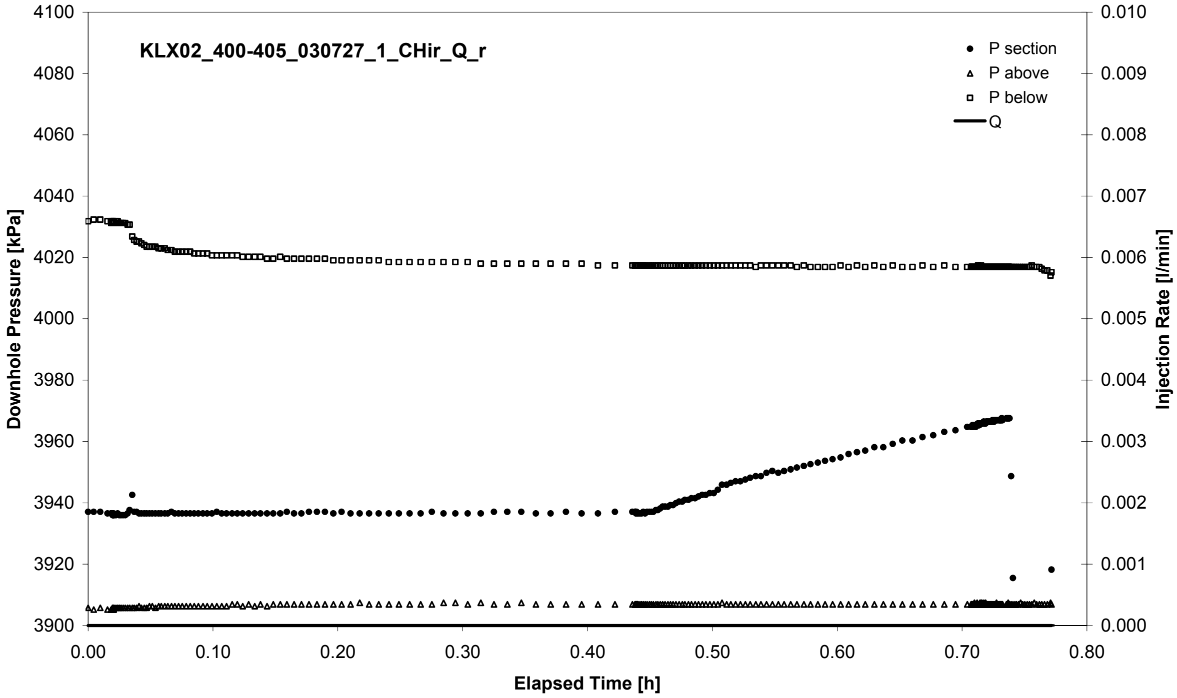
Not Analysed

CHIR phase; HORNER match

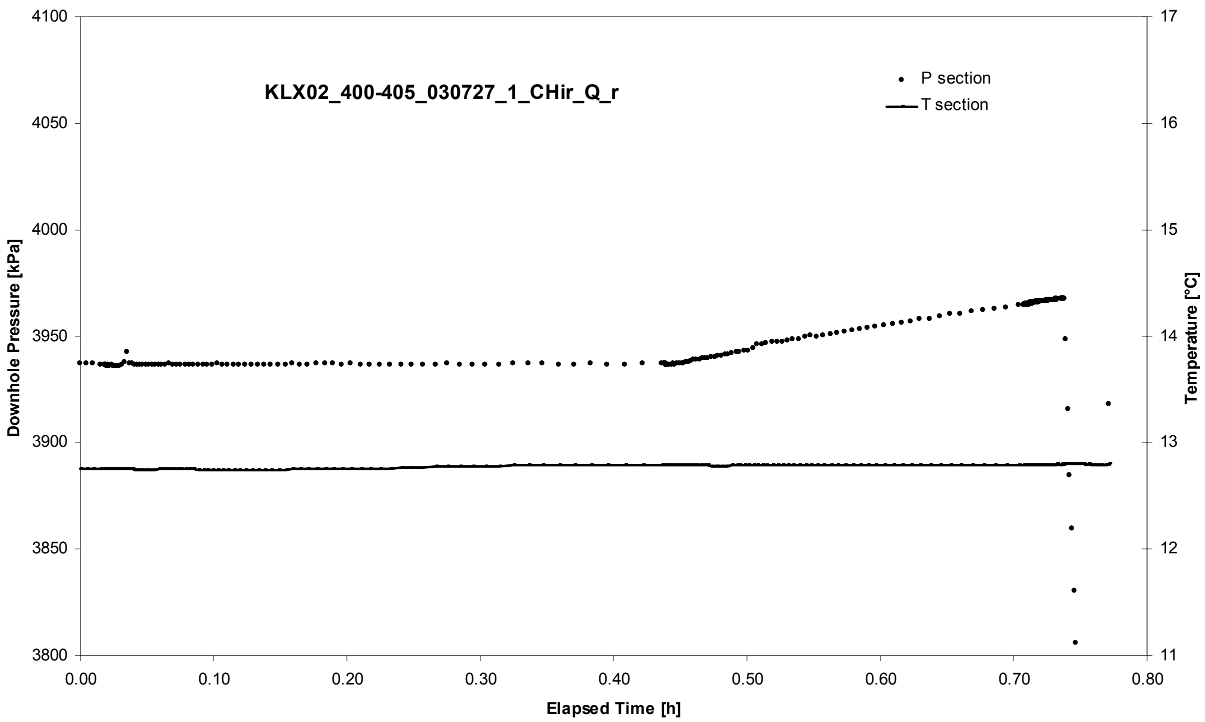
APPENDIX 2-57

Test 400 – 405 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

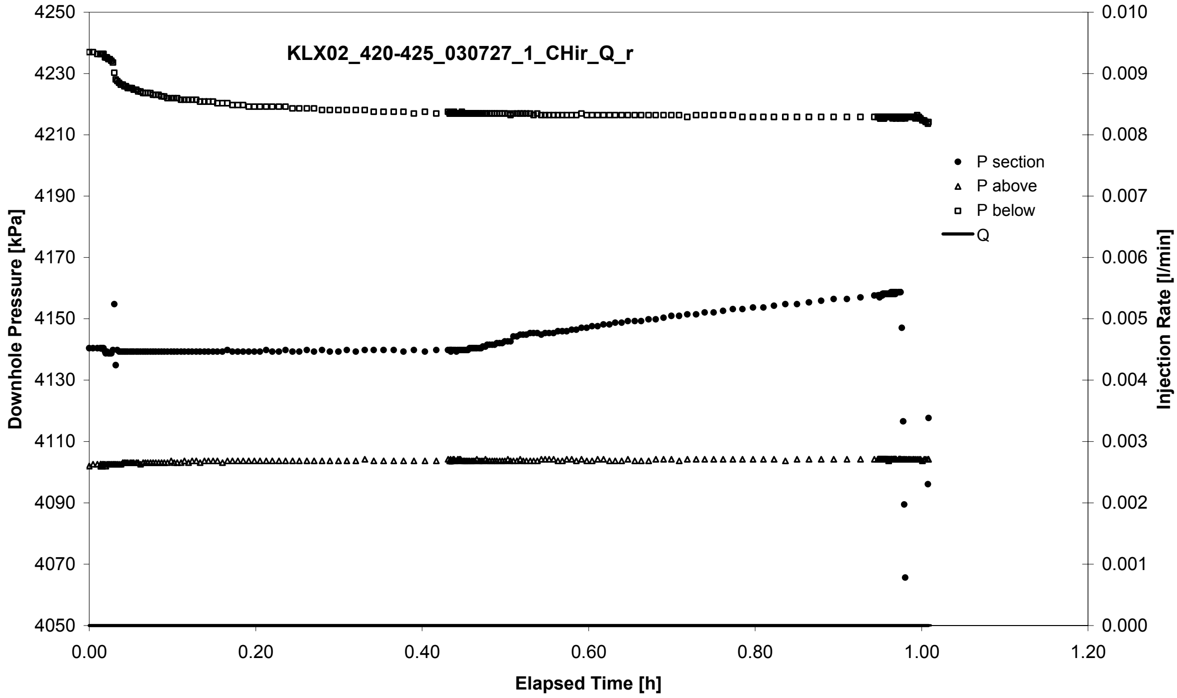
Not Analysed

CHIR phase; HORNER match

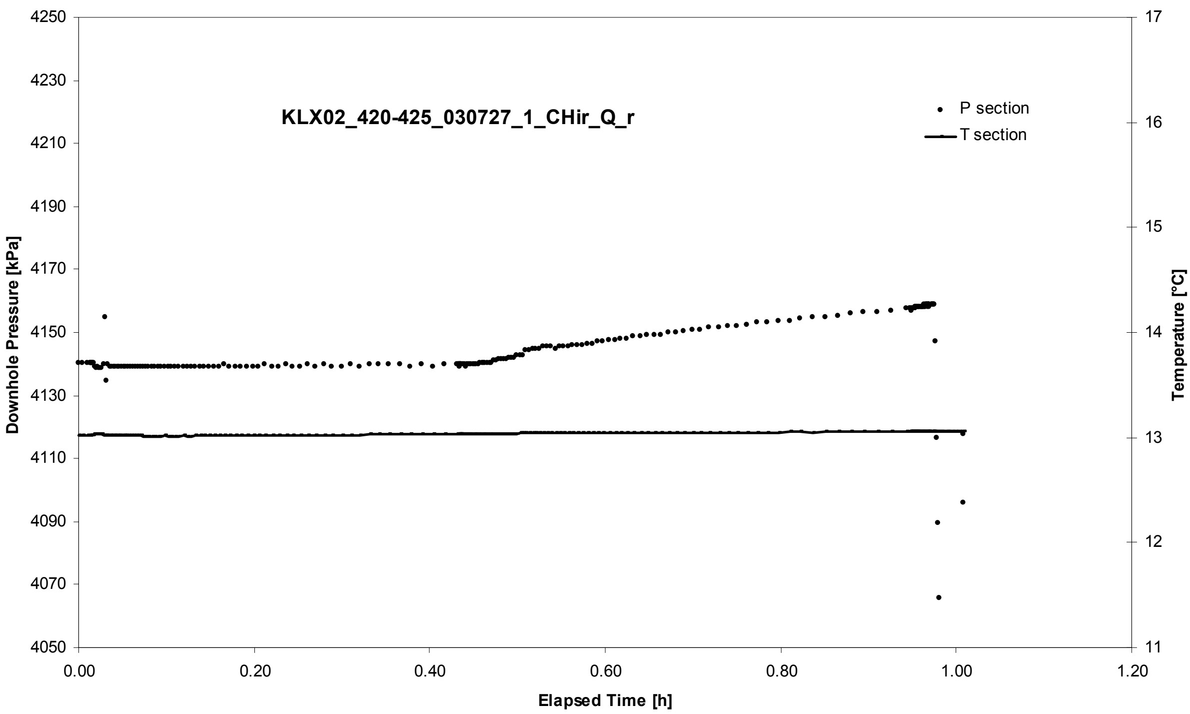
APPENDIX 2-58

Test 420 – 425 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

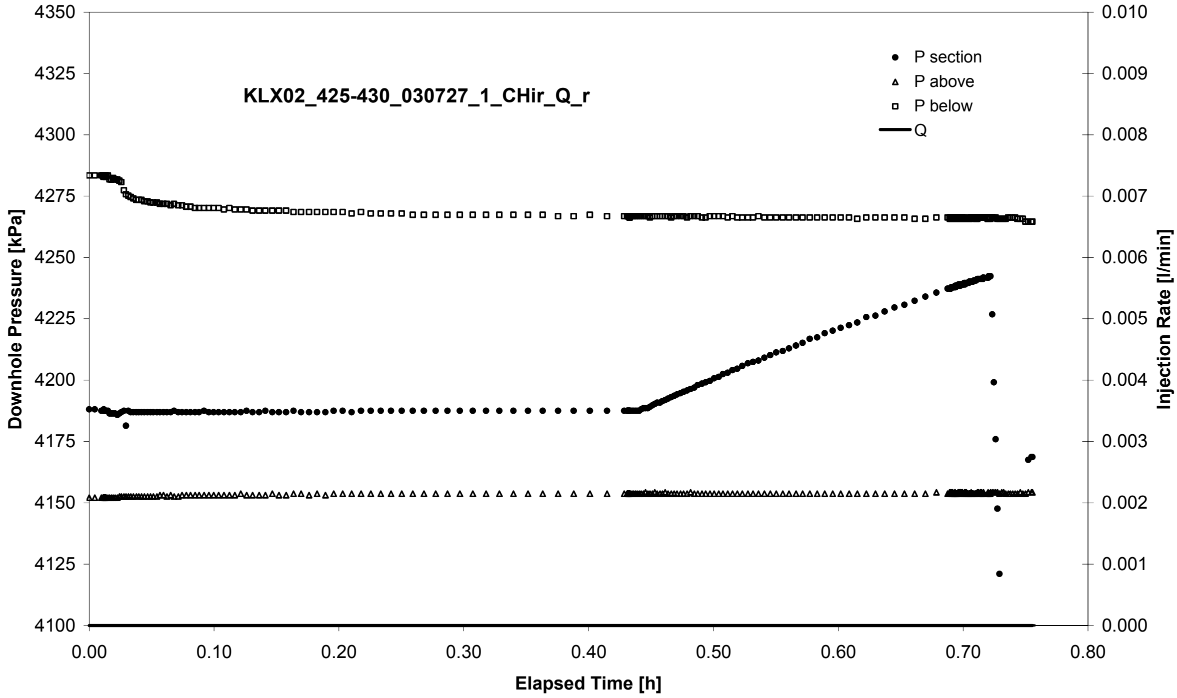
Not Analysed

CHIR phase; HORNER match

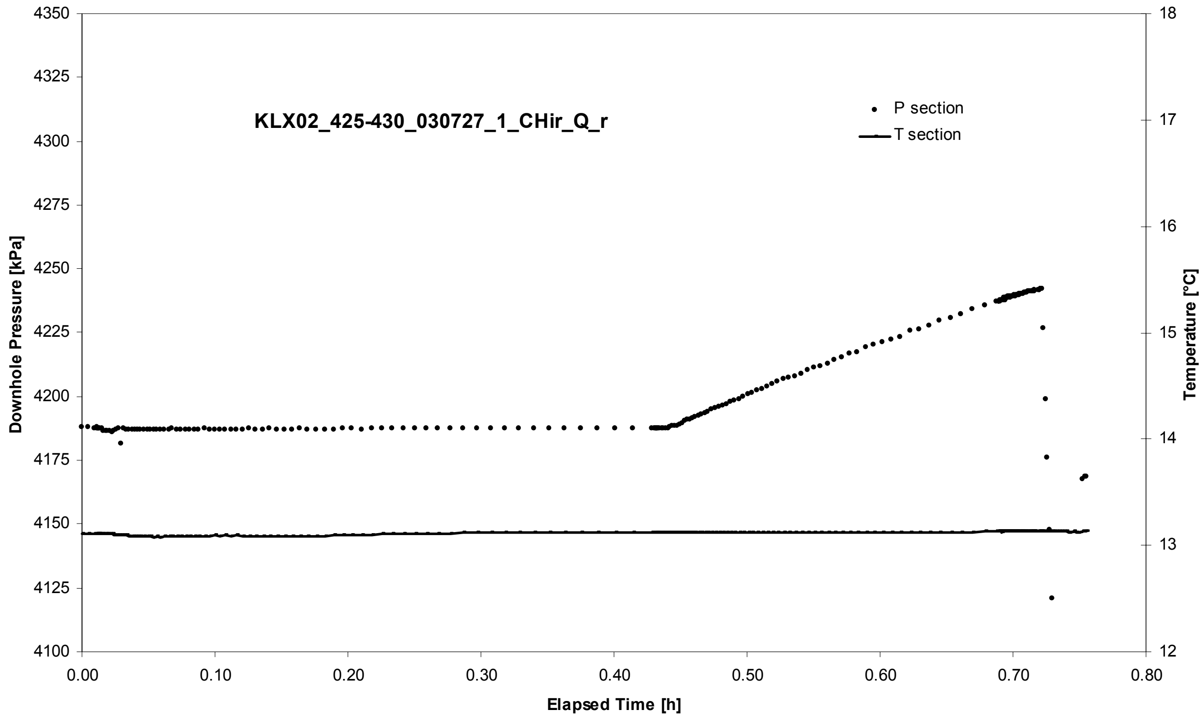
APPENDIX 2-59

Test 425 – 430 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

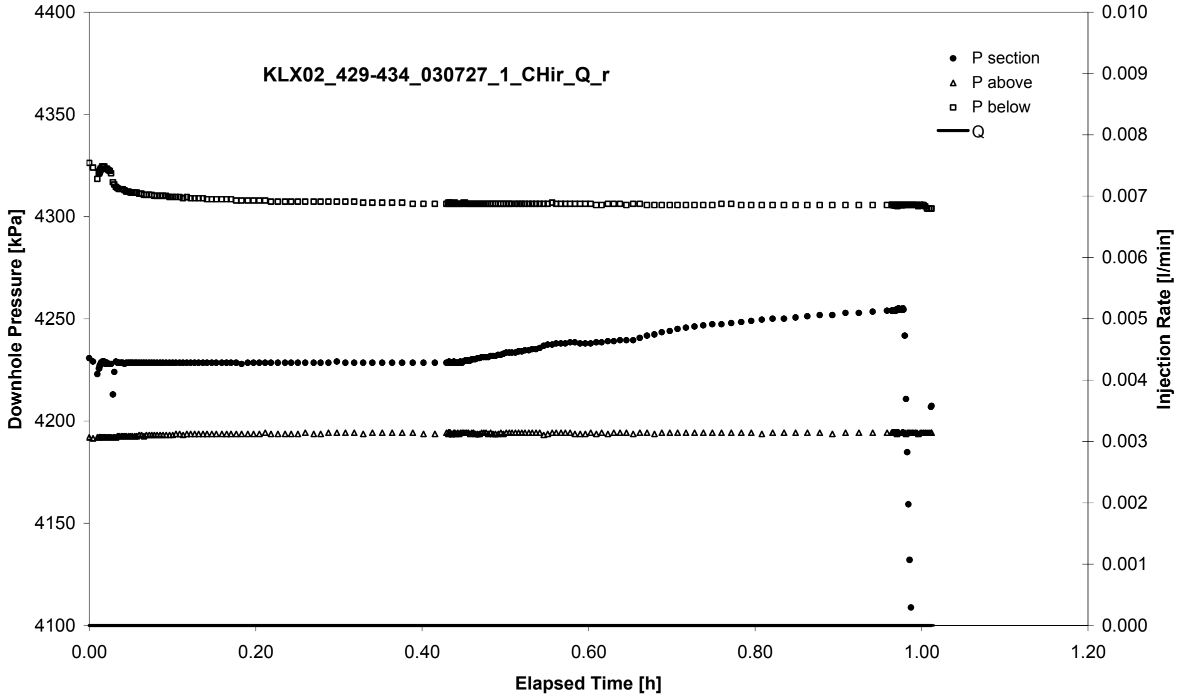
Not Analysed

CHIR phase; HORNER match

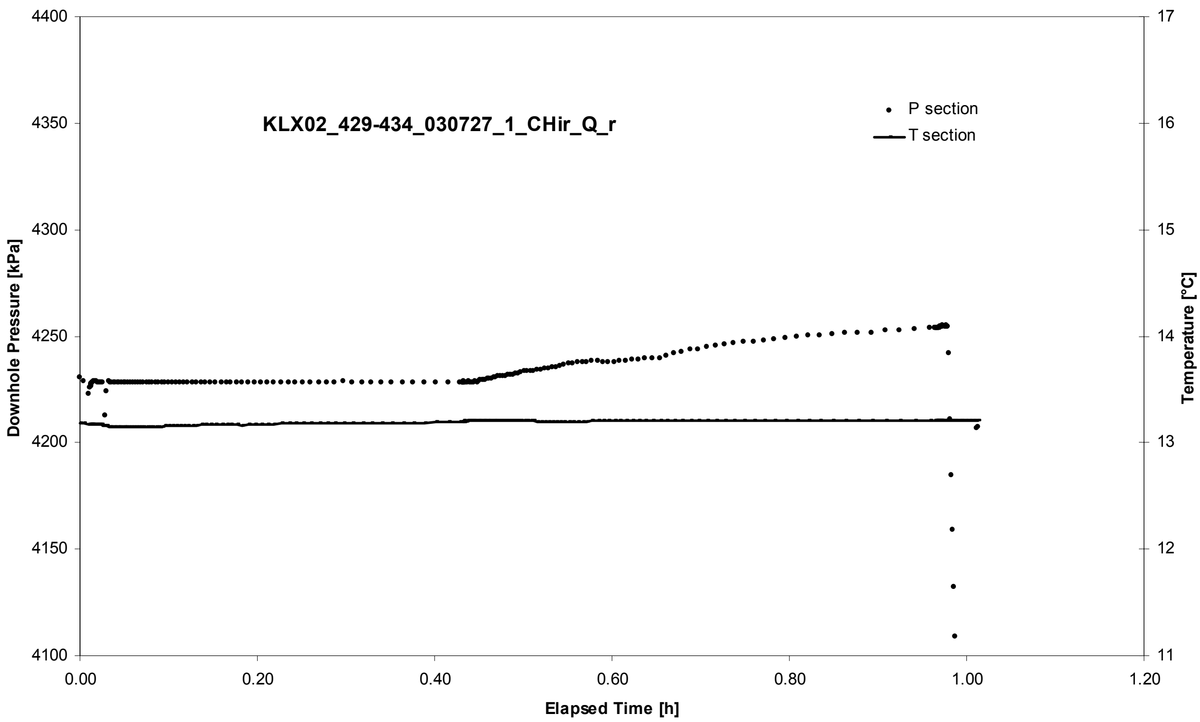
APPENDIX 2-60

Test 429 – 434 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

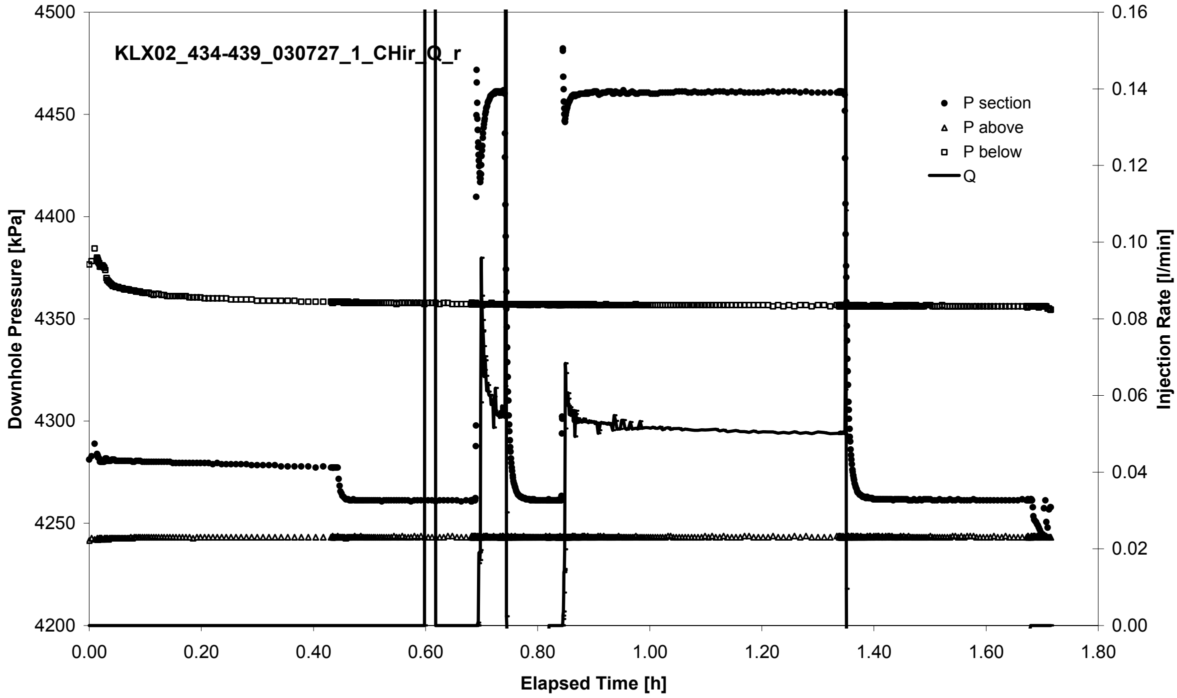
Not Analysed

CHIR phase; HORNER match

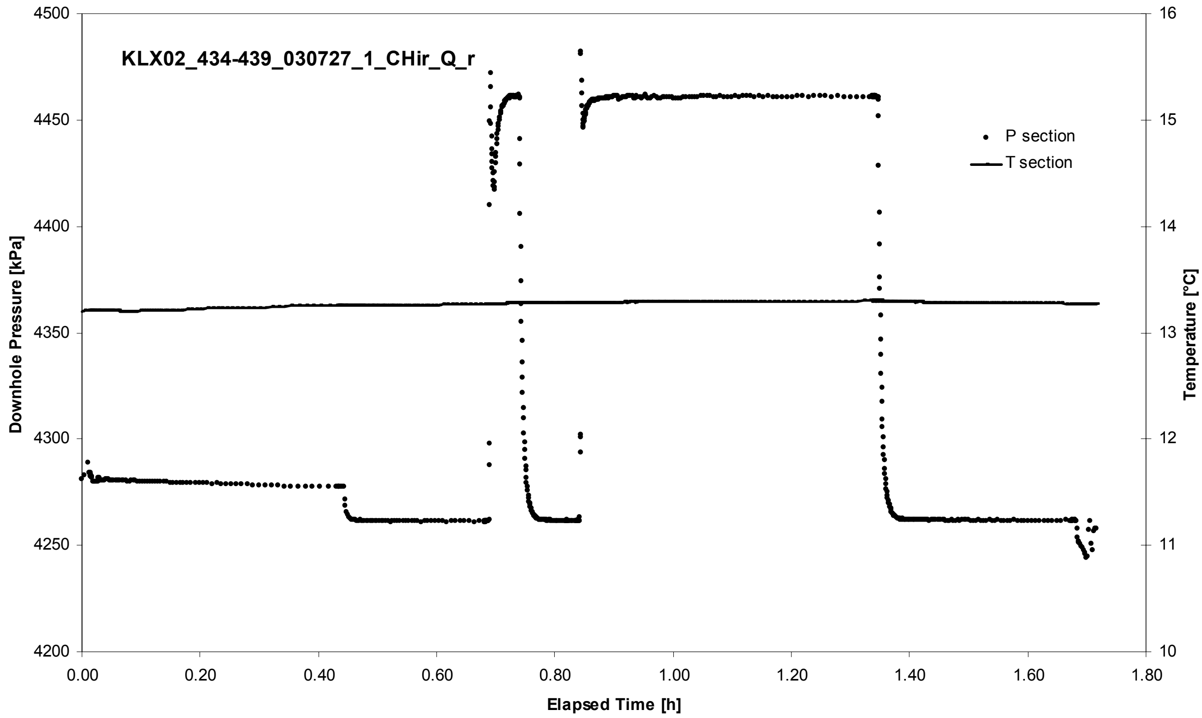
APPENDIX 2-61

Test 434 – 439 m

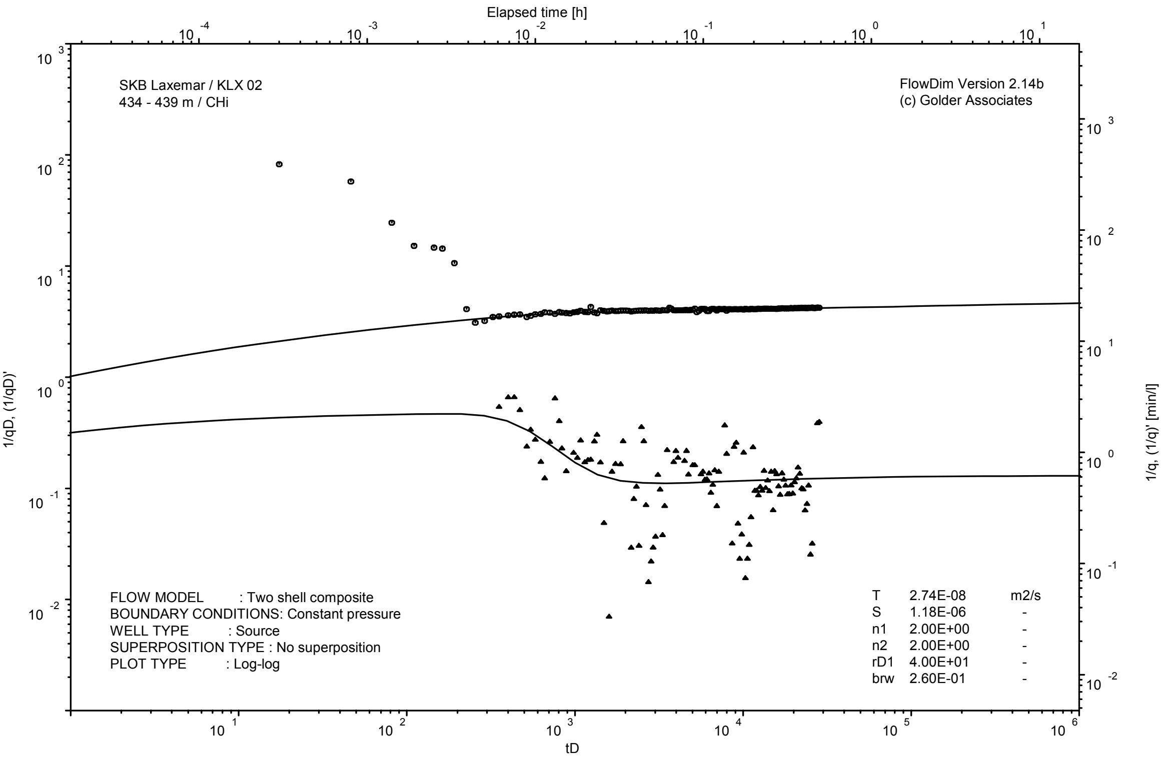
Analysis diagrams



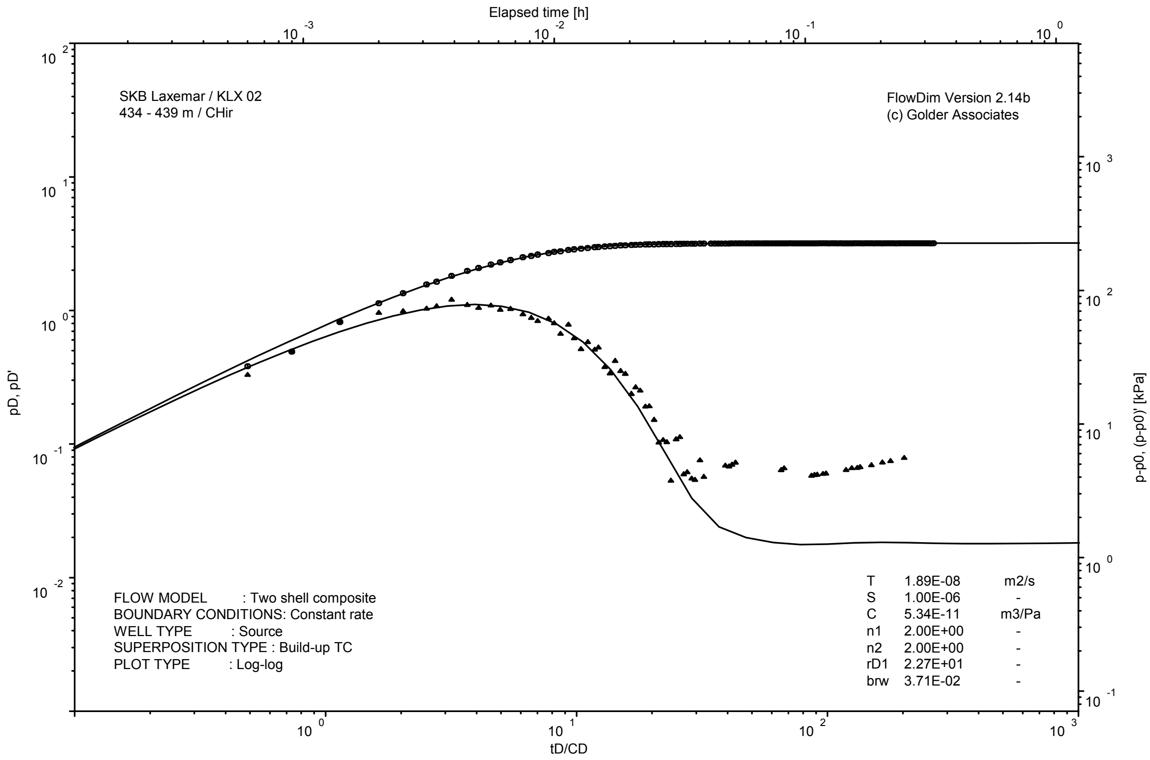
Pressure and flow rate vs. time; cartesian plot



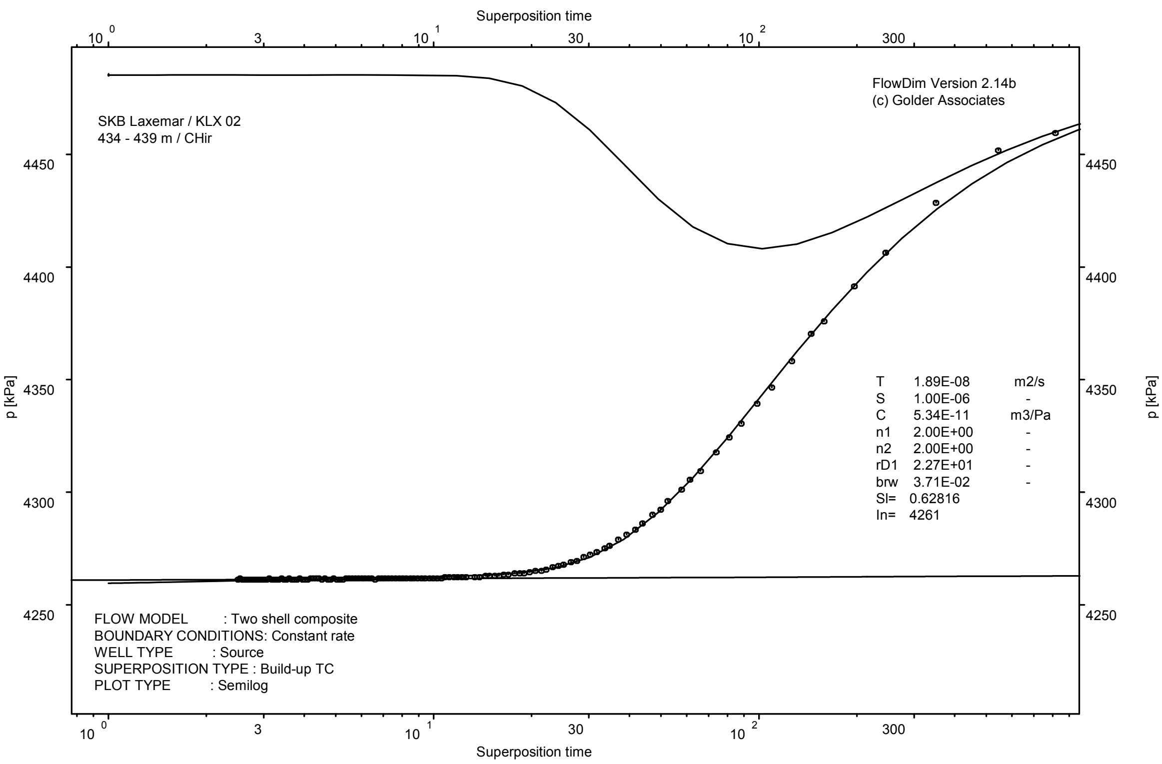
Pressure and temperature in the test section; cartesian plot



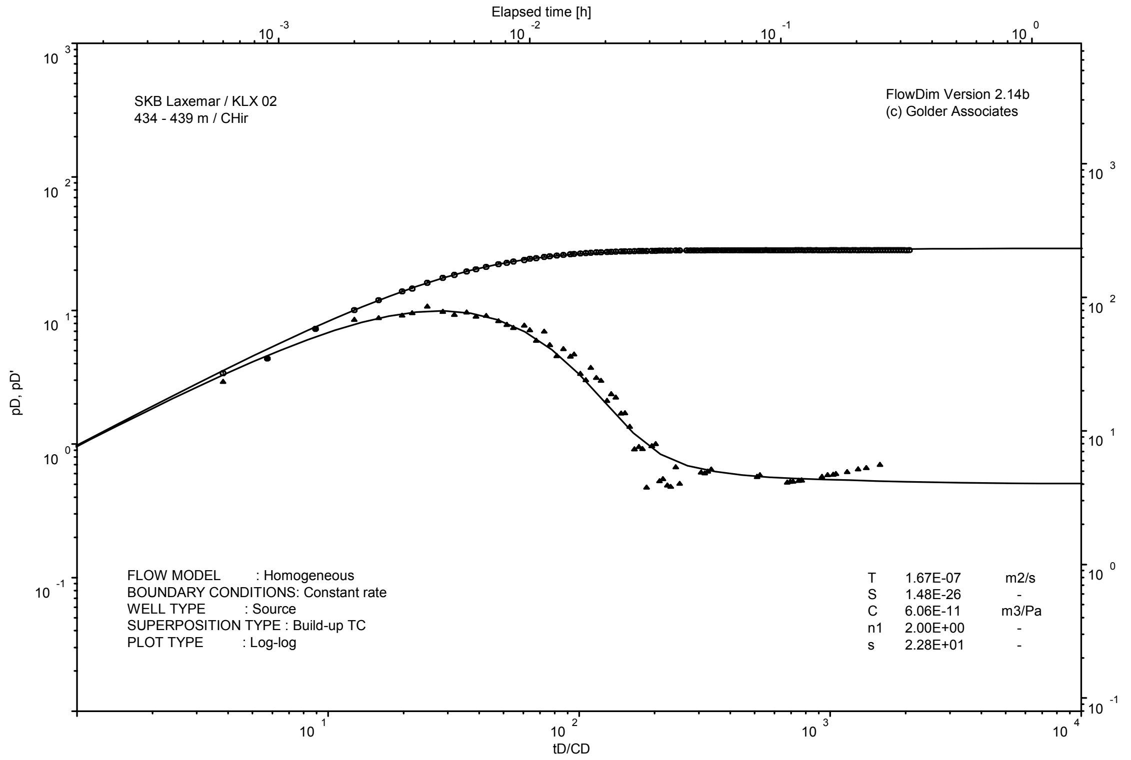
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

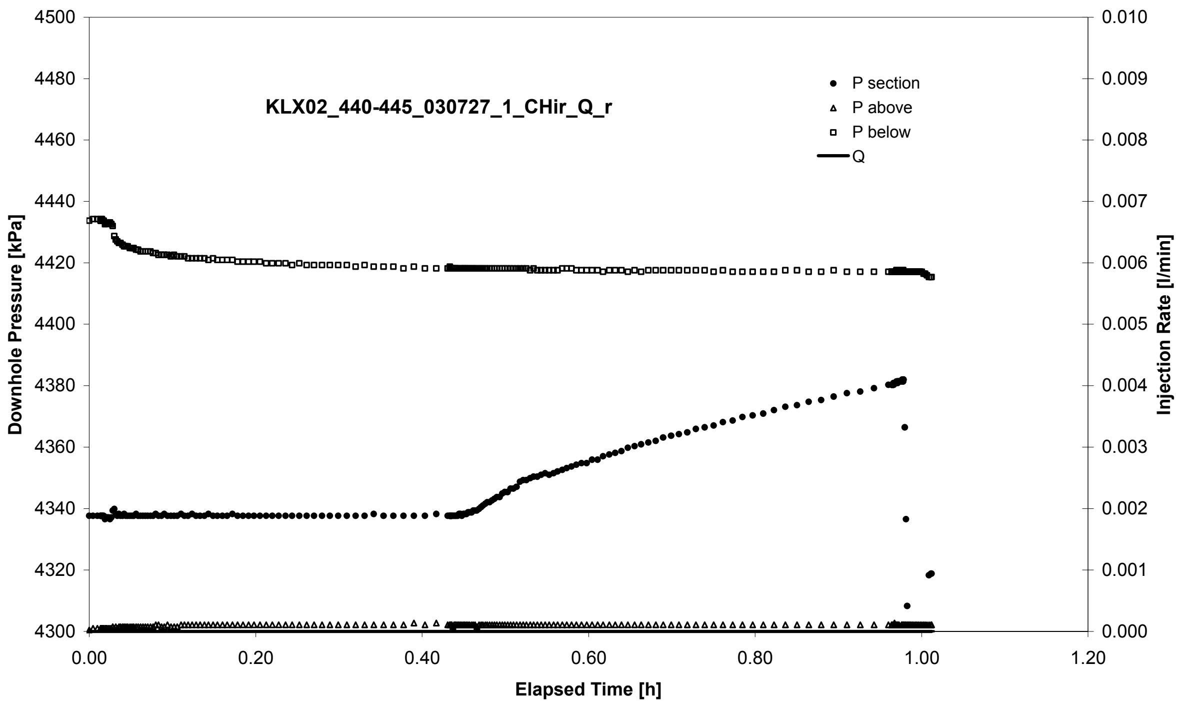


CHIR phase; Homogeneous model analyses, log-log match

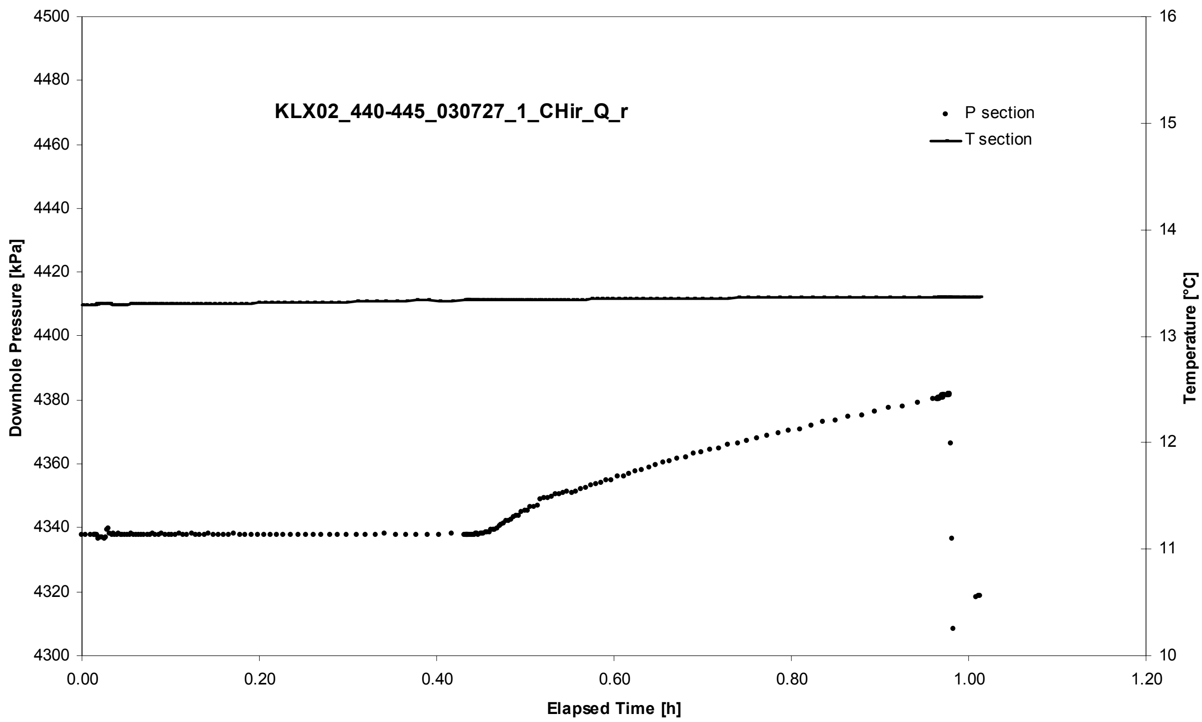
APPENDIX 2-62

Test 440 – 445 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

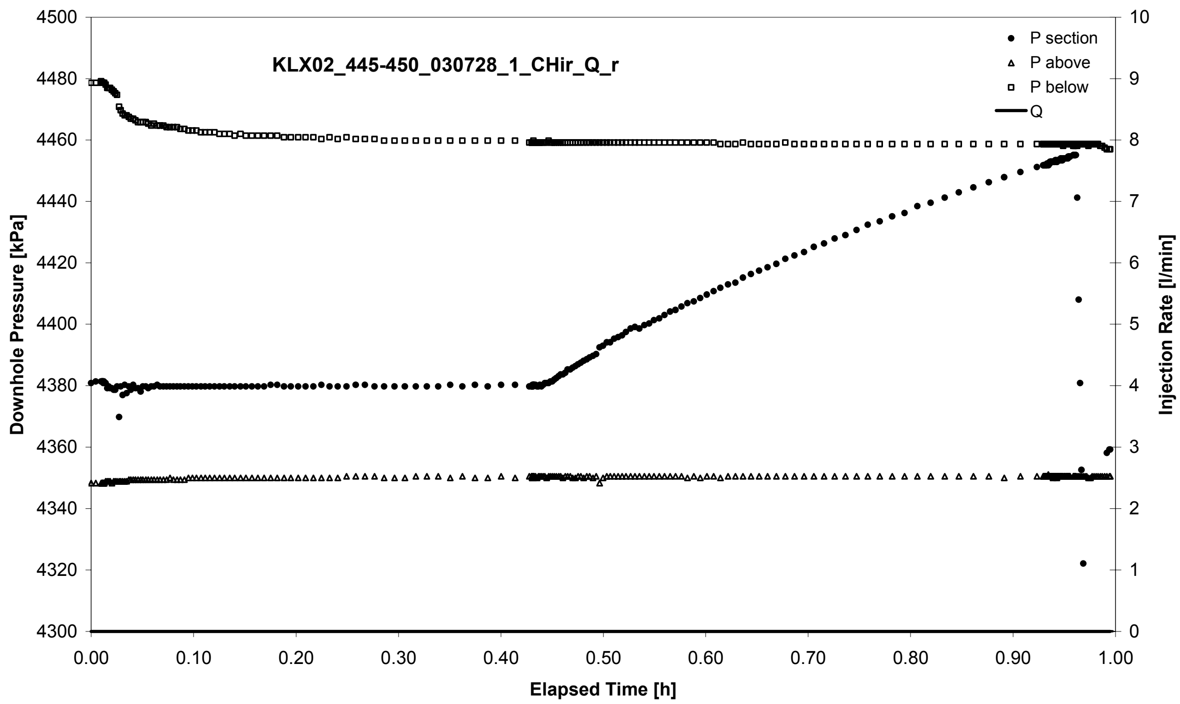
Not Analysed

CHIR phase; HORNER match

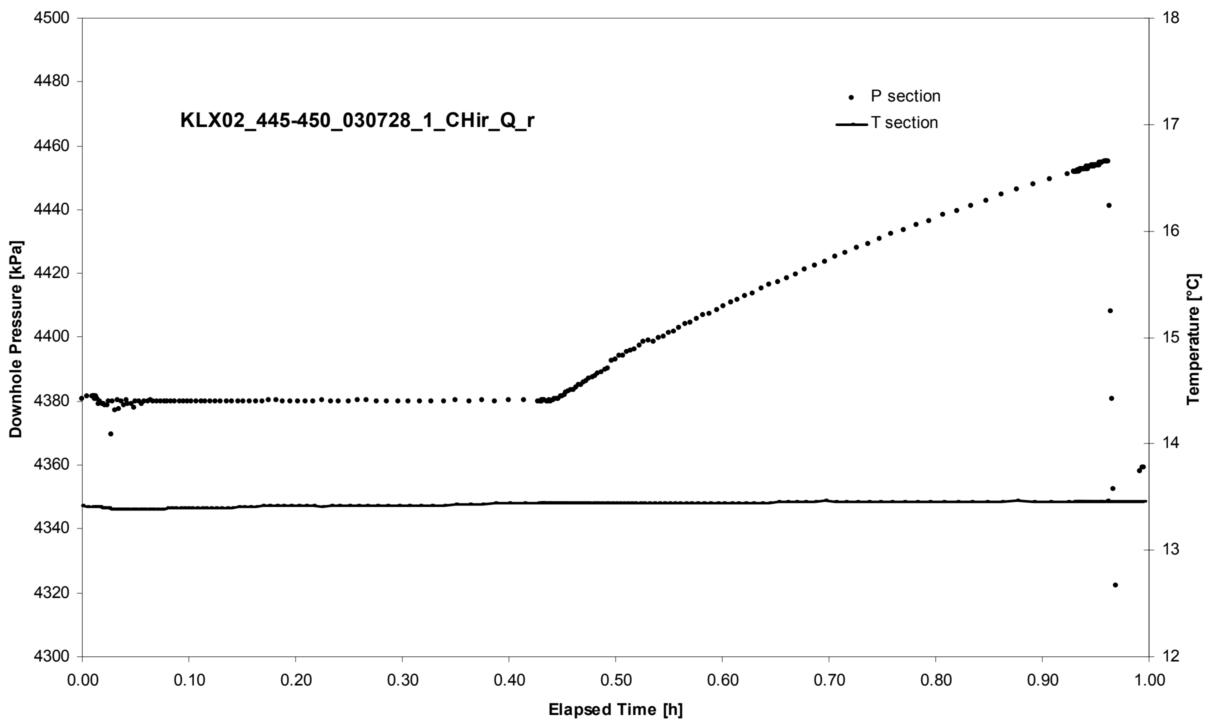
APPENDIX 2-63

Test 445 – 450 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

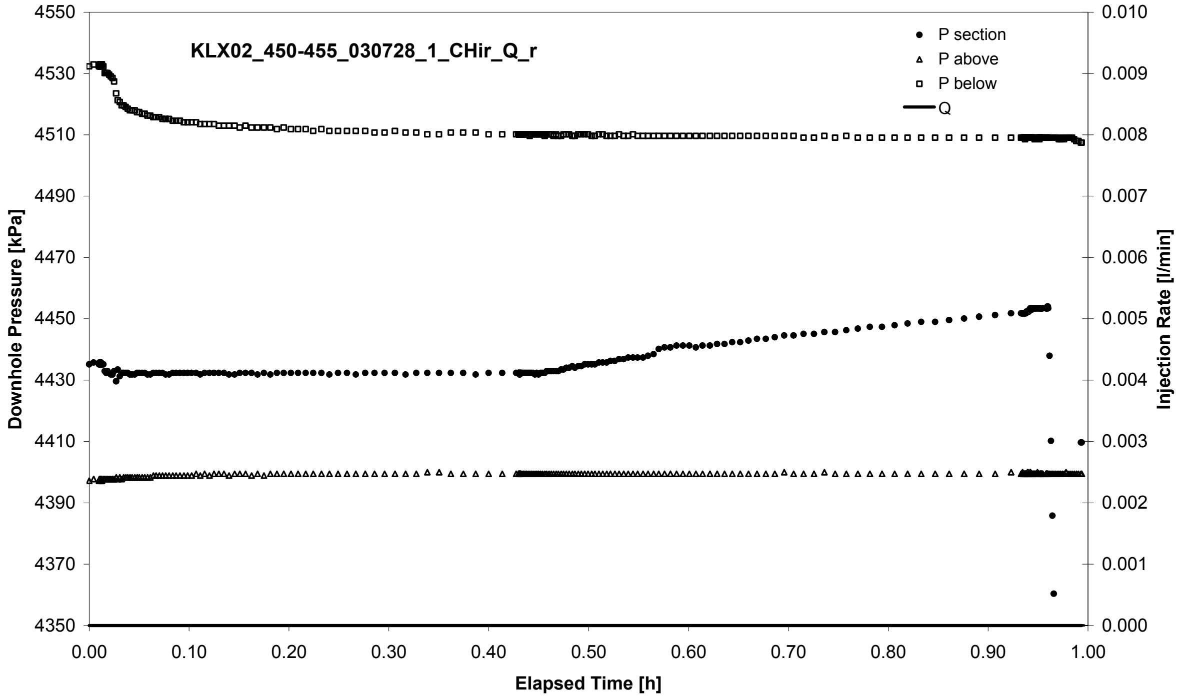
Not Analysed

CHIR phase; HORNER match

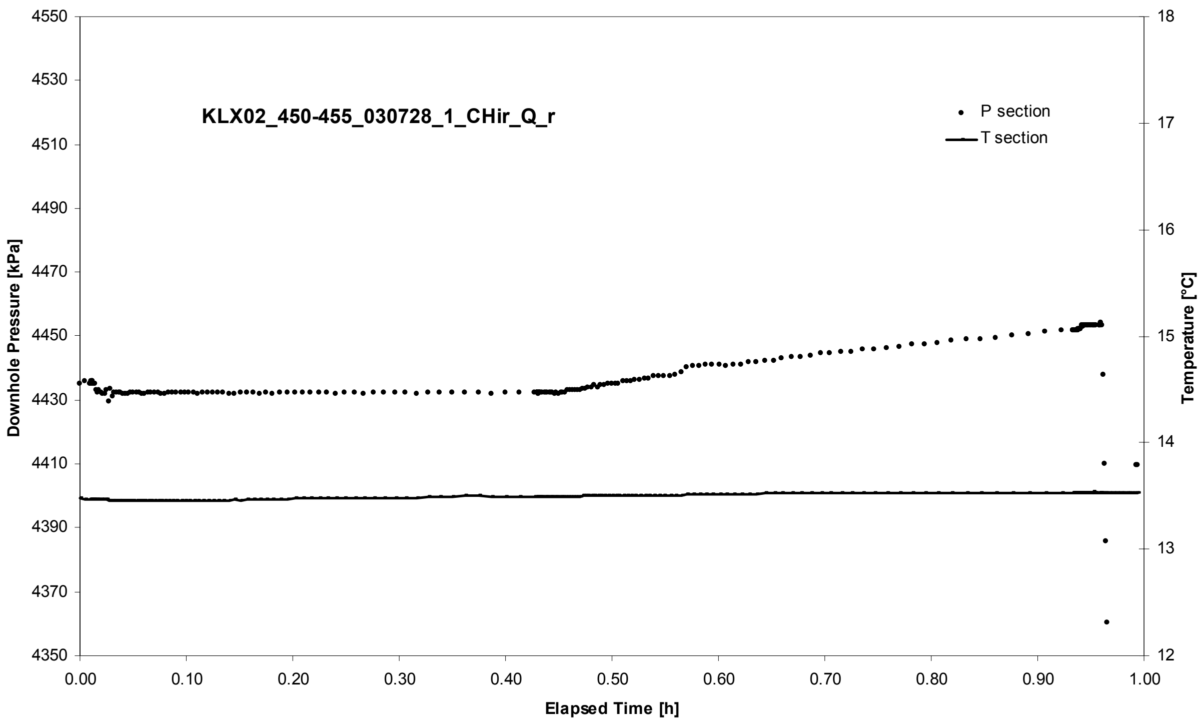
APPENDIX 2-64

Test 450 – 455 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

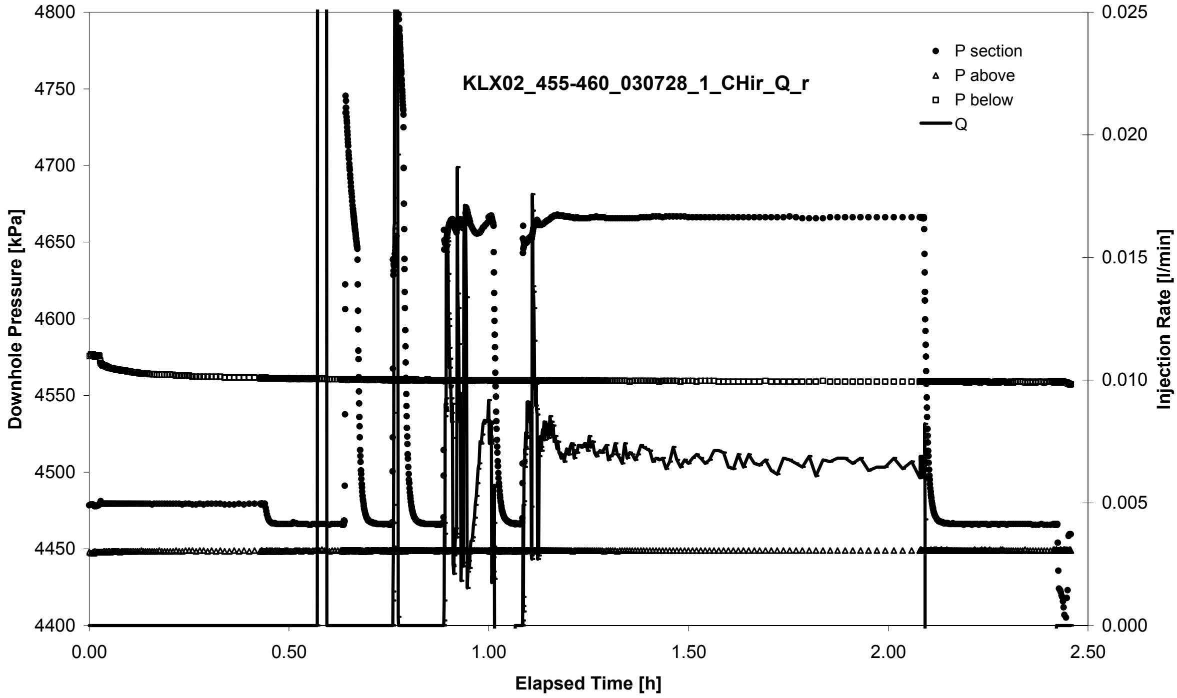
Not Analysed

CHIR phase; HORNER match

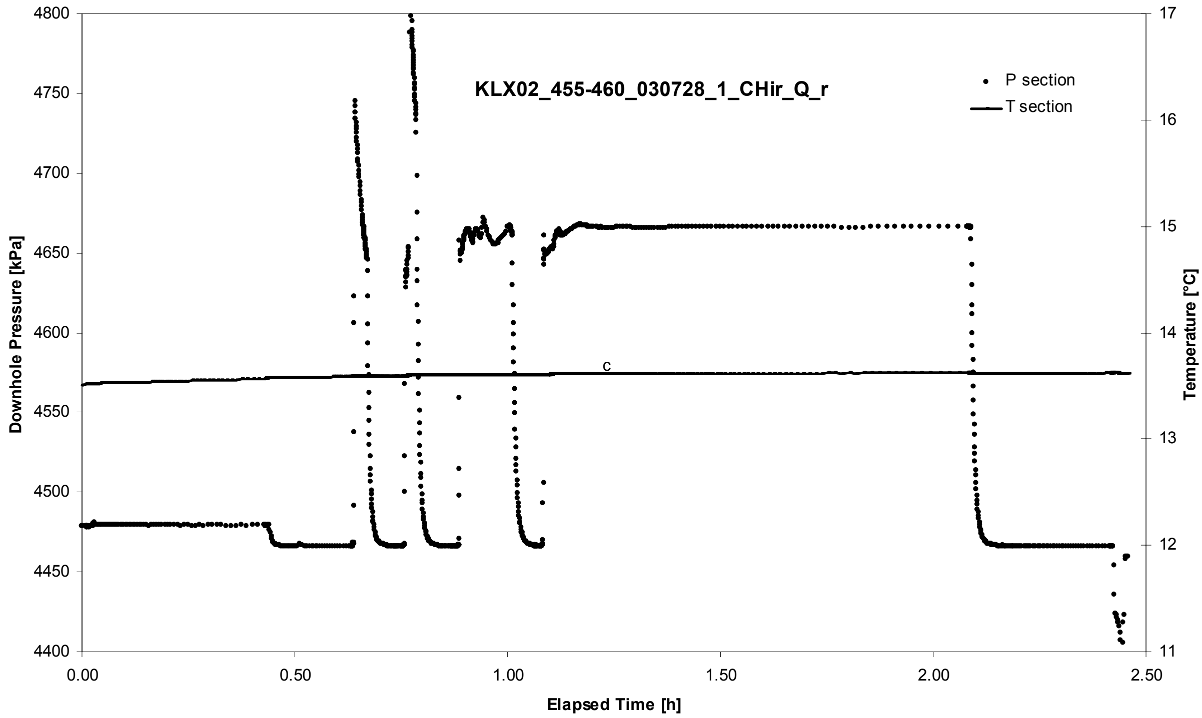
APPENDIX 2-65

Test 455 – 460 m

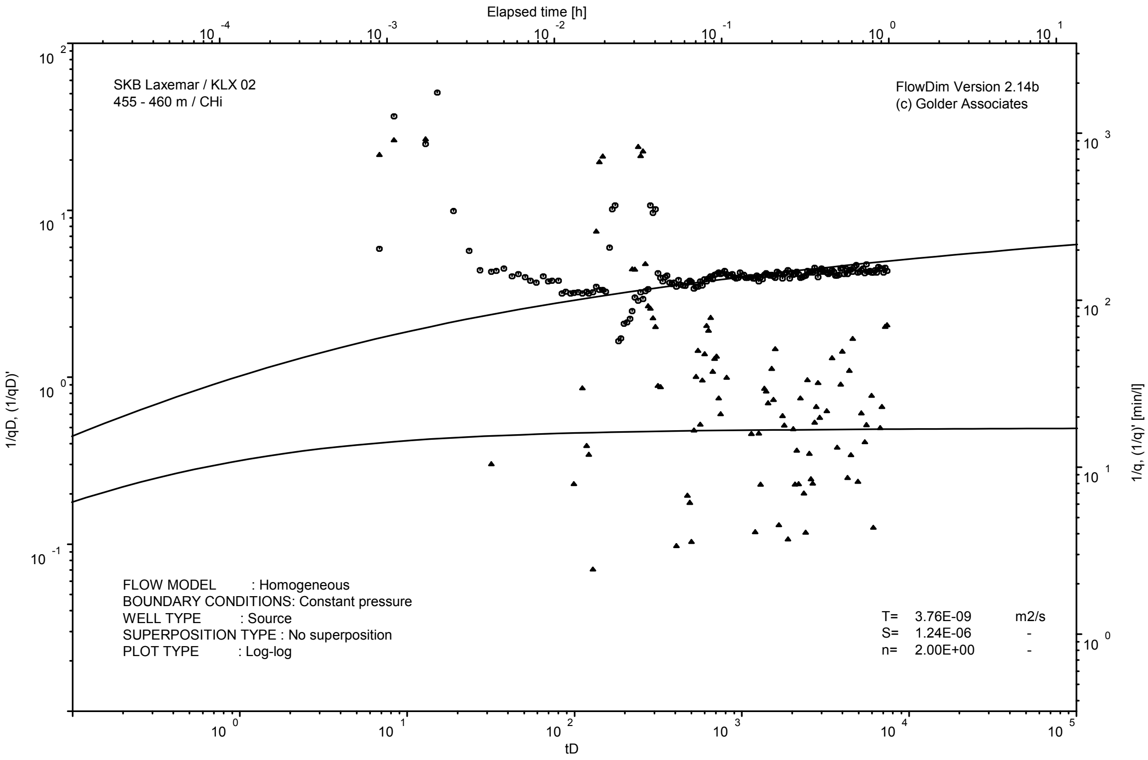
Analysis diagrams



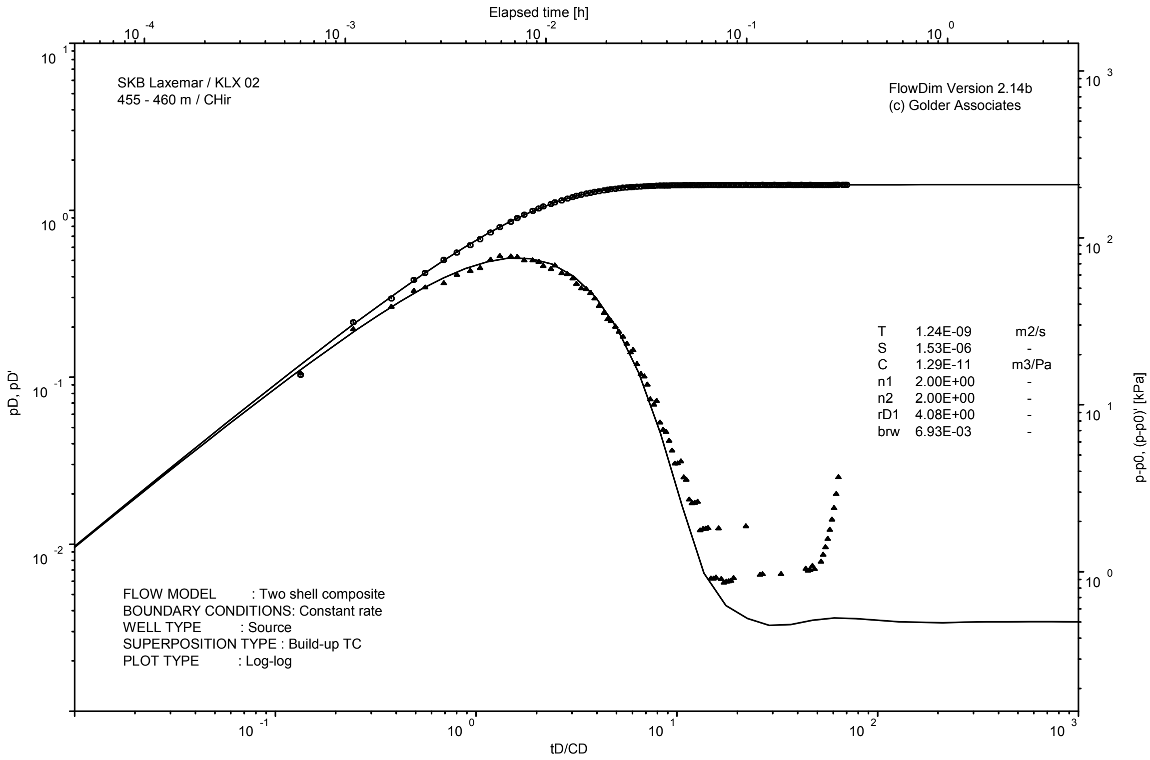
Pressure and flow rate vs. time; cartesian plot



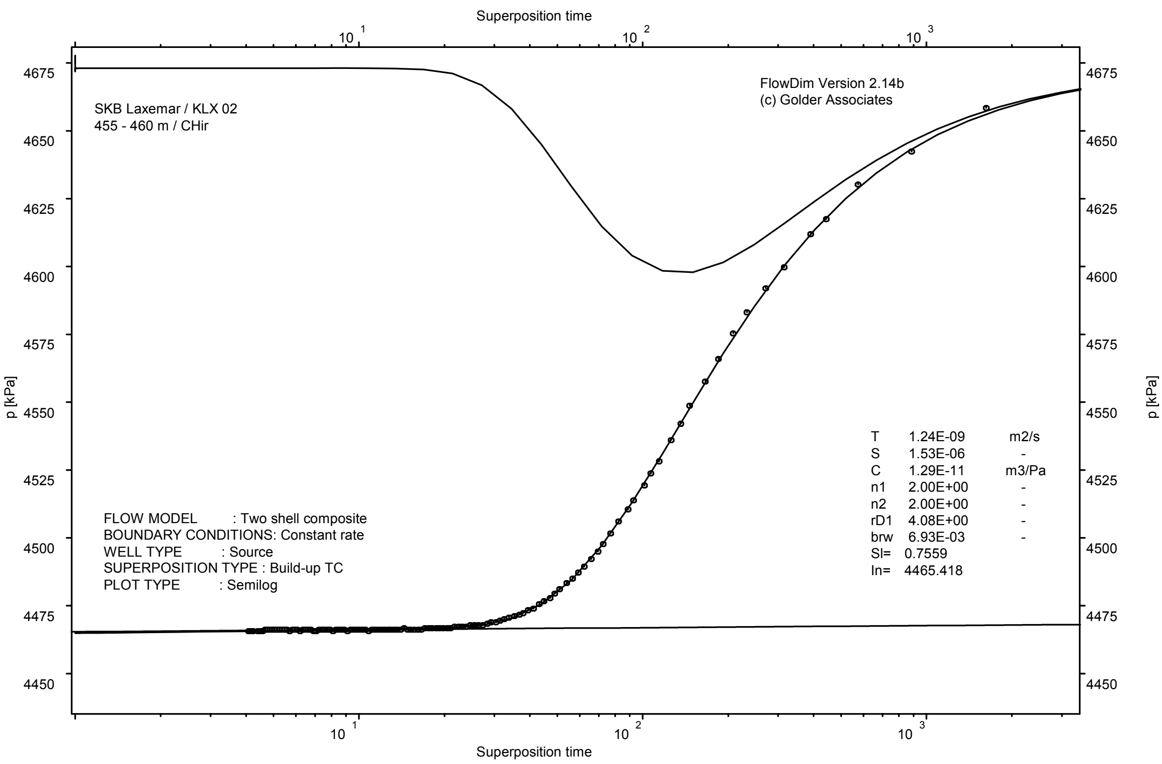
Pressure and temperature in the test section; cartesian plot



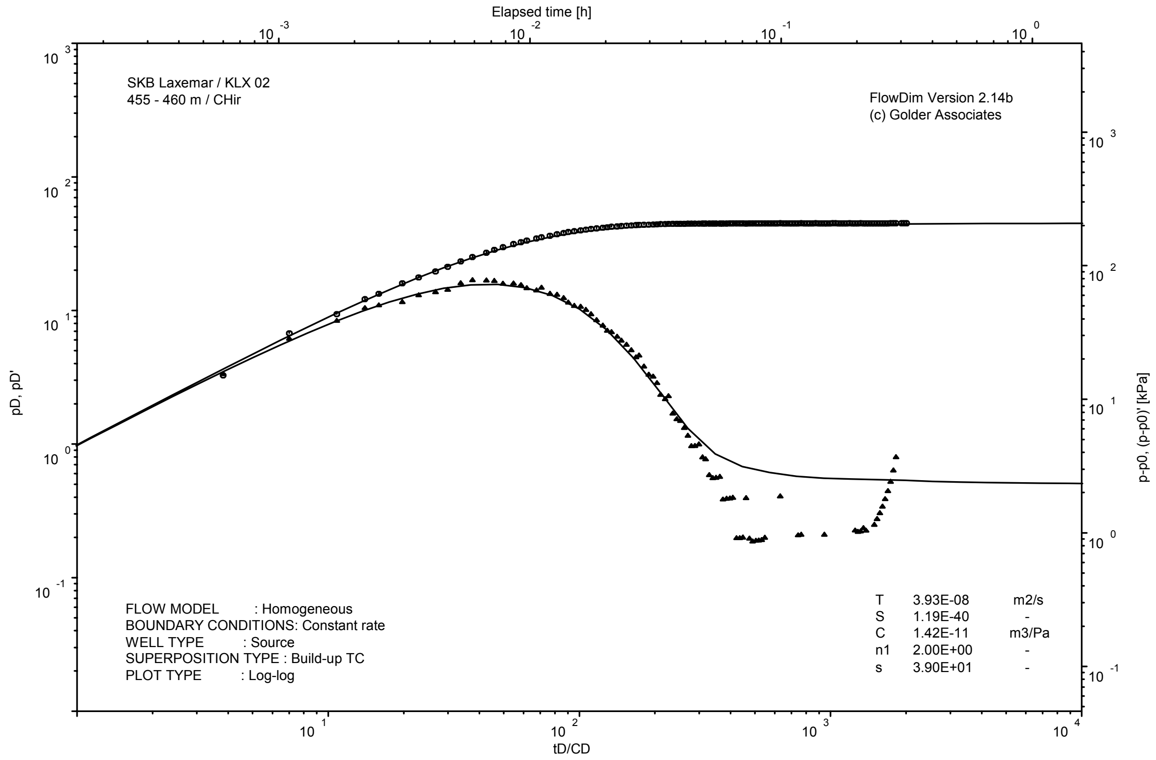
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

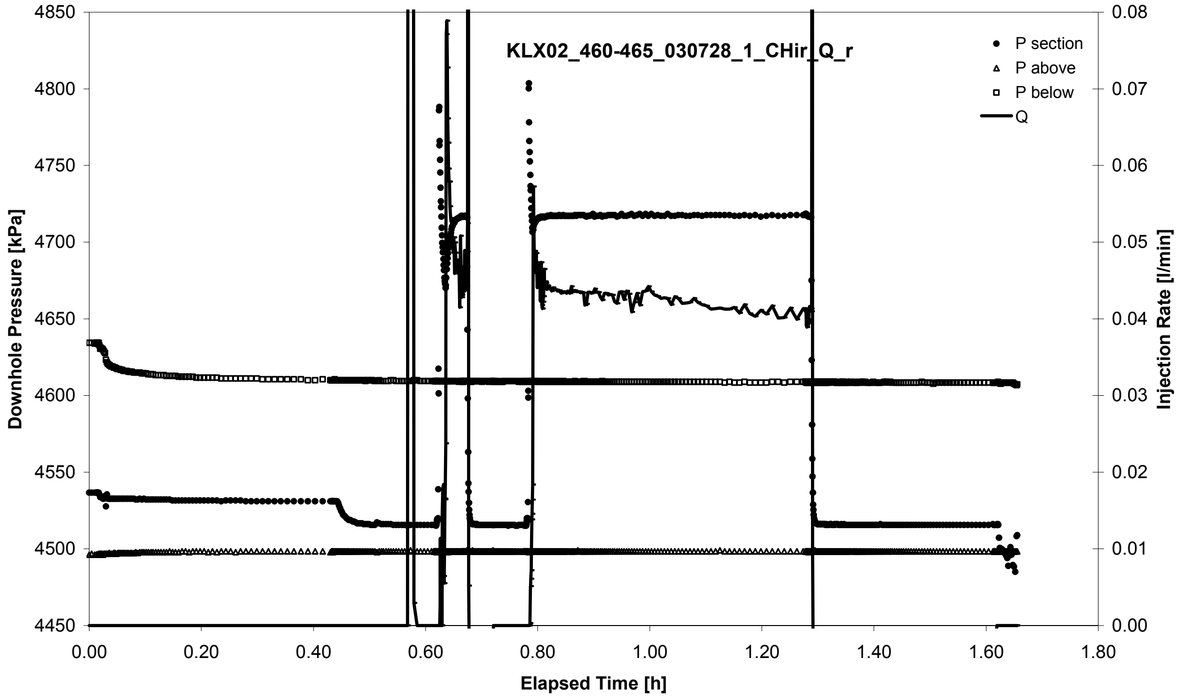


CHIR phase; Homogeneous model analyses, log-log match

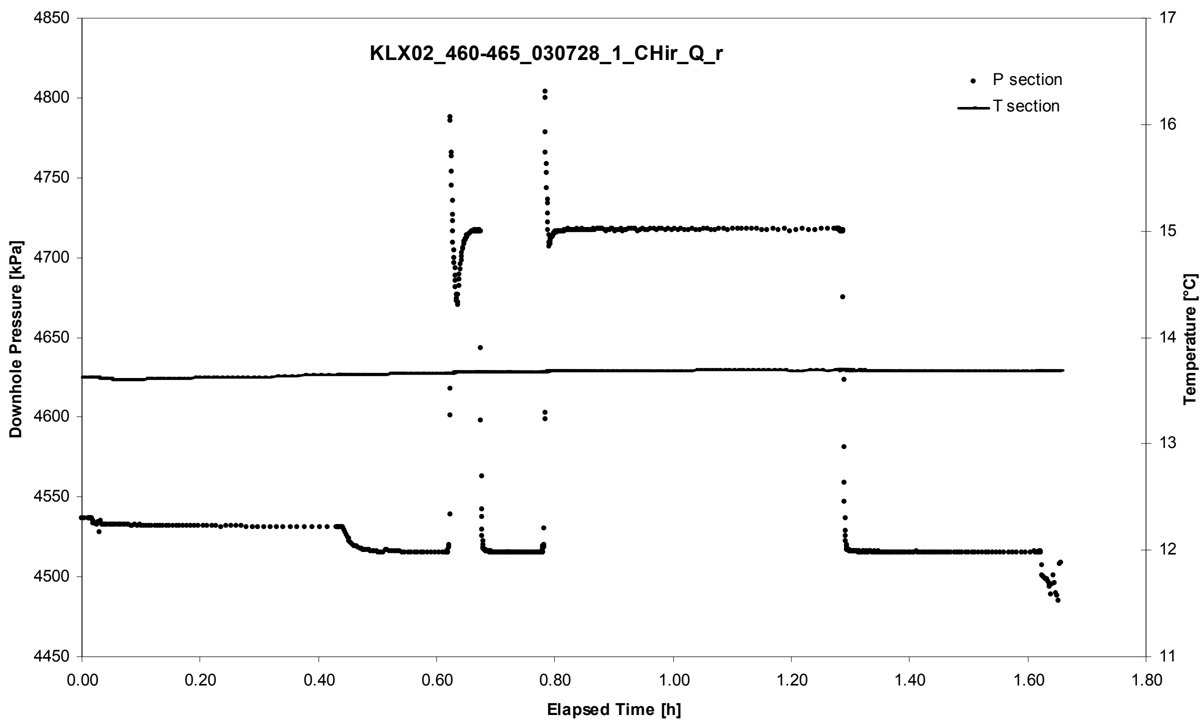
APPENDIX 2-66

Test 460 – 465 m

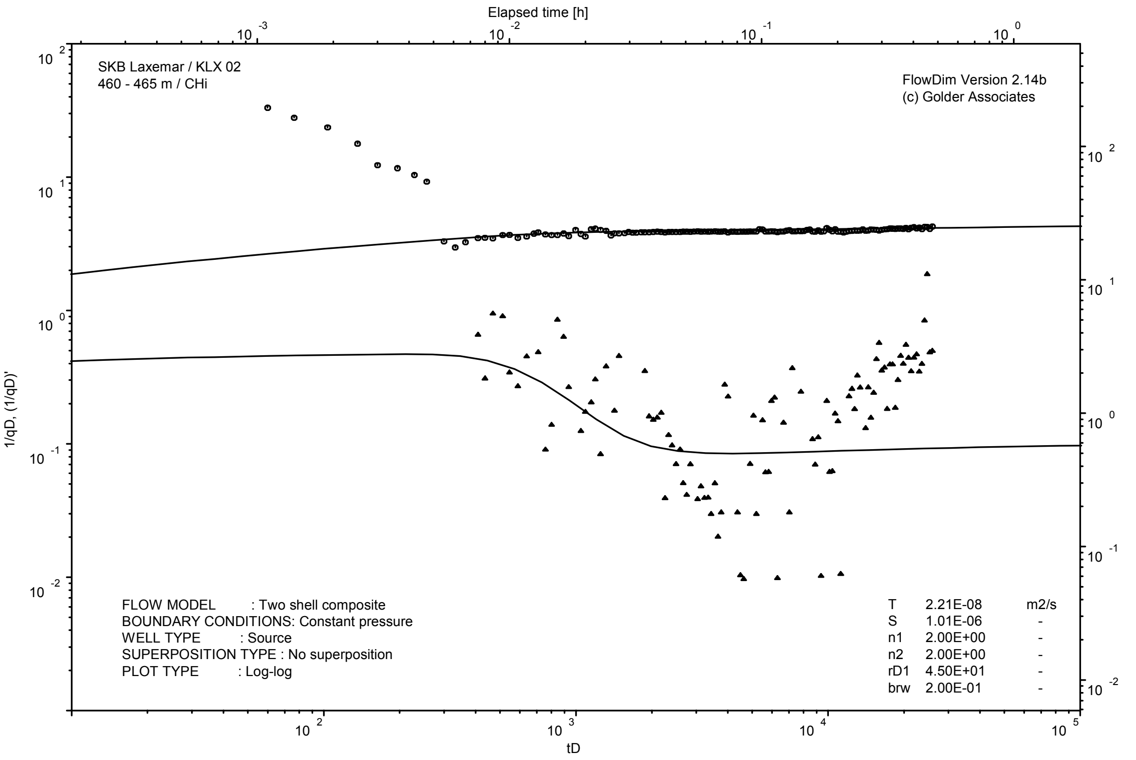
Analysis diagrams



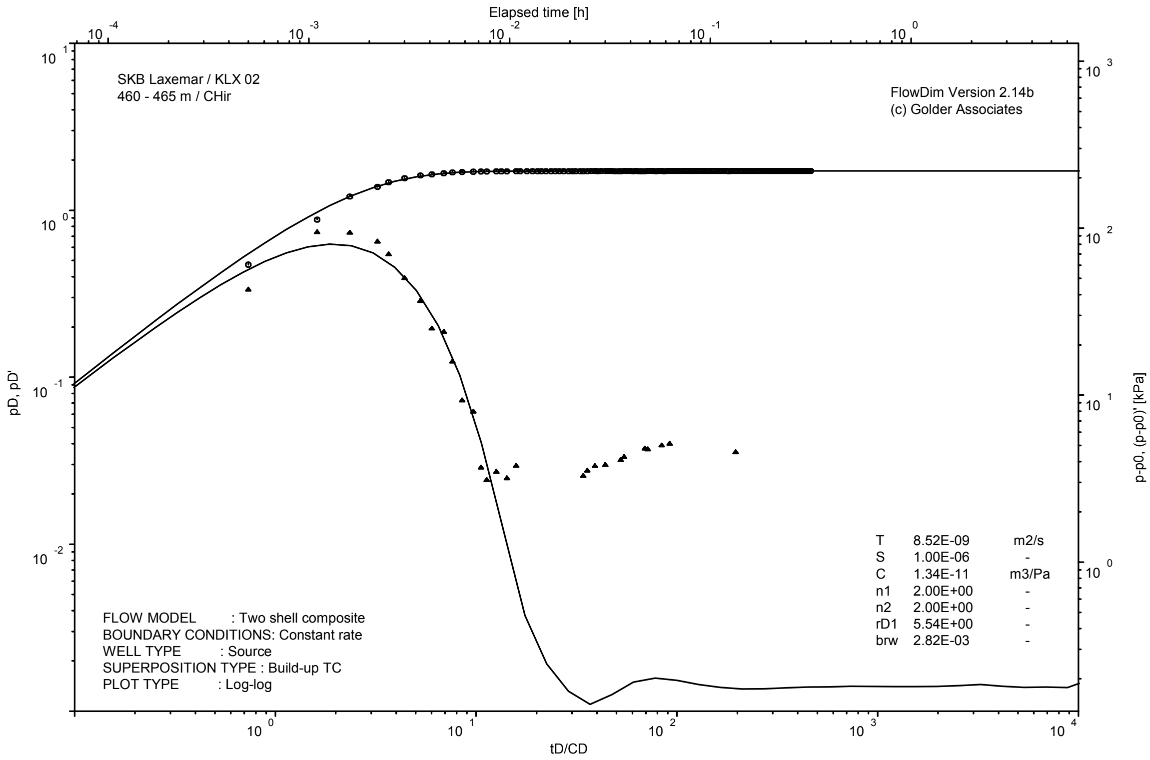
Pressure and flow rate vs. time; cartesian plot



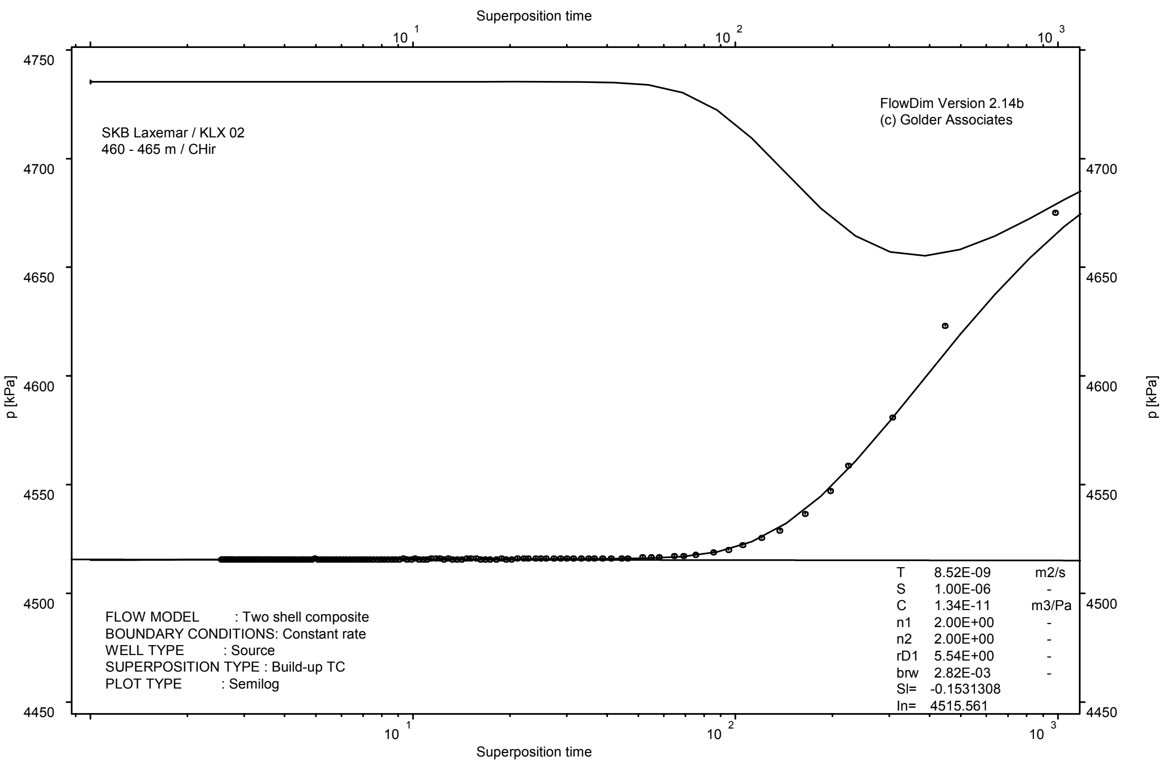
Pressure and temperature in the test section; cartesian plot



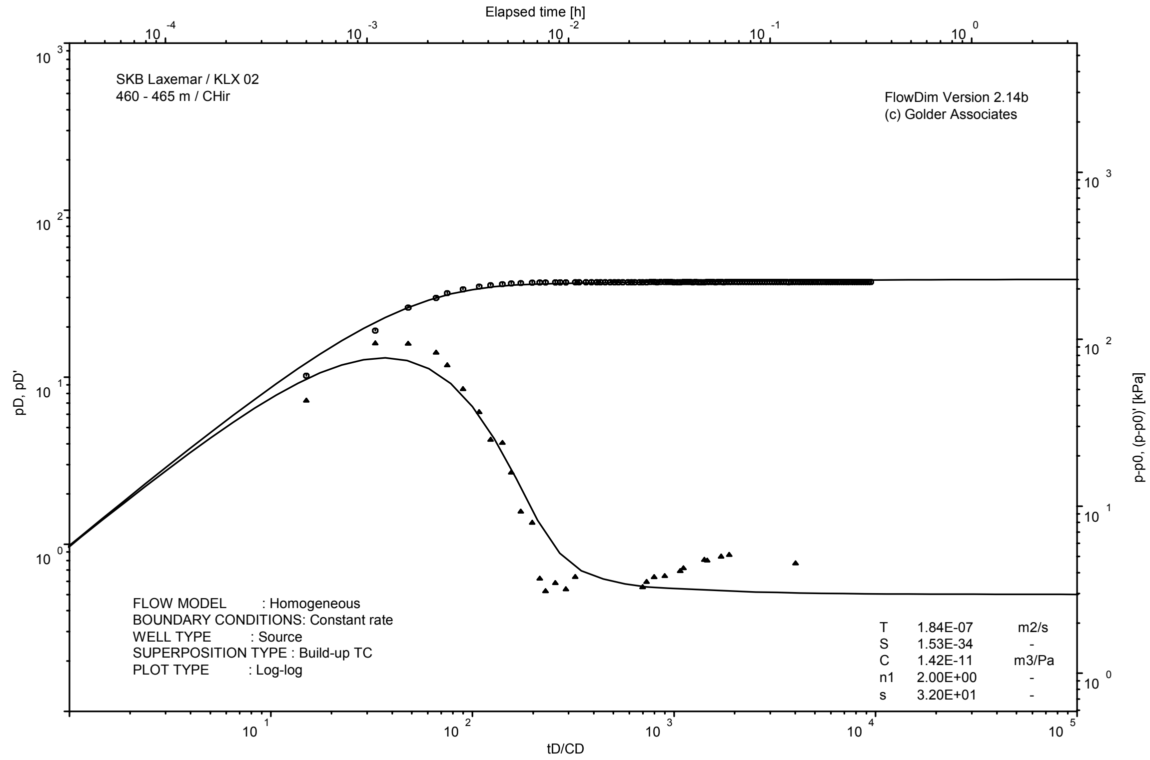
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

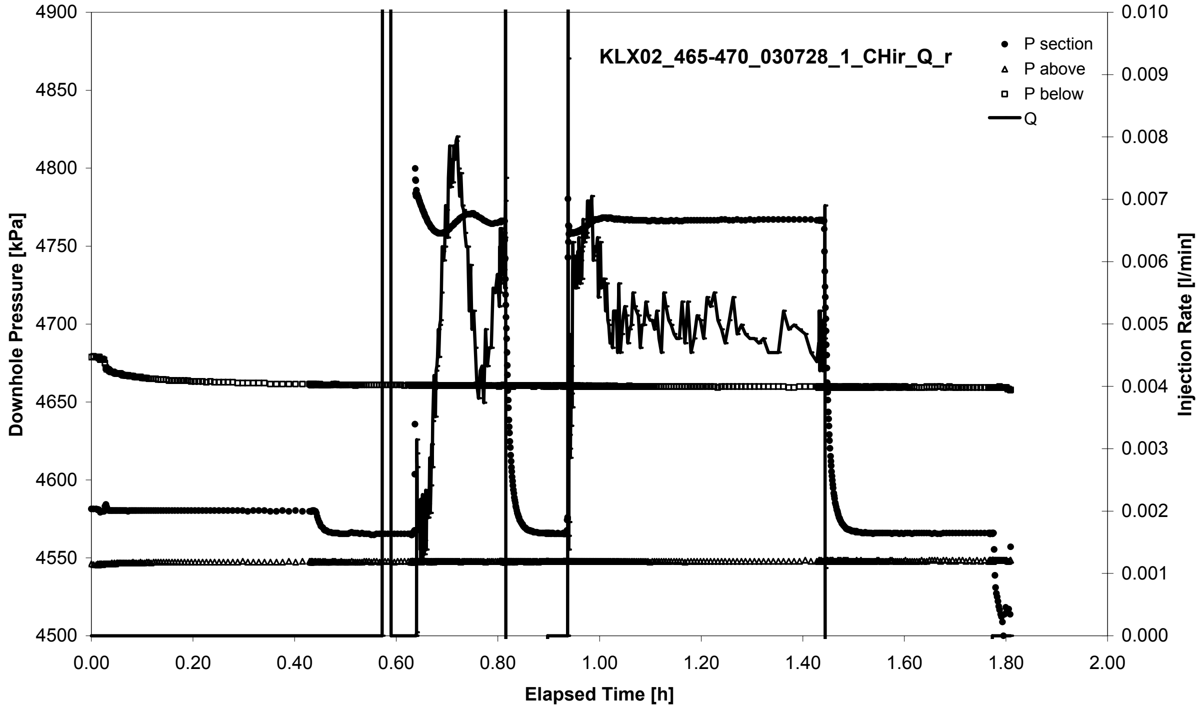


CHIR phase; Homogeneous model analyses, log-log match

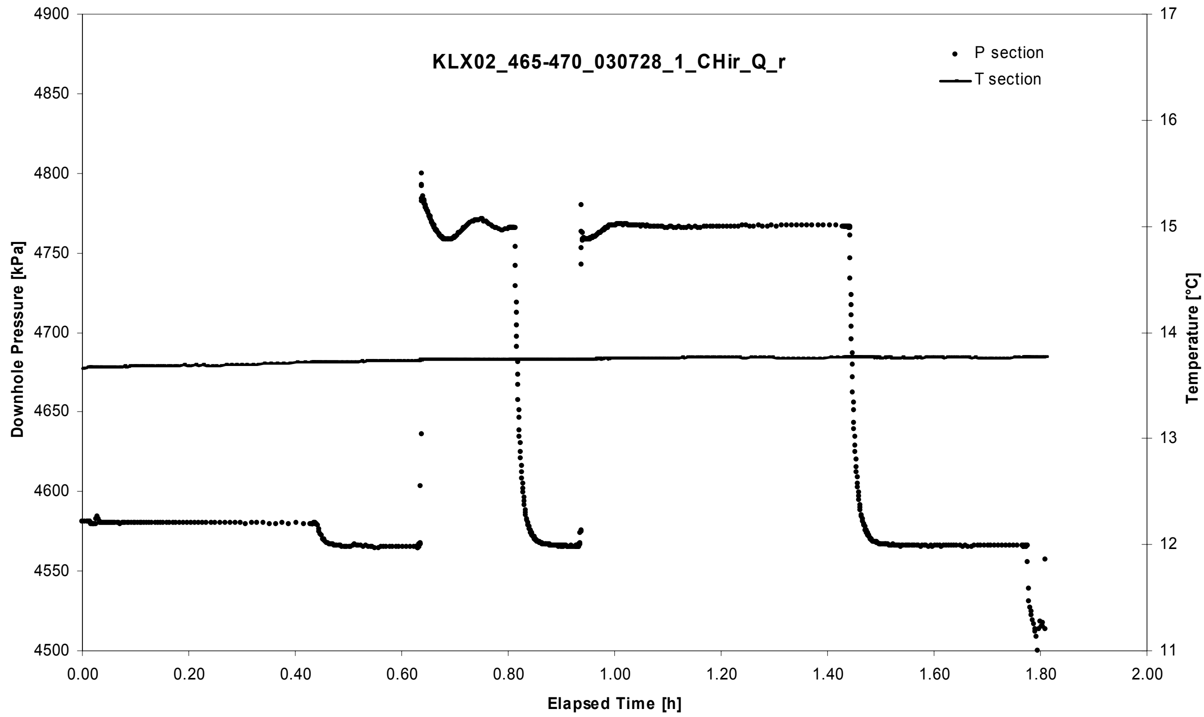
APPENDIX 2-67

Test 465 – 470 m

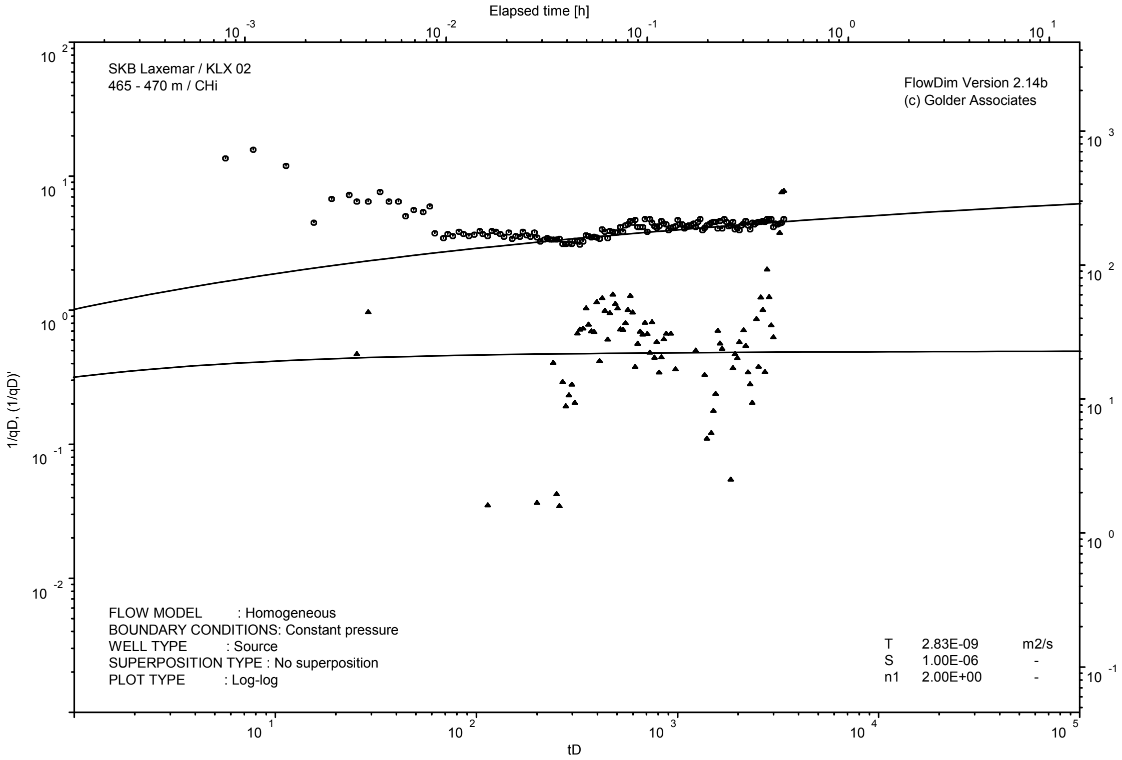
Analysis diagrams



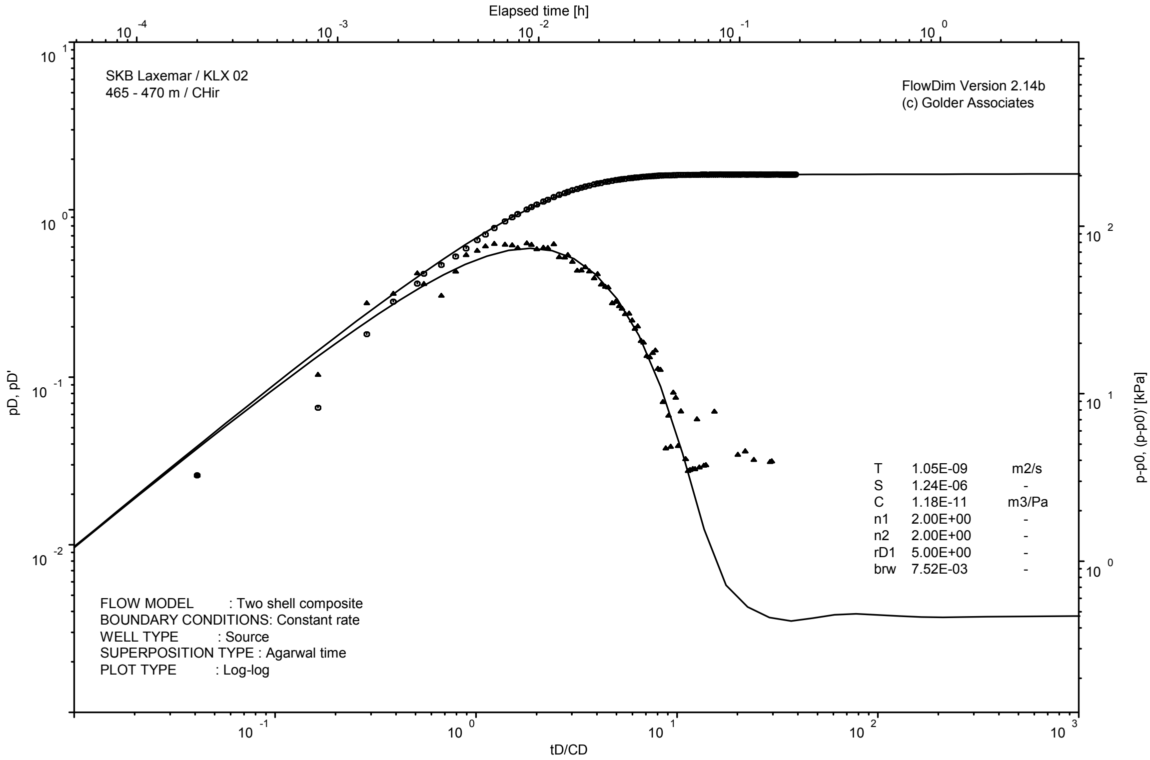
Pressure and flow rate vs. time; cartesian plot



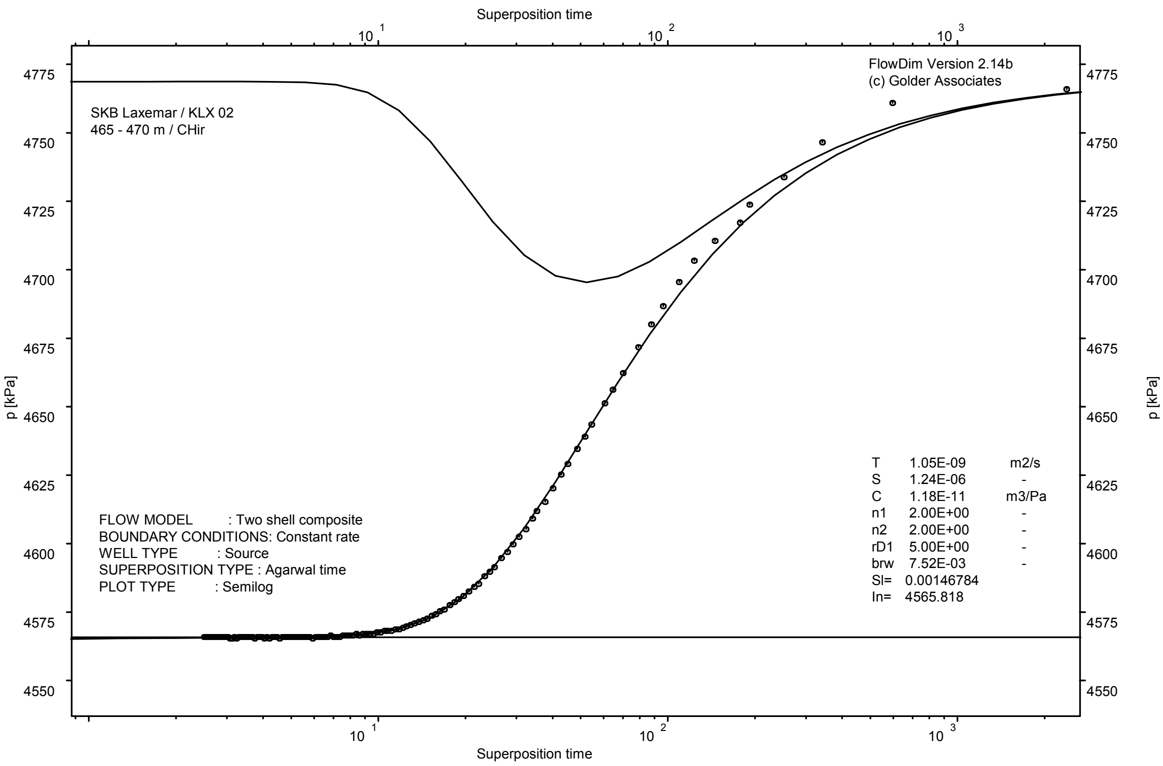
Pressure and temperature in the test section; cartesian plot



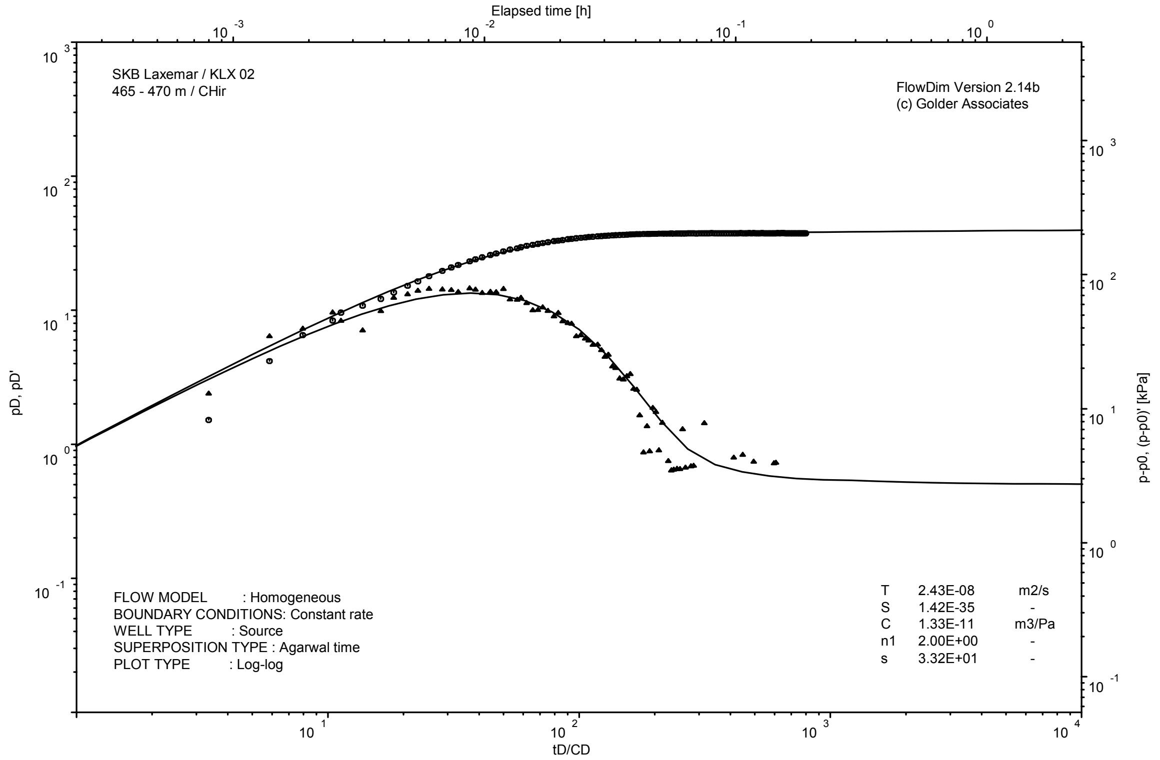
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

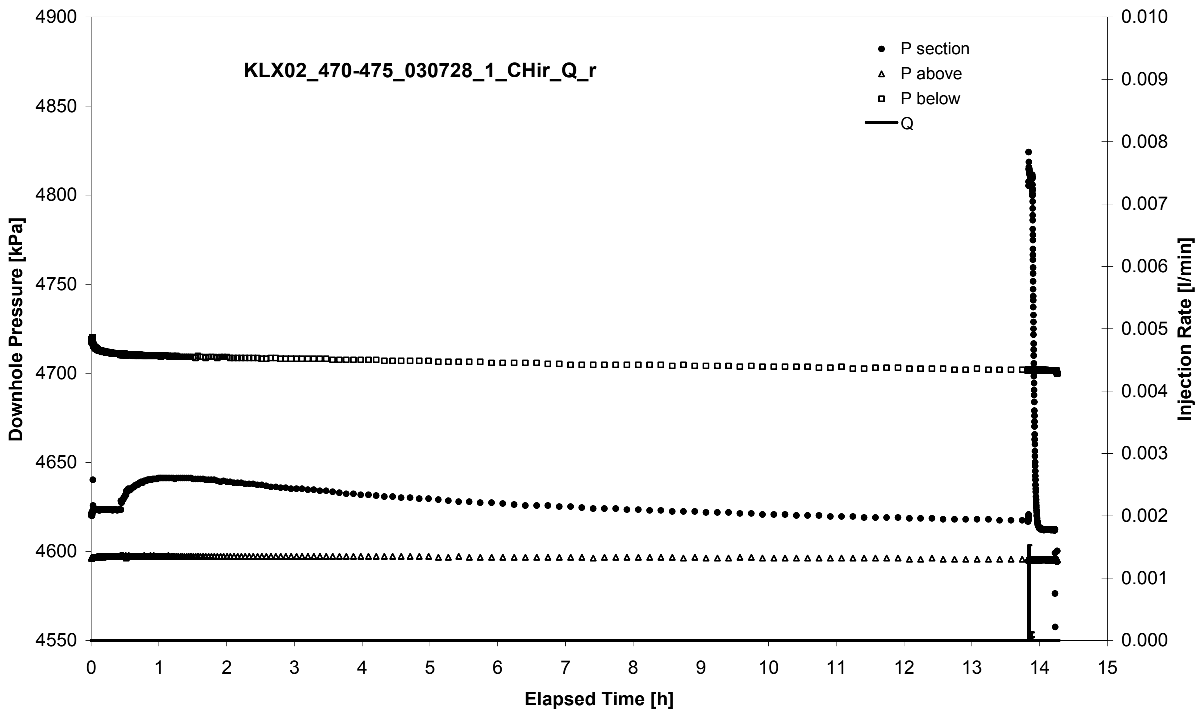


CHIR phase; Homogeneous model analyses, log-log match

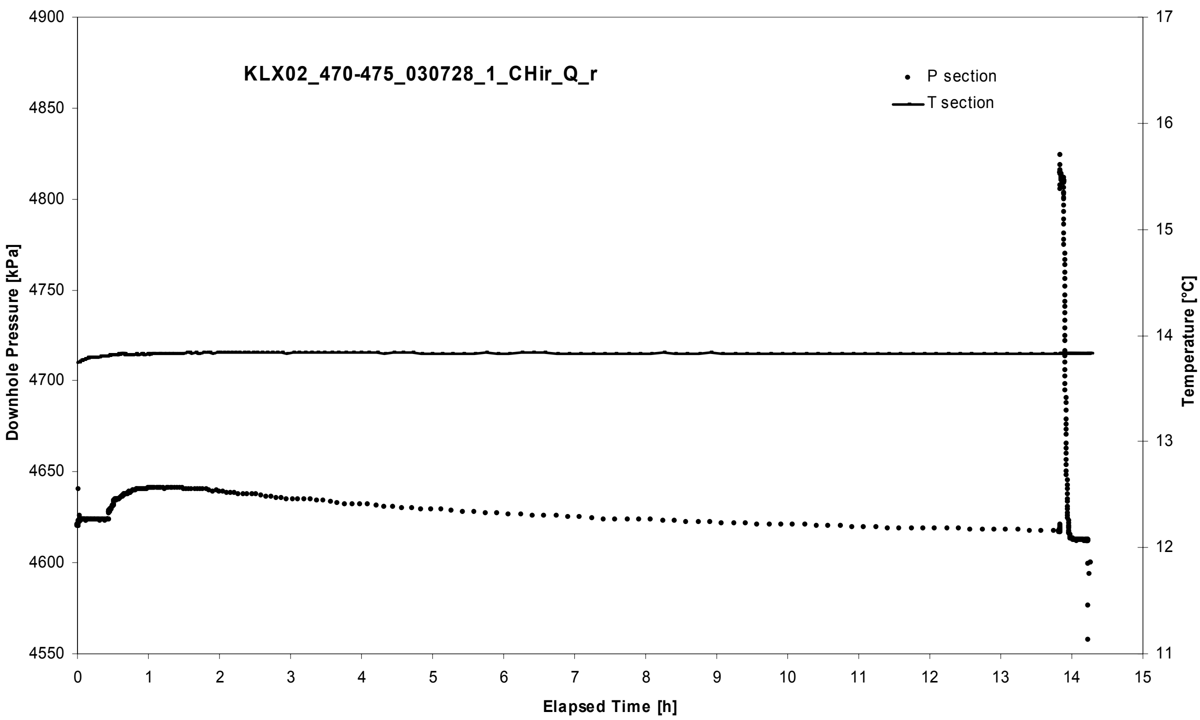
APPENDIX 2-68

Test 470 – 475 m

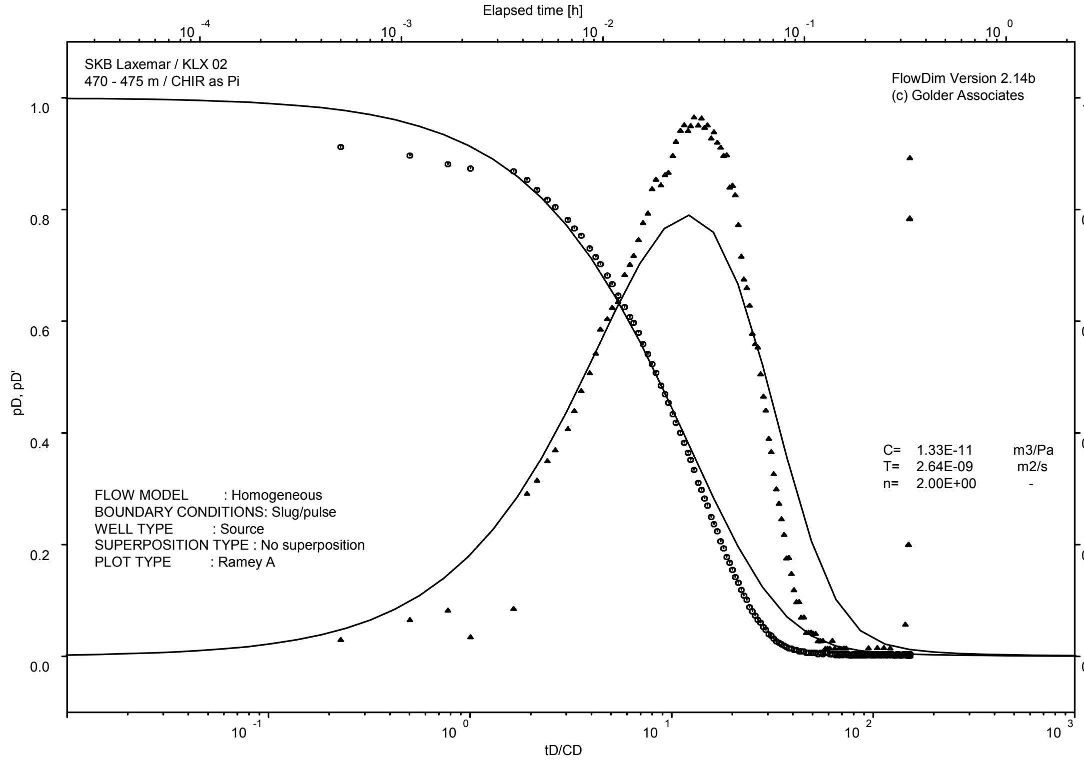
Analysis diagrams



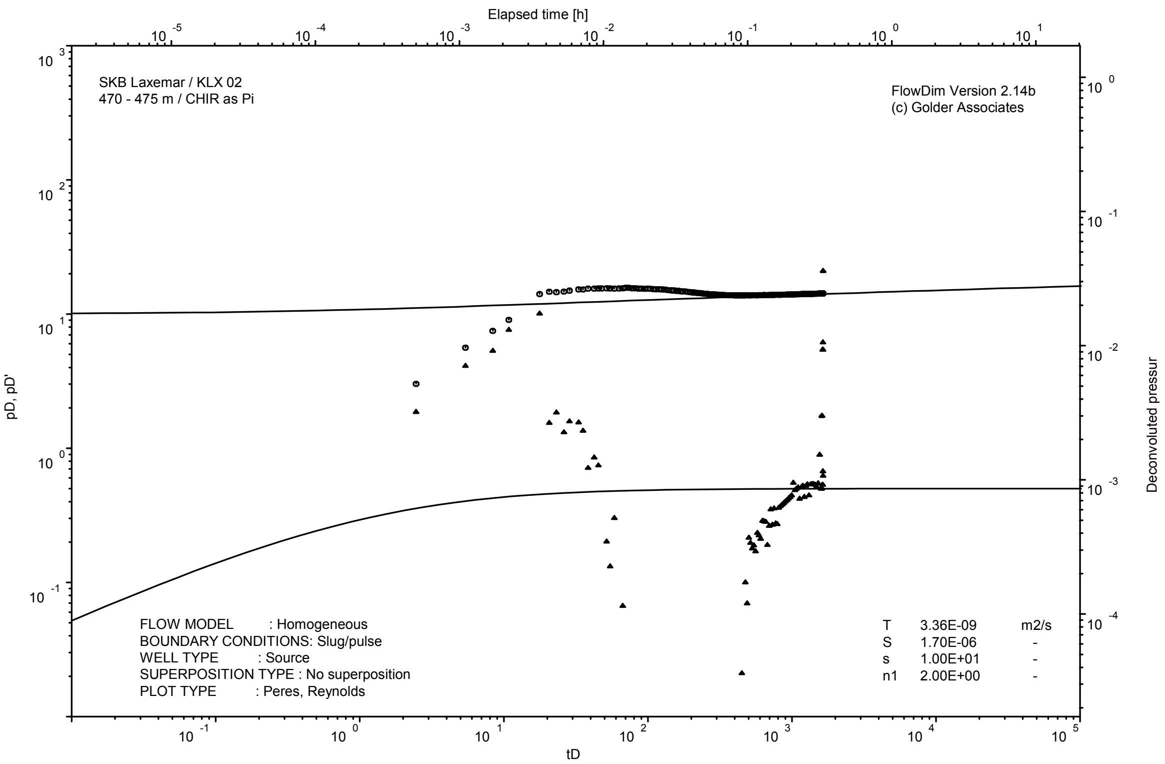
Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot



CHIR phase; RAMEY match

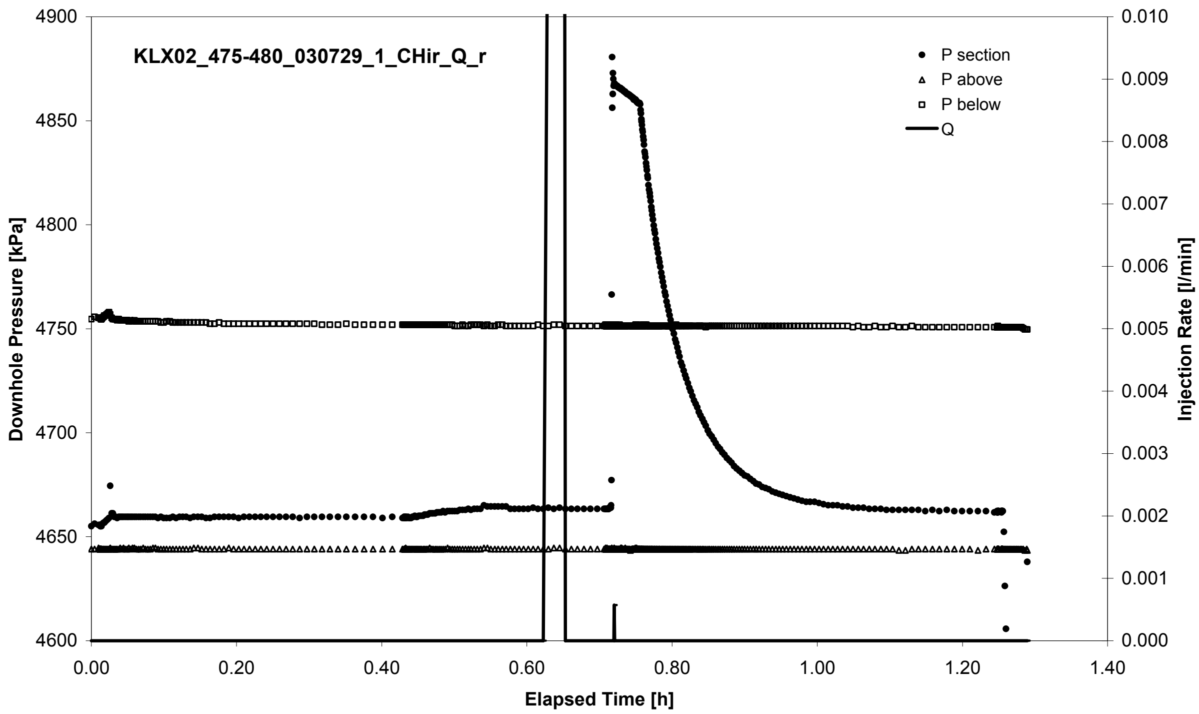


CHIR phase analysed as pulse injection; deconvolution match

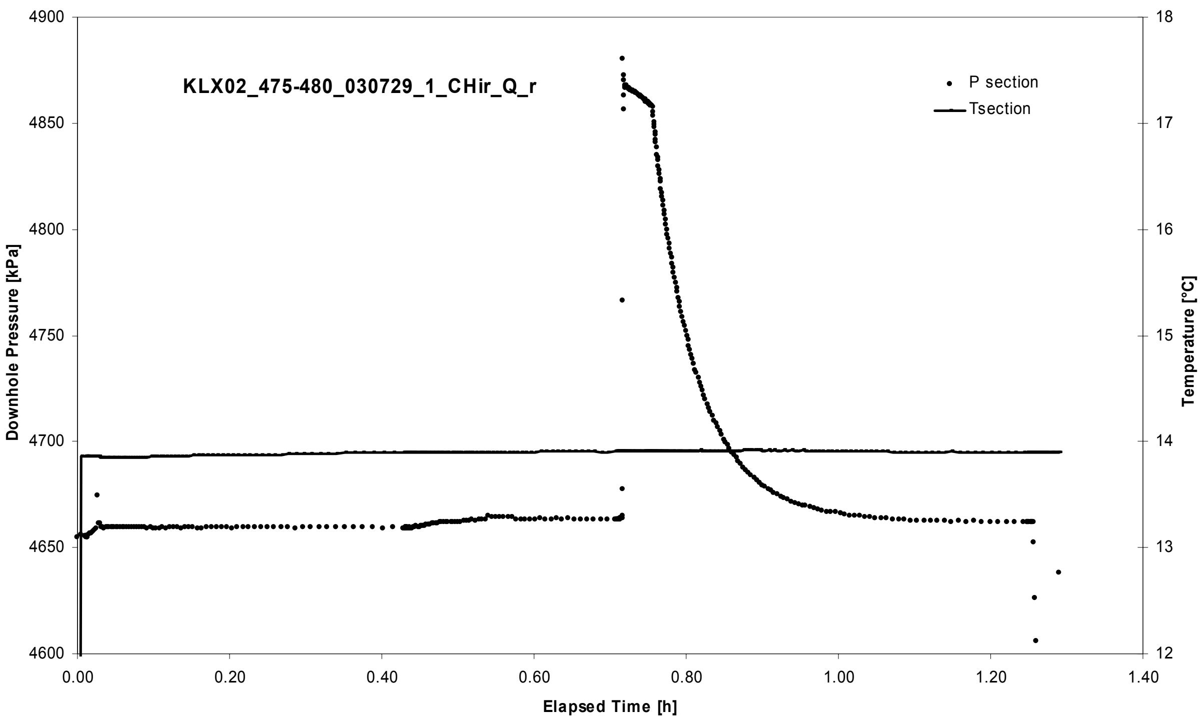
APPENDIX 2-69

Test 475 – 480 m

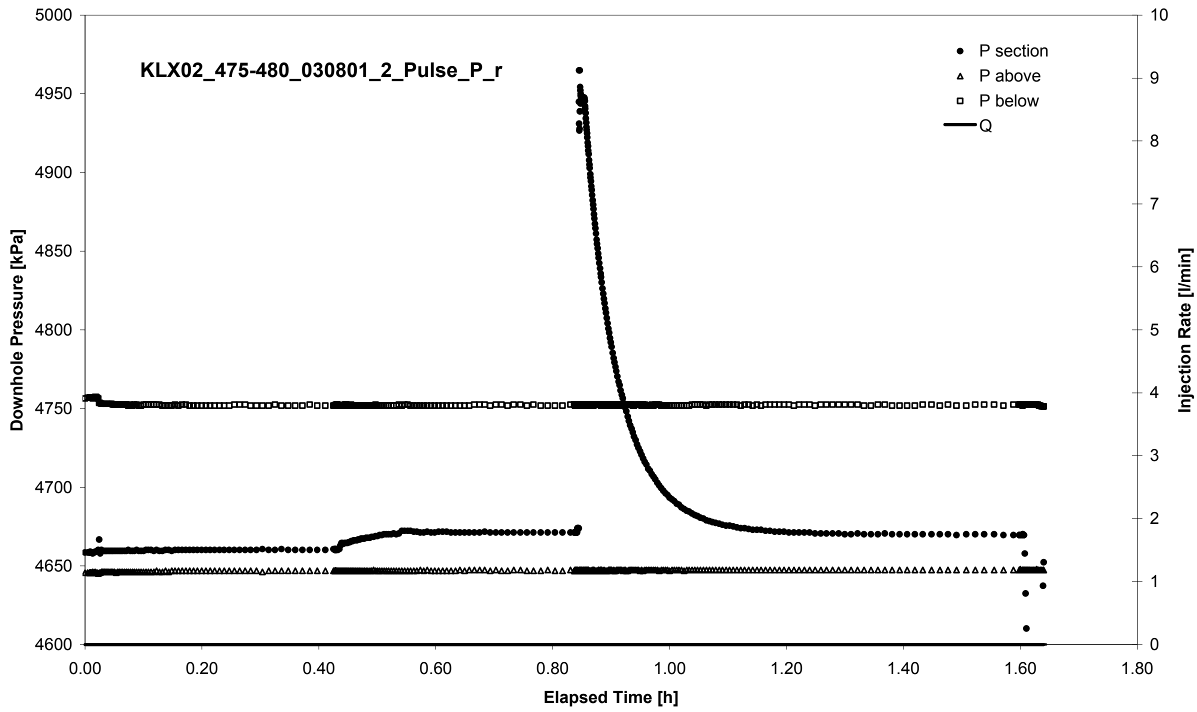
Analysis diagrams



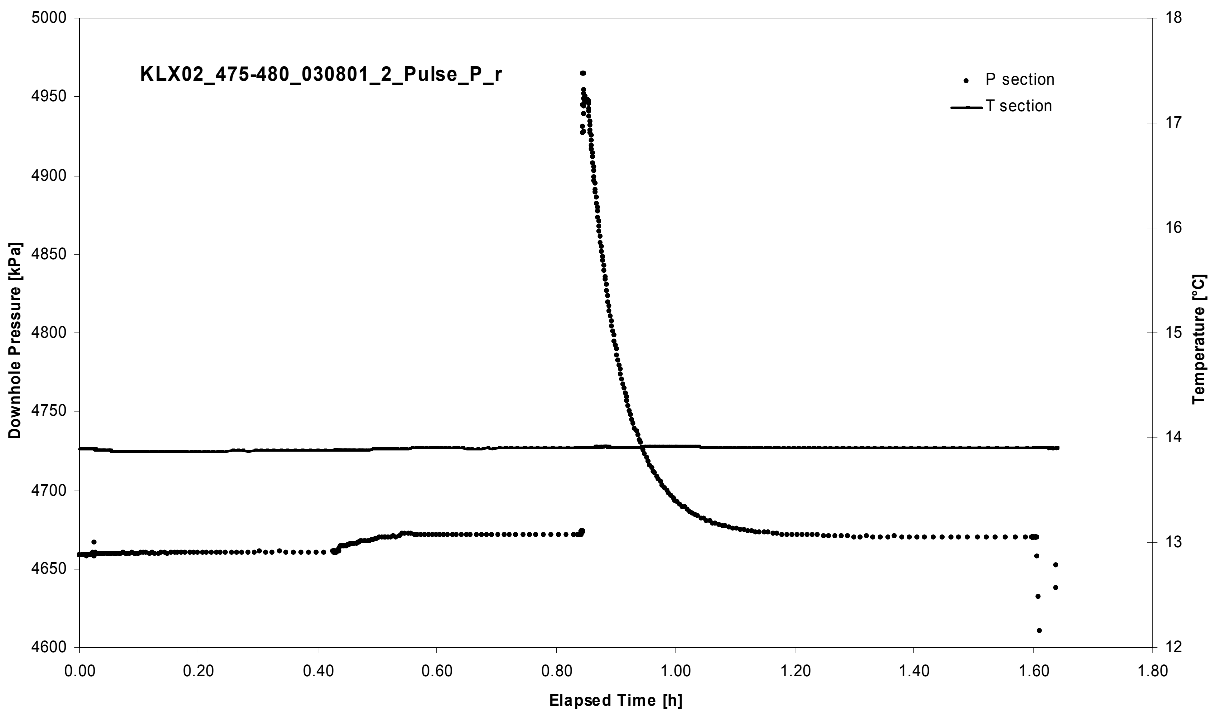
Pressure and flow rate vs. time; cartesian plot (test repeated)



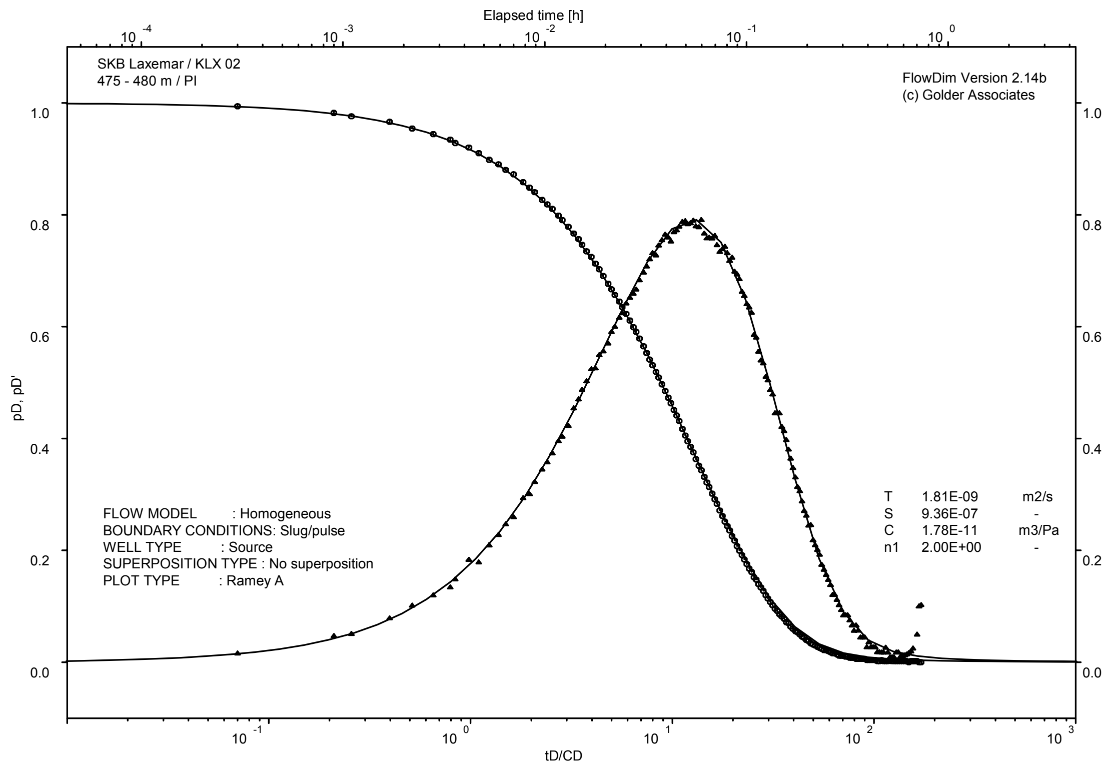
Pressure and temperature in the test section; cartesian plot (test repeated)



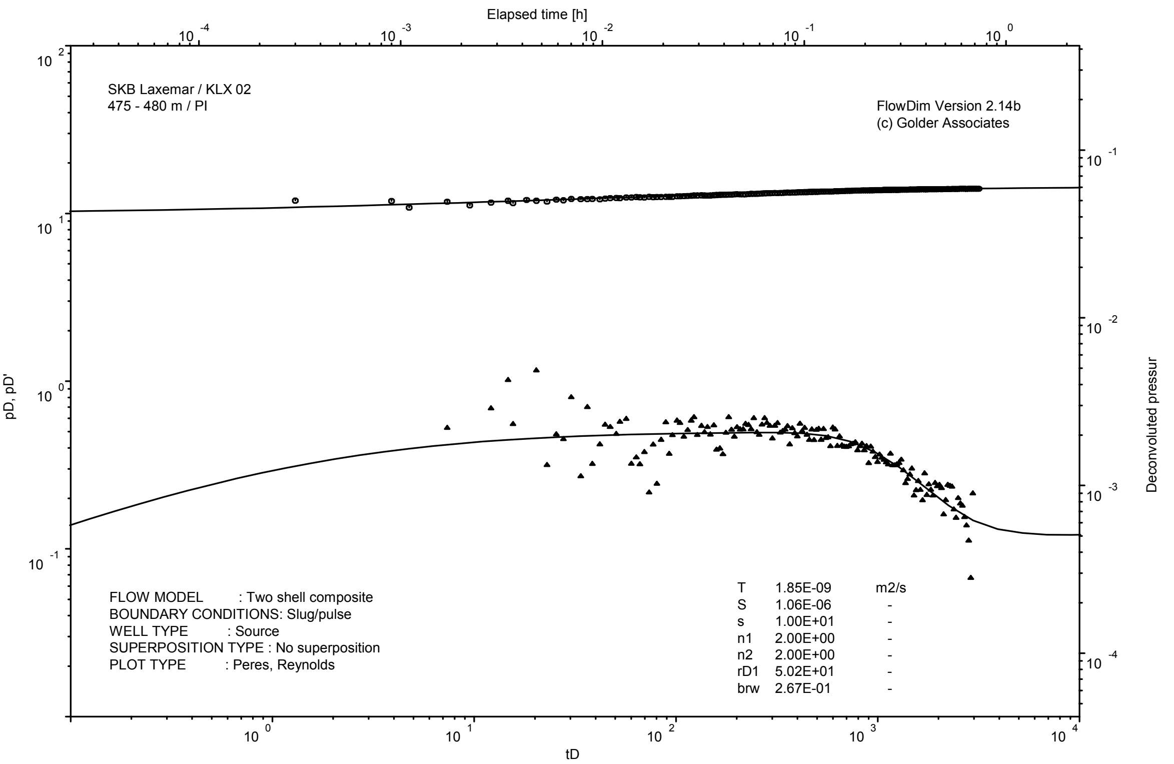
Pressure and flow rate vs. time; cartesian plot (analysed)



Pressure and temperature in the test section; cartesian plot (analysed)



CHIR phase; RAMEY match

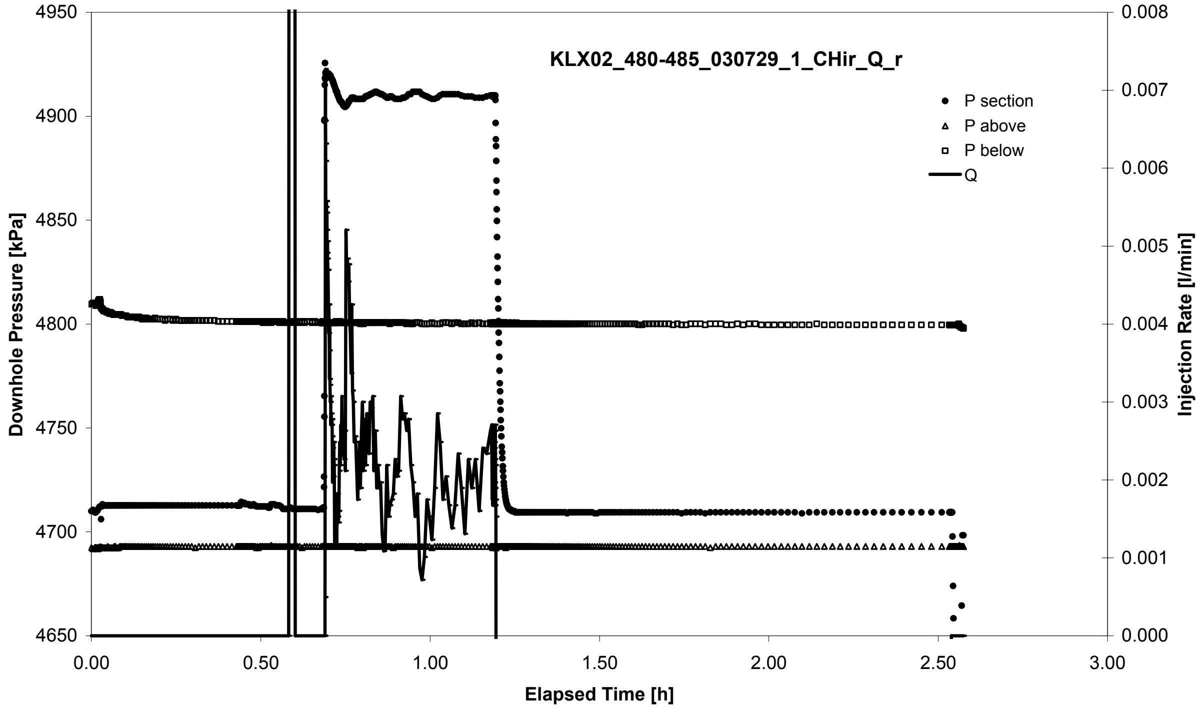


CHIR phase analysed as pulse injection; deconvolution match

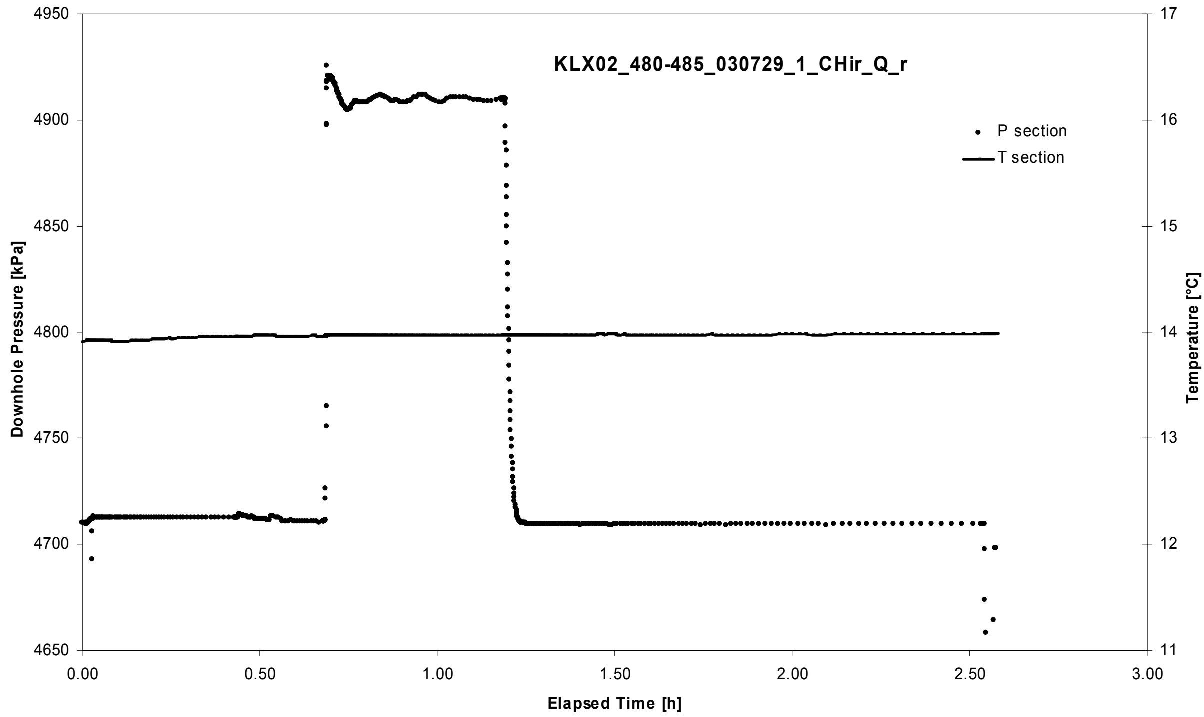
APPENDIX 2-70

Test 480 – 485 m

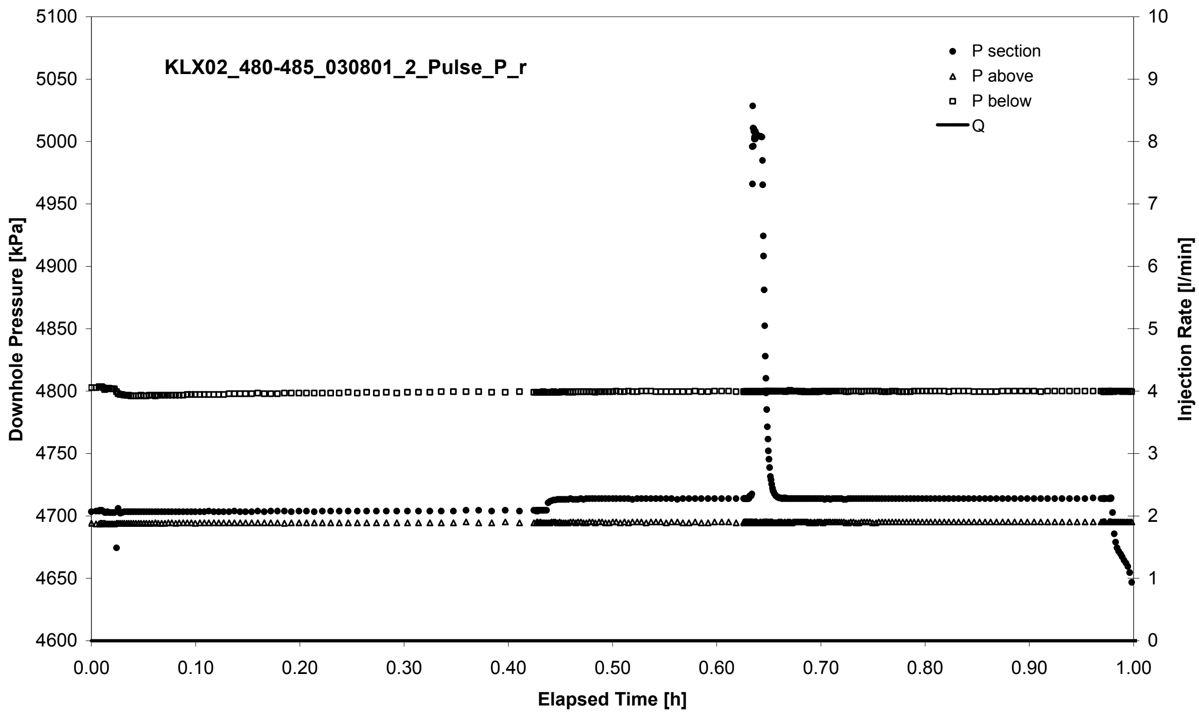
Analysis diagrams



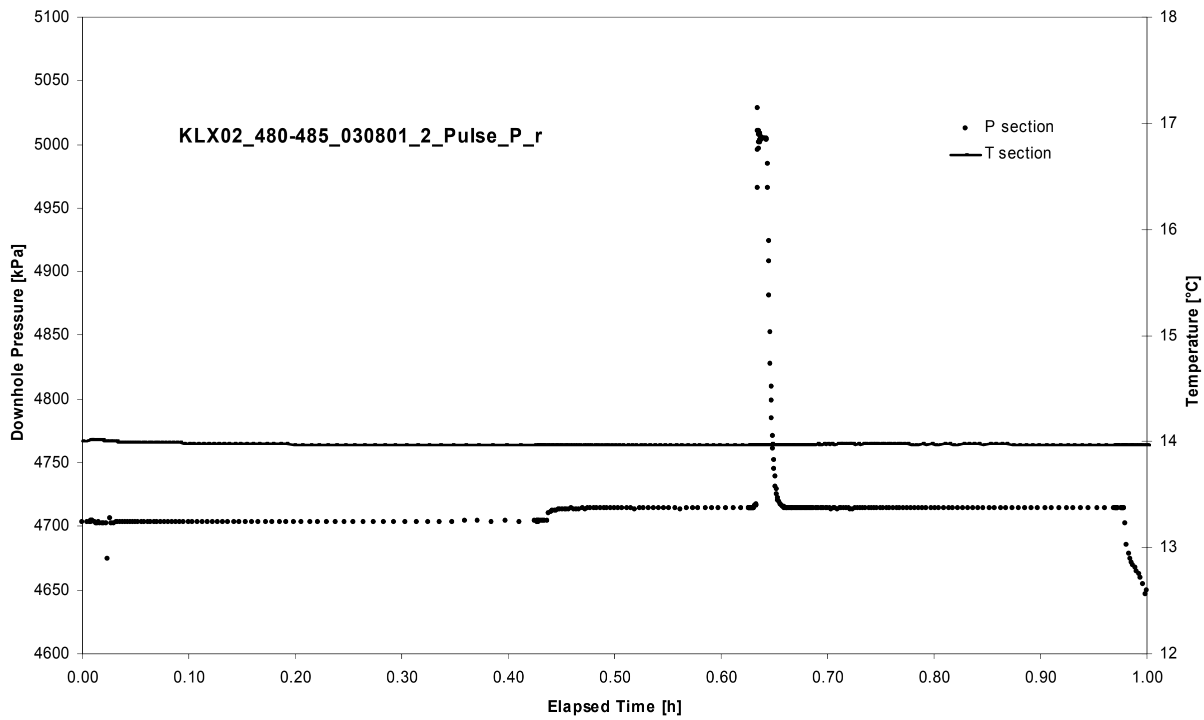
Pressure and flow rate vs. time; cartesian plot (test repeated and analysed)



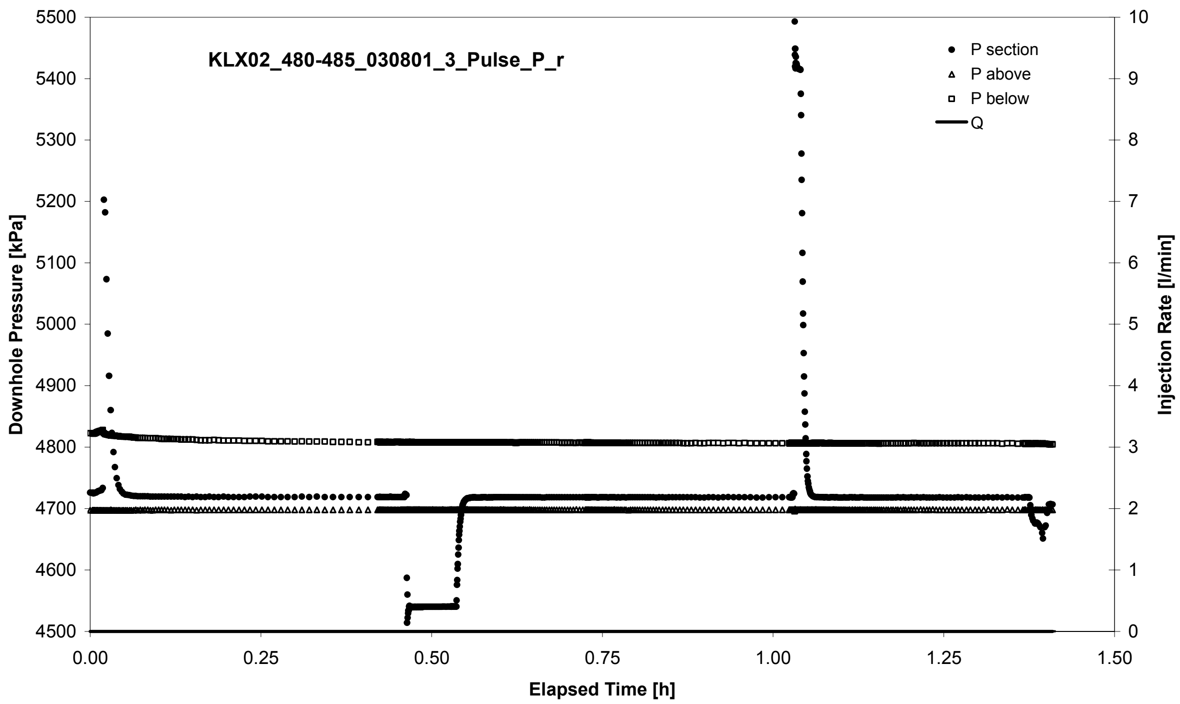
Pressure and temperature in the test section; cartesian plot (test repeated and analysed)



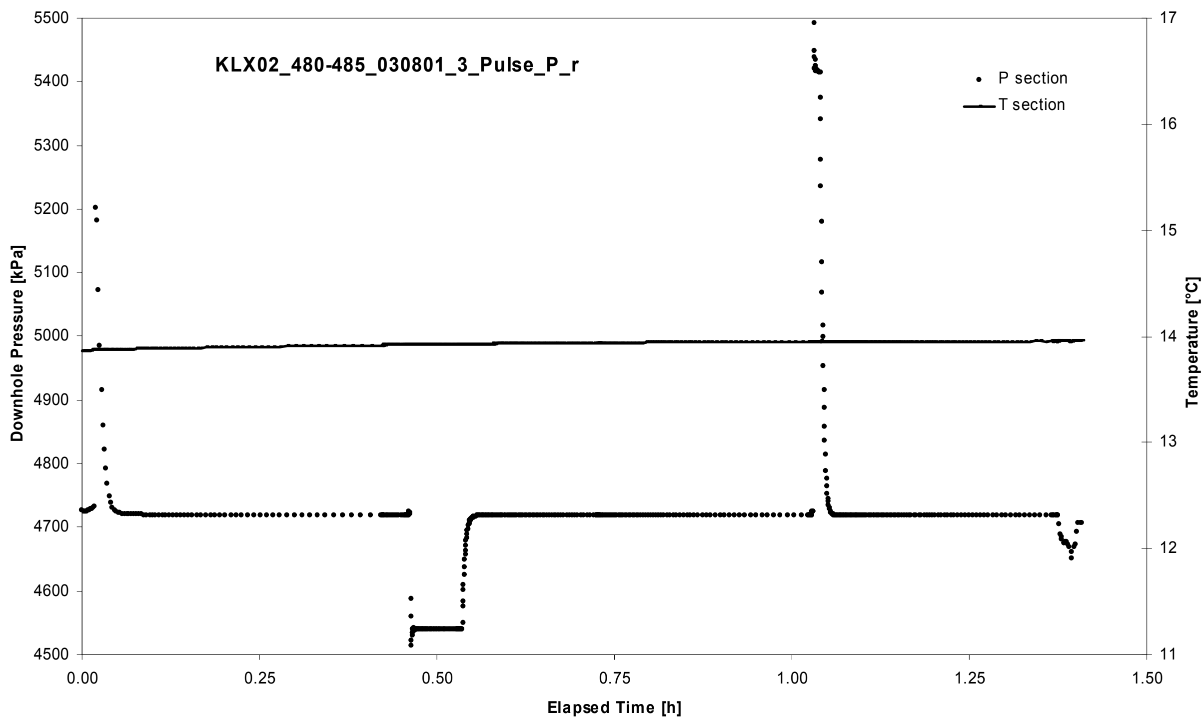
Pressure and flow rate vs. time; cartesian plot (test repeated)



Pressure and temperature in the test section; cartesian plot (test repeated)



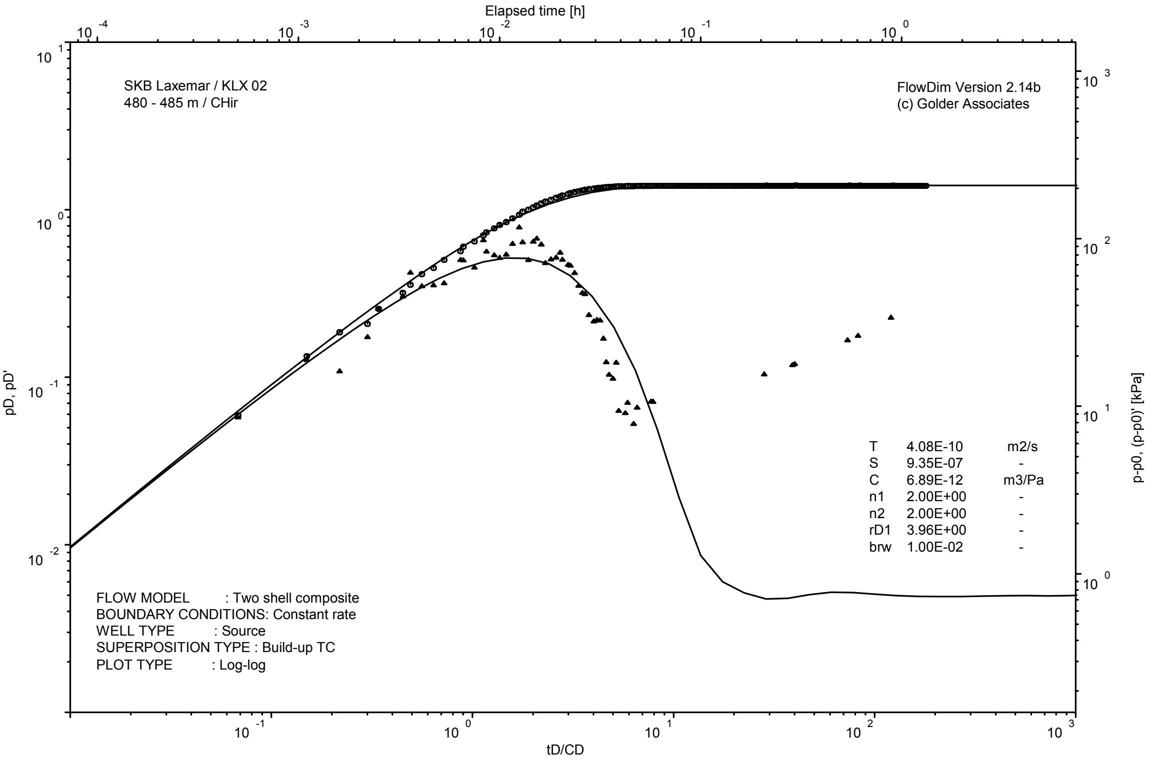
Pressure and flow rate vs. time; cartesian plot



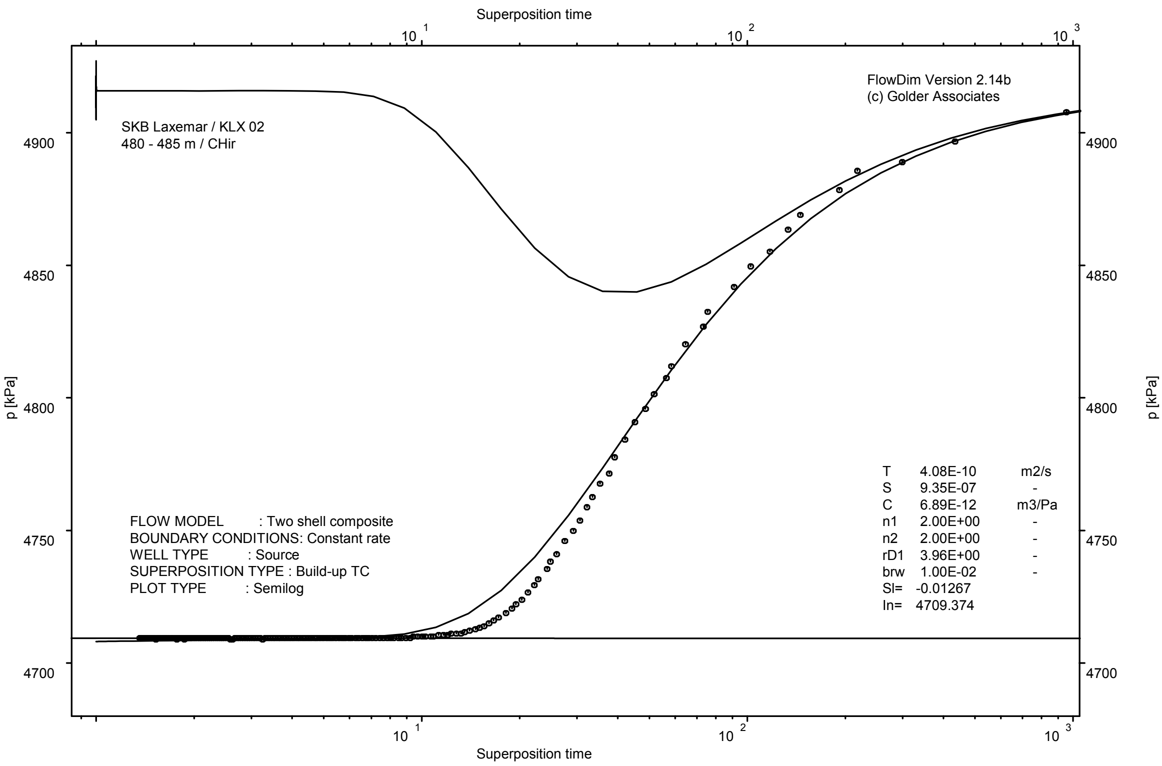
Pressure and temperature in the test section; cartesian plot

Not Analysed

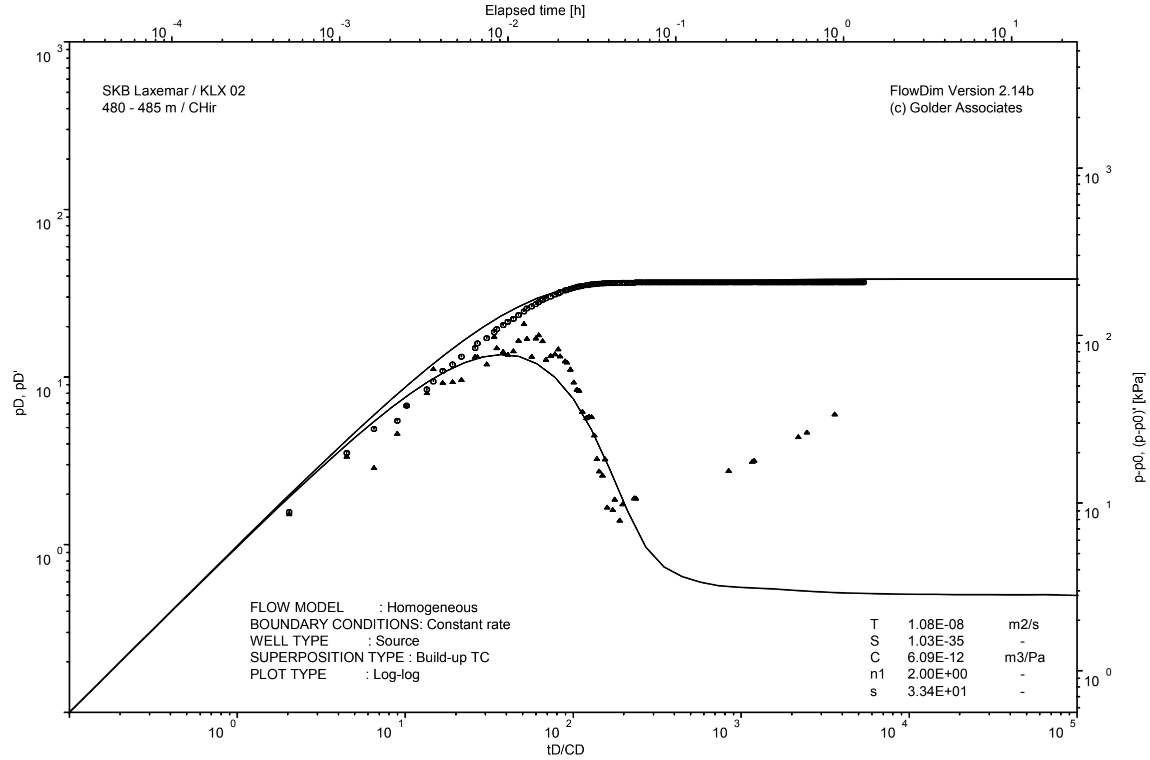
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

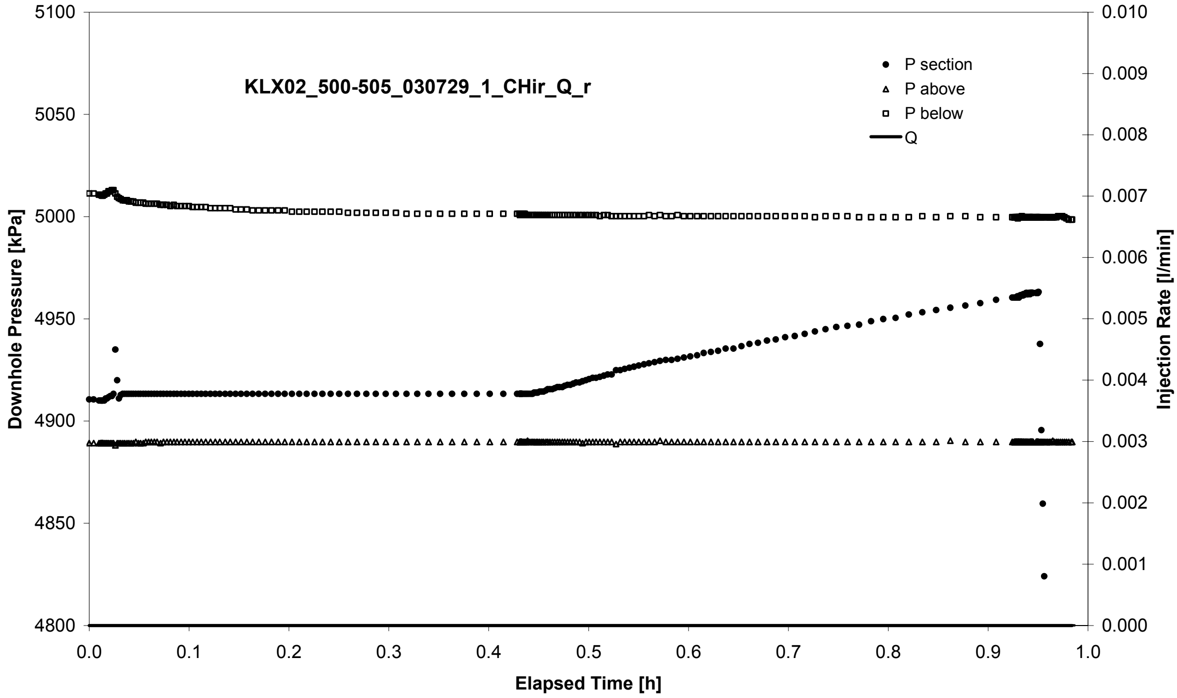


CHIR phase; Homogeneous model analyses, log-log match

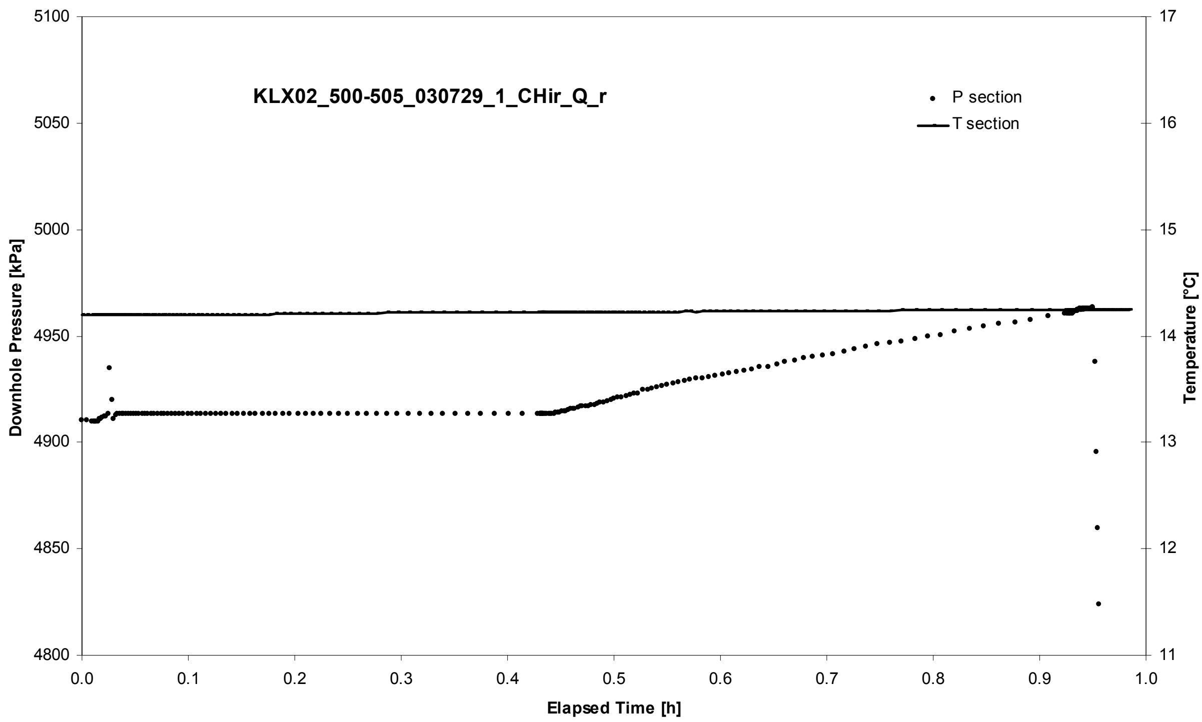
APPENDIX 2-71

Test 500 – 505 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

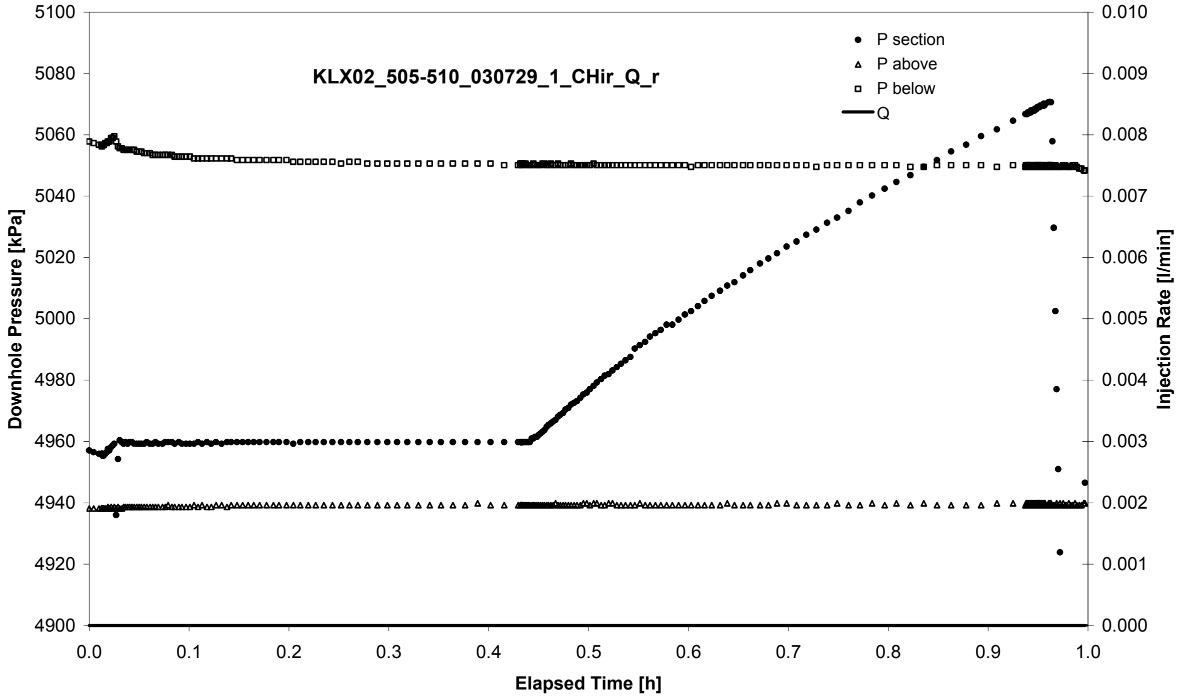
Not Analysed

CHIR phase; HORNER match

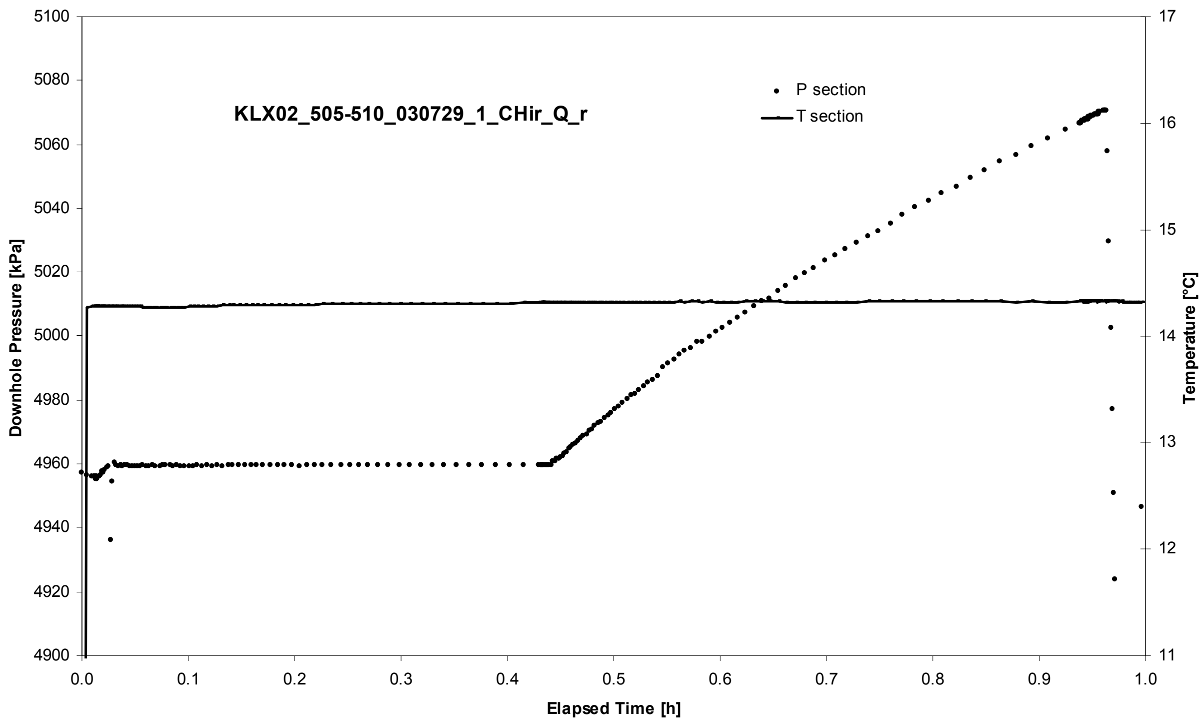
APPENDIX 2-72

Test 505 – 510 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

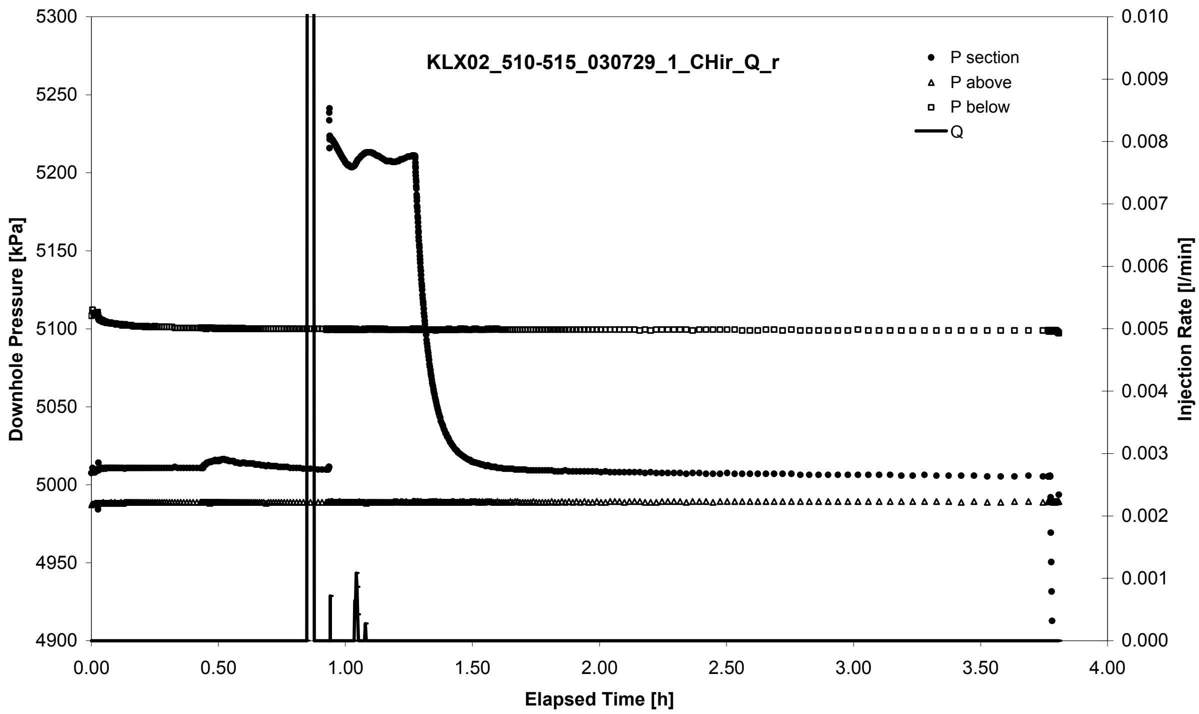
Not Analysed

CHIR phase; HORNER match

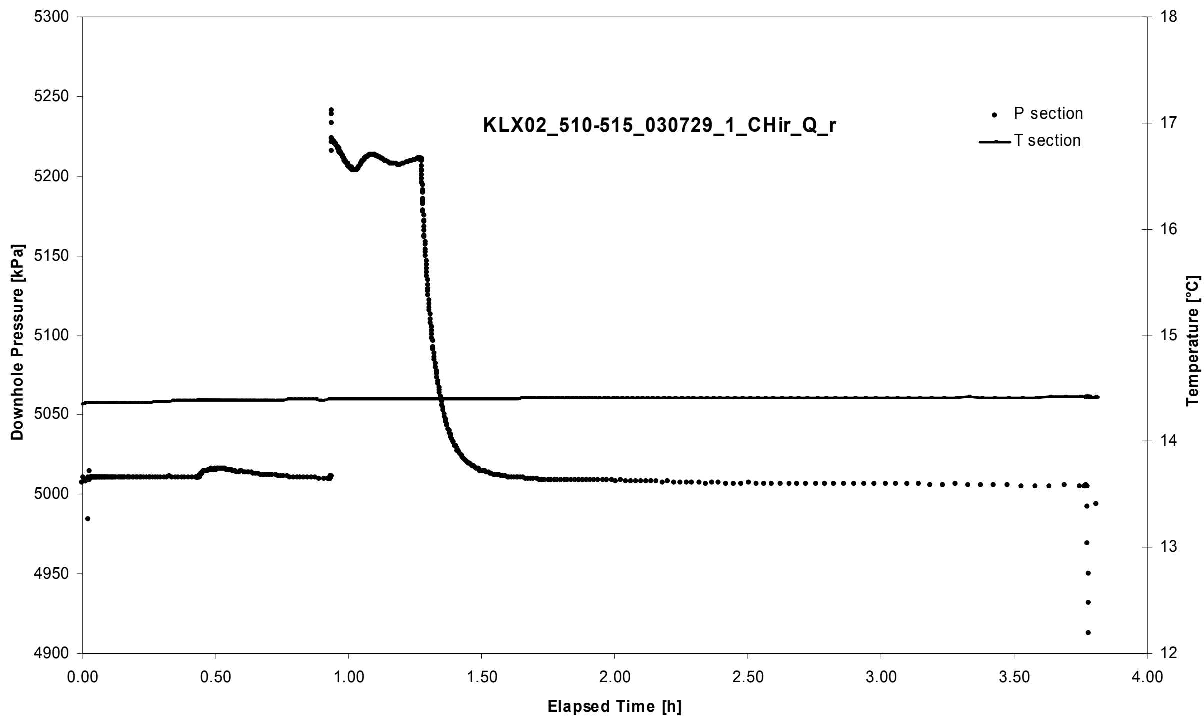
APPENDIX 2-73

Test 510 – 515 m

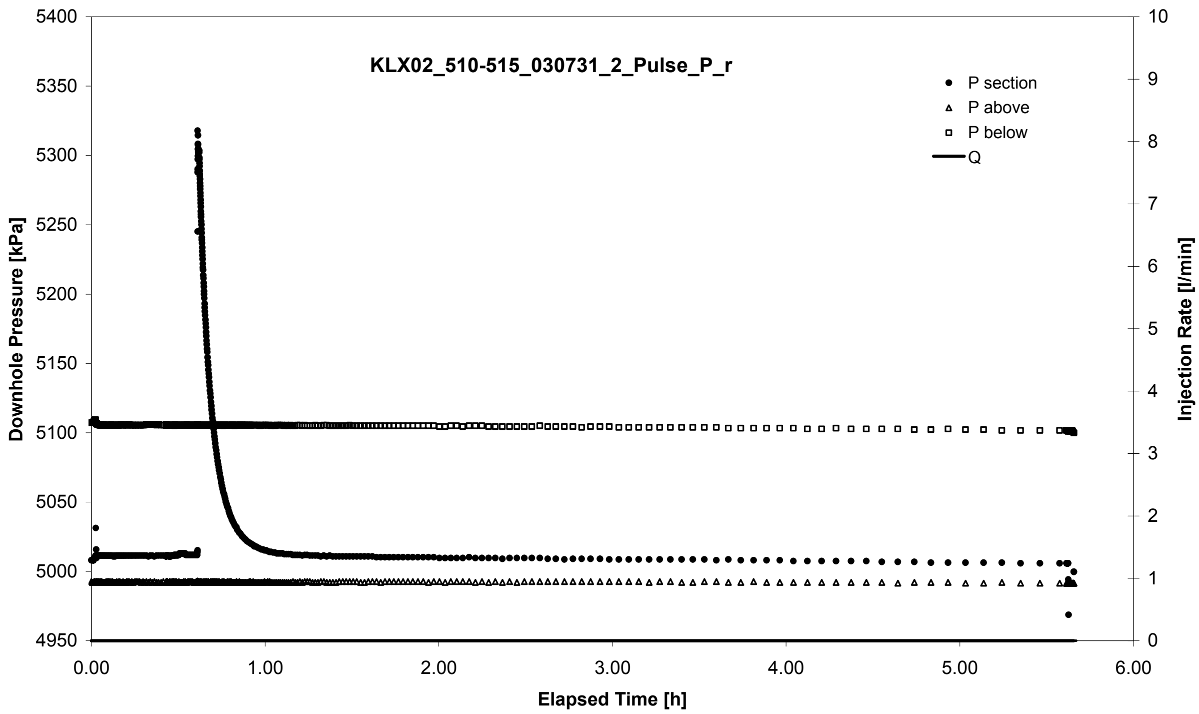
Analysis diagrams



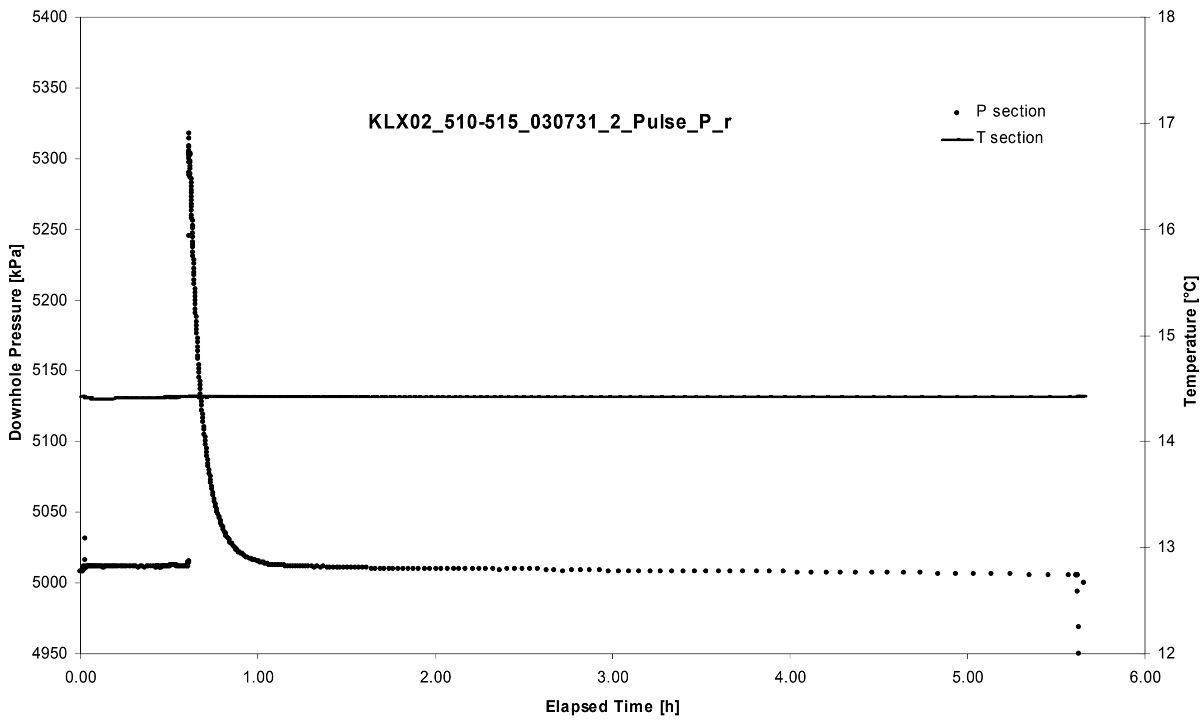
Pressure and flow rate vs. time; cartesian plot (test repeated and analysed)



Pressure and temperature in the test section; cartesian plot (test repeated and analysed)



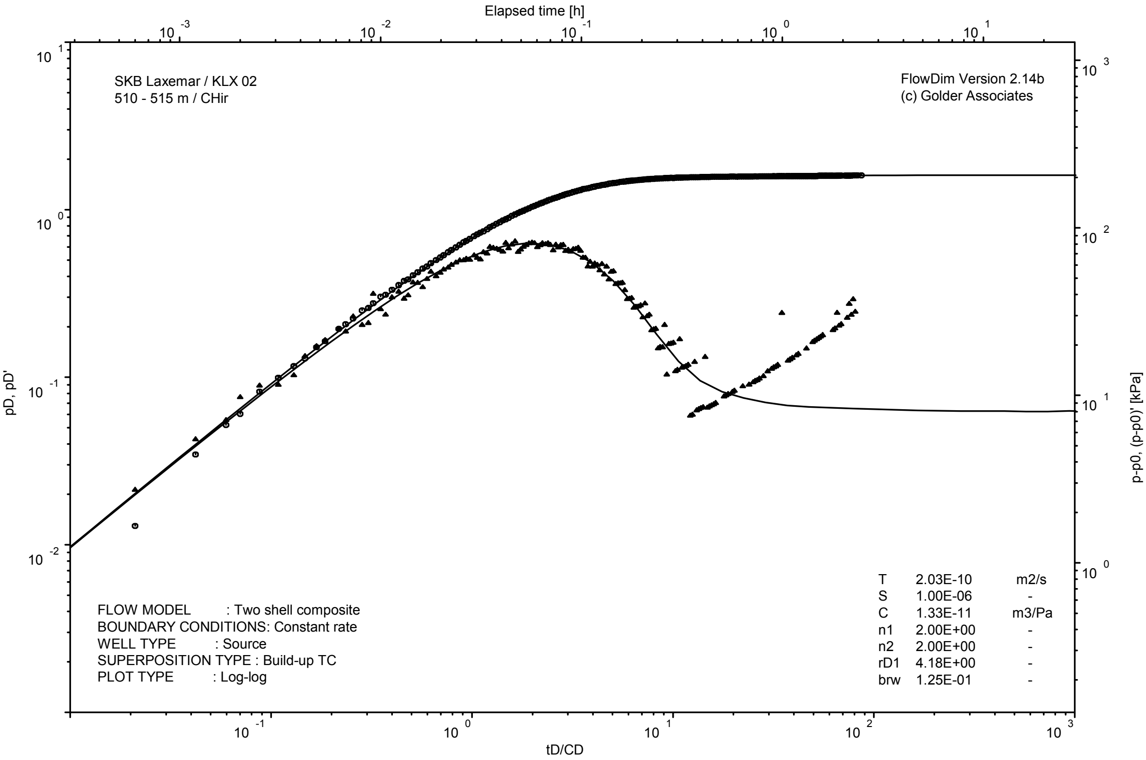
Pressure and flow rate vs. time; cartesian plot



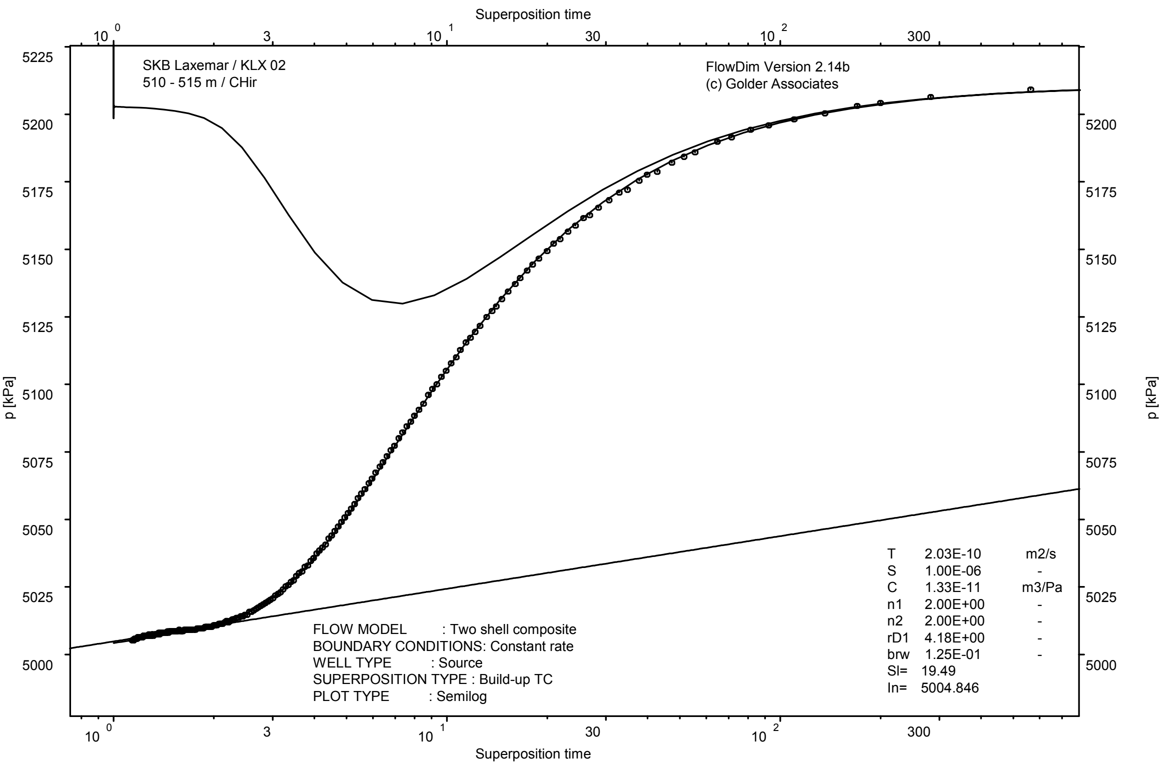
Pressure and temperature in the test section; cartesian plot

Not Analysed

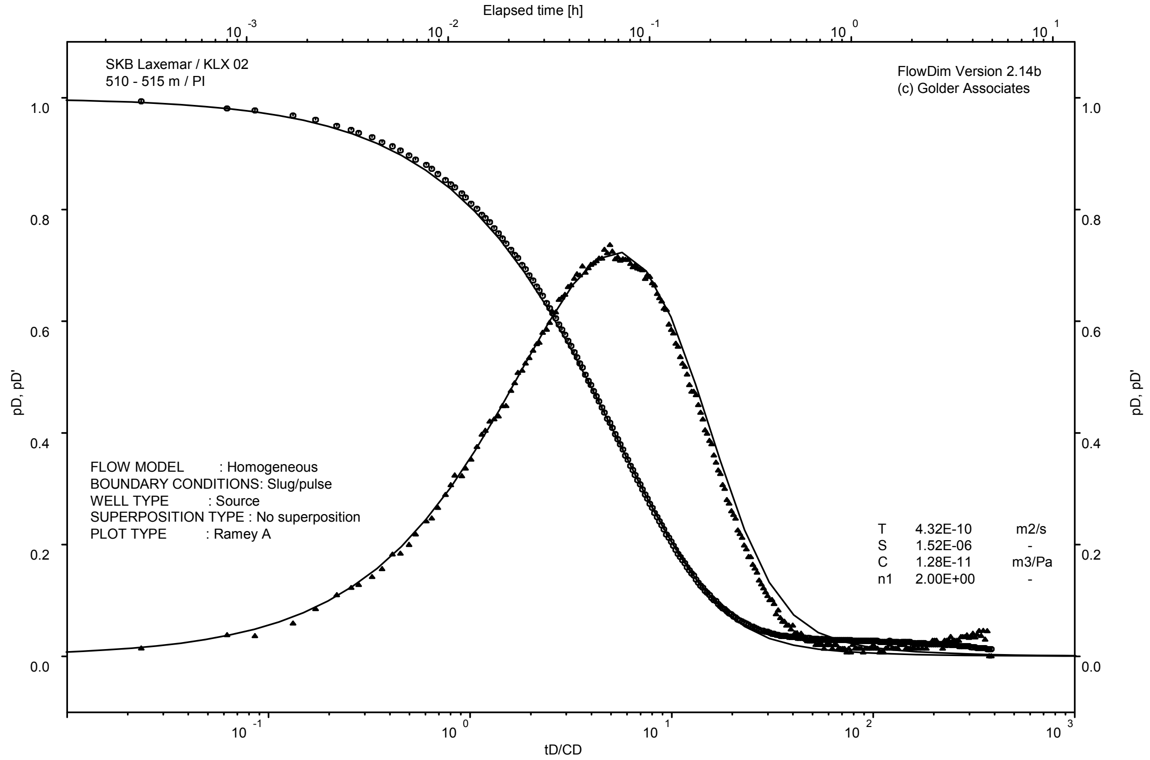
CHI phase; log-log match



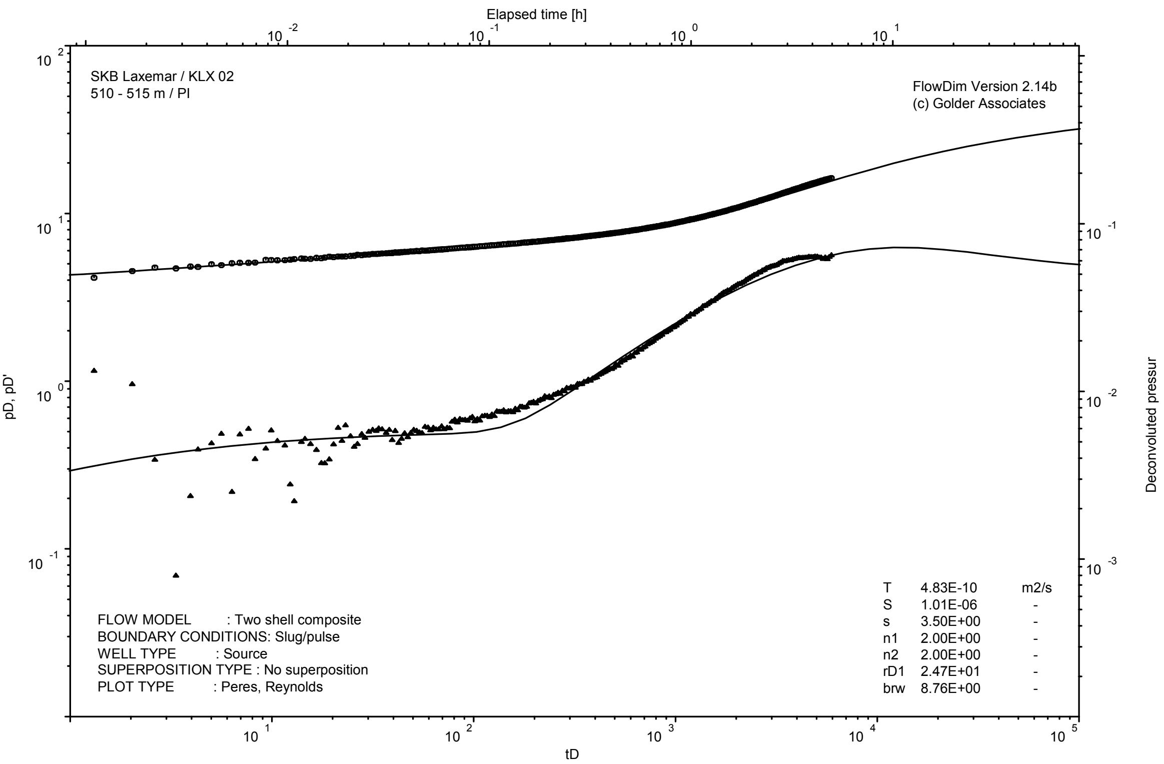
CHIR phase; log-log match



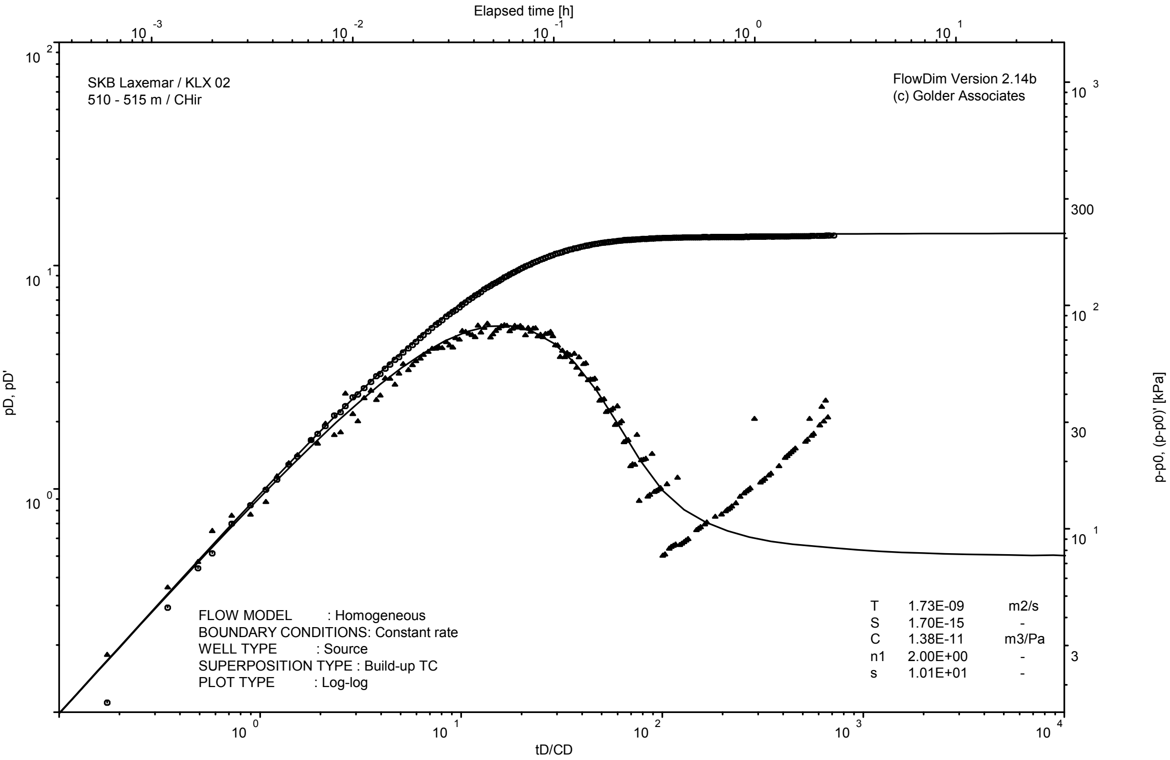
CHIR phase; HORNER match



CHIR phase; RAMEY match



CHIR phase analysed as pulse injection; deconvolution match

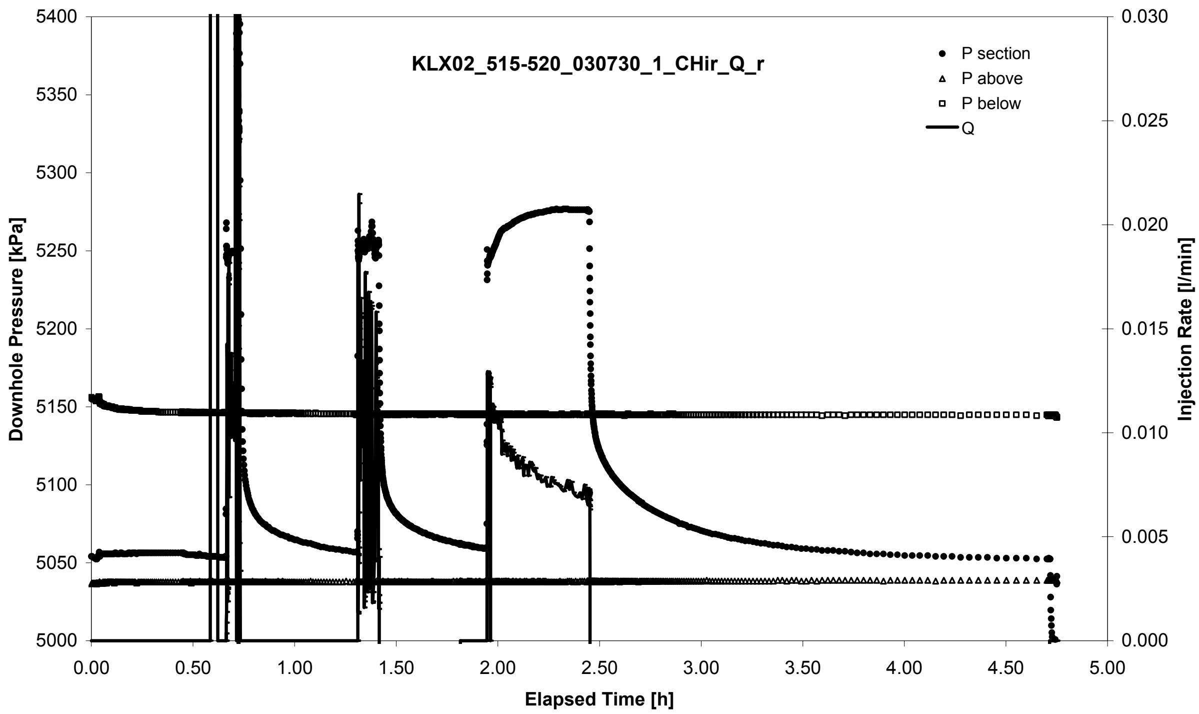


CHIR phase; Homogeneous model analyses, log-log match

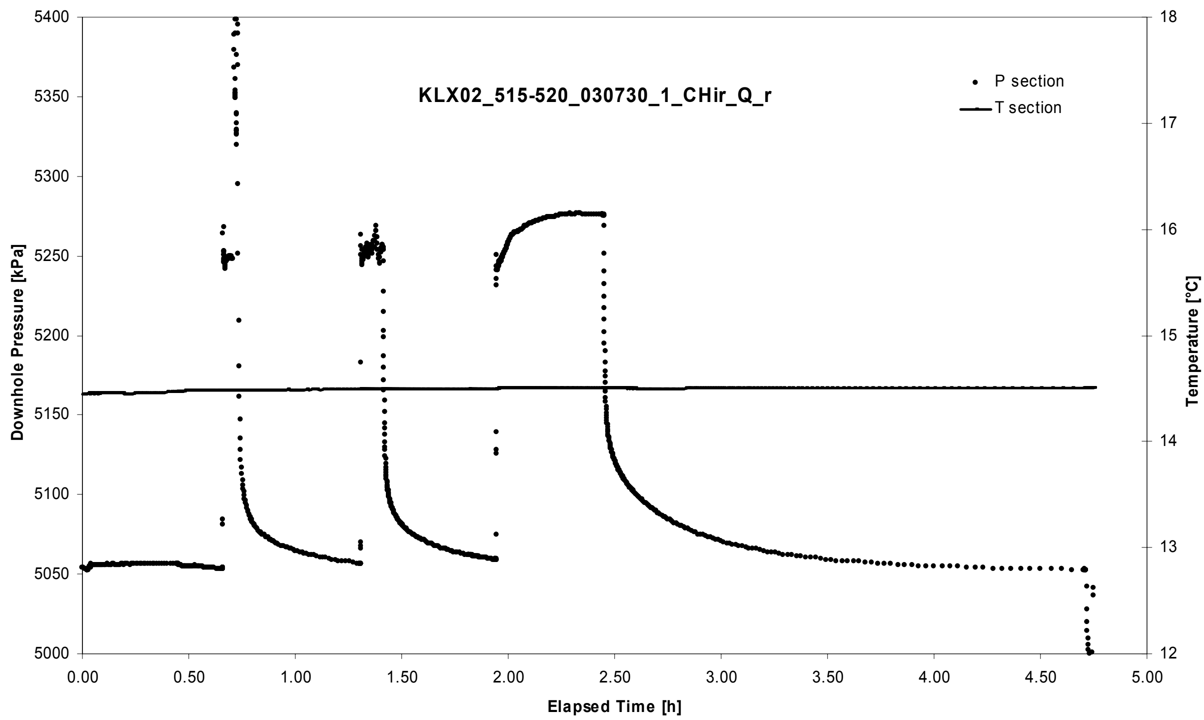
APPENDIX 2-2-74

Test 515 – 520 m

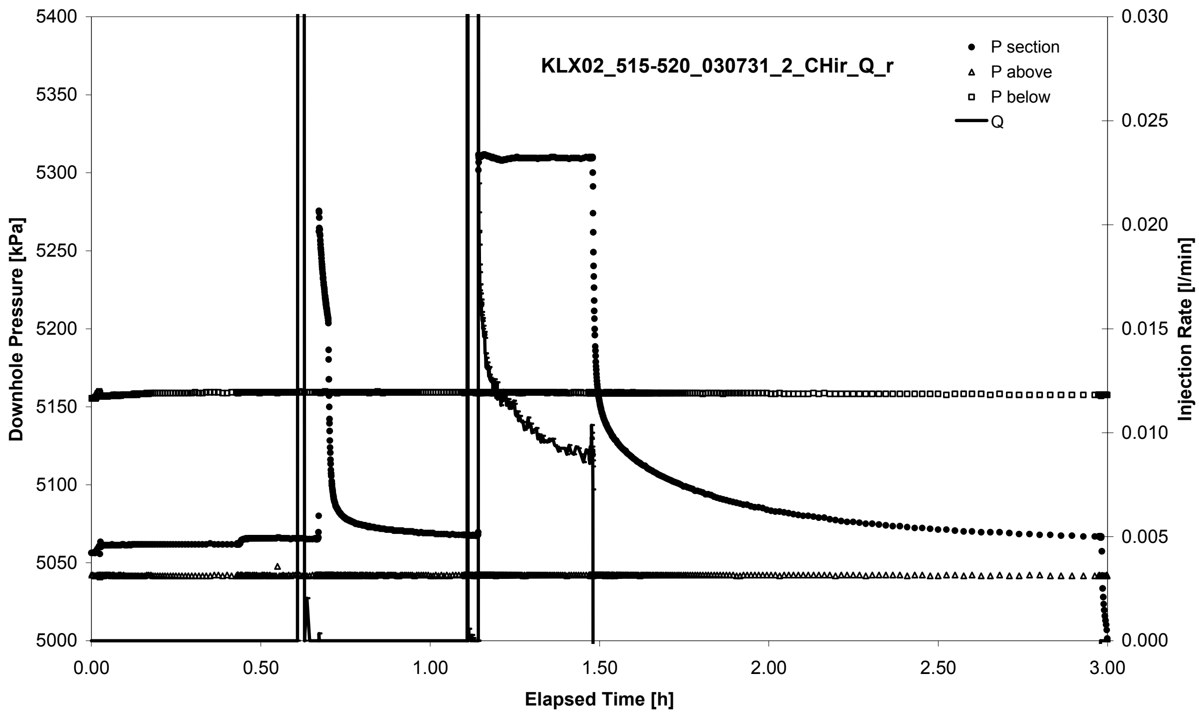
Analysis diagrams



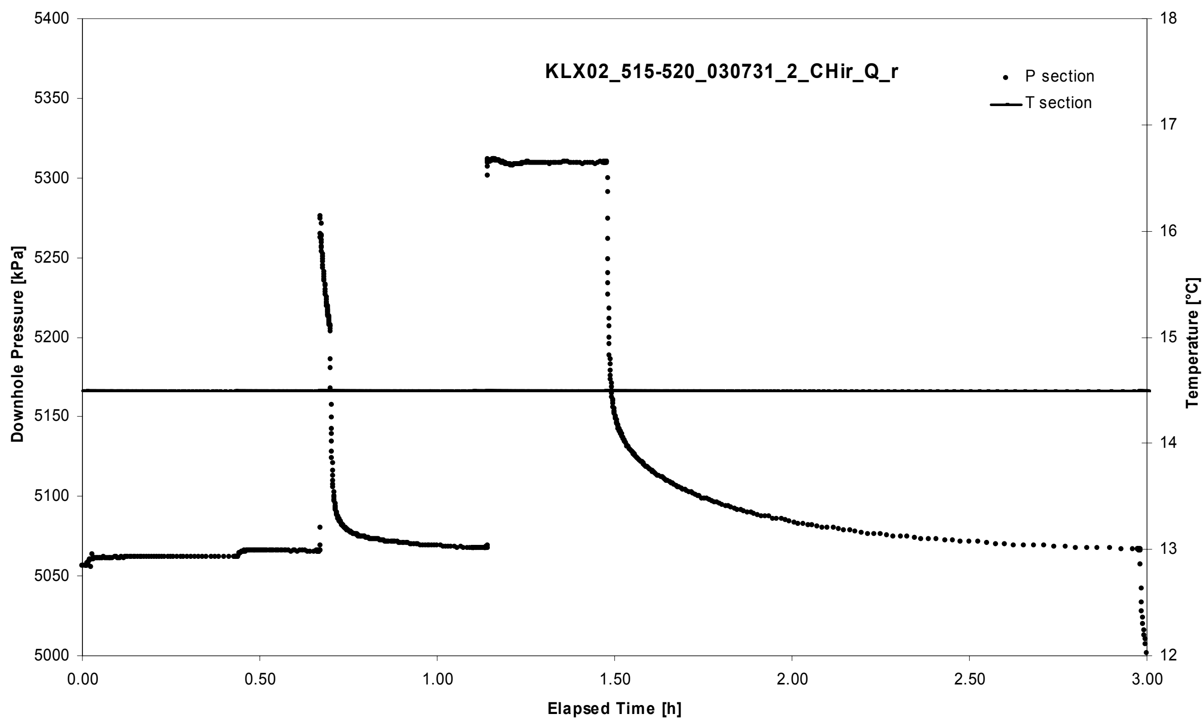
Pressure and flow rate vs. time; cartesian plot (test repeated)



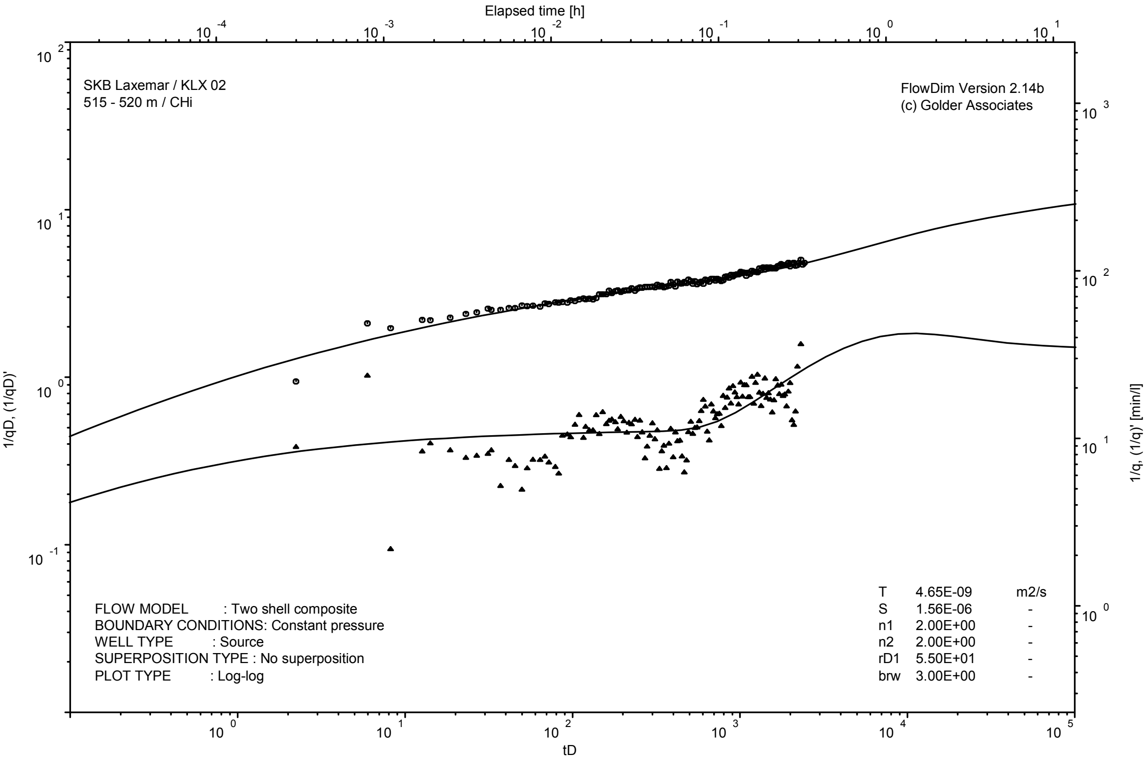
Pressure and temperature in the test section; cartesian plot (test repeated)



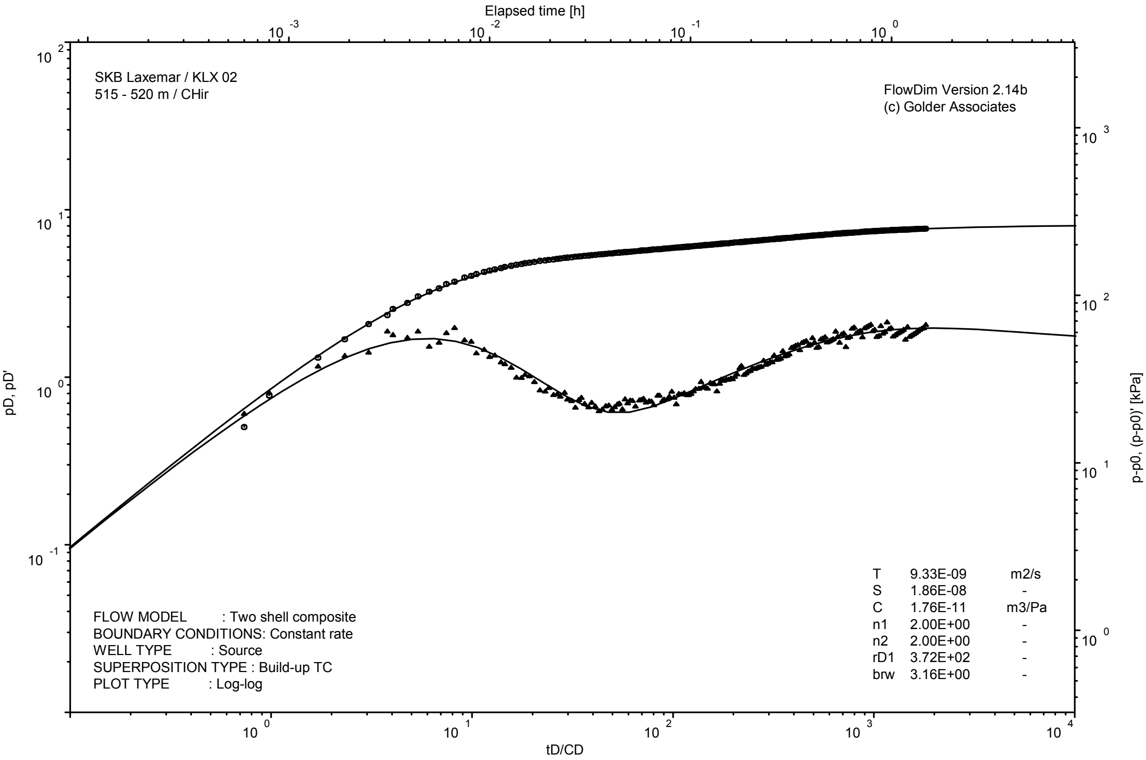
Pressure and flow rate vs. time; cartesian plot (analysed)



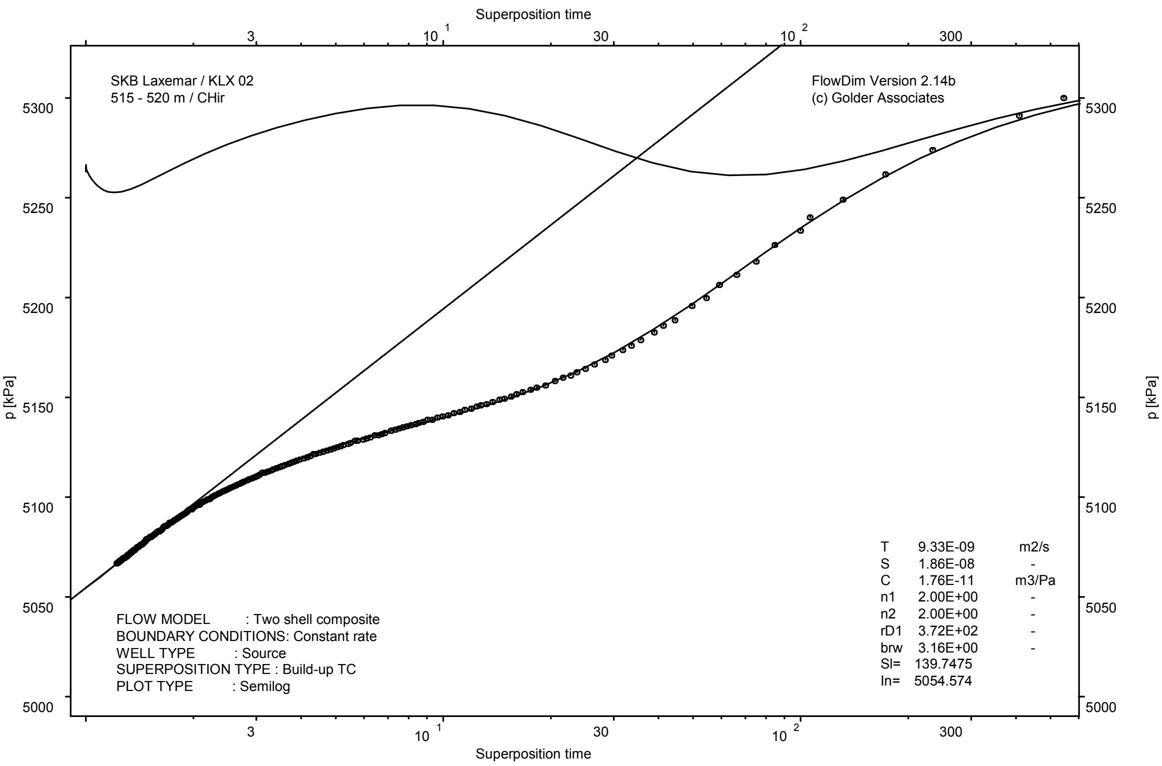
Pressure and temperature in the test section; cartesian plot (analysed)



CHI phase; log-log match



CHIR phase; log-log match

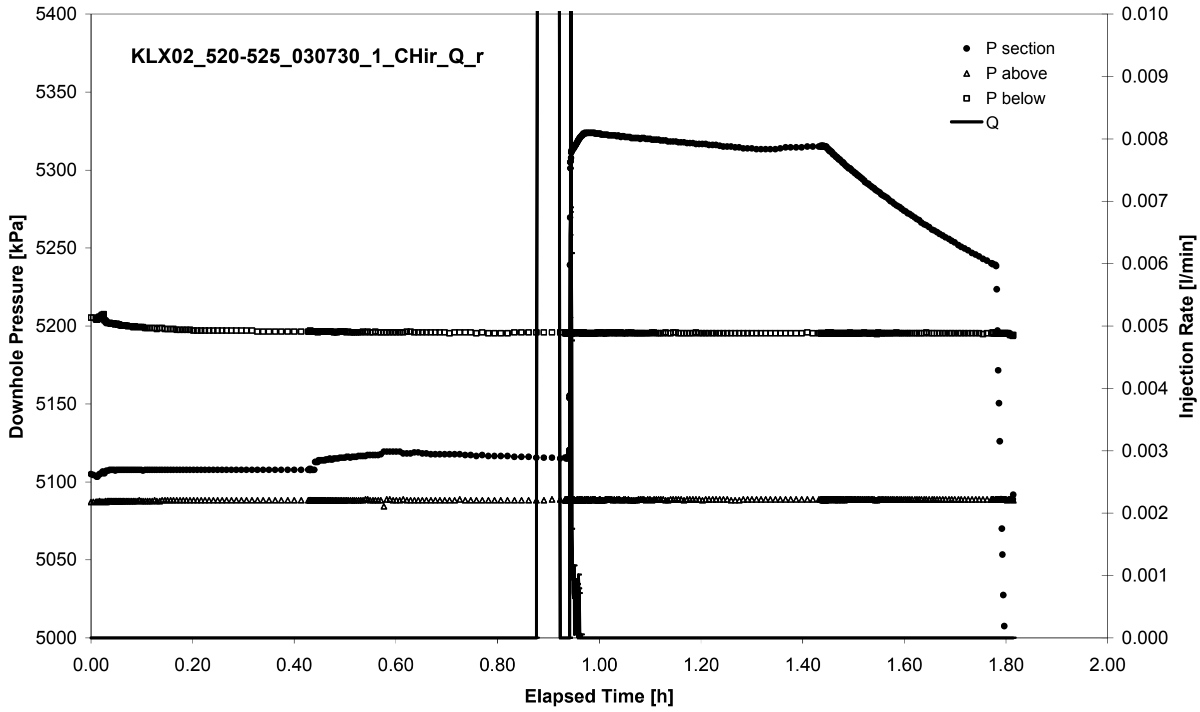


CHIR phase; HORNER match

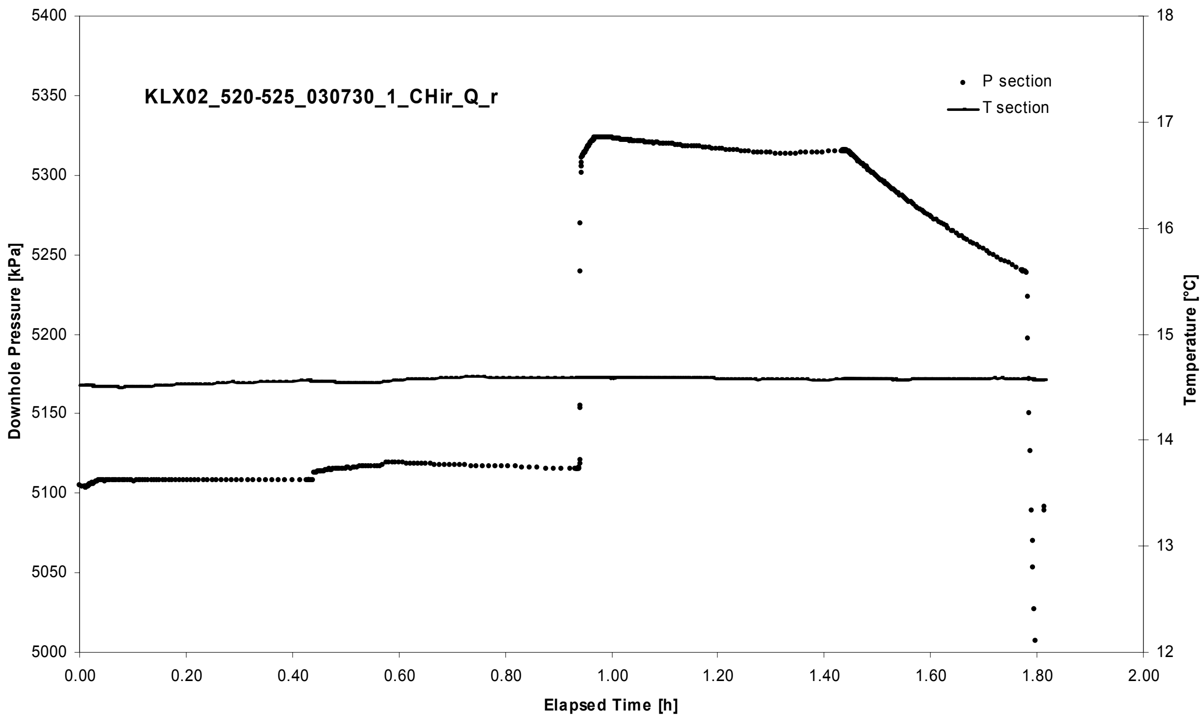
APPENDIX 2-75

Test 520 – 525 m

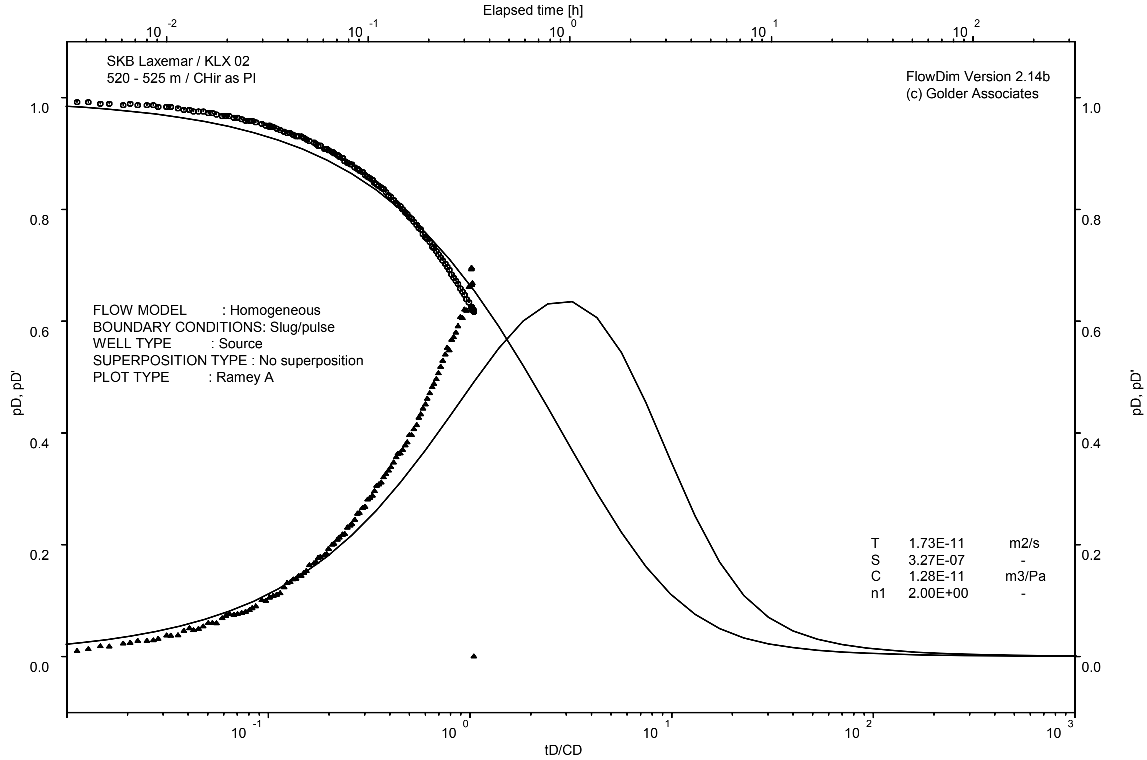
Analysis diagrams



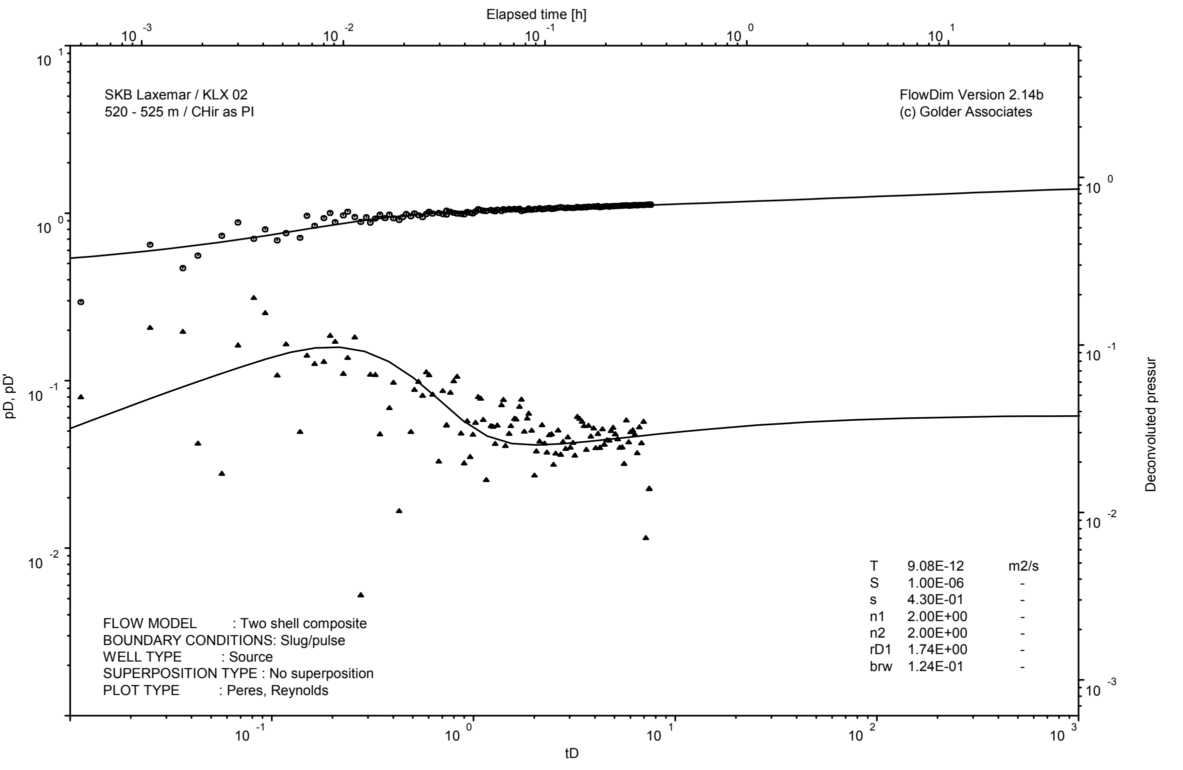
Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot



CHIR phase; RAMEY match

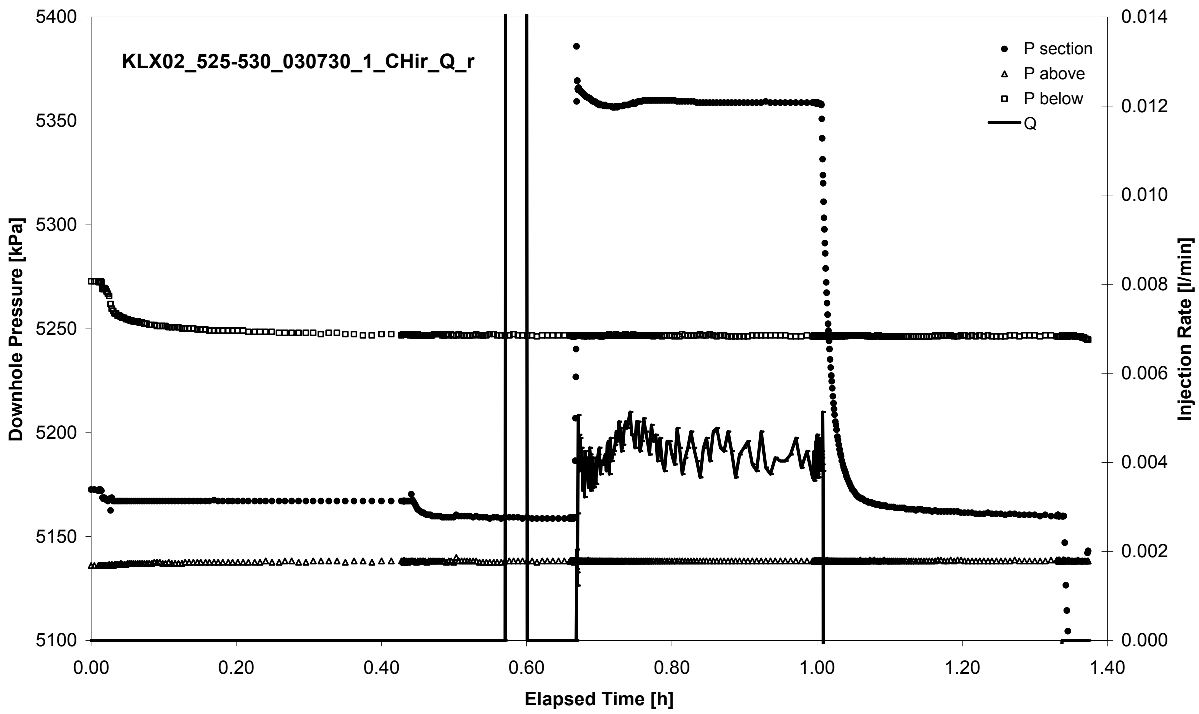


CHIR phase analysed as pulse injection; deconvolution match

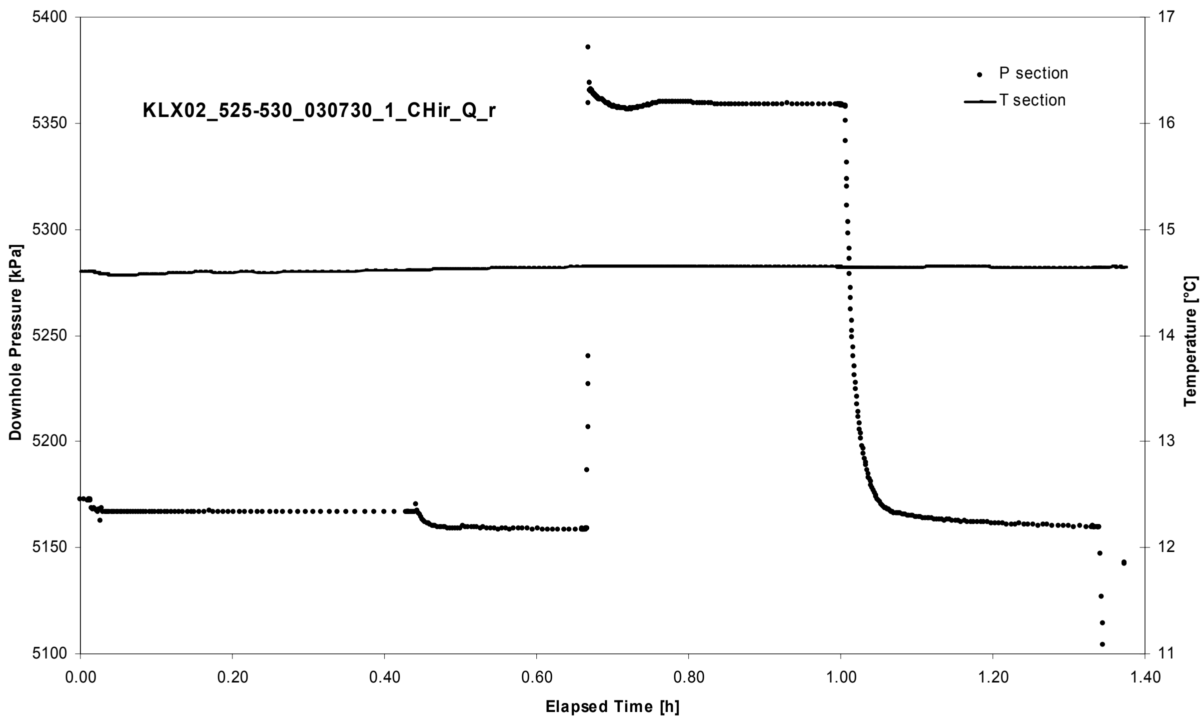
APPENDIX 2-76

Test 525 – 530 m

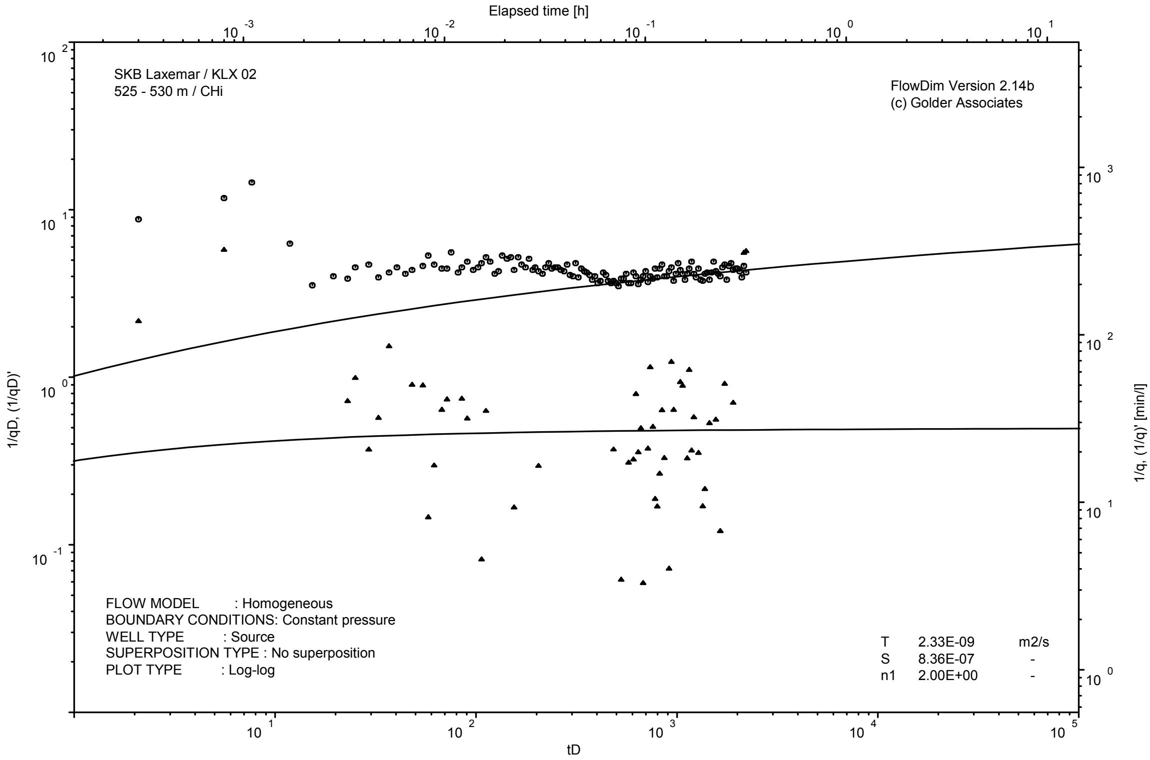
Analysis diagrams



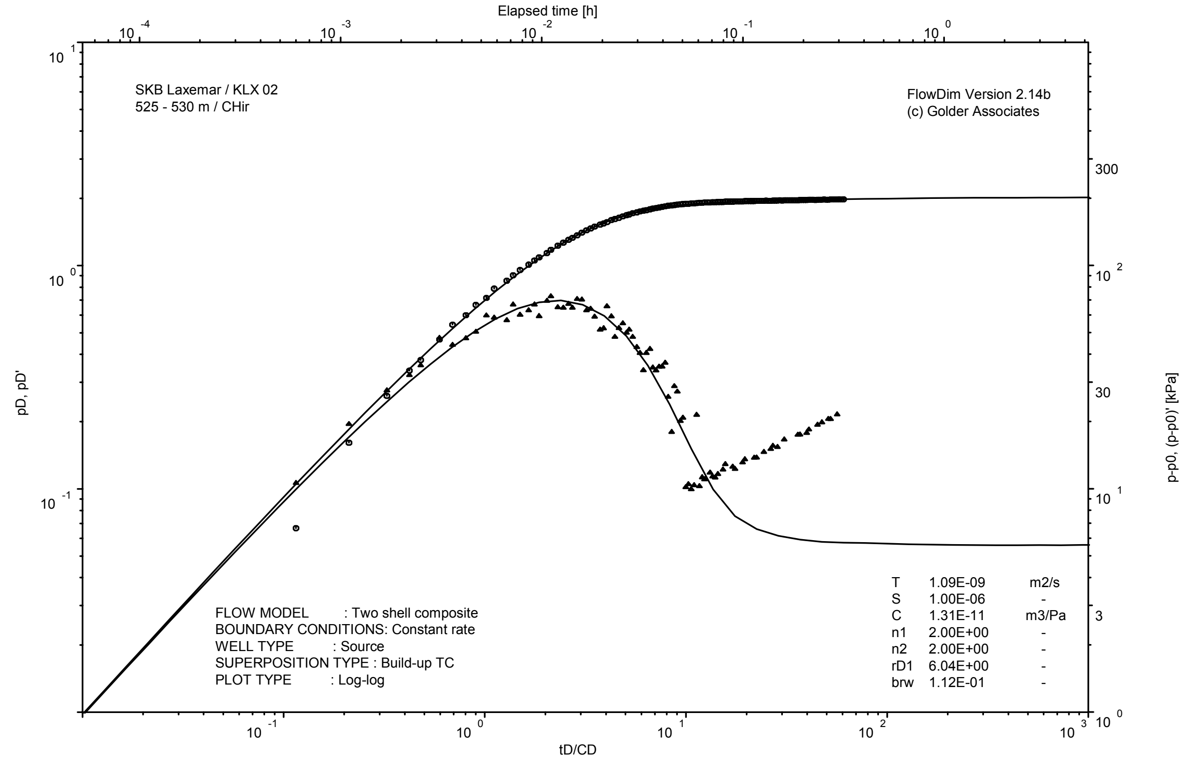
Pressure and flow rate vs. time; cartesian plot



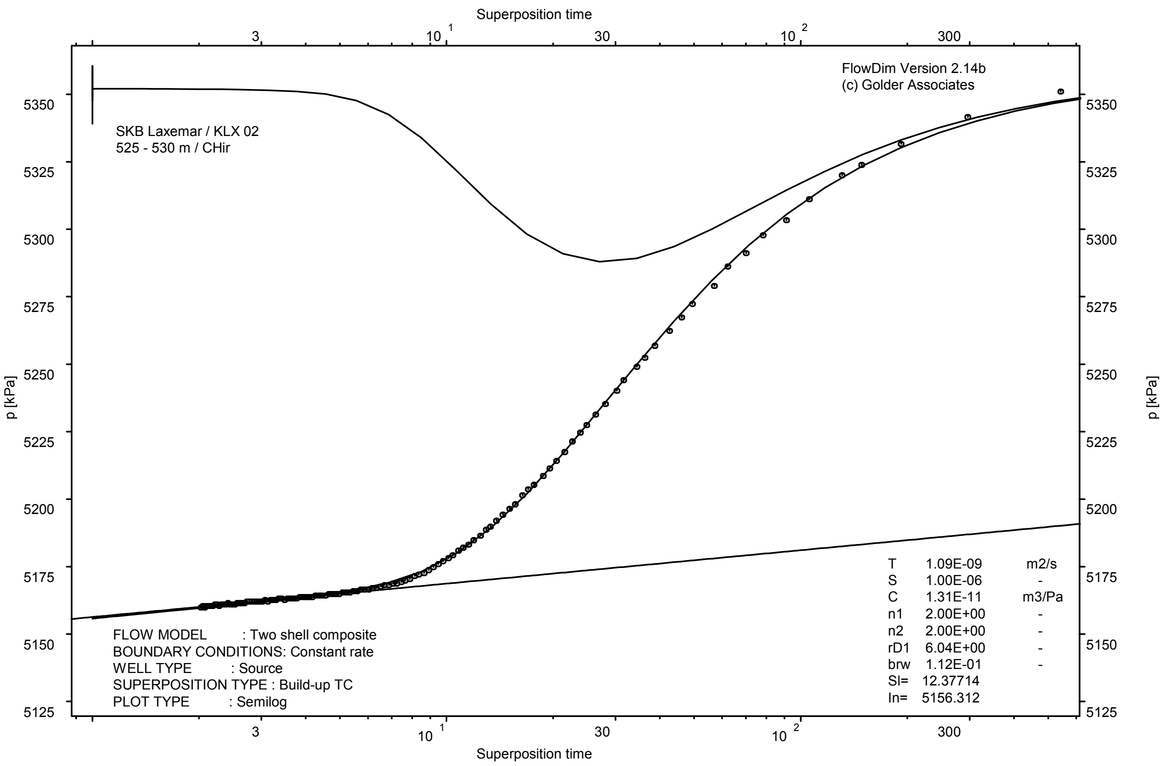
Pressure and temperature in the test section; cartesian plot



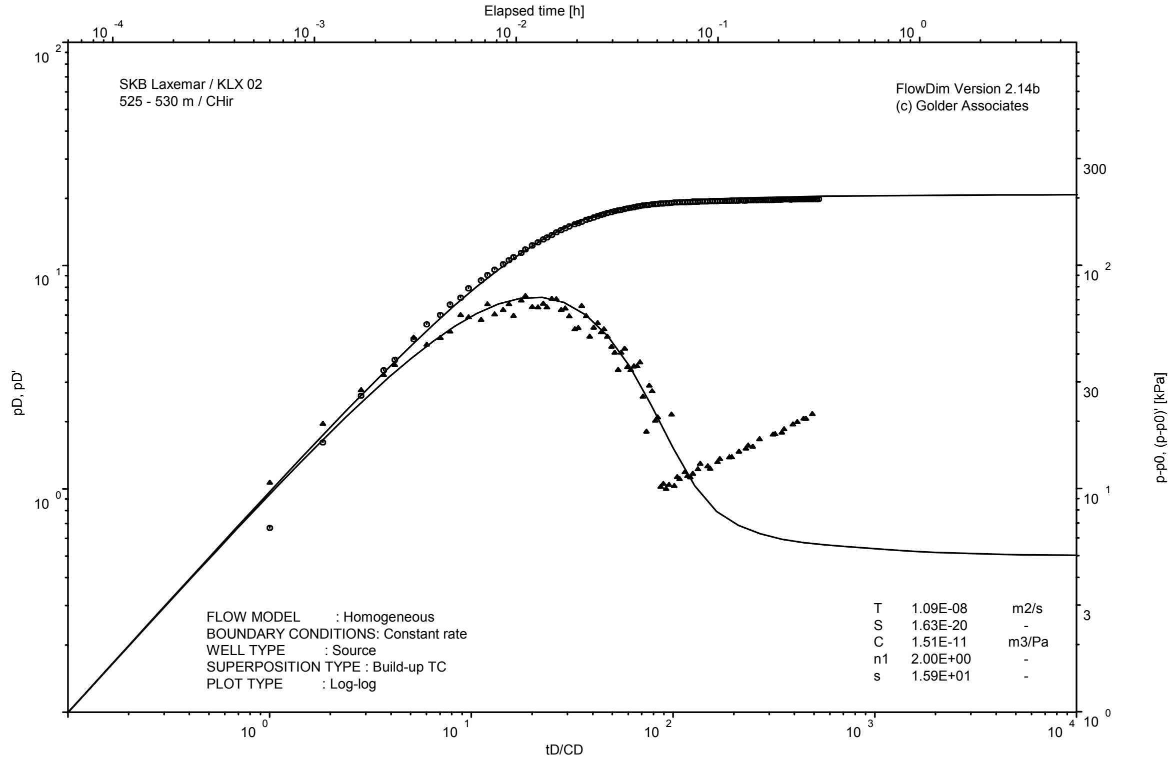
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

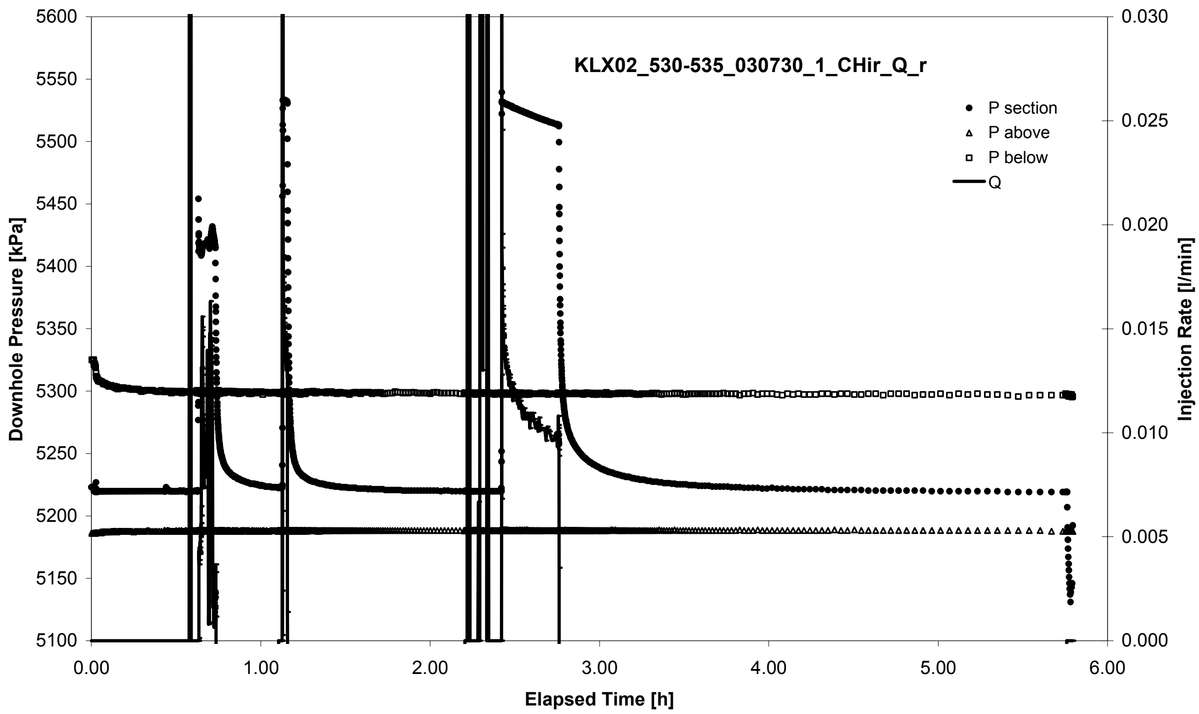


CHIR phase; Homogeneous model analyses, log-log match

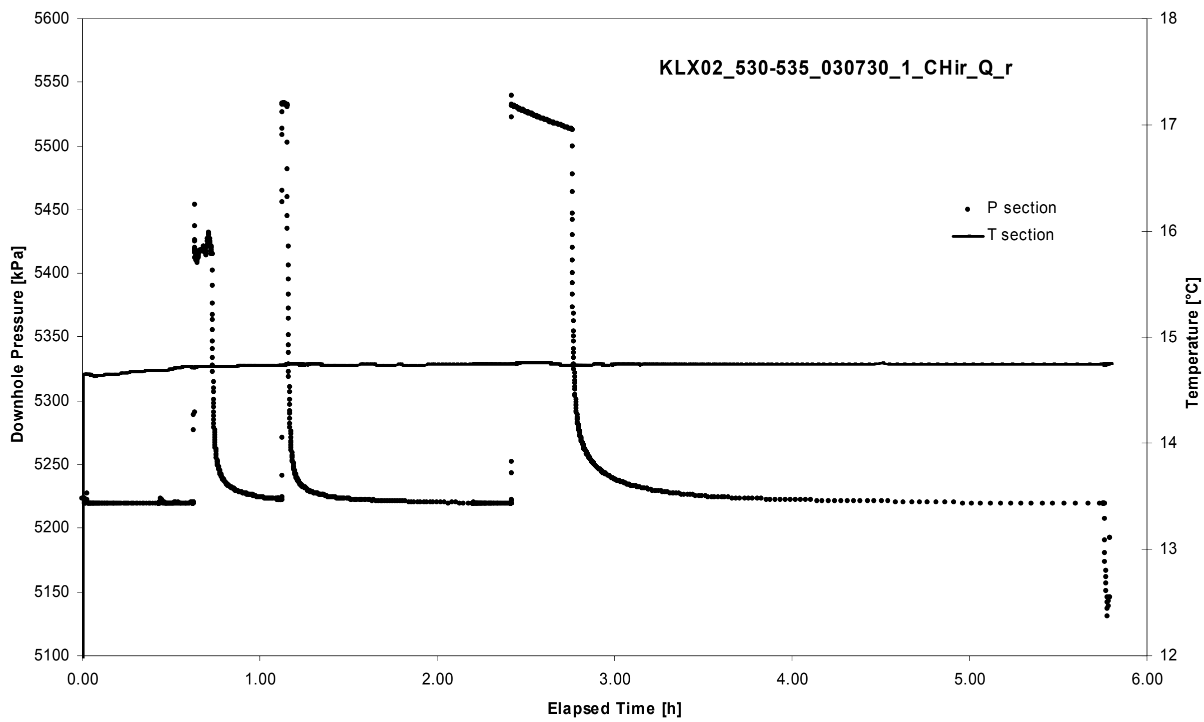
APPENDIX 2-78

Test 530 – 535 m

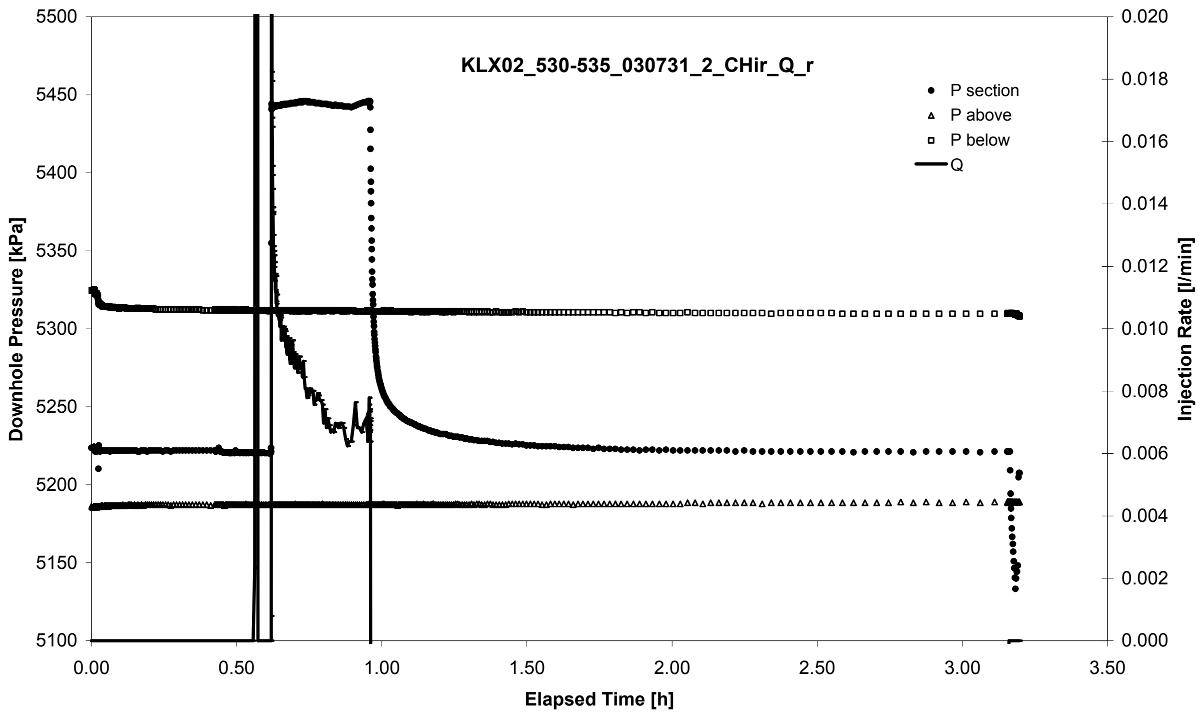
Analysis diagrams



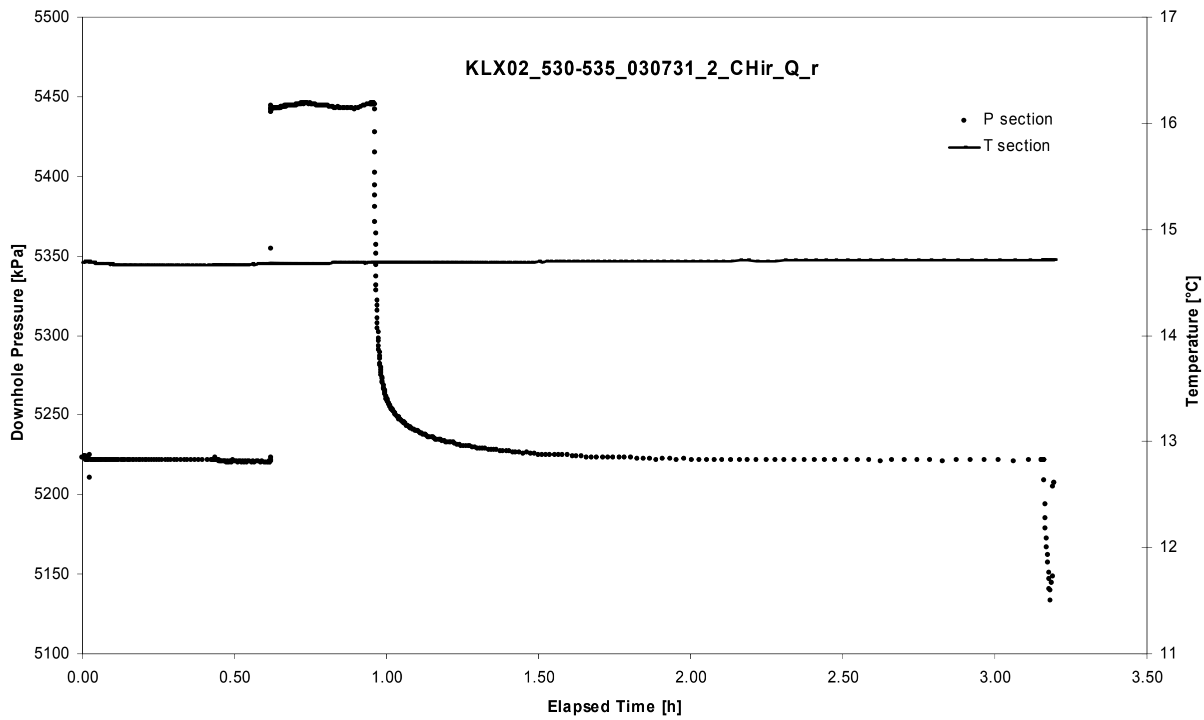
Pressure and flow rate vs. time; cartesian plot (test repeated)



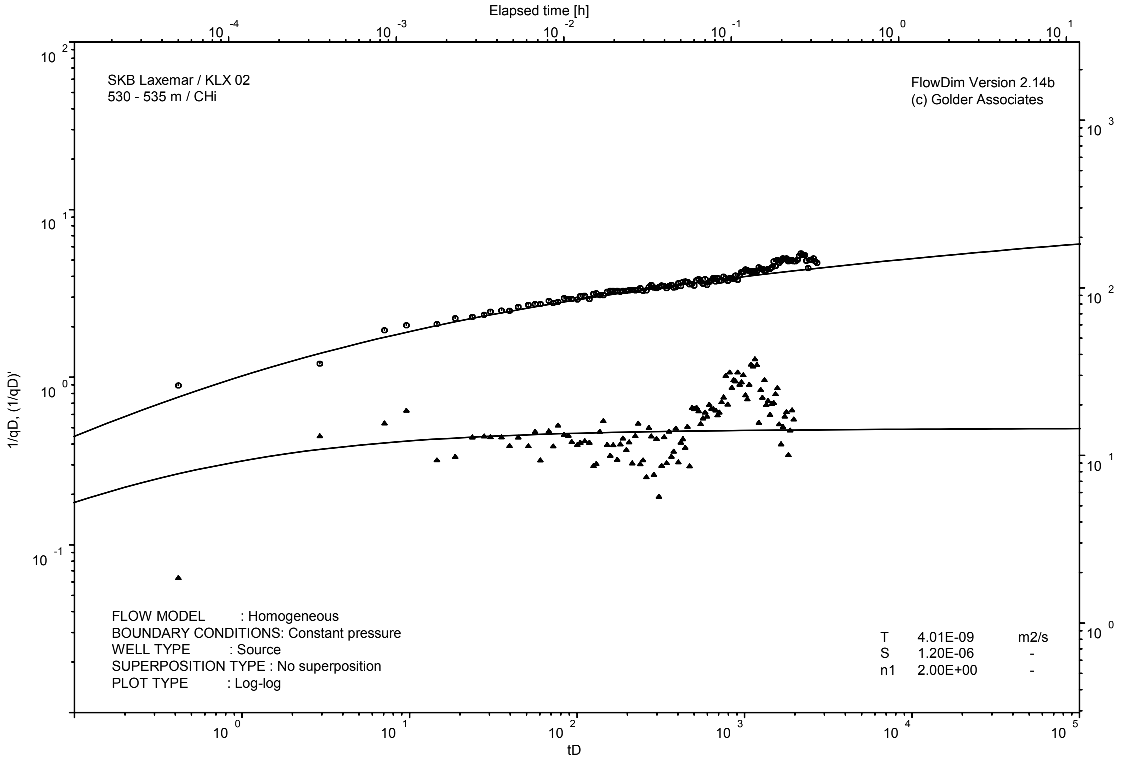
Pressure and temperature in the test section; cartesian plot (test repeated)



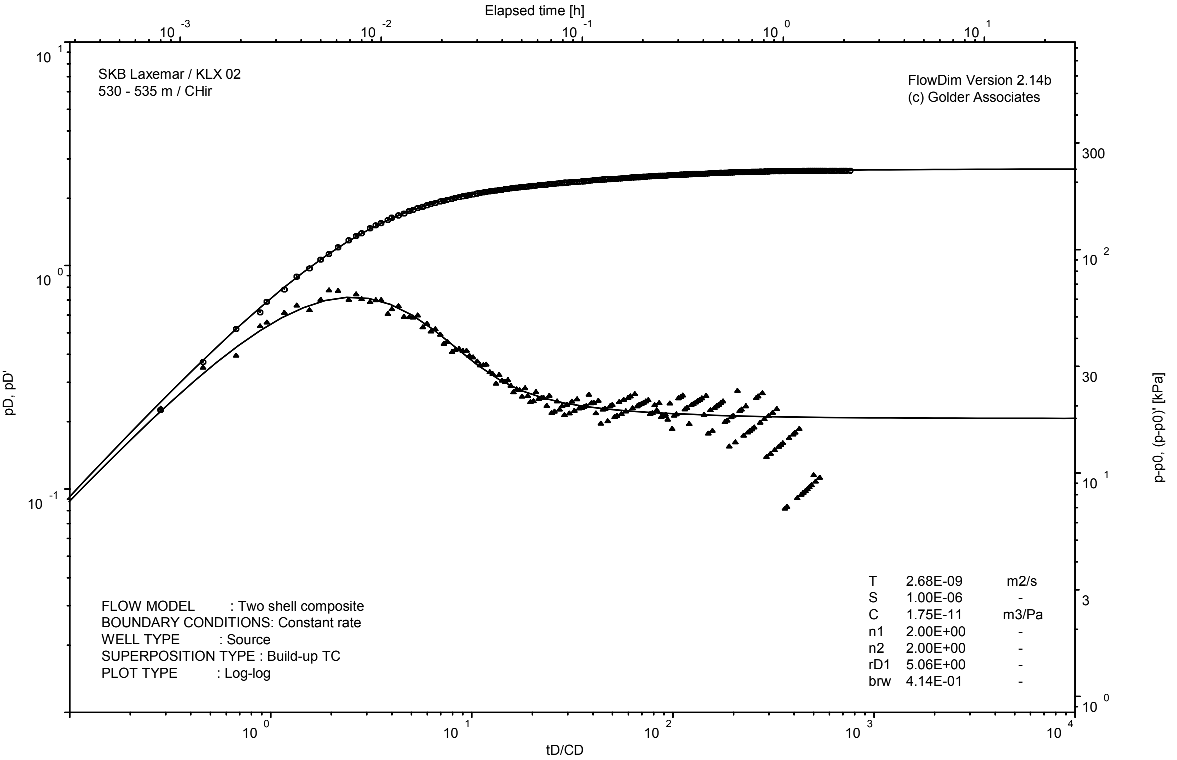
Pressure and flow rate vs. time; cartesian plot (analysed)



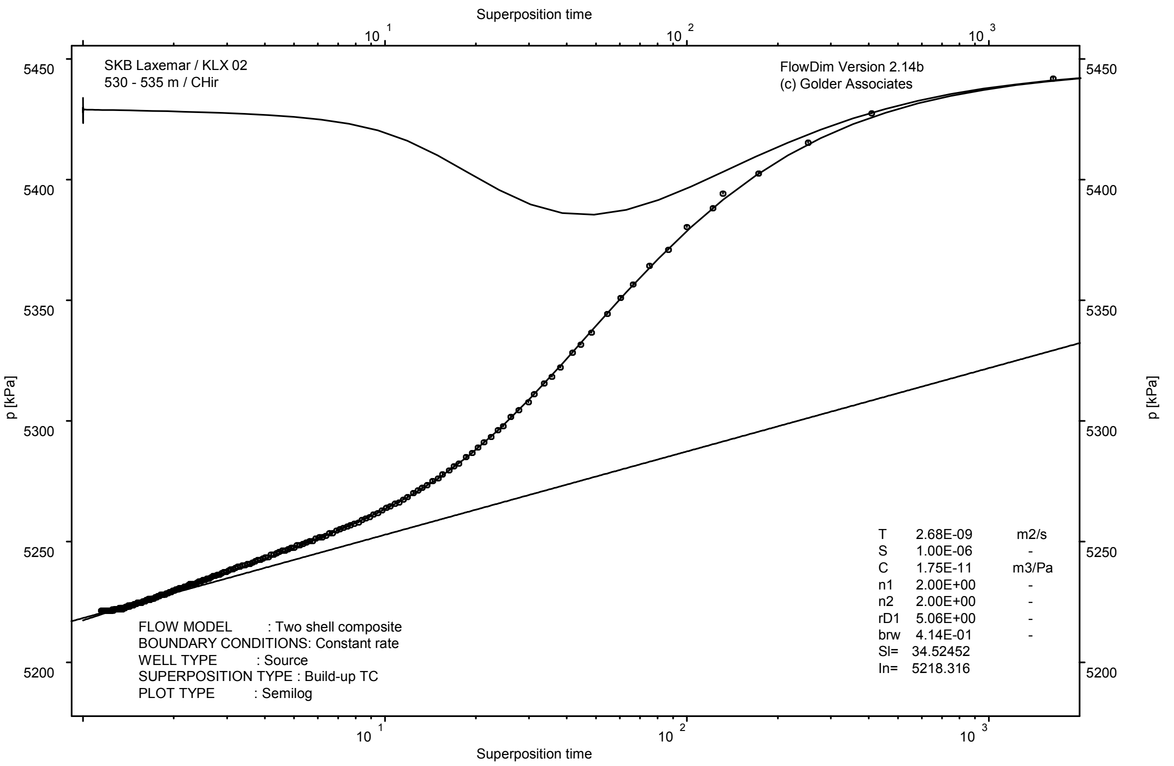
Pressure and temperature in the test section; cartesian plot (analysed)



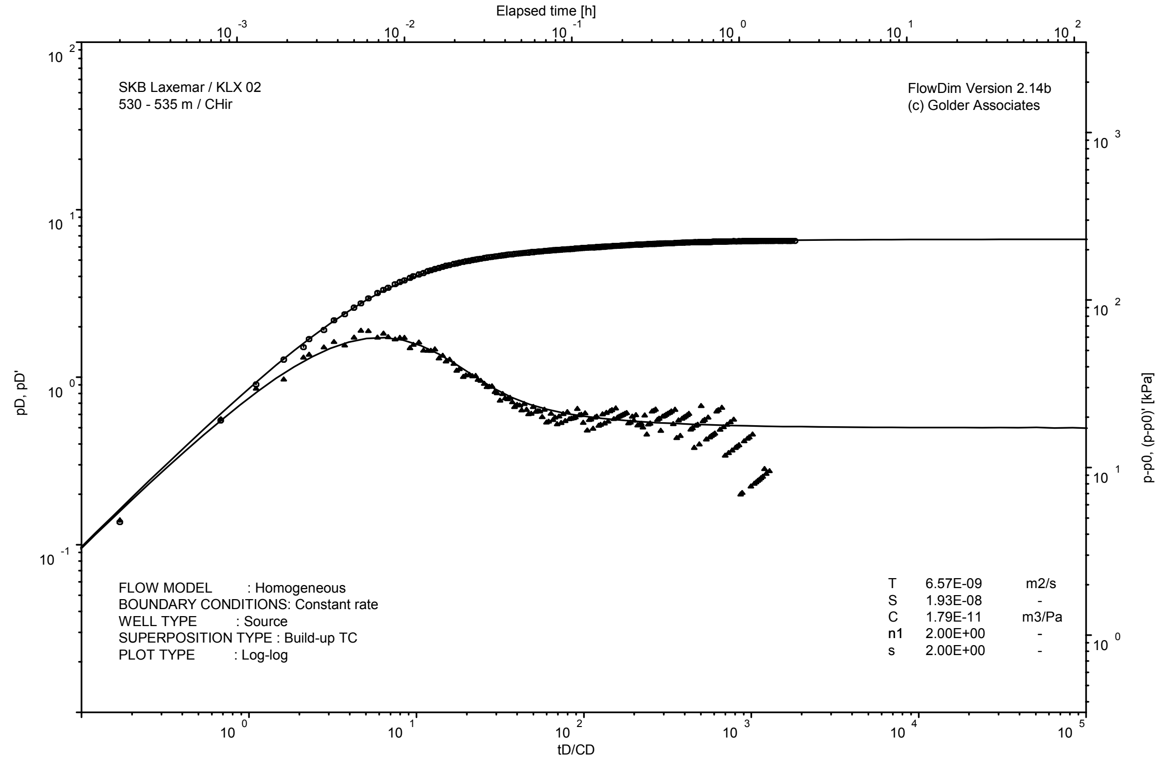
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match

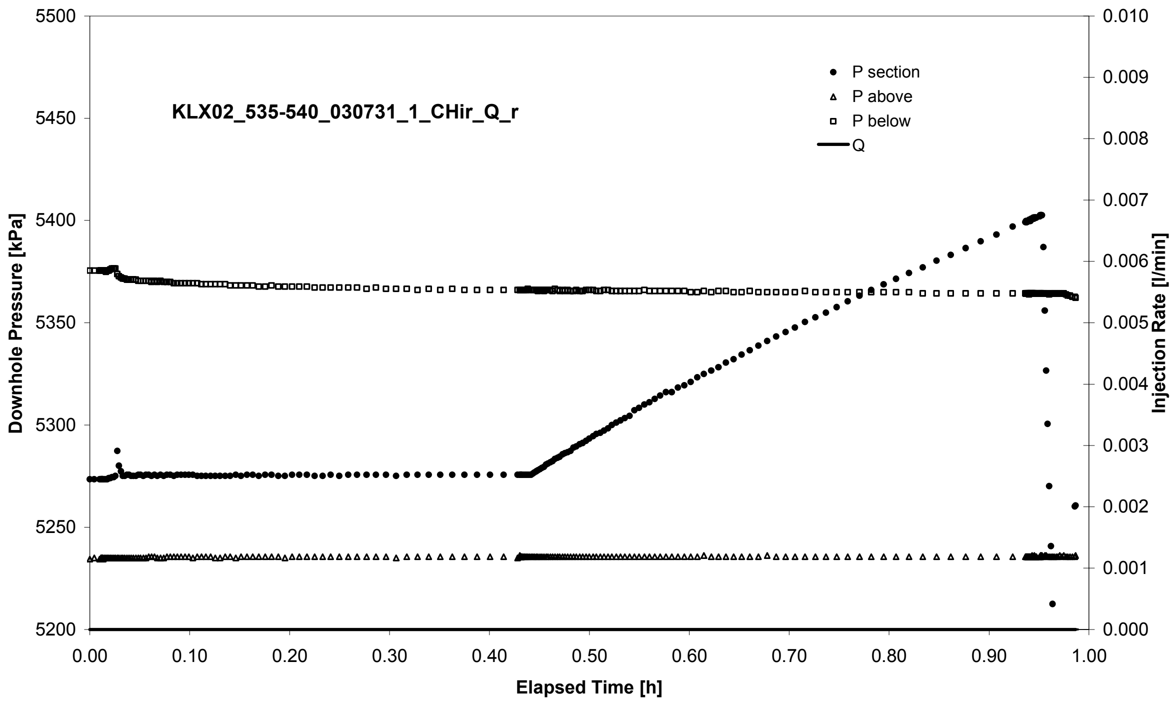


CHIR phase; Homogeneous model analyses, log-log match

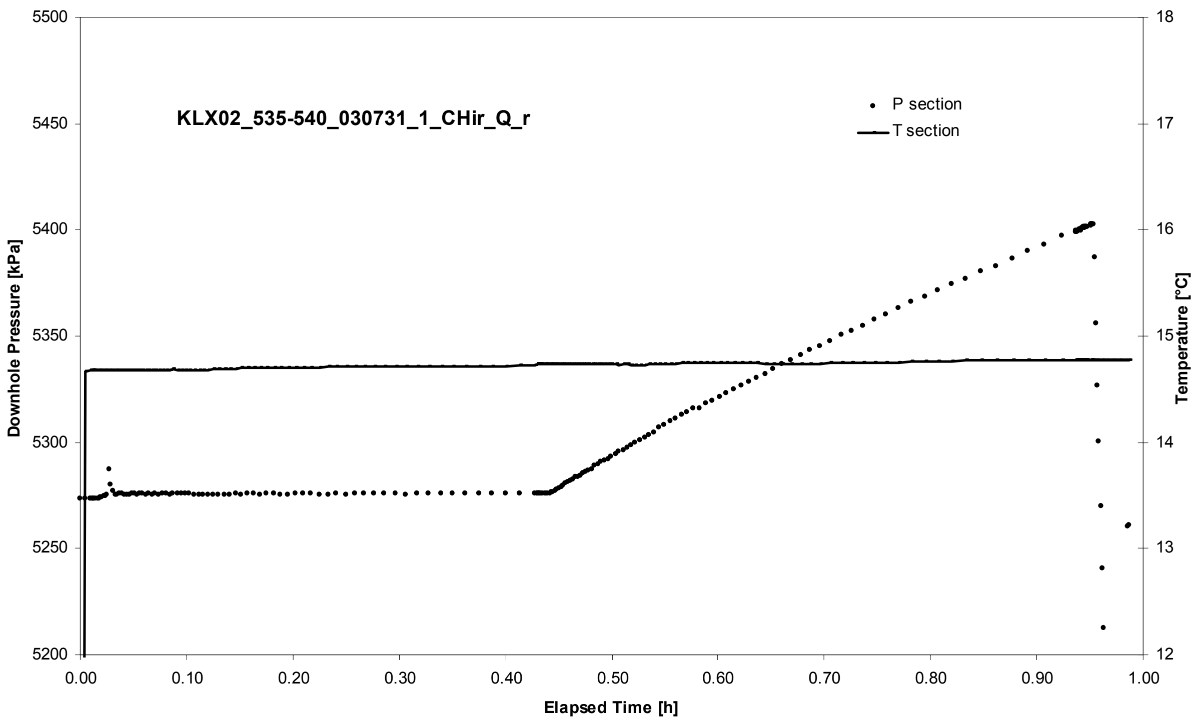
APPENDIX 2-79

Test 535 – 540 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

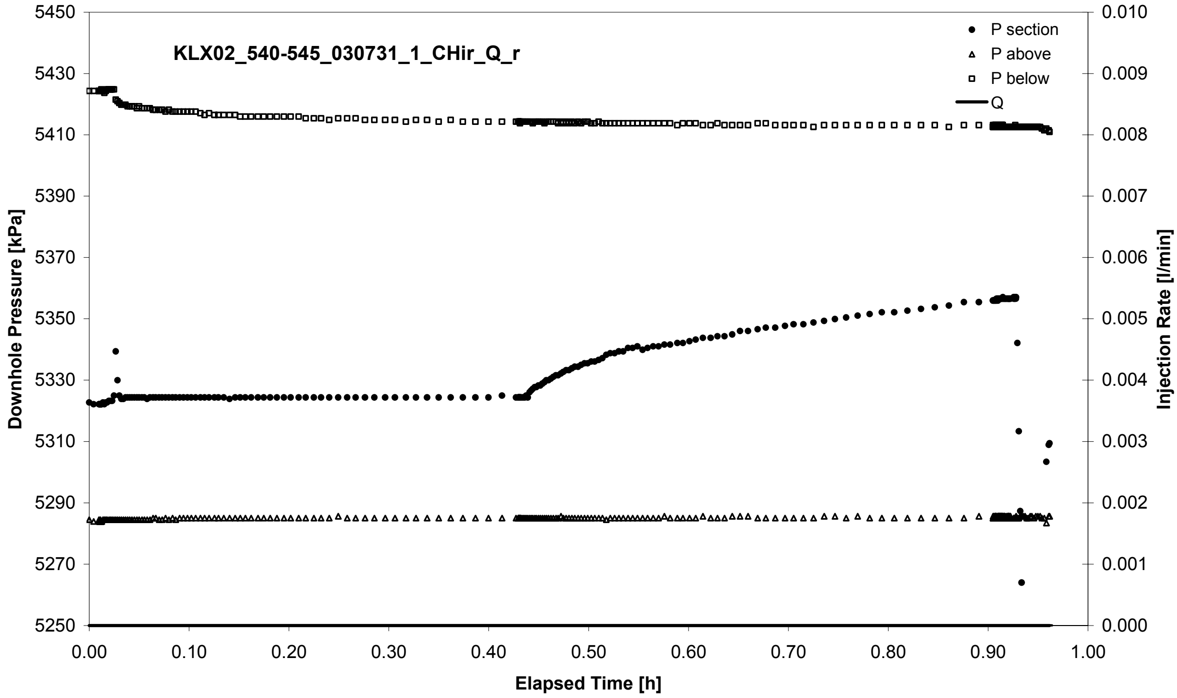
Not Analysed

CHIR phase; HORNER match

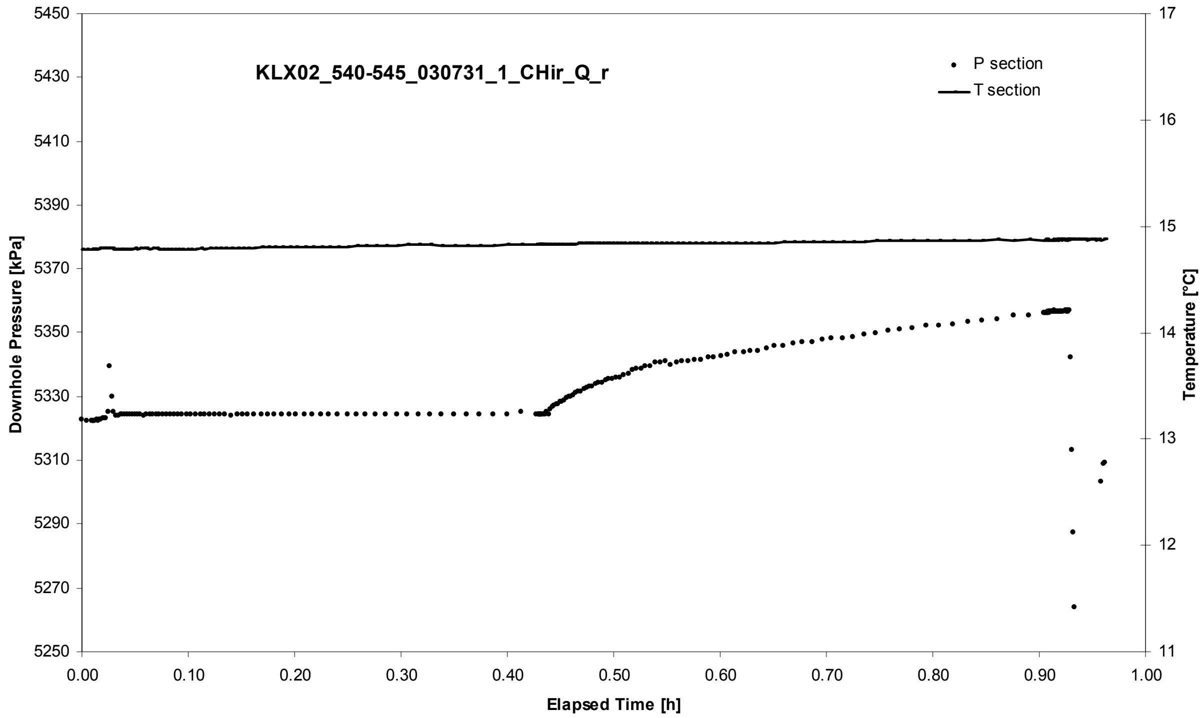
APPENDIX 2-80

Test 540 – 545 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Pressure and temperature in the test section; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

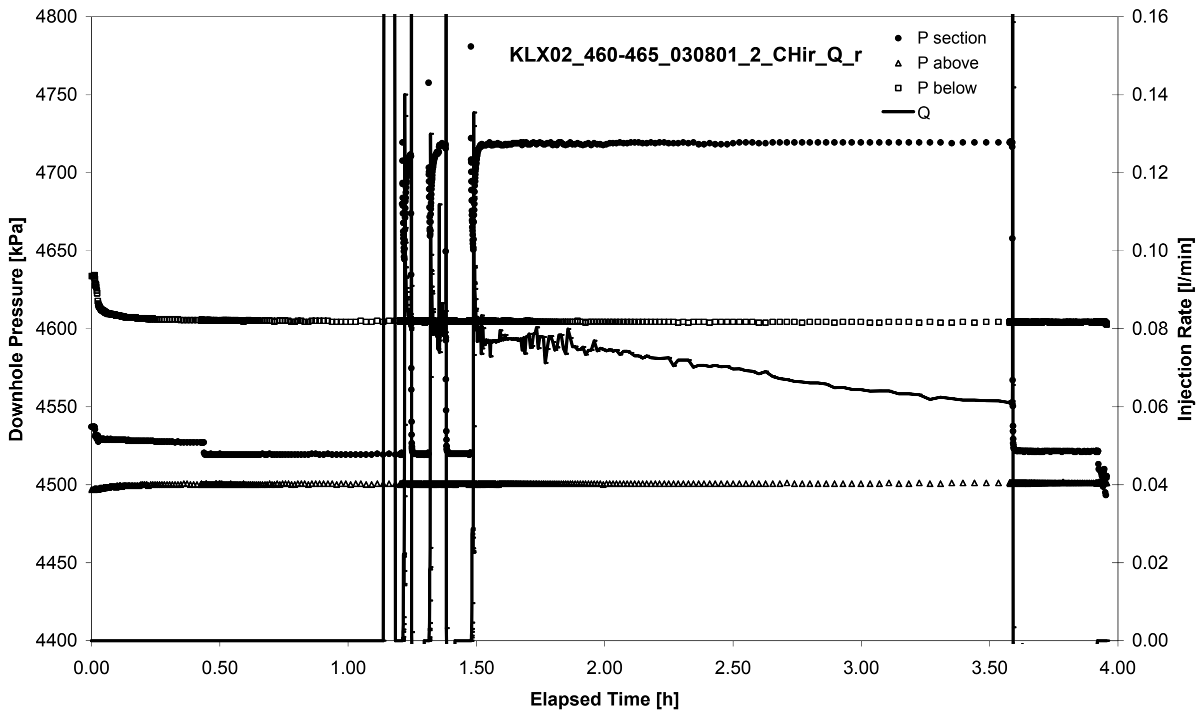
Not Analysed

CHIR phase; HORNER match

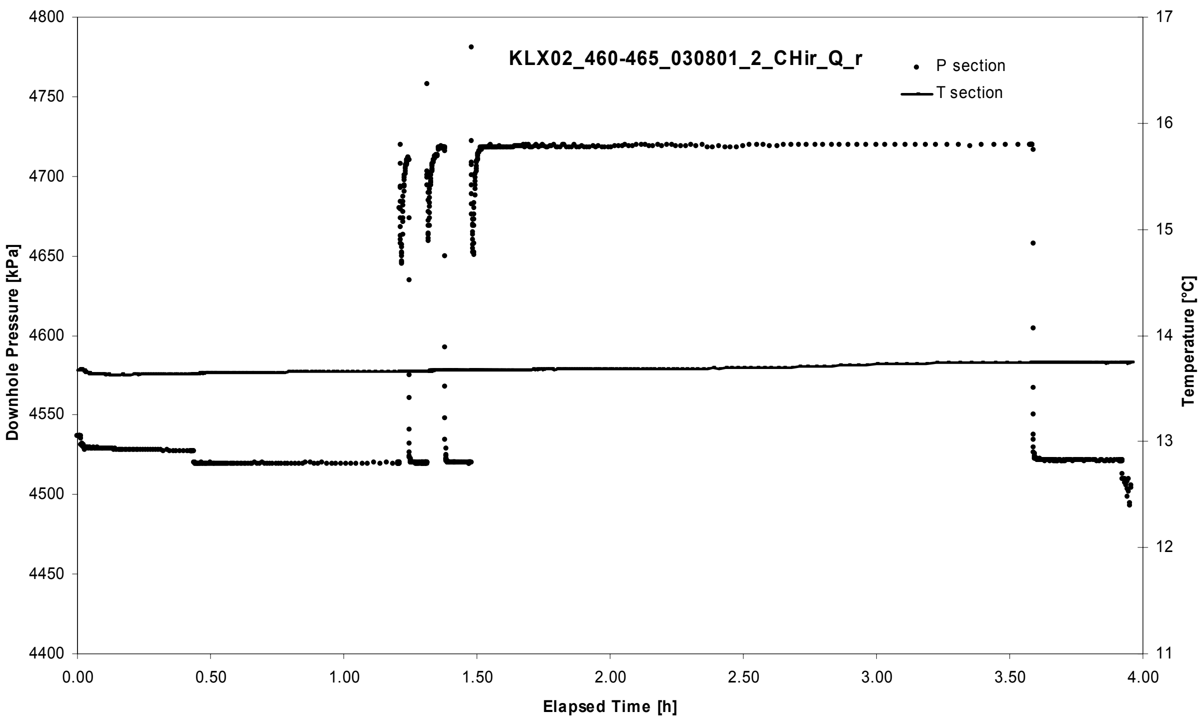
APPENDIX 2-81

Test 460 – 465 m

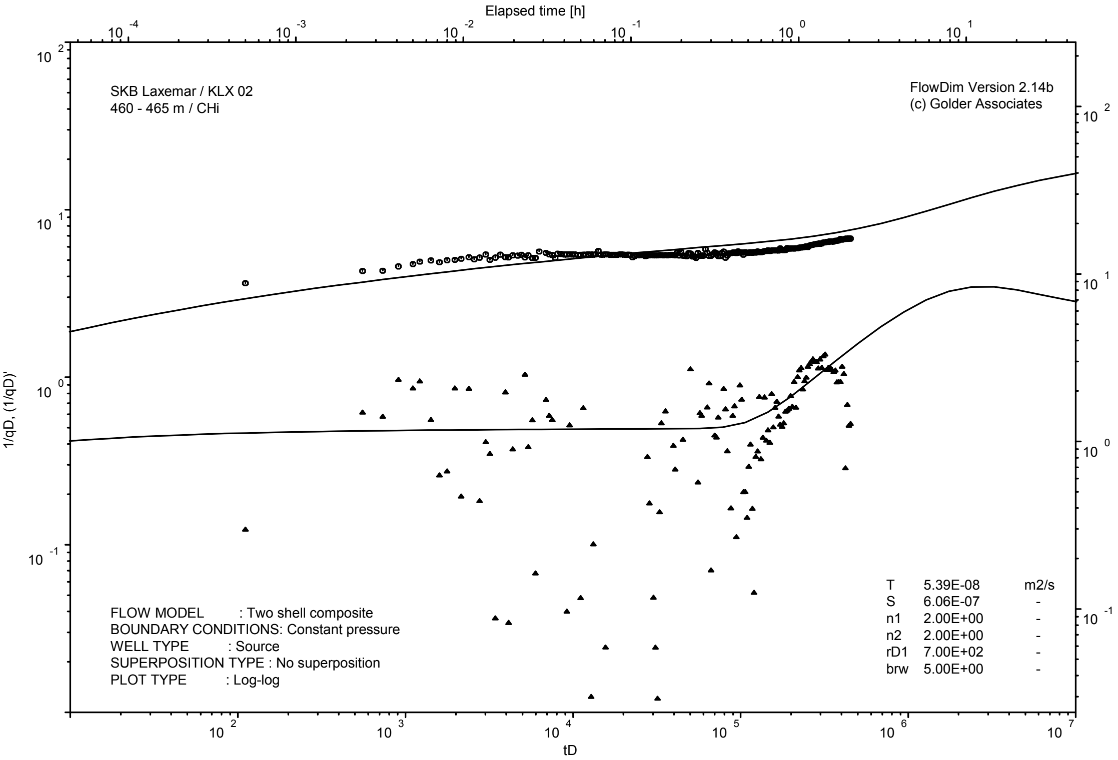
Analysis diagrams



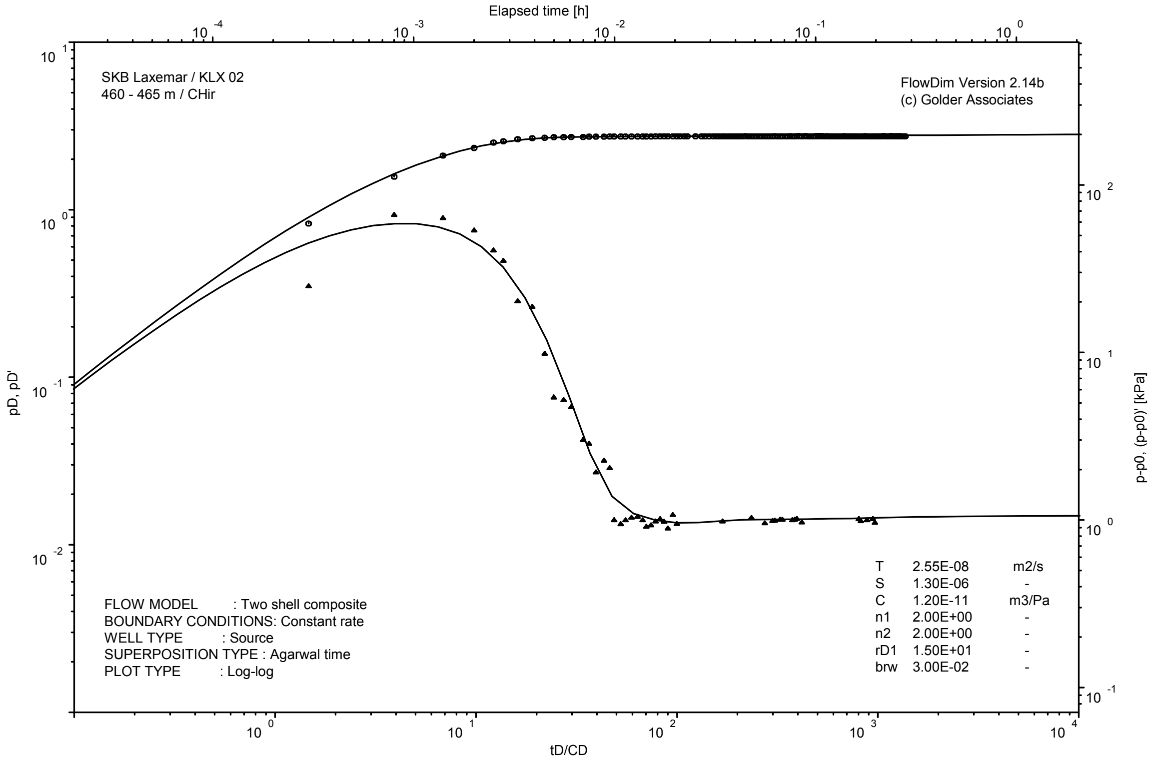
Pressure and flow rate vs. time; cartesian plot



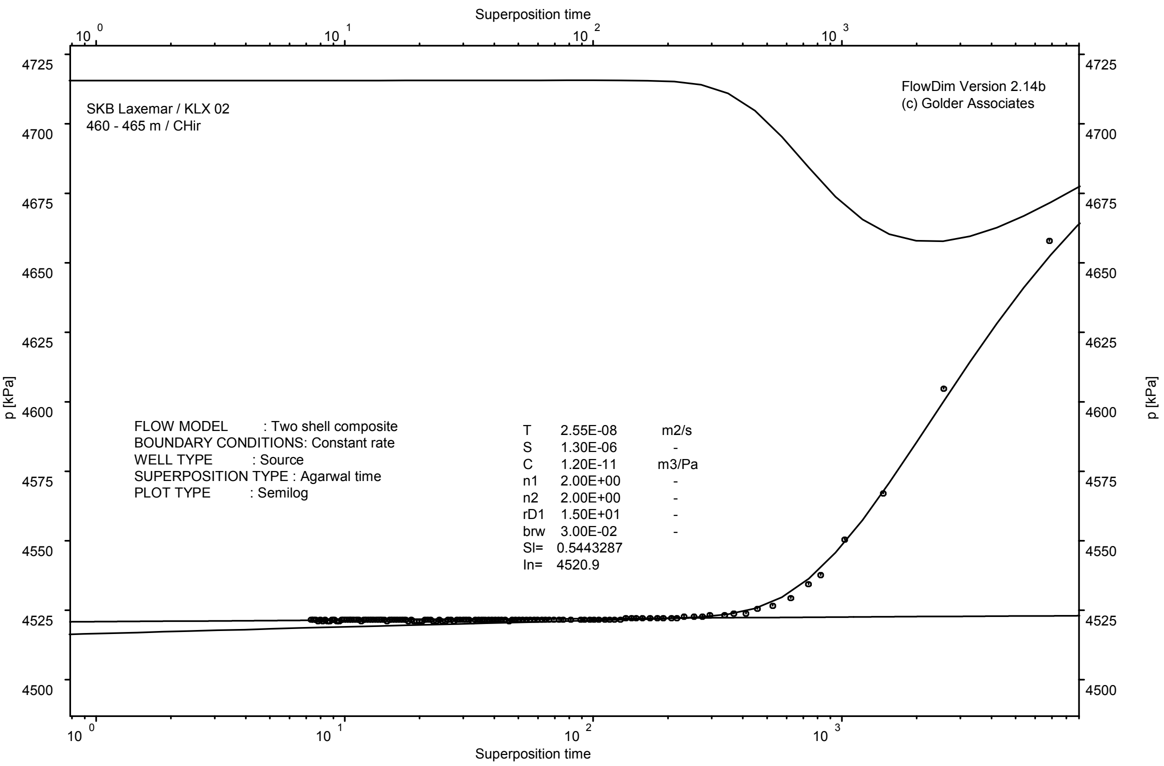
Pressure and temperature in the test section; cartesian plot



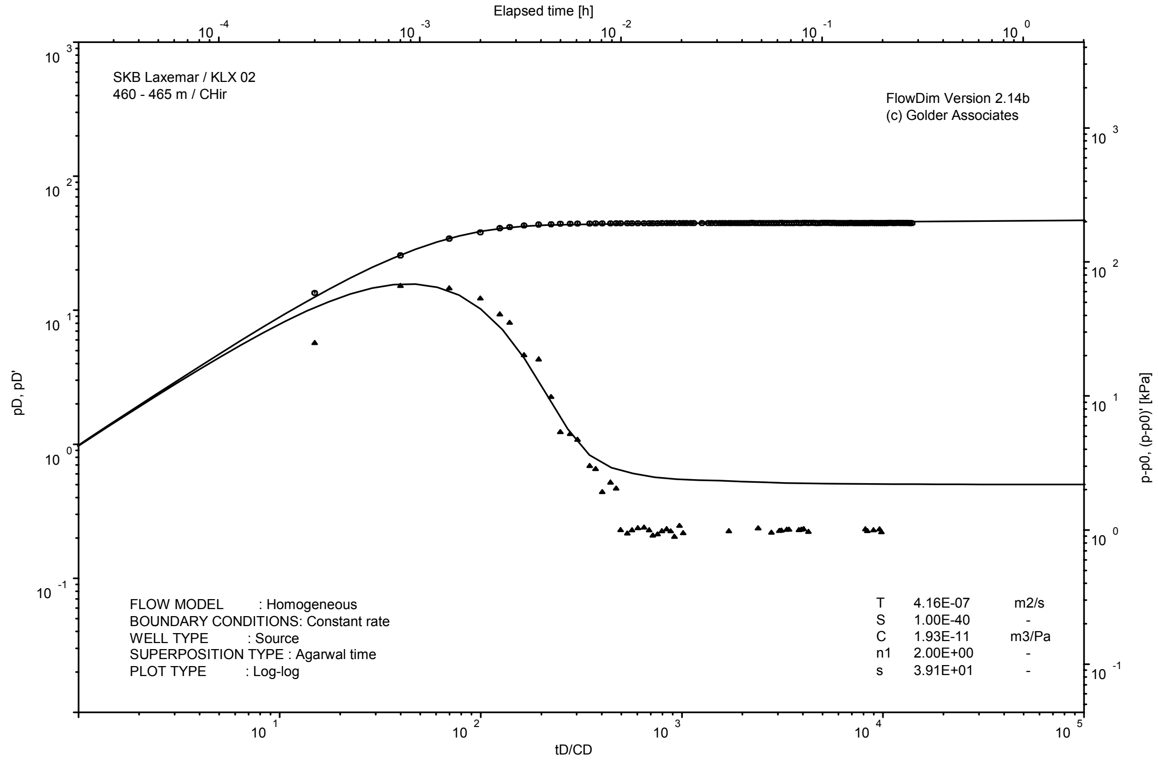
CHI phase; log-log match



CHIR phase; log-log match



CHIR phase; HORNER match



CHIR phase; Homogeneous model analyses, log-log match

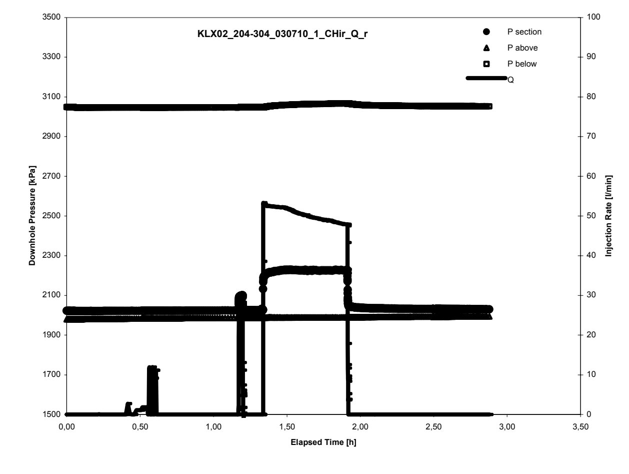
APPENDIX 3

Test Summary Sheets

Test Summary Sheet

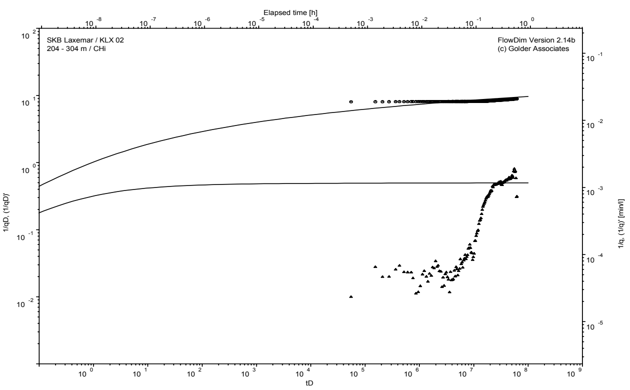
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	1
Borehole ID:	KLX 02	Test start:	030710 08:23
Test section from - to (m):	204 - 304 m brp	Responsible for test execution:	N. Rahm
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

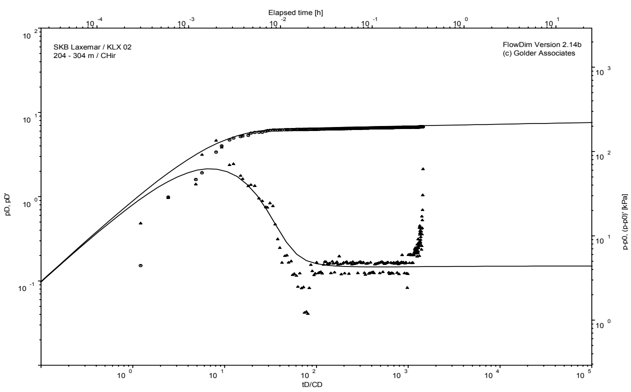


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	2021		
p_i (kPa) =	2026		
p_p(kPa) =	2227	p_F (kPa) =	2030
Q_p (m^3/s)=	7,92E-04		
tp (s) =	2160	t_F (s) =	2040
S el S^* (-)=	1,26E-06	S el S^* (-)=	2,80E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	11		
Derivative fact.=	0,16	Derivative fact.=	0,09
Results		**Results**	
Q/s (m^2/s)=	3,86E-05		
T_M (m^2/s)=	5,03E-05		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	13,65	dt_1 (min) =	1,2876
dt_2 (min) =	20,98	dt_2 (min) =	16,6572
T (m^2/s) =	5,6E-05	T (m^2/s) =	5,0E-05
S (-) =	1,3E-06	S (-) =	2,8E-06
K_s (m/s) =	5,6E-07	K_s (m/s) =	5,0E-07
S_s (1/m) =	1,3E-08	S_s (1/m) =	2,8E-08
C (m^3/Pa) =	N.A.	C (m^3/Pa) =	2,6E-08
C_D (-) =	N.A.	C_D (-) =	3,1E-03
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	13,65	C (m^3/Pa) =	2,6E-08
dt_2 (min) =	20,98	C_D (-) =	3,1E-03
T_T (m^2/s) =	5,6E-05	ξ (-) =	0
S (-) =	1,3E-06		
K_s (m/s) =	5,6E-07		
S_s (1/m) =	1,3E-08		

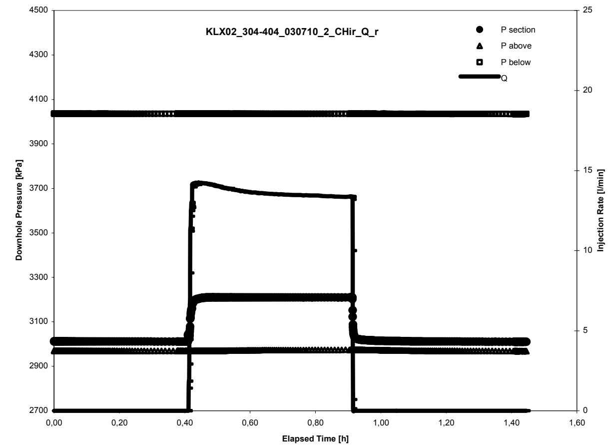
Comments:

The radial composite flow model selected for the analysis of the CHIR phase reflects the presence of a zone of lower transmissivity in the borehole vicinity. With a discontinuity radius of 19 m (calculated assuming S = 2.8E-6) the inner composite zone cannot be regarded as a skin. Therefore, the inner composite shell parameters are regarded as representative for the small scale formation properties.

Test Summary Sheet

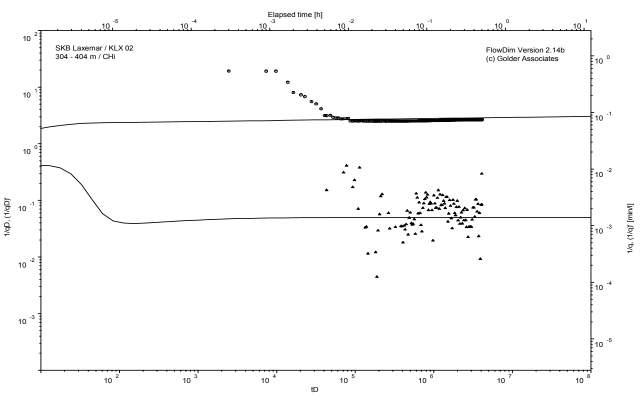
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	2
Borehole ID:	KLX 02	Test start:	030710 13:06
Test section from - to (m):	304 - 404 m brp	Responsible for test execution:	N. Rahm
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

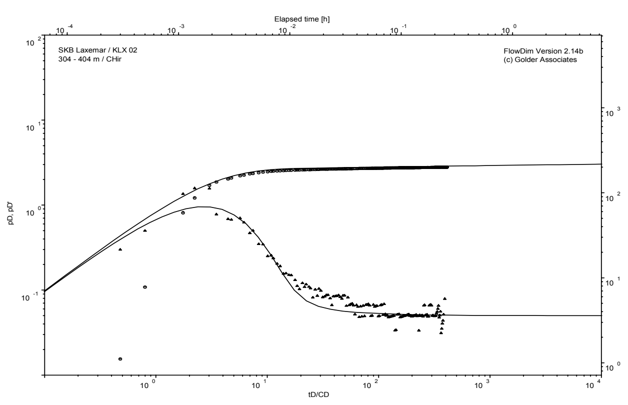


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3012		
p_i (kPa) =	3011		
p_p(kPa) =	3210	p_F (kPa) =	3010
Q_p (m^3/s)=	2,20E-04		
tp (s) =	1980	t_F (s) =	1800
S el S^* (-)=	1,40E-06	S el S^* (-)=	7,69E-07
EC_w (mS/m)=			
$Temp_w$(gr C)=	11,2		
Derivative fact.=	0,02	Derivative fact.=	0,09
Results		**Results**	
Q/s (m^2/s)=	1,08E-05		
T_M (m^2/s)=	1,41E-05		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	3,59	dt_1 (min) =	2,30
dt_2 (min) =	24,35	dt_2 (min) =	13,32
T (m^2/s) =	4,6E-05	T (m^2/s) =	4,9E-05
S (-) =	1,4E-06	S (-) =	7,7E-07
K_s (m/s) =	4,6E-07	K_s (m/s) =	4,9E-07
S_s (1/m) =	1,4E-08	S_s (1/m) =	7,7E-09
C (m^3/Pa) =	N.A.	C (m^3/Pa) =	7,1E-09
C_D (-) =	N.A.	C_D (-) =	3,1E-03
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	2,30	C (m^3/Pa) =	7,1E-09
dt_2 (min) =	13,32	C_D (-) =	3,1E-03
T_T (m^2/s) =	4,9E-05	ξ (-) =	0
S (-) =	7,7E-07		
K_s (m/s) =	4,9E-07		
S_s (1/m) =	7,7E-09		

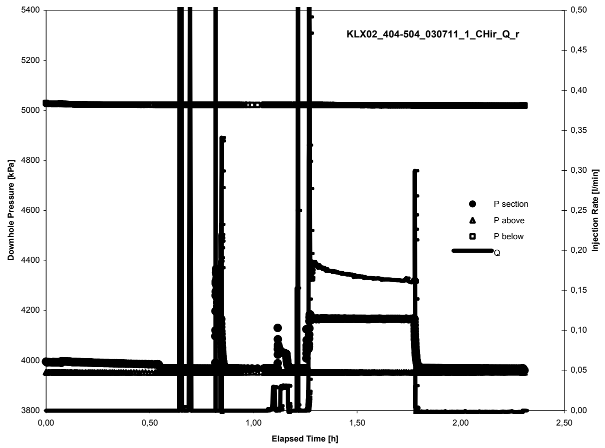
Comments:

The radial composite flow model selected for the analysis of the CHI and CHIR phase reflects the presence of a zone of lower transmissivity in the borehole vicinity. With a discontinuity radius of 0.38 m (calculated assuming S = 7.7E-7) the inner composite zone can be regarded as a skin. Therefore, the outer composite shell parameters are regarded as representative for the small to medium scale formation properties.

Test Summary Sheet

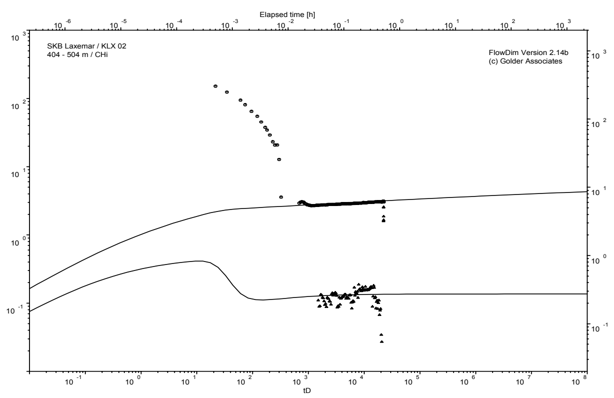
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	3
Borehole ID:	KLX 02	Test start:	030710 17:17
Test section from - to (m):	404 - 504 m brp	Responsible for test execution:	N. Rahm
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

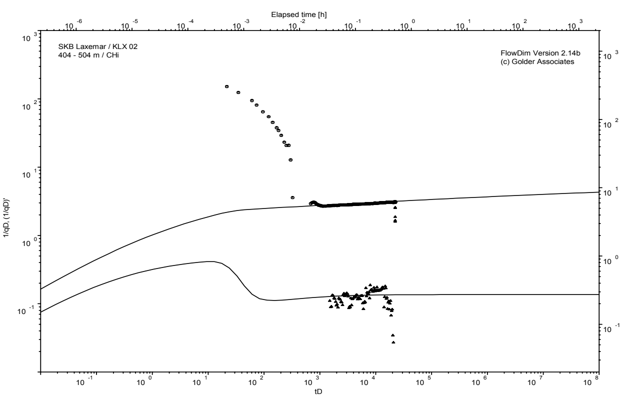


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3994		
p_i (kPa) =	3968		
p_p(kPa) =	4167	p_F (kPa) =	3969
Q_p (m^3/s)=	2,67E-06		
tp (s) =	1980	t_F (s) =	1920
S el S^* (-)=	3,8E-06	S el S^* (-)=	2,8E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	*		
Derivative fact.=	0,17	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	1,31E-07		
T_M (m^2/s)=	1,71E-07		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	3,85	dt_1 (min) =	3,92
dt_2 (min) =	10,50	dt_2 (min) =	13,53
T (m^2/s) =	6,5E-08	T (m^2/s) =	5,3E-07
S (-) =	3,8E-06	S (-) =	2,8E-06
K_s (m/s) =	6,5E-10	K_s (m/s) =	5,3E-09
S_s (1/m) =	3,8E-08	S_s (1/m) =	2,8E-08
C (m^3/Pa) =	N.A.	C (m^3/Pa) =	2,6E-10
C_D (-) =	N.A.	C_D (-) =	3,1E-05
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	3,92	C (m^3/Pa) =	2,6E-10
dt_2 (min) =	13,53	C_D (-) =	3,1E-05
T_T (m^2/s) =	5,3E-07	ξ (-) =	0
S (-) =	2,8E-06		
K_s (m/s) =	5,3E-09		
S_s (1/m) =	2,8E-08		

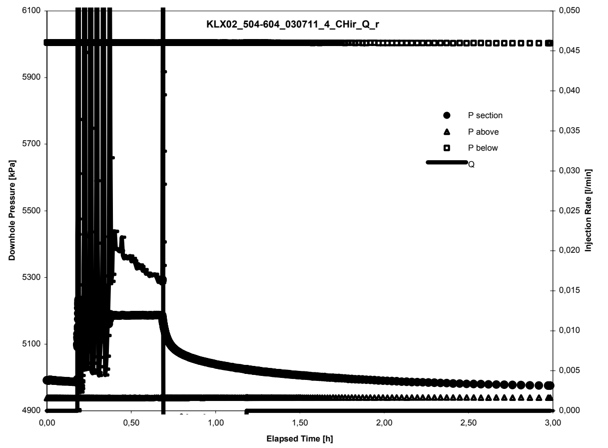
Comments:

The radial composite flow model selected for the analysis of the CHI and CHIR phases reflects the presence of a zone of lower transmissivity in the borehole vicinity. With a discontinuity radius of 0.38 m (calculated assuming S = 2.8E-6) the inner composite zone can be regarded as a skin. Therefore, the outer composite shell parameters are regarded as representative for the small to medium scale formation properties.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	4
Borehole ID:	KLX 02	Test start:	030711 10:05
Test section from - to (m):	504 - 604 m brp	Responsible for test execution:	N. Rahm
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

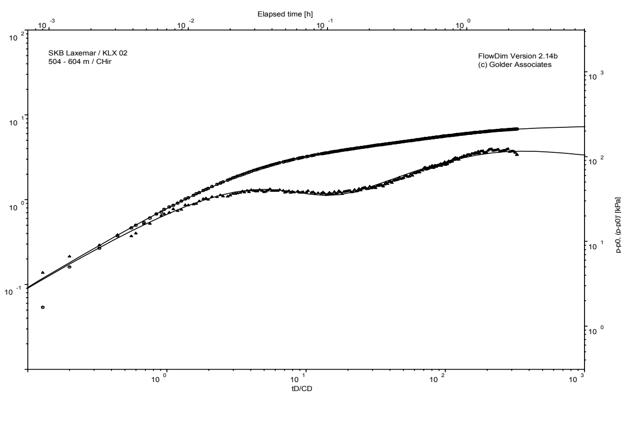


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4968		
p_i (kPa) =	4987		
p_p(kPa) =	5187	p_F (kPa) =	4975
Q_p (m^3/s)=	2,67E-07		
tp (s) =	1800	t_F (s) =	8340
S el S^* (-)=	NA	S el S^* (-)=	1,10E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,4		
Derivative fact.=		Derivative fact.=	0,07
Results		**Results**	
Q/s (m^2/s)=	1,31E-08		
T_M (m^2/s)=	1,70E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	1,70
dt_2 (min) =	NA	dt_2 (min) =	52,00
T (m^2/s) =	NA	T (m^2/s) =	1,5E-08
S (-) =	NA	S (-) =	1,1E-06
K_s (m/s) =	NA	K_s (m/s) =	1,5E-10
S_s (1/m) =	NA	S_s (1/m) =	1,1E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	2,5E-10
C_D (-) =	NA	C_D (-) =	7,6E-05
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	1,70	C (m^3/Pa) =	2,5E-10
dt_2 (min) =	52,00	C_D (-) =	7,6E-05
T_T (m^2/s) =	1,5E-08	ξ (-) =	0
S (-) =	1,1E-06		
K_s (m/s) =	1,5E-10		
S_s (1/m) =	1,1E-08		

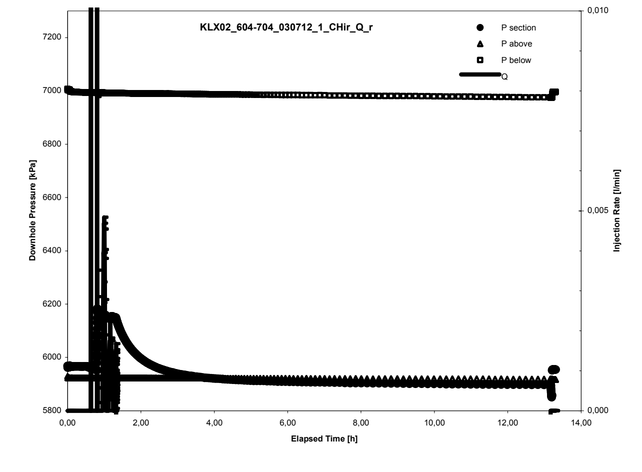
Comments:

The CHI data is not analysable. The radial composite flow model selected for the analysis of the CHIR phase reflects the presence of a zone of higher transmissivity in the borehole vicinity. With a discontinuity radius of 2.4 m (calculated assuming S = 1.1E-6) the inner composite zone cannot be regarded as a skin. Therefore, the inner composite shell parameters are regarded as representative for the small scale formation properties.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	5
Borehole ID:	KLX 02	Test start:	030711 18:46
Test section from - to (m):	604 - 704 m brp	Responsible for test execution:	N. Rahm
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

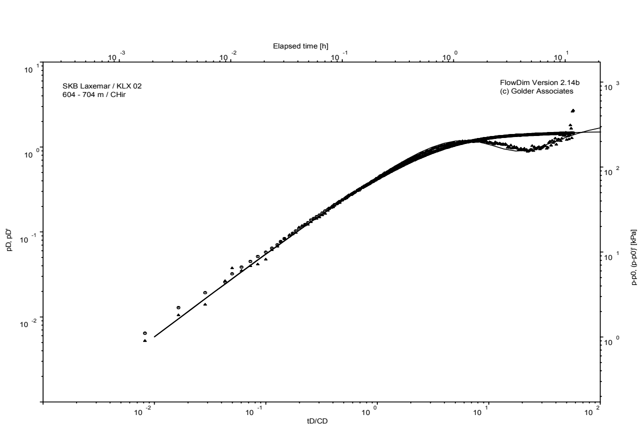


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	5963		
p_i (kPa) =	5953		
p_p(kPa) =	6149	p_F (kPa) =	5897
Q_p (m^3/s)=	2,50E-08		
tp (s) =	1800	t_F (s) =	42300
S el S* (-)=	NA	S el S* (-)=	2,8E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	15,8		
Derivative fact.=		Derivative fact.=	0,09
Results		**Results**	
Q/s (m^2/s)=	1,25E-09		
T_M (m^2/s)=	1,63E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	283,88
dt_2 (min) =	NA	dt_2 (min) =	660,18
T (m^2/s) =	NA	T (m^2/s) =	3,0E-10
S (-) =	NA	S (-) =	2,8E-06
K_s (m/s) =	NA	K_s (m/s) =	3,0E-12
S_s (1/m) =	NA	S_s (1/m) =	2,8E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,4E-10
C_D (-) =	NA	C_D (-) =	1,7E-05
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	
Selected representative parameters.			
dt_1 (min) =	283,88	C (m^3/Pa) =	1,4E-10
dt_2 (min) =	660,18	C_D (-) =	1,7E-05
T_T (m^2/s) =	3,0E-10	ξ (-) =	0
S (-) =	2,8E-06		
K_s (m/s) =	3,0E-12		
S_s (1/m) =	2,8E-08		

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



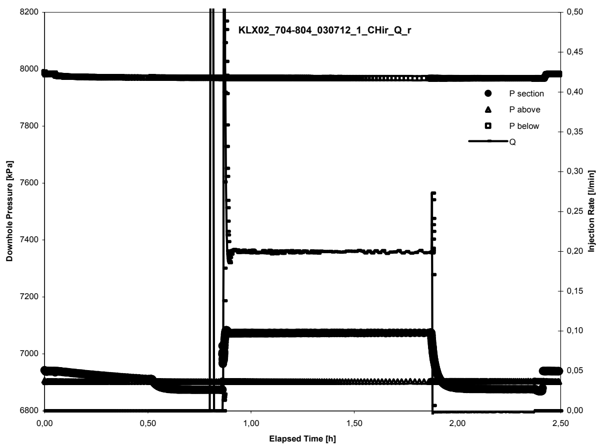
Comments:

The CHI data is not analysable. The radial composite flow model selected for the analysis of the CHIR phase reflects the presence of a zone of higher transmissivity in the borehole vicinity. With a discontinuity radius of 1.2 m (calculated assuming S = 2.8E-6) the inner composite zone cannot be regarded as a skin. Therefore, the inner composite shell parameters are regarded as representative for the small scale formation properties.

Test Summary Sheet

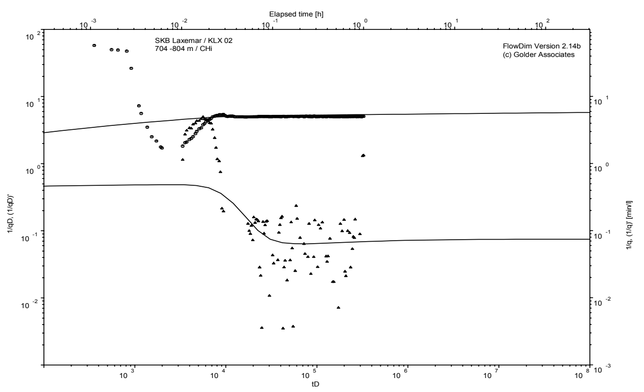
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	6
Borehole ID:	KLX 02	Test start:	030712 09:31
Test section from - to (m):	704 - 804 m brp	Responsible for test execution:	N. Rahm
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

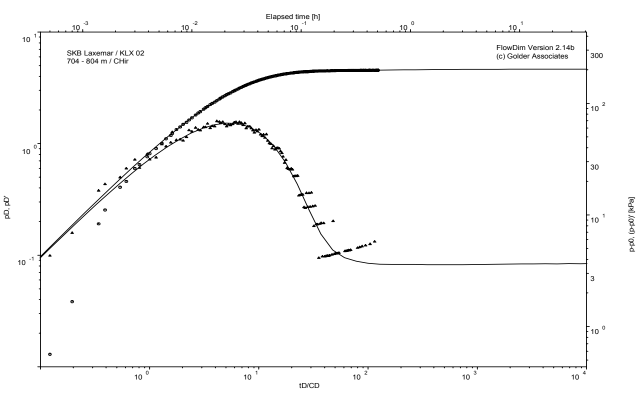


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	6939		
p_i (kPa) =	6874		
p_p(kPa) =	7074	p_F (kPa) =	6876
Q_p (m^3/s)=	3,32E-06		
tp (s) =	3600	t_F (s) =	1800
S el S^* (-)=	1,00E-06	S el S^* (-)=	3,20E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	17,3		
Derivative fact.=	0,02	Derivative fact.=	0,07
Results		**Results**	
Q/s (m^2/s)=	1,63E-07		
T_M (m^2/s)=	2,12E-07		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	7,03	dt_1 (min) =	*
dt_2 (min) =	47,40	dt_2 (min) =	*
T (m^2/s) =	1,3E-07	T (m^2/s) =	1,2E-07
S (-) =	1,0E-06	S (-) =	3,2E-06
K_s (m/s) =	1,3E-09	K_s (m/s) =	1,2E-09
S_s (1/m) =	1,0E-08	S_s (1/m) =	3,2E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,1E-09
C_D (-) =	NA	C_D (-) =	3,8E+02
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	7,03	C (m^3/Pa) =	1,1E-09
dt_2 (min) =	47,40	C_D (-) =	3,8E+02
T_T (m^2/s) =	1,2E-07	ξ (-) =	0
S (-) =	3,2E-06		
K_s (m/s) =	1,2E-09		
S_s (1/m) =	3,2E-08		

Comments:

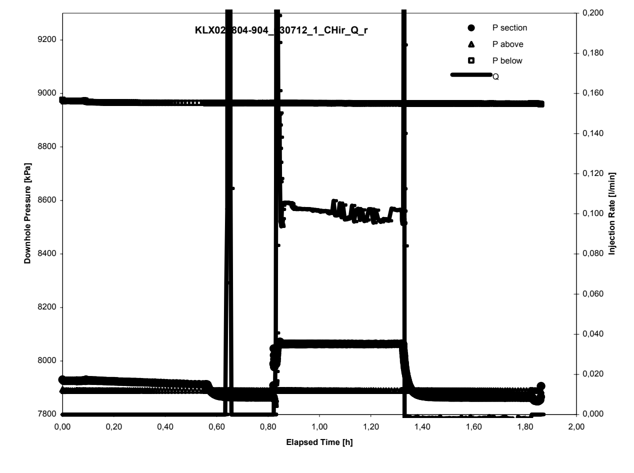
* : IARF not measured

The radial composite flow model selected for the analysis of the CHI and CHIR phases reflects the presence of a zone of lower transmissivity in the borehole vicinity. With a discontinuity radius of between 2.9 m and 6.5 m (calculated assuming a storativity of 3.2E-6 and 1.0E-6 respectively) the inner composite zone cannot be regarded as a skin. Therefore, the inner composite shell parameters are regarded as representative for the small to medium scale formation properties.

Test Summary Sheet

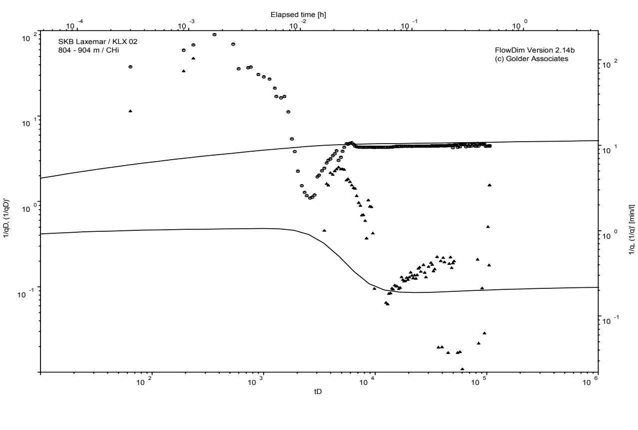
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	7
Borehole ID:	KLX 02	Test start:	030712 14:29
Test section from - to (m):	804 - 904 m brp	Responsible for test execution:	N. Rahm
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

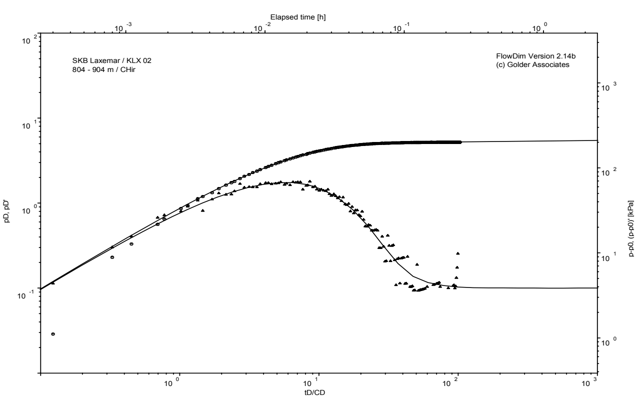


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	7926		
p_i (kPa) =	7864		
p_p(kPa) =	8063	p_F (kPa) =	7862
Q_p (m^3/s)=	1,58E-06		
tp (s) =	1800	t_F (s) =	1980
S el S^* (-)=	6,90E-07	S el S^* (-)=	2,90E-07
EC_w (mS/m)=			
$Temp_w$(gr C)=	18,9		
Derivative fact.=	0,27	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	7,81E-08		
T_M (m^2/s)=	1,02E-07		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	2,77	dt_1 (min) =	8,76
dt_2 (min) =	25,60	dt_2 (min) =	13,87
T (m^2/s) =	5,9E-08	T (m^2/s) =	6,9E-08
S (-) =	6,9E-07	S (-) =	2,9E-07
K_s (m/s) =	5,9E-10	K_s (m/s) =	6,9E-10
S_s (1/m) =	6,9E-09	S_s (1/m) =	2,9E-09
C (m^3/Pa) =	NA	C (m^3/Pa) =	3,9E-10
C_D (-) =	NA	C_D (-) =	1,4E+03
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	8,76	C (m^3/Pa) =	3,9E-10
dt_2 (min) =	13,87	C_D (-) =	1,4E+03
T_T (m^2/s) =	6,9E-08	ξ (-) =	0
S (-) =	2,9E-07		
K_s (m/s) =	6,9E-10		
S_s (1/m) =	2,9E-09		

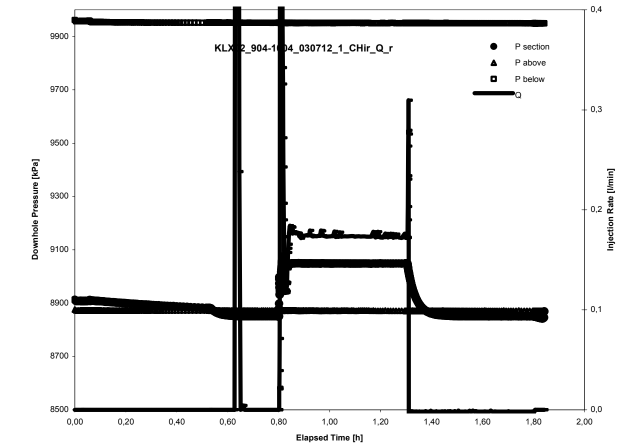
Comments:

The radial composite flow model selected for the analysis of the CHI and CHIR phases reflects the presence of a zone of lower transmissivity in the borehole vicinity. With a discontinuity radius of between 3.8 m and 5.3 m (calculated assuming a storativity of 2.9E-7 and 4.2E-7 respectively) the inner composite zone cannot be regarded as a skin. Therefore, the inner composite shell parameters are regarded as representative for the small to medium scale formation properties.

Test Summary Sheet

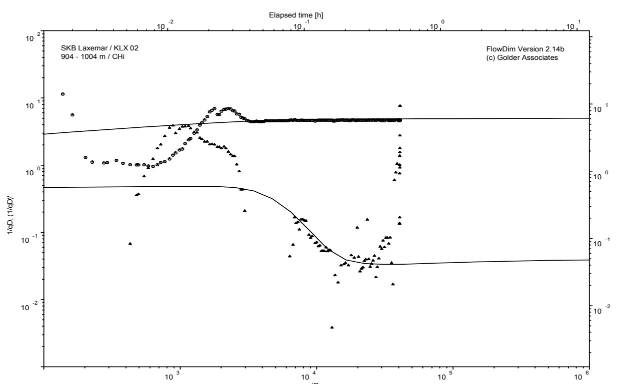
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	8
Borehole ID:	KLX 02	Test start:	030712 17:51
Test section from - to (m):	904 - 1004 m brp	Responsible for test execution:	N. Rahm
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

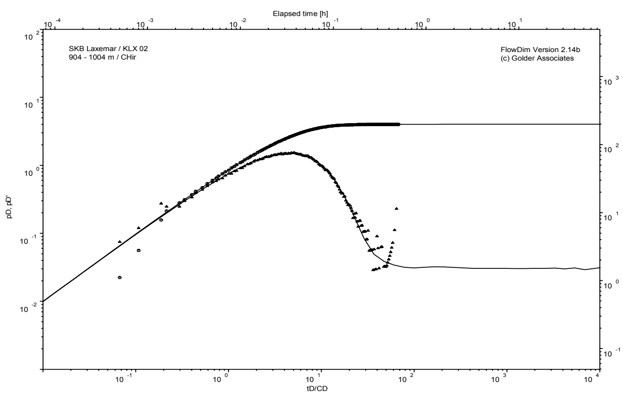


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	8909		
p_i (kPa) =	8850		
p_p(kPa) =	9048	p_F (kPa) =	8850
Q_p (m^3/s)=	2,87E-06		
tp (s) =	1800	t_F (s) =	1800
S el S^* (-)=	3,30E-06	S el S^* (-)=	2,30E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	20,5		
Derivative fact.=	0,30	Derivative fact.=	0,12
Results		**Results**	
Q/s (m^2/s)=	1,42E-07		
T_M (m^2/s)=	1,85E-07		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	18,72	dt_1 (min) =	*
dt_2 (min) =	20,62	dt_2 (min) =	*
T (m^2/s) =	1,1E-07	T (m^2/s) =	9,1E-08
S (-) =	3,3E-06	S (-) =	2,3E-06
K_s (m/s) =	1,1E-09	K_s (m/s) =	9,1E-10
S_s (1/m) =	3,3E-08	S_s (1/m) =	2,3E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,6E-09
C_D (-) =	NA	C_D (-) =	7,5E+02
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	*	C (m^3/Pa) =	1,6E-09
dt_2 (min) =	*	C_D (-) =	7,5E+02
T_T (m^2/s) =	9,1E-08	ξ (-) =	0
S (-) =	2,3E-06		
K_s (m/s) =	9,1E-10		
S_s (1/m) =	2,3E-08		

Comments:

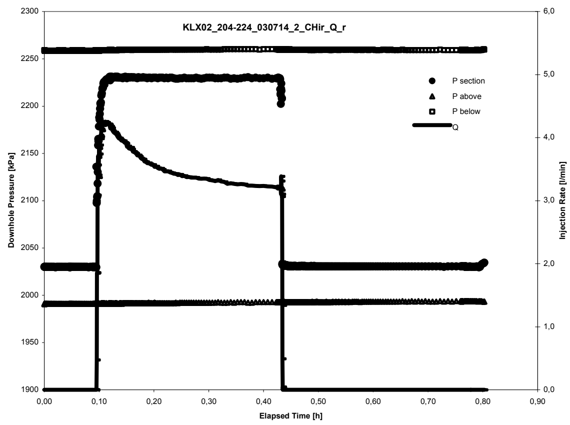
* : IARF not measured

The radial composite flow model selected for the analysis of the CHI and CHIR phases reflects the presence of a zone of lower transmissivity in the borehole vicinity. With a discontinuity radius of between 1.9 m and 4.6 m (calculated assuming a storativity of 2.3E-6 and 3.3E-6 respectively) the inner composite zone cannot be regarded as a skin. Therefore, the inner composite shell parameters are regarded as representative for the small to medium scale formation properties.

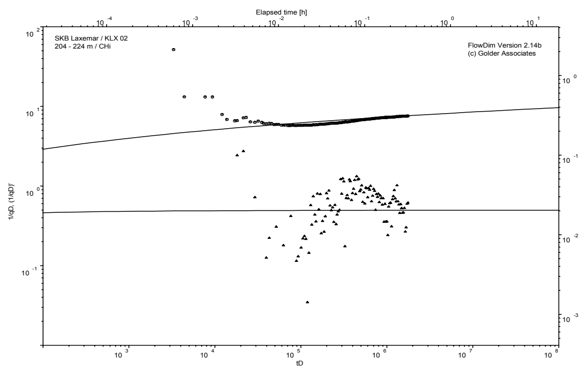
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	9
Borehole ID:	KLX 02	Test start:	030714 12:16
Test section from - to (m):	204 - 224 m brp	Responsible for test execution:	N. Rahm
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

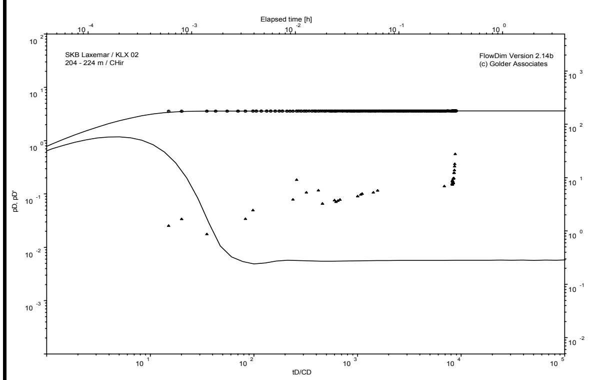
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	2029		
p_i (kPa) =	2030		
p_p(kPa) =	2230	p_F (kPa) =	2030
Q_p (m^3/s)=	5,34E-05		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1,40E-06	S el S^* (-)=	2,60E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	9,8		
Derivative fact.=	0,02	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	2,62E-06		
T_M (m^2/s)=	2,74E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	3,07	dt_1 (min) =	*
dt_2 (min) =	17,02	dt_2 (min) =	*
T (m^2/s) =	3,2E-06	T (m^2/s) =	1,9E-06
S (-) =	1,4E-06	S (-) =	2,6E-06
K_s (m/s) =	1,6E-07	K_s (m/s) =	9,5E-08
S_s (1/m) =	7,0E-08	S_s (1/m) =	1,3E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,7E-10
C_D (-) =	NA	C_D (-) =	7,2E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.

dt_1 (min) =	3,07	C (m^3/Pa) =	1,7E-10
dt_2 (min) =	17,02	C_D (-) =	7,2E+01
T_T (m^2/s) =	3,2E-06	ξ (-) =	0
S (-) =	1,4E-06		
K_s (m/s) =	1,6E-07		
S_s (1/m) =	7,0E-08		

Comments:

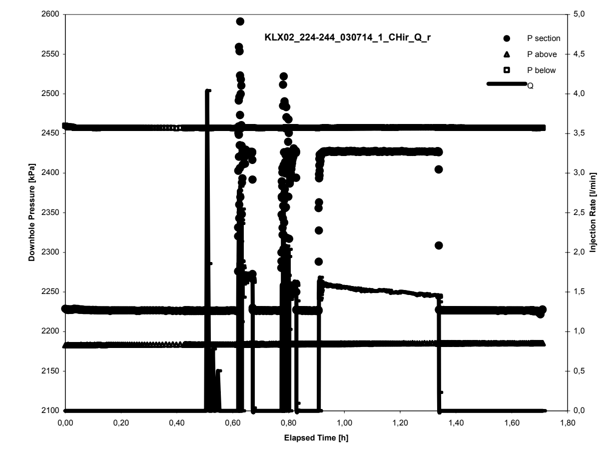
* : IARF not measured

The radial composite flow model selected for the analysis of the CHIR phase is based on the sharp downward slope of the derivative at middle times. Although the late times data quality is poor (the CHIR phase reached static conditions relatively quickly), the outer composite shell seems to show a transmissivity of more than one order of magnitude higher than in the vicinity of the borehole (inner shell). The radius of the inner shell was calculated to 1.4 m (calculated assuming S = 2.6E-6) and appears too big to be regarded as a skin. Therefore, the inner composite shell parameters are regarded as representative for the small scale formation properties. It should be noted however, that the formation shows larger transmissivities further away from the test interval.

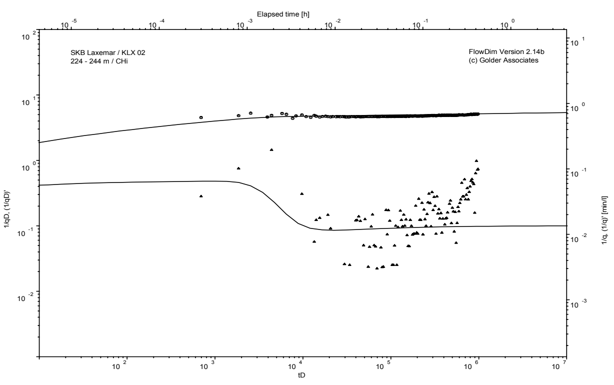
Test Summary Sheet

Project:	Site Investigations	Test type:[1]	3
Area:	Laxemar	Test no:	10
Borehole ID:	KLX 02	Test start:	030714 15:32
Test section from - to (m):	224 - 244 m brp	Responsible for test execution:	N. Rahm
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

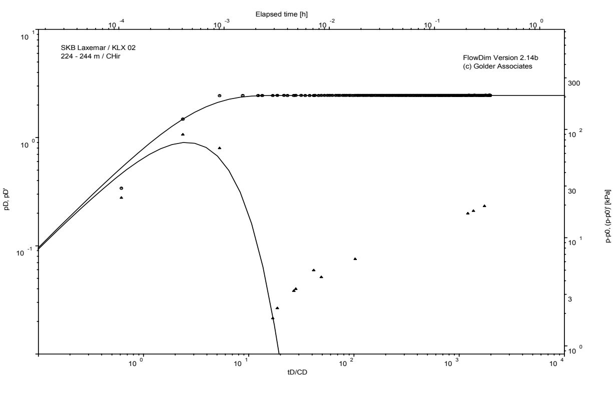
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	2228		
p_i (kPa) =	2227		
p_p(kPa) =	2427	p_F (kPa) =	2227
Q_p (m^3/s)=	2,40E-05		
tp (s) =	1500	t_F (s) =	1200
S el S^* (-)=	1,0E-06	S el S^* (-)=	1,7E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	10,2		
Derivative fact.=	0,10	Derivative fact.=	0,00
Results		**Results**	
Q/s (m^2/s)=	1,18E-06		
T_M (m^2/s)=	1,23E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0,53	dt_1 (min) =	*
dt_2 (min) =	14,66	dt_2 (min) =	*
T (m^2/s) =	9,7E-07	T (m^2/s) =	4,7E-07
S (-) =	1,0E-06	S (-) =	1,7E-06
K_s (m/s) =	4,9E-08	K_s (m/s) =	2,4E-08
S_s (1/m) =	5,0E-08	S_s (1/m) =	8,5E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,9E-10
C_D (-) =	NA	C_D (-) =	1,2E+02
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.			
dt_1 (min) =	0,53	C (m^3/Pa) =	1,9E-10
dt_2 (min) =	14,66	C_D (-) =	1,2E+02
T_T (m^2/s) =	9,7E-07	ξ (-) =	0
S (-) =	1,0E-06		
K_s (m/s) =	4,9E-08		
S_s (1/m) =	5,0E-08		

Comments:

* : IARF not measured

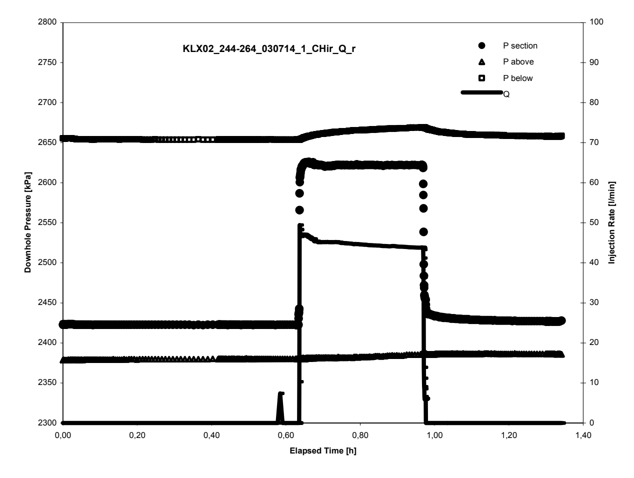
The CHIR phase reached static conditions relatively quickly which was interpreted as a 2 shell composite as well with a strong increase of transmissivity of the outer composite shell. Due to the early recovery during the CHIR phase, the results derived from the CHI phase are regarded as being more reliable.

The radius of the inner shell was calculated to 3.8 m (calculated assuming S = 1.0E-6) and appears too big to be regarded as a skin. Therefore, the inner composite shell parameters are regarded as representative for the small scale formation properties. It should be noted however, that the formation shows larger transmissivities further away from the test interval.

Test Summary Sheet

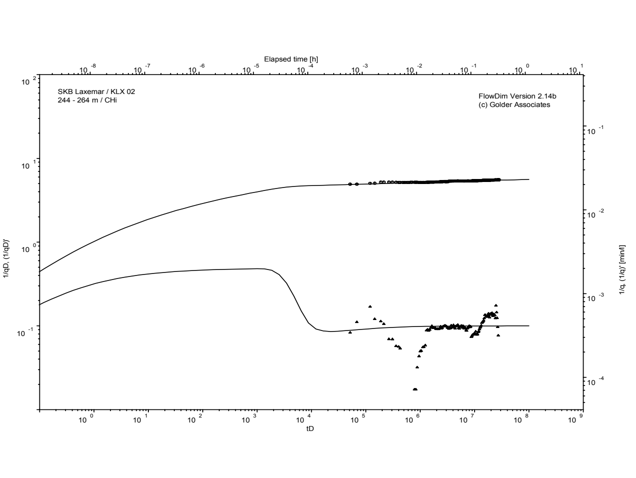
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	11
Borehole ID:	KLX 02	Test start:	030714 17:50
Test section from - to (m):	244 - 264 m brp	Responsible for test execution:	N. Rahm
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

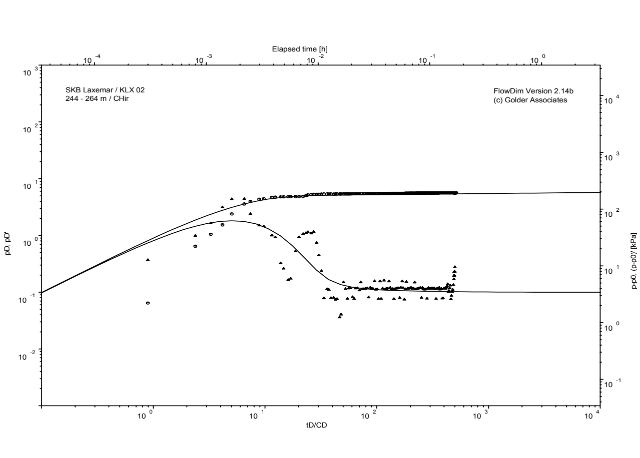


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	2423		
p_i (kPa) =	2423		
p_p(kPa) =	2622	p_F (kPa) =	2427
Q_p (m^3/s)=	7,31E-04		
tp (s) =	1200	t_F (s) =	1500
S el S^* (-)=	9,2E-07	S el S^* (-)=	2,9E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	10,4		
Derivative fact.=	0,04	Derivative fact.=	0,08
Results		**Results**	
Q/s (m^2/s)=	3,60E-05		
T_M (m^2/s)=	3,77E-05		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	1,05	dt_1 (min) =	1,06
dt_2 (min) =	13,22	dt_2 (min) =	9,51
T (m^2/s) =	1,6E-04	T (m^2/s) =	1,7E-04
S (-) =	9,2E-07	S (-) =	2,9E-06
K_s (m/s) =	8,0E-06	K_s (m/s) =	8,5E-06
S_s (1/m) =	4,6E-08	S_s (1/m) =	1,5E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	2,7E-08
C_D (-) =	NA	C_D (-) =	9,9E+03
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	1,06	C (m^3/Pa) =	2,7E-08
dt_2 (min) =	9,51	C_D (-) =	9,9E+03
T_T (m^2/s) =	1,7E-04	ξ (-) =	0
S (-) =	2,9E-06		
K_s (m/s) =	8,5E-06		
S_s (1/m) =	1,5E-07		

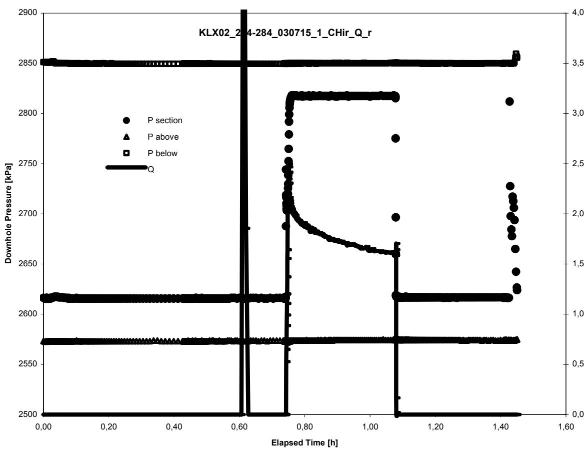
Comments:

An infinite acting radial composite flow model was identified, whereas the inner composite zone can only be seen in the CHIR data. Although the composite radius was calculated to 3.8 m (calculated assuming S = 2.9E-6) it is believed that the result was influenced by the malfunction of the test valve. It is therefore a more conservative approach to treat the inner composite zone as a skin effect and chose the outer composite zone transmissivity as being more representative for the formation properties.

Test Summary Sheet

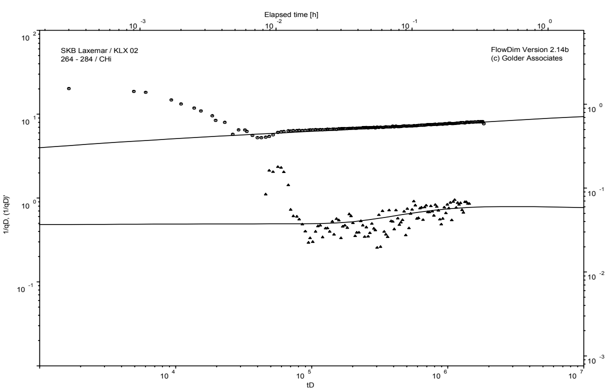
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	12
Borehole ID:	KLX 02	Test start:	030715 08:25
Test section from - to (m):	264 - 284 m brp	Responsible for test execution:	N. Rahm
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

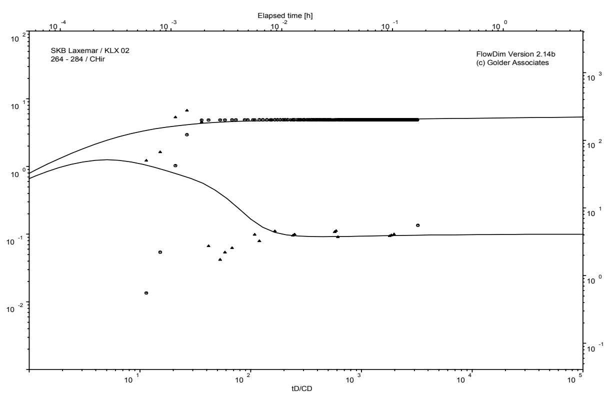


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	2616		
p_i (kPa) =	2616		
p_p(kPa) =	2817	p_F (kPa) =	2617
Q_p (m^3/s)=	2,67E-05		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	7,8E-07	S el S^* (-)=	1,6E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	10,8		
Derivative fact.=	0,09	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	1,31E-06		
T_M (m^2/s)=	1,37E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	1,27	dt_1 (min) =	0,52
dt_2 (min) =	15,79	dt_2 (min) =	6,19
T (m^2/s) =	1,7E-06	T (m^2/s) =	1,1E-06
S (-) =	7,8E-07	S (-) =	1,6E-06
K_s (m/s) =	8,5E-08	K_s (m/s) =	5,5E-08
S_s (1/m) =	3,9E-08	S_s (1/m) =	8,0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,4E-10
C_D (-) =	NA	C_D (-) =	9,3E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	1,27	C (m^3/Pa) =	1,4E-10
dt_2 (min) =	15,79	C_D (-) =	9,3E+01
T_T (m^2/s) =	1,7E-06	ξ (-) =	0
S (-) =	7,8E-07		
K_s (m/s) =	8,5E-08		
S_s (1/m) =	3,9E-08		

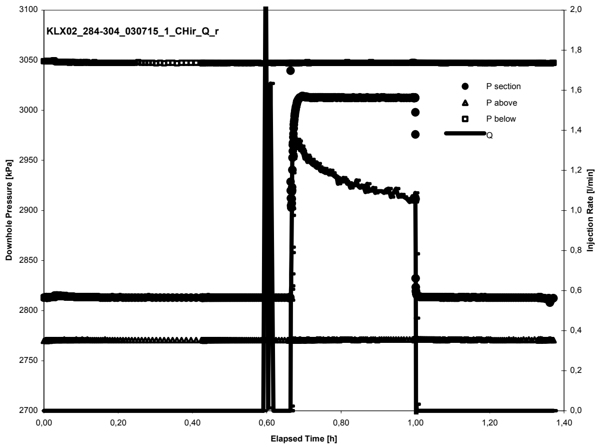
Comments:

An infinite acting radial composite flow model was identified. Based on the CHI results, the composite discontinuity radius was calculated to 32.3 m (calculated assuming S = 7.8E-7), which indicates that the inner composite shell parameters can be seen as representative for the small to medium scale formation properties.

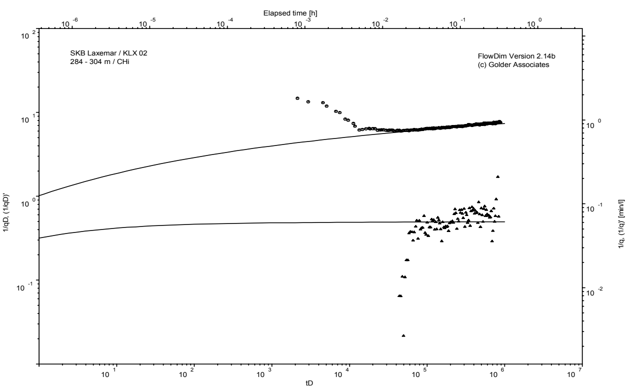
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	13
Borehole ID:	KLX 02	Test start:	030715 10:46
Test section from - to (m):	284 - 304 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

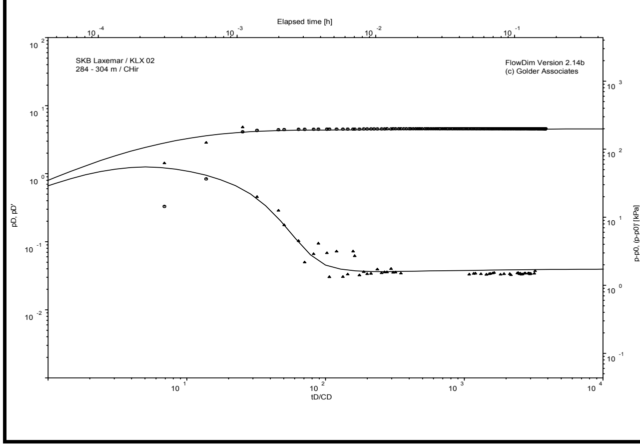
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	2813		
p_i (kPa) =	2813		
p_p(kPa) =	3012	p_F (kPa) =	2813
Q_p (m^3/s)=	1,75E-05		
tp (s) =	1200	t_F (s) =	1200
S el S* (-)=	9,9E-07	S el S* (-)=	7,5E-07
EC_w (mS/m)=			
$Temp_w$(gr C)=	11,1		
Derivative fact.=	0,19	Derivative fact.=	0,07
Results		**Results**	
Q/s (m^2/s)=	8,63E-07		
T_M (m^2/s)=	9,02E-07		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	2,25	dt_1 (min) =	0,46
dt_2 (min) =	11,78	dt_2 (min) =	7,86
T (m^2/s) =	1,1E-06	T (m^2/s) =	6,9E-07
S (-) =	9,9E-07	S (-) =	7,5E-07
K_s (m/s) =	5,5E-08	K_s (m/s) =	3,5E-08
S_s (1/m) =	5,0E-08	S_s (1/m) =	3,8E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	6,9E-11
C_D (-) =	NA	C_D (-) =	1,0E+02
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.

dt_1 (min) =	2,25	C (m^3/Pa) =	6,9E-11
dt_2 (min) =	11,78	C_D (-) =	1,0E+02
T_T (m^2/s) =	1,1E-06	ξ (-) =	0
S (-) =	9,9E-07		
K_s (m/s) =	5,5E-08		
S_s (1/m) =	5,0E-08		

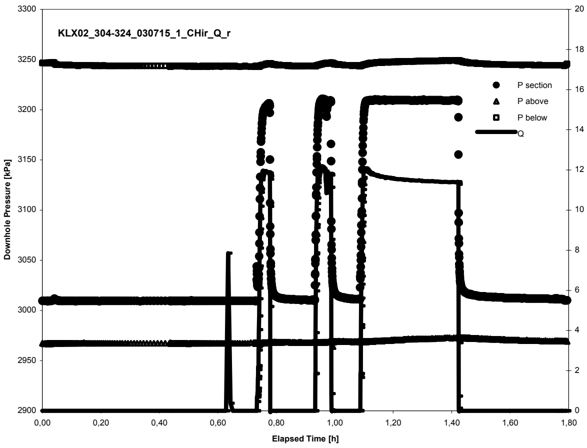
Comments:

The flow model identification was based on the shape of the semi-log derivative of the CHI phase. An infinite acting radial homogeneous flow model was identified. The CHIR phase was analysed using a 2 shell composite flow model, this behaviour is however attributed to a skin effect.

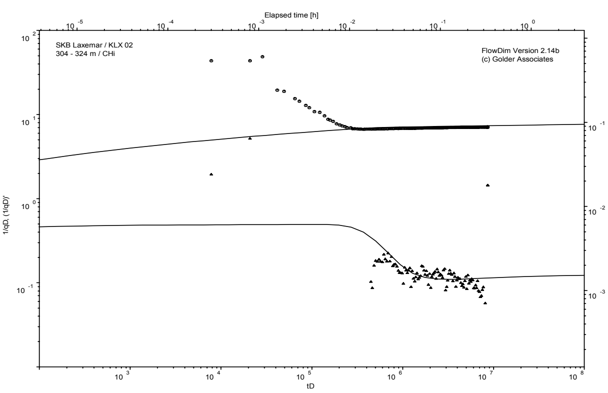
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	14
Borehole ID:	KLX 02	Test start:	030715 12:56
Test section from - to (m):	304 - 324 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

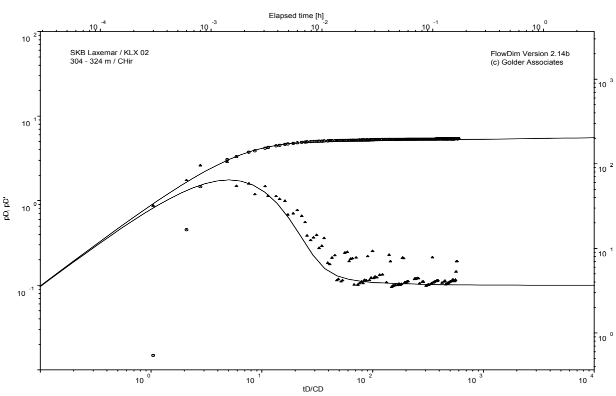
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	3010		
p_i (kPa) =	3011		
p_p(kPa) =	3210	p_F (kPa) =	3011
Q_p (m^3/s)=	1,90E-04		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1,0E-06	S el S^* (-)=	5,9E-07
EC_w (mS/m)=			
$Temp_w$(gr C)=	11,4		
Derivative fact.=	0,12	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	9,36E-06		
T_M (m^2/s)=	9,80E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	1,60	dt_1 (min) =	0,92
dt_2 (min) =	15,40	dt_2 (min) =	9,63
T (m^2/s) =	4,2E-05	T (m^2/s) =	4,1E-05
S (-) =	1,0E-06	S (-) =	5,9E-07
K_s (m/s) =	2,1E-06	K_s (m/s) =	2,1E-06
S_s (1/m) =	5,0E-08	S_s (1/m) =	3,0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	5,5E-09
C_D (-) =	NA	C_D (-) =	1,0E+04
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.

dt_1 (min) =	1,60	C (m^3/Pa) =	5,5E-09
dt_2 (min) =	15,40	C_D (-) =	1,0E+04
T_T (m^2/s) =	4,2E-05	ξ (-) =	0
S (-) =	1,0E-06		
K_s (m/s) =	2,1E-06		
S_s (1/m) =	5,0E-08		

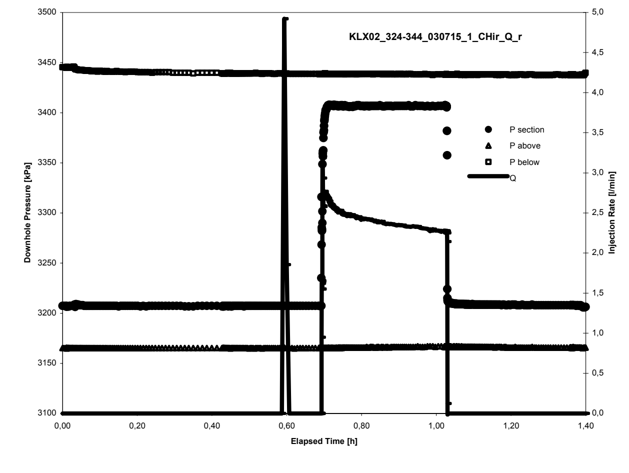
Comments:

The early time data of the CHI phase does not allow characterizing the inner composite zone; however, for a given storativity around 1E-6 the presence of a lower transmissivity zone around the borehole (inner zone) is a necessary assumption which allows matching the late times. Based on the CHI analysis, the outer zone transmissivity is seen as representative for the interval transmissivity.

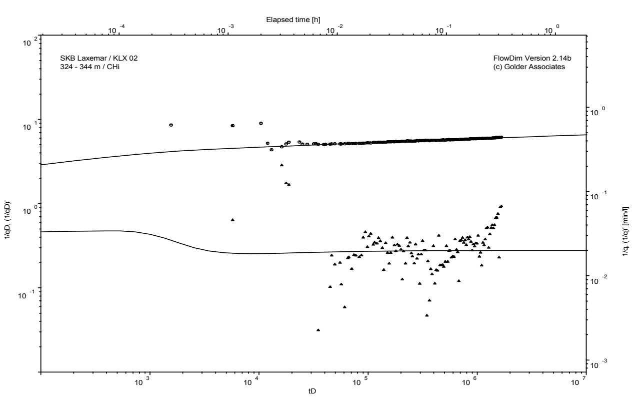
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	15
Borehole ID:	KLX 02	Test start:	030715 15:33
Test section from - to (m):	324 - 344 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

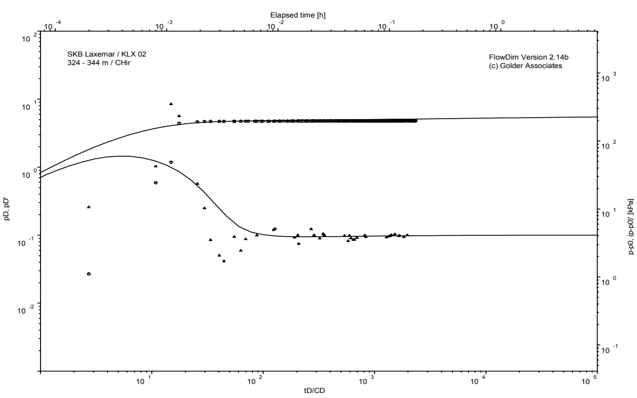
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	3207		
p_i (kPa) =	3207		
p_p(kPa) =	3407	p_F (kPa) =	3207
Q_p (m^3/s)=	3,79E-05		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	8,7E-07	S el S^* (-)=	2,9E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	11,7		
Derivative fact.=	0,08	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	1,86E-06		
T_M (m^2/s)=	1,95E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	1,13	dt_1 (min) =	0,84
dt_2 (min) =	12,35	dt_2 (min) =	8,10
T (m^2/s) =	3,2E-06	T (m^2/s) =	7,8E-06
S (-) =	8,7E-07	S (-) =	2,9E-06
K_s (m/s) =	1,6E-07	K_s (m/s) =	3,9E-07
S_s (1/m) =	4,4E-08	S_s (1/m) =	1,5E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	2,7E-10
C_D (-) =	NA	C_D (-) =	9,9E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.

dt_1 (min) =	1,13	C (m^3/Pa) =	2,7E-10
dt_2 (min) =	12,35	C_D (-) =	9,9E+01
T_T (m^2/s) =	3,2E-06	ξ (-) =	0
S (-) =	8,7E-07		
K_s (m/s) =	1,6E-07		
S_s (1/m) =	4,4E-08		

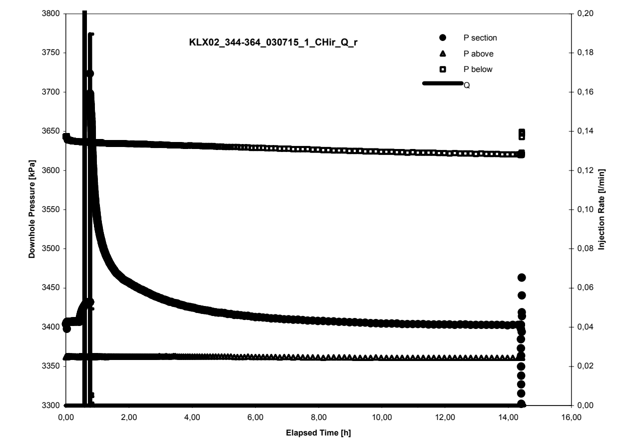
Comments:

The choice of a 2 shell radial composite model was mainly based on the necessity of modelling a positive skin factor for matching the CHI phase. The choice of the model is also consistent with the CHIR phase, however, it should be noted that this phase has very poor diagnostic capacity due to the very fast pressure recovery.

Test Summary Sheet

Project:	Site investigation	Test type:[1]	PI (see table 6.1)
Area:	Laxemar	Test no:	16
Borehole ID:	KLX 02	Test start:	030715 17:31
Test section from - to (m):	344 - 364 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2\cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

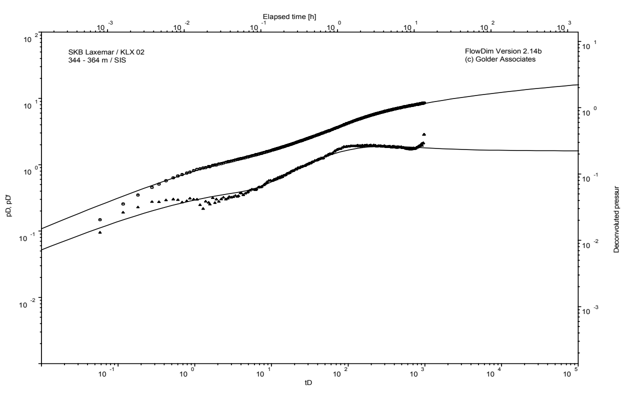


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3404		
p_i (kPa) =	3432		
p_p(kPa) =	3666	p_F (kPa) =	3403
Q_p (m^3/s)=	-		
tp (s) =	300	t_F (s) =	49440
S el S^* (-)=	NA	S el S^* (-)=	2,9E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	12,0		
Derivative fact.=	NA	Derivative fact.=	0,07
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	NA	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	182,96
dt_2 (min) =	NA	dt_2 (min) =	550,18
T (m^2/s) =	NA	T (m^2/s) =	2,6E-11
S (-) =	NA	S (-) =	2,9E-06
K_s (m/s) =	NA	K_s (m/s) =	1,3E-12
S_s (1/m) =	NA	S_s (1/m) =	1,5E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	2,7E-11
C_D (-) =	NA	C_D (-) =	1,0E+01
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	182,96	C (m^3/Pa) =	2,7E-11
dt_2 (min) =	550,18	C_D (-) =	1,0E+01
T_T (m^2/s) =	2,6E-11	ξ (-) =	0
S (-) =	2,9E-06		
K_s (m/s) =	1,3E-12		
S_s (1/m) =	1,5E-07		

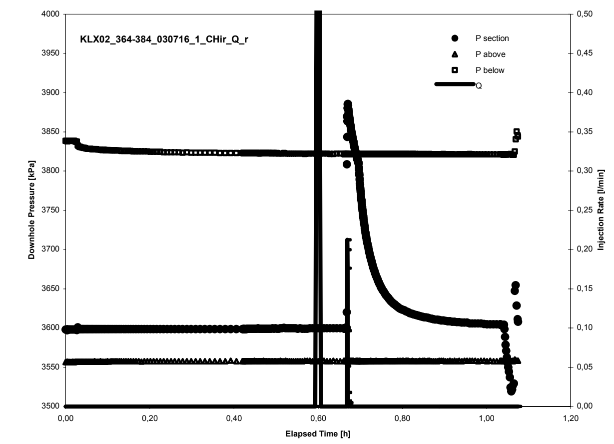
Comments:

The flow model identification is uncertain and mainly based on the shape of the semi-log derivative of the deconvolved CHIR phase. Due to the very small composite radius, it is believed that the outer composite zone is representative for the formation properties.
The transmissivity derived from the transient analysis (both composite shells) ranges from 2.6E-11 to 8.5E-11 m2/s. Considering the inherent uncertainties related to the measurement (e.g. specially the measurement of the wellbore storage coefficient) and to the analysis process (e.g. numeric distortion when calculating the derivative and pressure history effects), the confidence range for the transmissivity is estimated to be 1E-11 to 5E-10 m2/s (the outer zone transmissivity is considered as most representative)

Test Summary Sheet

Project:	Site investigation	Test type:[1]	PI (see table 6.1)
Area:	Laxemar	Test no:	17
Borehole ID:	KLX 02	Test start:	030716 08:35
Test section from - to (m):	364 - 384 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

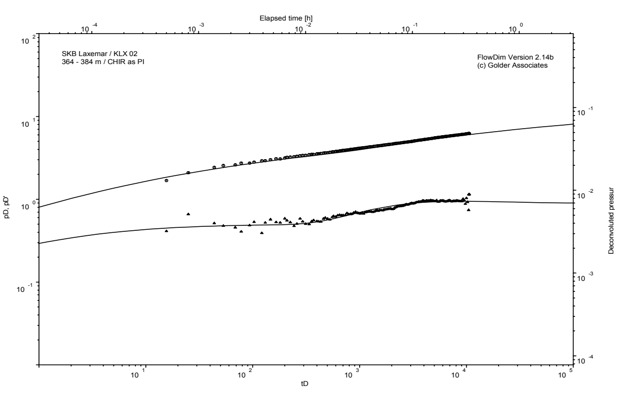


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3598		
p_i (kPa) =	3600		
p_p(kPa) =	3810	p_F (kPa) =	3604
Q_p (m^3/s)=	-		
tp (s) =	120	t_F (s) =	1320
S el S^* (-)=	NA	S el S^* (-)=	2,5E-07
EC_w (mS/m)=			
$Temp_w$(gr C)=	12,3		
Derivative fact.=	NA	Derivative fact.=	0,18
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	NA	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	0,60
dt_2 (min) =	NA	dt_2 (min) =	17,43
T (m^2/s) =	NA	T (m^2/s) =	1,8E-09
S (-) =	NA	S (-) =	2,5E-07
K_s (m/s) =	NA	K_s (m/s) =	9,0E-11
S_s (1/m) =	NA	S_s (1/m) =	1,3E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	5,8E-11
C_D (-) =	NA	C_D (-) =	2,5E+02
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	0,60	C (m^3/Pa) =	5,8E-11
dt_2 (min) =	17,43	C_D (-) =	2,5E+02
T_T (m^2/s) =	1,8E-09	ξ (-) =	0
S (-) =	2,5E-07		
K_s (m/s) =	9,0E-11		
S_s (1/m) =	1,3E-08		

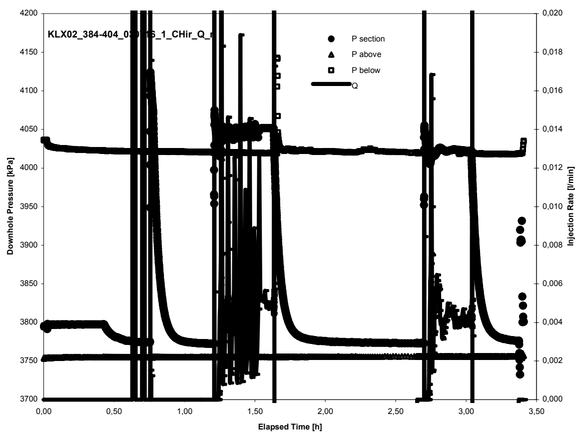
Comments:

The flow model identification is uncertain and mainly based on the shape of the semi-log derivative of the deconvolved CHIR phase. Due to the very small composite radius, it is believed that the outer composite zone is representative for the formation properties.
The transmissivity derived from the transient analysis (both composite shells) ranges from 1.8E-9 to 3.2E-9 m2/s. Considering the inherent uncertainties related to the measurement (e.g. specially the measurement of the wellbore storage coefficient) and to the analysis process (e.g. numeric distortion when calculating the derivative and pressure history effects), the confidence range for the transmissivity is estimated to be 5E-10 to 1E-8 m2/s (the outer zone transmissivity is considered as most representative).

Test Summary Sheet

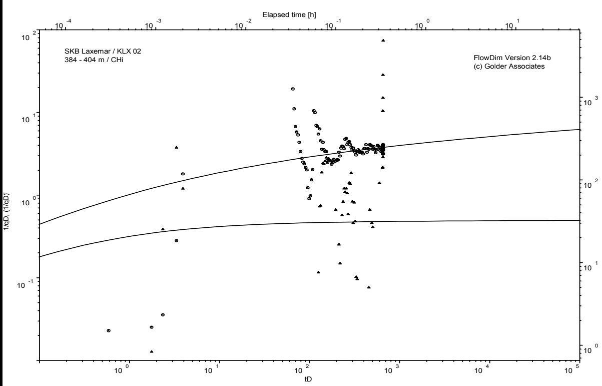
Project:	Site investigation	Test type:[1]	3
Area:	Laxemar	Test no:	18
Borehole ID:	KLX 02	Test start:	030716 10:20
Test section from - to (m):	384 - 404 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

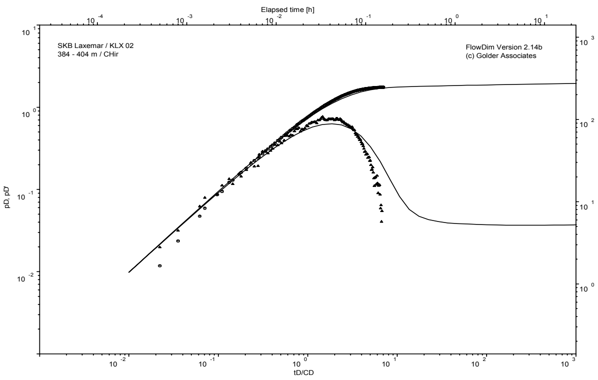


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3795		
p_i (kPa) =	3773		
p_p(kPa) =	4022	p_F (kPa) =	3776
Q_p (m^3/s)=	6,96E-08		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	2,5E-06	S el S^* (-)=	3,8E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	12,5		
Derivative fact.=	0,15	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	2,74E-09		
T_M (m^2/s)=	2,87E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	*	dt_1 (min) =	*
dt_2 (min) =	*	dt_2 (min) =	*
T (m^2/s) =	2,0E-09	T (m^2/s) =	2,2E-08
S (-) =	2,5E-06	S (-) =	3,8E-06
K_s (m/s) =	1,0E-10	K_s (m/s) =	1,1E-09
S_s (1/m) =	1,3E-07	S_s (1/m) =	1,9E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	3,5E-11
C_D (-) =	NA	C_D (-) =	9,8E+00
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	3,5E-11
dt_2 (min) =	*	C_D (-) =	9,8E+00
T_T (m^2/s) =	2,2E-08	ξ (-) =	0
S (-) =	3,8E-06		
K_s (m/s) =	1,1E-09		
S_s (1/m) =	1,9E-07		

Comments:

* : IARF not measured

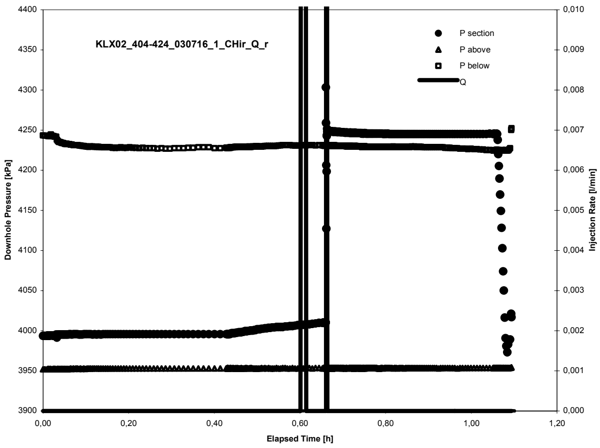
The flow model identification was based on the shape of the semi-log derivative of the CHIR phase. An infinite acting radial homogeneous flow model was identified chosen for the analysis. The downward sloping derivative at late times was interpreted as the transition to a higher transmissivity composite shell. This behaviour could also indicate transition to a higher flow dimension. Due to the small composite radius (r1 = 0.2 m calculated assuming S = 3.8E-6) the outer zone transmissivity is seen to be more representative for the formation properties.

The analysis of the CHI phase was conducted using a radial homogeneous flow model. The data is of poor quality, such that no specific flow model identification is possible.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	PI (see table 6.1)
Area:	Laxemar	Test no:	19
Borehole ID:	KLX 02	Test start:	030716 14:23
Test section from - to (m):	404 - 424 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

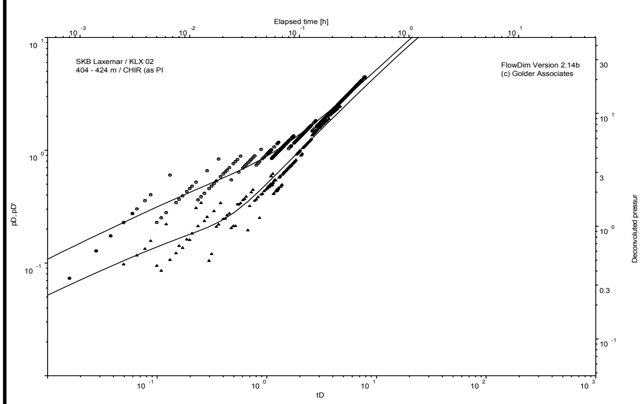


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3994		
p_i (kPa) =	4010		
p_p(kPa) =	4247	p_F (kPa) =	4246
Q_p (m^3/s)=	-		
tp (s) =	180	t_F (s) =	1200
S el S^* (-)=	NA	S el S^* (-)=	2,2E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	12,8		
Derivative fact.=	NA	Derivative fact.=	0,36
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	NA	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	3,6E-13
S (-) =	NA	S (-) =	2,2E-06
K_s (m/s) =	NA	K_s (m/s) =	1,8E-14
S_s (1/m) =	NA	S_s (1/m) =	1,1E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,9E-10
C_D (-) =	NA	C_D (-) =	9,3E+01
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	1,9E-10
dt_2 (min) =	*	C_D (-) =	9,3E+01
T_T (m^2/s) =	3,6E-13	ξ (-) =	0
S (-) =	2,2E-06		
K_s (m/s) =	1,8E-14		
S_s (1/m) =	1,1E-07		

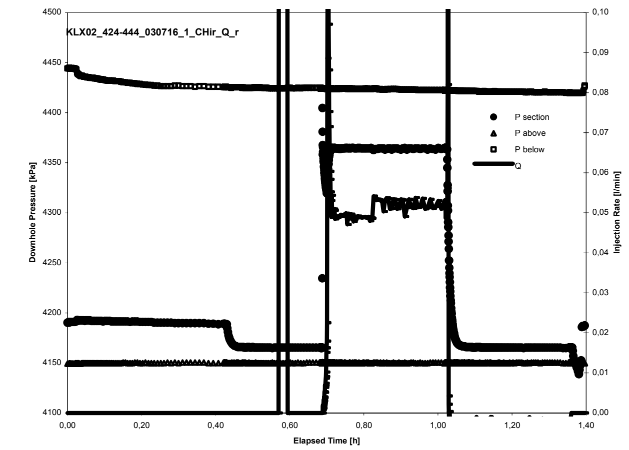
Comments:

The transmissivity derived from the transient analysis (both composite shells) ranges from 3.6E-13 to 1.8E-11 m2/s. Considering the inherent uncertainties related to the measurement (e.g. specially the measurement of the wellbore storage coefficient) and to the analysis process (e.g. numeric distortion when calculating the derivative and pressure history effects), the confidence range for the transmissivity is estimated to be 3E-13 to 2E-11 m2/s (the outer zone transmissivity is considered as most representative).

Test Summary Sheet

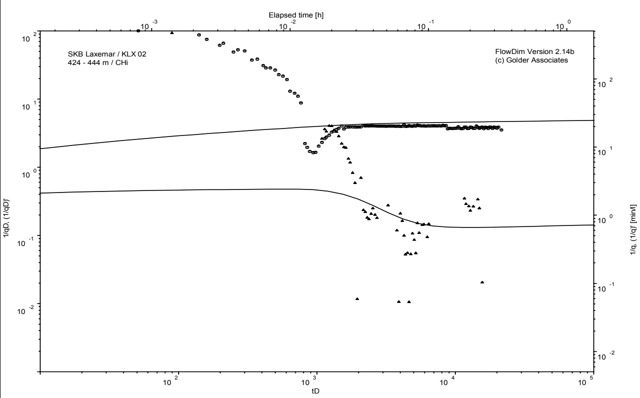
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	20
Borehole ID:	KLX 02	Test start:	030716 16:07
Test section from - to (m):	424 - 444 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

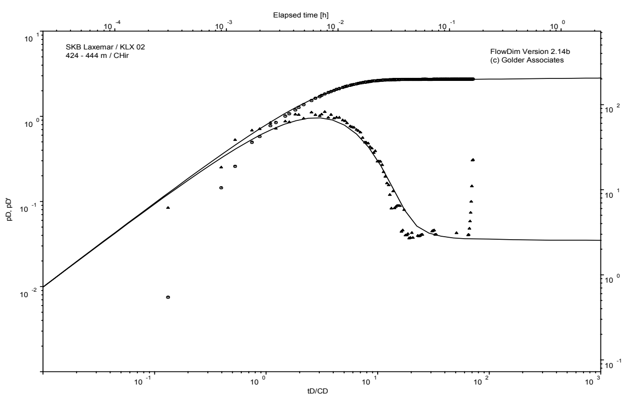


Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	4191		
p_i (kPa) =	4165		
p_p(kPa) =	4364	p_F (kPa) =	4165
Q_p (m^3/s)=	8,22E-07		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1,0E-06	S el S^* (-)=	1,0E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,1		
Derivative fact.=	0,11	Derivative fact.=	0,03
Results		**Results**	
Q/s (m^2/s)=	4,05E-08		
T_M (m^2/s)=	4,24E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	*	dt_1 (min) =	3,19
dt_2 (min) =	*	dt_2 (min) =	6,94
T (m^2/s) =	8,6E-08	T (m^2/s) =	2,6E-07
S (-) =	1,0E-06	S (-) =	1,0E-06
K_s (m/s) =	4,3E-09	K_s (m/s) =	1,3E-08
S_s (1/m) =	5,0E-08	S_s (1/m) =	5,0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	9,4E-11
C_D (-) =	NA	C_D (-) =	1,0E+02
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	3,19	C (m^3/Pa) =	9,4E-11
dt_2 (min) =	6,94	C_D (-) =	1,0E+02
T_T (m^2/s) =	2,6E-07	ξ (-) =	0
S (-) =	1,0E-06		
K_s (m/s) =	1,3E-08		
S_s (1/m) =	5,0E-08		

Comments:

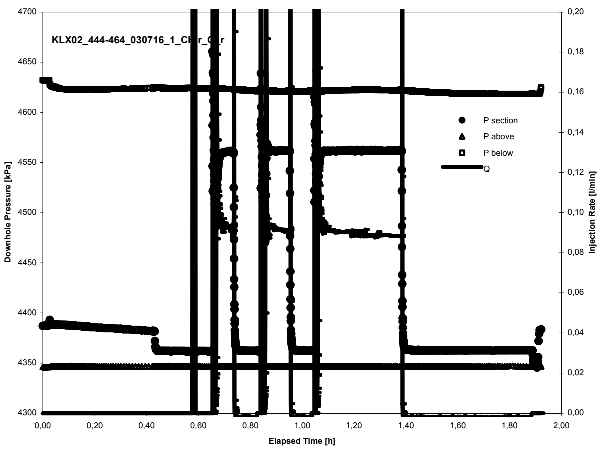
* : IARF not measured

The downward slope of the CHIR derivative at late times was interpreted as a transition to an outer composite shell of higher transmissivity. It is not clear which of the composite shells should be seen as representative of the formation properties.

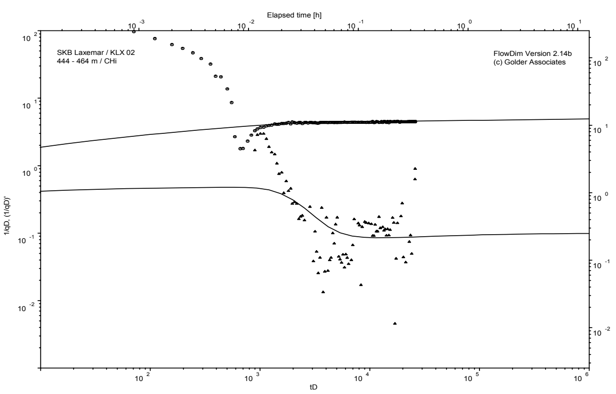
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	21
Borehole ID:	KLX 02	Test start:	030716 18:03
Test section from - to (m):	444 - 464 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

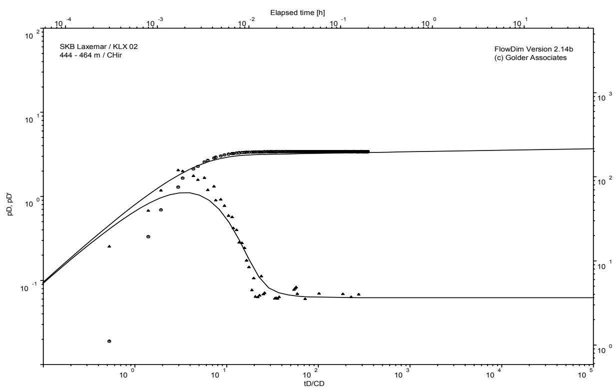
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	4387		
p_i (kPa) =	4363		
p_p(kPa) =	4562	p_F (kPa) =	4363
Q_p (m^3/s)=	1,47E-06		
tp (s) =	1200	t_F (s) =	1800
S el S^* (-)=	1,6E-06	S el S^* (-)=	5,7E-07
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,4		
Derivative fact.=	0,17	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	7,26E-08		
T_M (m^2/s)=	7,60E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	5,33	dt_1 (min) =	1,28
dt_2 (min) =	17,92	dt_2 (min) =	9,43
T (m^2/s) =	2,6E-07	T (m^2/s) =	3,2E-07
S (-) =	1,6E-06	S (-) =	5,7E-07
K_s (m/s) =	1,3E-08	K_s (m/s) =	1,6E-08
S_s (1/m) =	8,0E-08	S_s (1/m) =	2,9E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	5,3E-11
C_D (-) =	NA	C_D (-) =	1,0E+02
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.			
dt_1 (min) =	5,33	C (m^3/Pa) =	5,3E-11
dt_2 (min) =	17,92	C_D (-) =	1,0E+02
T_T (m^2/s) =	2,6E-07	ξ (-) =	0
S (-) =	1,6E-06		
K_s (m/s) =	1,3E-08		
S_s (1/m) =	8,0E-08		

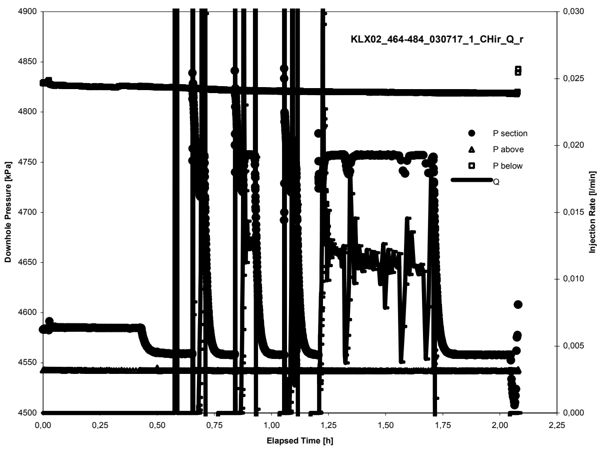
Comments:

The early time data of the CHI phase does not allow characterizing the inner composite zone; however, for a given storativity around 1E-6 the presence of a lower transmissivity zone around the borehole (inner zone) is a necessary assumption which allows matching the late times. Based on the CHI analysis, the outer zone transmissivity is seen as representative for the interval transmissivity.

Test Summary Sheet

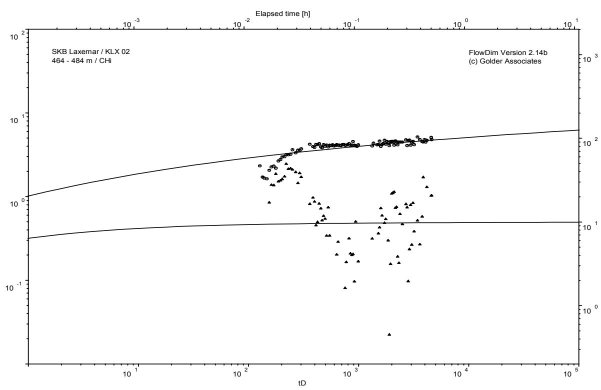
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	22
Borehole ID:	KLX 02	Test start:	030717 08:08
Test section from - to (m):	464 - 484 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

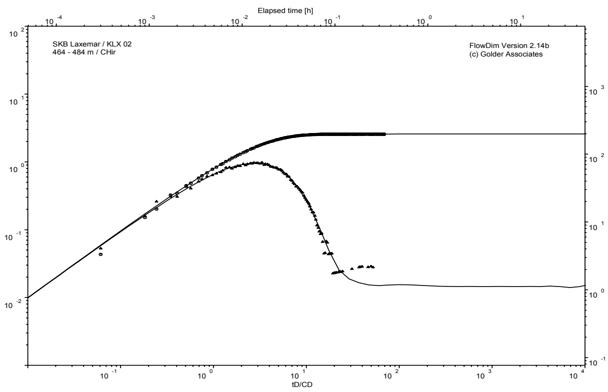


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4585		
p_i (kPa) =	4558		
p_p(kPa) =	4755	p_F (kPa) =	4558
Q_p (m^3/s)=	1,76E-07		
tp (s) =	1800	t_F (s) =	1200
S el S* (-)=	1,8E-06	S el S* (-)=	4,8E-07
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,7		
Derivative fact.=	0,22	Derivative fact.=	0,07
Results		**Results**	
Q/s (m^2/s)=	8,78E-09		
T_M (m^2/s)=	9,19E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	2,70	dt_1 (min) =	*
dt_2 (min) =	16,42	dt_2 (min) =	*
T (m^2/s) =	6,5E-09	T (m^2/s) =	1,3E-07
S (-) =	1,8E-06	S (-) =	4,8E-07
K_s (m/s) =	3,3E-10	K_s (m/s) =	6,5E-09
S_s (1/m) =	9,0E-08	S_s (1/m) =	2,4E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	4,4E-11
C_D (-) =	NA	C_D (-) =	1,0E+02
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	4,4E-11
dt_2 (min) =	*	C_D (-) =	1,0E+02
T_T (m^2/s) =	1,3E-07	ξ (-) =	0
S (-) =	4,8E-07		
K_s (m/s) =	6,5E-09		
S_s (1/m) =	2,4E-08		

Comments:

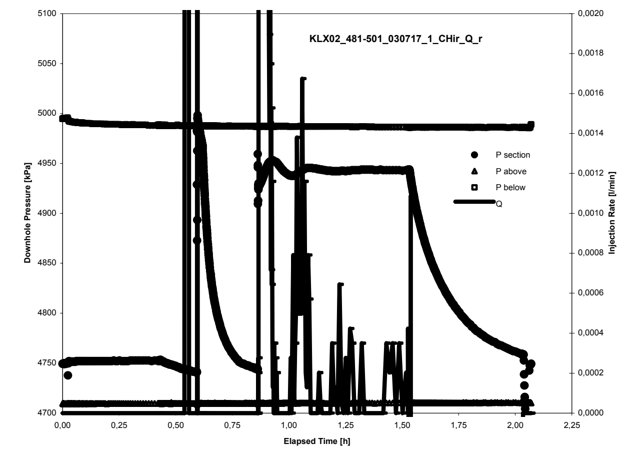
* : IARF not measured

The early time data of the CHI phase does not allow flow model identification and it was analysed using a simple radial flow homogeneous model. The late time derivative of the CHIR phase slopes downwards indicating an increase of transmissivity at some distance away from the borehole. Due to the relatively small extent of the composite inner zone (0.47 m calculated assuming S = 4.8E-7) the outer composite zone is seen as representative for the formation properties.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	23
Borehole ID:	KLX 02	Test start:	030717 10:48
Test section from - to (m):	481 - 501 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

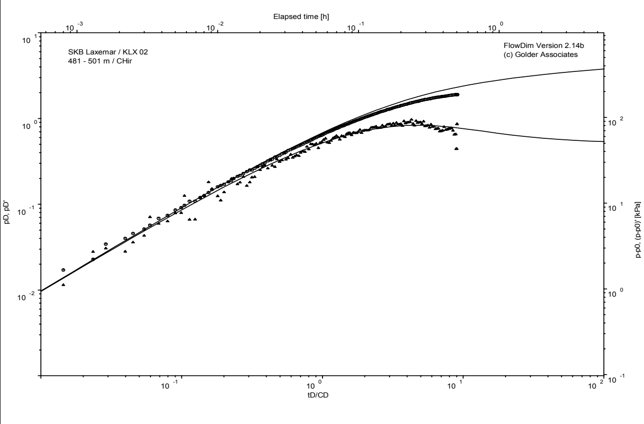


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4749		
p_i (kPa) =	4744		
p_p(kPa) =	4943	p_F (kPa) =	4759
Q_p (m^3/s)=	3,33E-09		
tp (s) =	1800	t_F (s) =	1800
S el S* (-)=	NA	S el S* (-)=	1,9E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,9		
Derivative fact.=	NA	Derivative fact.=	0,07
Results		**Results**	
Q/s (m^2/s)=	1,64E-10		
T_M (m^2/s)=	1,72E-10		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	1,3E-10
S (-) =	NA	S (-) =	1,9E-06
K_s (m/s) =	NA	K_s (m/s) =	6,5E-12
S_s (1/m) =	NA	S_s (1/m) =	9,5E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,7E-11
C_D (-) =	NA	C_D (-) =	9,7E+00
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	1,7E-11
dt_2 (min) =	*	C_D (-) =	9,7E+00
T_T (m^2/s) =	1,3E-10	ξ (-) =	0
S (-) =	1,9E-06		
K_s (m/s) =	6,5E-12		
S_s (1/m) =	9,5E-08		

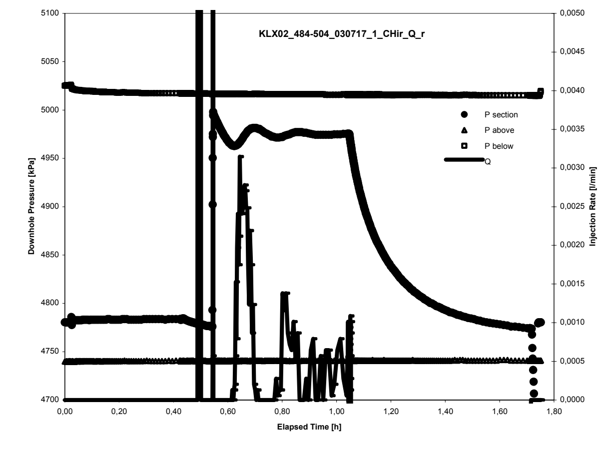
Comments:

* : IARF not measured
The flow model identification was mainly based on the shape of the semi-log derivative of the CHIR phase. Given the very low transmissivity, most of the CHIR data is masked wellbore storage. The transmissivity derived from the transient analysis of the CHIR phase is lower or equal to 1.3E-10 m2/s.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	24
Borehole ID:	KLX 02	Test start:	030717 13:21
Test section from - to (m):	484 - 504 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

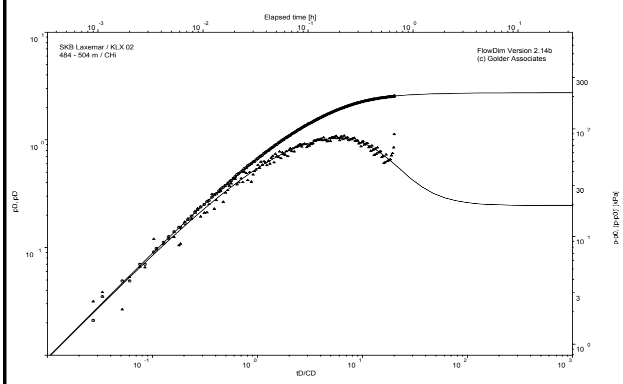


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4781		
p_i (kPa) =	4776		
p_p(kPa) =	4975	p_F (kPa) =	4774
Q_p (m^3/s)=	8,28E-09		
tp (s) =	1800	t_F (s) =	2400
S el S^* (-)=	NA	S el S^* (-)=	9,9E-07
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,0		
Derivative fact.=	NA	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	4,08E-10		
T_M (m^2/s)=	4,27E-10		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	1,6E-10
S (-) =	NA	S (-) =	9,9E-07
K_s (m/s) =	NA	K_s (m/s) =	8,0E-12
S_s (1/m) =	NA	S_s (1/m) =	5,0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,3E-11
C_D (-) =	NA	C_D (-) =	1,4E+01
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	1,3E-11
dt_2 (min) =	*	C_D (-) =	1,4E+01
T_T (m^2/s) =	1,6E-10	ξ (-) =	0
S (-) =	9,9E-07		
K_s (m/s) =	8,0E-12		
S_s (1/m) =	5,0E-08		

Comments:

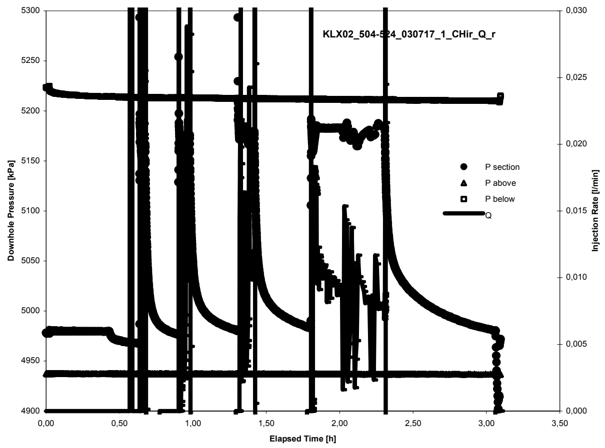
* : IARF not measured

The near borehole transmissivity derived from the transient analysis of the CHIR phase is lower or equal to 1.6E-10 m2/s. Further away from the borehole (r1 = 0.56 m, assuming S = 9.9E-7) the transmissivity seems to increase slightly (downward slope of the derivative); a value of 3.3E-10 m2/s was derived for the outer zone. Regarding the fact that the transmissivity is very low and the injection rate was below the measurement range of the flowmeter the derived transmissivities could be up to one order of magnitude lower than derived from the analysis. In the same time, due to the fact that the derivative does not reach infinite acting regime at late times, the outer zone transmissivity could be higher than calculated (estimated up to one order of magnitude).

Test Summary Sheet

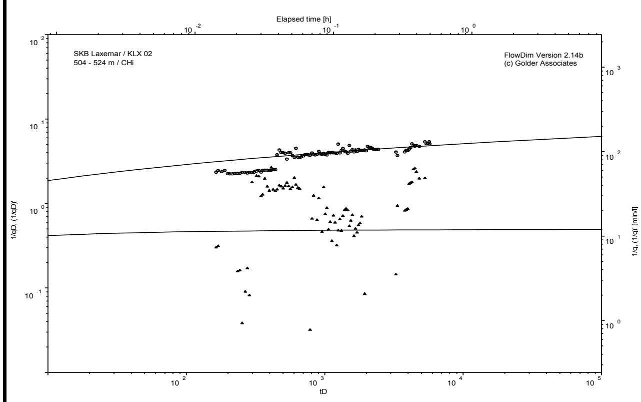
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	25
Borehole ID:	KLX 02	Test start:	030717 15:40
Test section from - to (m):	504 - 524 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

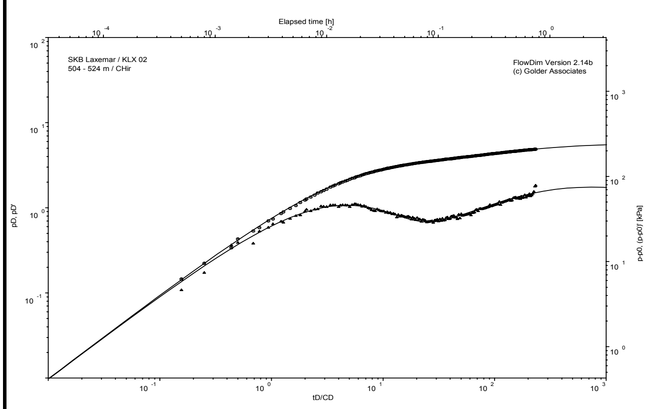


Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	4978		
p_i (kPa) =	4983		
p_p(kPa) =	5183	p_F (kPa) =	4980
Q_p (m^3/s)=	1,30E-07		
tp (s) =	1800	t_F (s) =	2700
S el S^* (-)=	1,2E-06	S el S^* (-)=	1,0E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,3		
Derivative fact.=	0,18	Derivative fact.=	0,08
Results		**Results**	
Q/s (m^2/s)=	6,36E-09		
T_M (m^2/s)=	6,66E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	*	dt_1 (min) =	3,55
dt_2 (min) =	*	dt_2 (min) =	6,88
T (m^2/s) =	5,4E-09	T (m^2/s) =	5,4E-09
S (-) =	1,2E-06	S (-) =	1,0E-06
K_s (m/s) =	2,7E-10	K_s (m/s) =	2,7E-10
S_s (1/m) =	6,0E-08	S_s (1/m) =	5,0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	3,9E-11
C_D (-) =	NA	C_D (-) =	4,3E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	3,55	C (m^3/Pa) =	3,9E-11
dt_2 (min) =	6,88	C_D (-) =	4,3E+01
T_T (m^2/s) =	5,4E-09	ξ (-) =	0
S (-) =	1,0E-06		
K_s (m/s) =	2,7E-10		
S_s (1/m) =	5,0E-08		

Comments:

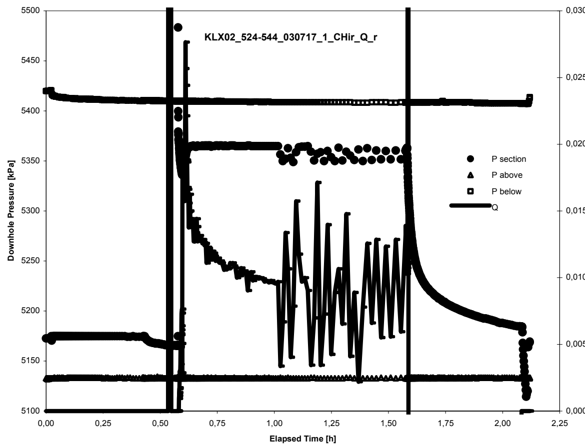
* : IARF not measured

The early time data is masked by wellbore storage, which is indicated by a unit slope derivative. At middle times the derivative becomes flat indicating radial flow in the vicinity of the borehole. At late times the derivative shows an upward slope of 0.5 which may either indicate linear flow or represent a transition period to a zone of lower transmissivity. Based on the derived composite radius (r1 = 1.83 m calculated assuming S = 1.0E-6) it is estimated that the inner composite zone is more representative for the formation properties.

Test Summary Sheet

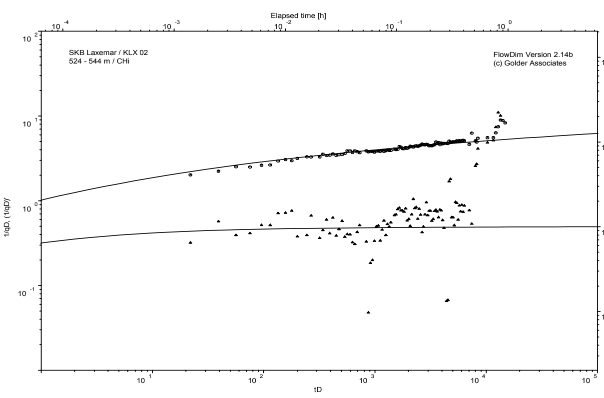
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	26
Borehole ID:	KLX 02	Test start:	030717 19:25
Test section from - to (m):	524 - 544 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

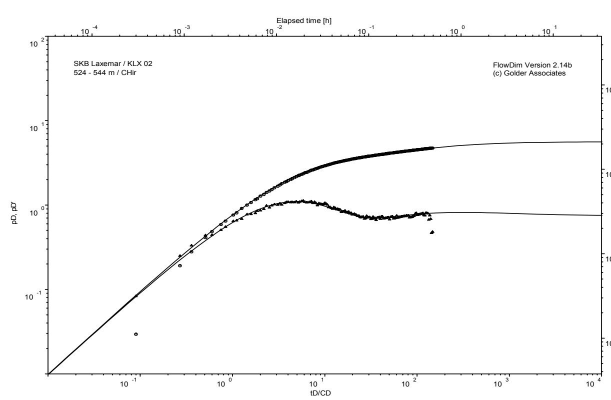


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	5173		
p_i (kPa) =	5165		
p_p(kPa) =	5363	p_F (kPa) =	5184
Q_p (m^3/s)=	1,17E-07		
tp (s) =	3600	t_F (s) =	1800
S el S^* (-)=	1,0E-06	S el S^* (-)=	1,6E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,6		
Derivative fact.=	0,20	Derivative fact.=	0,08
Results		**Results**	
Q/s (m^2/s)=	5,78E-09		
T_M (m^2/s)=	6,05E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0,22	dt_1 (min) =	6,34
dt_2 (min) =	5,32	dt_2 (min) =	26,22
T (m^2/s) =	6,4E-09	T (m^2/s) =	8,2E-09
S (-) =	1,0E-06	S (-) =	1,6E-06
K_s (m/s) =	3,2E-10	K_s (m/s) =	4,1E-10
S_s (1/m) =	5,0E-08	S_s (1/m) =	8,0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	6,3E-11
C_D (-) =	NA	C_D (-) =	4,2E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	6,34	C (m^3/Pa) =	6,3E-11
dt_2 (min) =	26,22	C_D (-) =	4,2E+01
T_T (m^2/s) =	8,2E-09	ξ (-) =	0
S (-) =	1,6E-06		
K_s (m/s) =	4,1E-10		
S_s (1/m) =	8,0E-08		

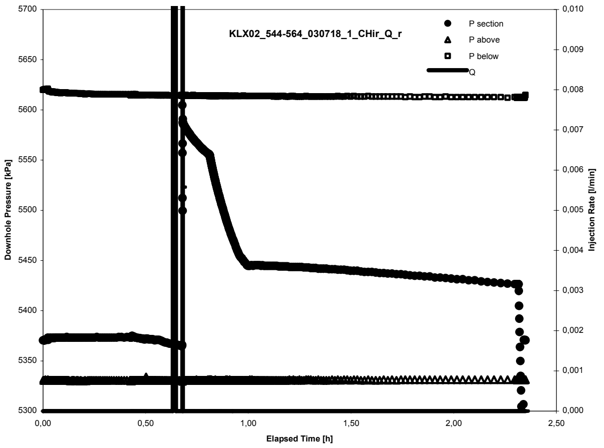
Comments:

The early time data is masked by wellbore storage, which is indicated by a unit slope derivative. At middle times the derivative becomes flat indicating radial flow in the vicinity of the borehole. At late times the derivative shows an upward slope of 0.08 which may either indicate sub-cylindrical flow or represent a transition period to a zone of lower transmissivity. Based on the derived composite radius (r1 = 1.92 m calculated assuming S = 1.6E-6) it is estimated that the inner composite zone is more representative for the formation properties.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	27
Borehole ID:	KLX 02	Test start:	030718 11:21
Test section from - to (m):	544 - 564 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	5371		
p_i (kPa) =	5365		
p_p(kPa) =	5555	p_F (kPa) =	5426
Q_p (m^3/s)=	-		
tp (s) =	480	t_F (s) =	5400
S el S* (-)=	NA	S el S* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,6		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	NA	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Selected representative parameters.

dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	NA	ξ (-) =	NA
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

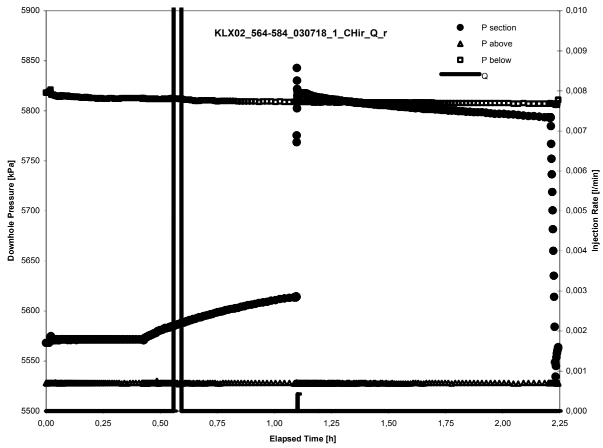
Comments:

The injection rate dropped below the measurement range of the flowmeter (q < 0.5 ml/min) almost instantaneously, indicating the very low transmissivity of the interval. None of the test phases is analysable, but the low injection rates show that the interval transmissivity must be lower than 1E-10 m2/s.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	PI (see table 6.1)
Area:	Laxemar	Test no:	28
Borehole ID:	KLX 02	Test start:	030718 14:16
Test section from - to (m):	564 - 584 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

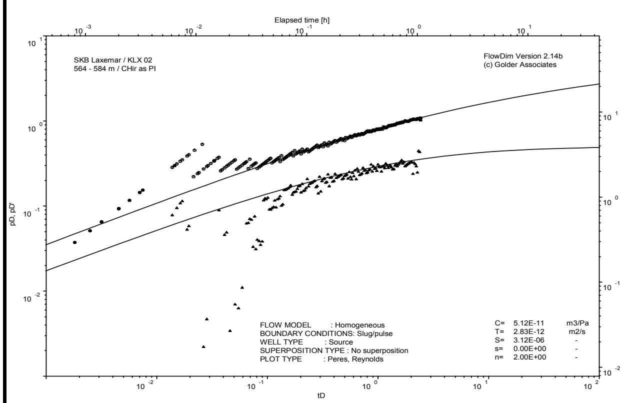


Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	5568		
p_i (kPa) =	5614		
p_p(kPa) =	5817	p_F (kPa) =	5794
Q_p (m^3/s)=	-		
tp (s) =	180	t_F (s) =	3840
S el S^* (-)=	NA	S el S^* (-)=	3,1E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,6		
Derivative fact.=	NA	Derivative fact.=	0,24
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	2,8E-12
S (-) =	NA	S (-) =	3,1E-06
K_s (m/s) =	NA	K_s (m/s) =	1,4E-13
S_s (1/m) =	NA	S_s (1/m) =	1,6E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	5,1E-11
C_D (-) =	NA	C_D (-) =	1,8E+01
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	5,1E-11
dt_2 (min) =	*	C_D (-) =	1,8E+01
T_T (m^2/s) =	2,8E-12	ξ (-) =	0
S (-) =	3,1E-06		
K_s (m/s) =	1,4E-13		
S_s (1/m) =	1,6E-07		

Comments:

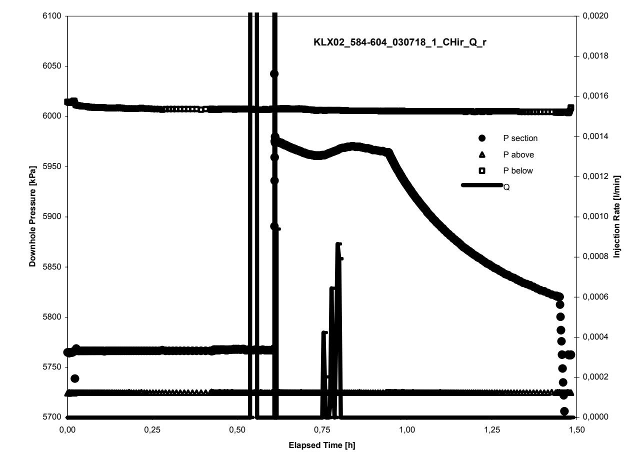
* : IARF not measured

The near borehole transmissivity derived from the transient analysis of the CHIR phase was calculated to 2.8E-12 m2/s. Regarding the fact that the transmissivity is very low, the injection rate was below the measurement range and there is considerable uncertainty concerning the wellbore storage coefficient the confidence range of the transmissivity is estimated to be between 1E-12 m2/s and 5E-11 m2/s.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	29
Borehole ID:	KLX 02	Test start:	030718 17:12
Test section from - to (m):	584 - 604 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

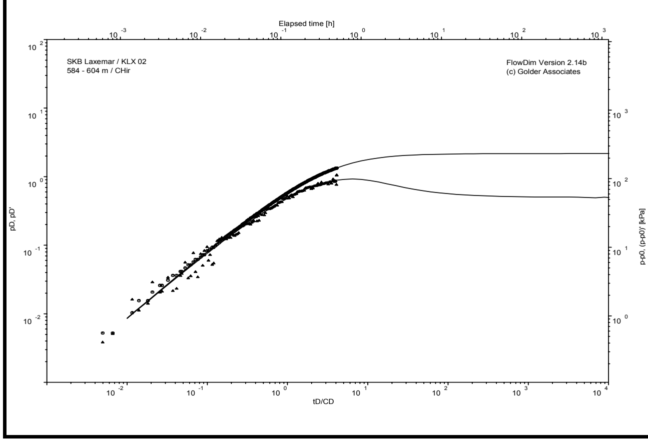


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	5765		
p_i (kPa) =	5767		
p_p(kPa) =	5963	p_F (kPa) =	5820
Q_p (m^3/s)=	8,33E-09		
tp (s) =	1200	t_F (s) =	1800
S el S* (-)=	NA	S el S* (-)=	3,5E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	15,5		
Derivative fact.=	NA	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	4,17E-10		
T_M (m^2/s)=	4,36E-10		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	1,2E-10
S (-) =	NA	S (-) =	3,5E-06
K_s (m/s) =	NA	K_s (m/s) =	6,0E-12
S_s (1/m) =	NA	S_s (1/m) =	1,8E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	3,4E-11
C_D (-) =	NA	C_D (-) =	1,0E+01
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	3,4E-11
dt_2 (min) =	*	C_D (-) =	1,0E+01
T_T (m^2/s) =	1,2E-10	ξ (-) =	0
S (-) =	3,5E-06		
K_s (m/s) =	6,0E-12		
S_s (1/m) =	1,8E-07		

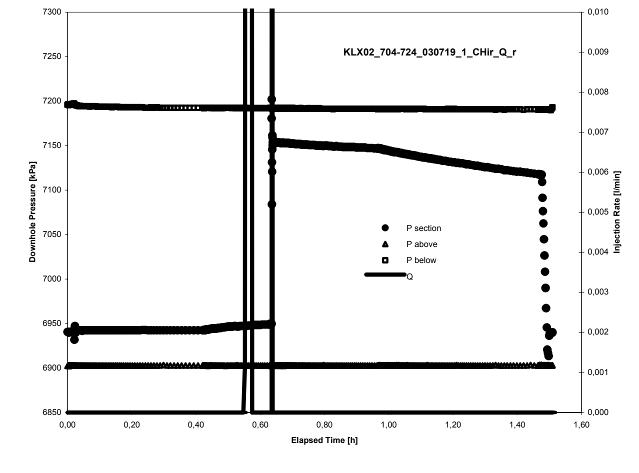
Comments:

* : IARF not measured
The transmissivity derived from the transient analysis of the CHIR phase is lower or equal to 1.2E-10 m2/s. Regarding the fact that the transmissivity is very low and the injection rate was below the measurement range of the flowmeter the derived transmissivity could be up to one order of magnitude lower than derived from the analysis.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	PI (see table 6.1)
Area:	Laxemar	Test no:	30
Borehole ID:	KLX 02	Test start:	030719 09:18
Test section from - to (m):	704 - 724 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

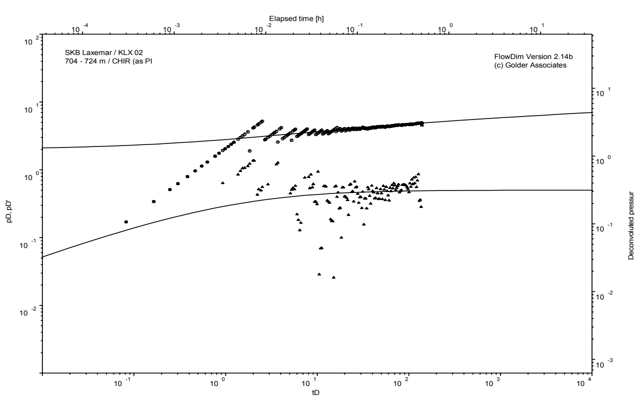


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	6941		
p_i (kPa) =	6950		
p_p(kPa) =	7147	p_F (kPa) =	7117
Q_p (m^3/s)=	-		
tp (s) =	1200	t_F (s) =	1800
S el S^* (-)=	NA	S el S^* (-)=	1,1E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	17,3		
Derivative fact.=	NA	Derivative fact.=	0,28
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	1,2E-10
S (-) =	NA	S (-) =	1,1E-06
K_s (m/s) =	NA	K_s (m/s) =	6,0E-12
S_s (1/m) =	NA	S_s (1/m) =	5,5E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,7E-10
C_D (-) =	NA	C_D (-) =	1,7E+02
ξ (-) =	NA	ξ (-) =	2
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	1,7E-10
dt_2 (min) =	*	C_D (-) =	1,7E+02
T_T (m^2/s) =	1,2E-10	ξ (-) =	2
S (-) =	1,1E-06		
K_s (m/s) =	6,0E-12		
S_s (1/m) =	5,5E-08		

Comments:

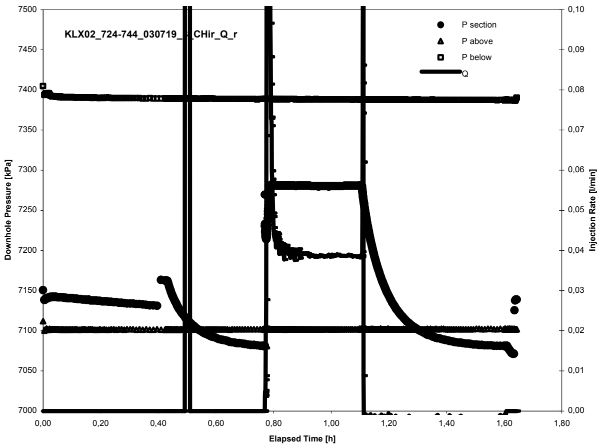
* : IARF not measured

The transmissivity derived from the transient analysis was 1.2E-10 m2/s. Considering the inherent uncertainties related to the measurement (e.g. specially the measurement of the wellbore storage coefficient) and to the analysis process (e.g. numeric distortion when calculating the deconvolved derivative and pressure history effects), the confidence range for the transmissivity is estimated to be 1E-11 to 3E-10 m2/s .

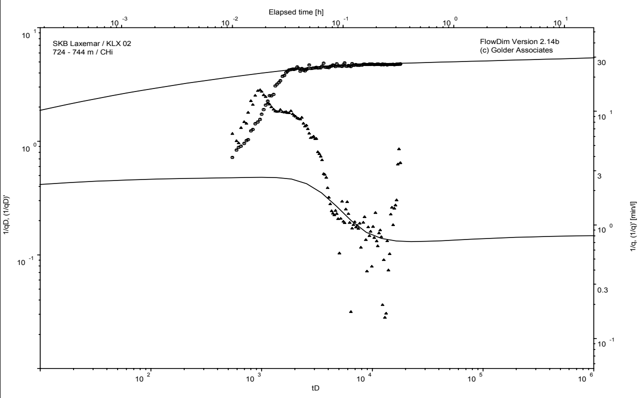
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	31
Borehole ID:	KLX 02	Test start:	030719 11:23
Test section from - to (m):	724 - 744 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

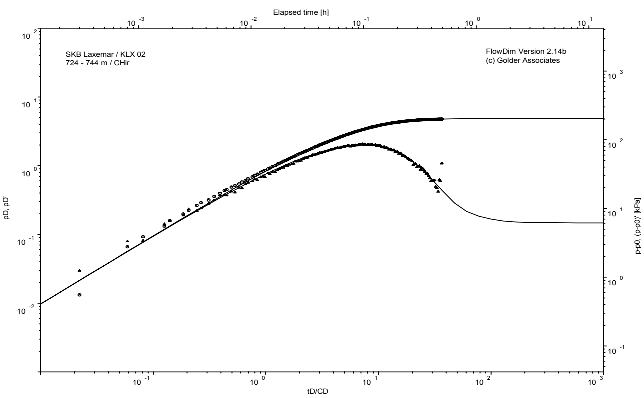
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	7139		
p_i (kPa) =	7081		
p_p(kPa) =	7281	p_F (kPa) =	7081
Q_p (m^3/s)=	6,33E-07		
tp (s) =	1200	t_F (s) =	1800
S el S^* (-)=	1,1E-06	S el S^* (-)=	1,1E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	17,7		
Derivative fact.=	0,37	Derivative fact.=	0,08
Results		**Results**	
Q/s (m^2/s)=	3,11E-08		
T_M (m^2/s)=	3,25E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	*	dt_1 (min) =	*
dt_2 (min) =	*	dt_2 (min) =	*
T (m^2/s) =	2,4E-08	T (m^2/s) =	2,8E-08
S (-) =	1,1E-06	S (-) =	1,1E-06
K_s (m/s) =	1,2E-09	K_s (m/s) =	1,4E-09
S_s (1/m) =	5,5E-08	S_s (1/m) =	5,5E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	8,6E-11
C_D (-) =	NA	C_D (-) =	8,5E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	8,6E-11
dt_2 (min) =	*	C_D (-) =	8,5E+01
T_T (m^2/s) =	2,8E-08	ξ (-) =	0
S (-) =	1,1E-06		
K_s (m/s) =	1,4E-09		
S_s (1/m) =	5,5E-08		

Comments:

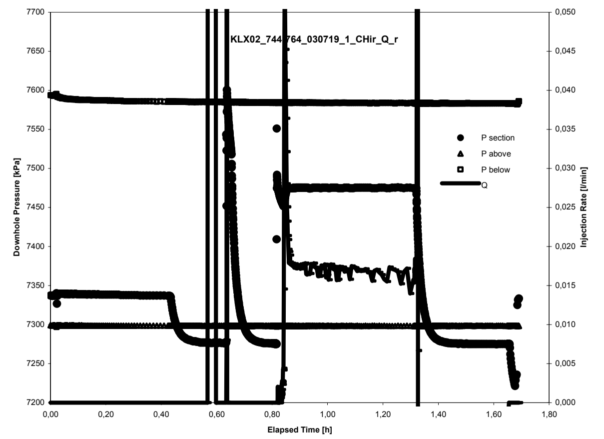
* : IARF not measured

The early time data is masked by wellbore storage, which is indicated by a unit slope derivative. At middle times the derivative becomes flat indicating radial flow in the vicinity of the borehole. At late times the derivative shows a downward slope of -1 which may either indicate above-cylindrical flow or represent a transition period to a zone of higher transmissivity. Based on the derived composite radius (r1 = 4.86 m calculated assuming S = 1.1E-6) it is estimated that the inner composite zone is more representative for the formation properties.

Test Summary Sheet

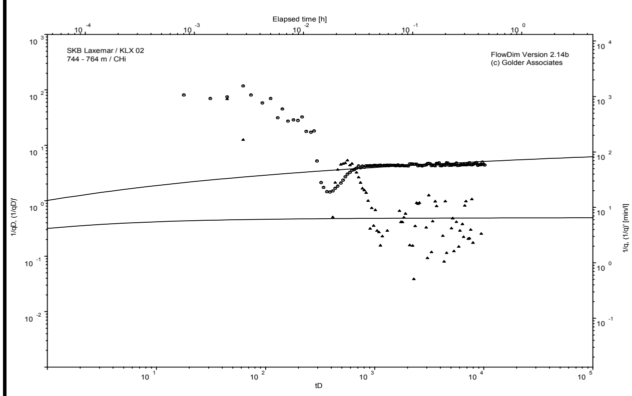
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	32
Borehole ID:	KLX 02	Test start:	030719 16:21
Test section from - to (m):	744 - 764 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

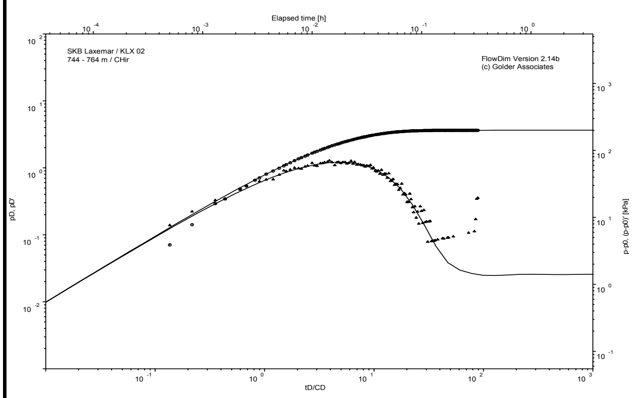


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	7337		
p_i (kPa) =	7275		
p_p(kPa) =	7475	p_F (kPa) =	7275
Q_p (m^3/s)=	2,79E-07		
tp (s) =	1800	t_F (s) =	1200
S el S^* (-)=	1,1E-06	S el S^* (-)=	1,1E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	18,0		
Derivative fact.=	0,09	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	1,37E-08		
T_M (m^2/s)=	1,43E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	5,00	dt_1 (min) =	*
dt_2 (min) =	14,00	dt_2 (min) =	*
T (m^2/s) =	9,9E-09	T (m^2/s) =	8,2E-09
S (-) =	1,1E-06	S (-) =	1,1E-06
K_s (m/s) =	4,9E-10	K_s (m/s) =	4,1E-10
S_s (1/m) =	5,5E-08	S_s (1/m) =	5,5E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	6,9E-11
C_D (-) =	NA	C_D (-) =	6,8E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	6,9E-11
dt_2 (min) =	*	C_D (-) =	6,8E+01
T_T (m^2/s) =	8,2E-09	ξ (-) =	0
S (-) =	1,1E-06		
K_s (m/s) =	4,1E-10		
S_s (1/m) =	5,5E-08		

Comments:

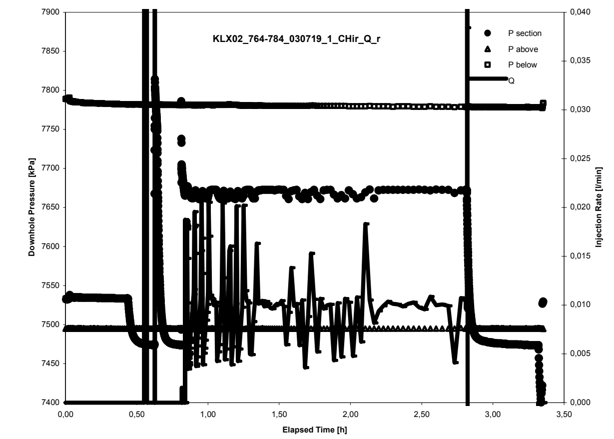
* : IARF not measured

The early time data is masked by wellbore storage, which is indicated by a unit slope derivative. At middle times the derivative becomes flat indicating radial flow in the vicinity of the borehole. At late times the derivative shows a downward slope of -1 which may either indicate above-cylindrical flow or represent a transition period to a zone of higher transmissivity. Based on the derived composite radius (r1 = 1.36 m calculated assuming S = 1.1E-6) it is estimated that the inner composite zone is more representative for the formation properties.

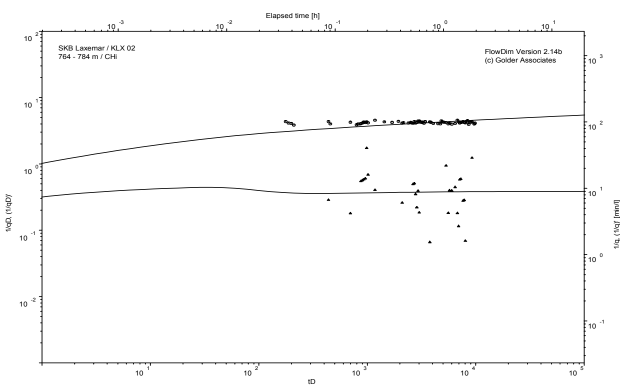
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	33
Borehole ID:	KLX 02	Test start:	030719 18:46
Test section from - to (m):	764 - 784 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

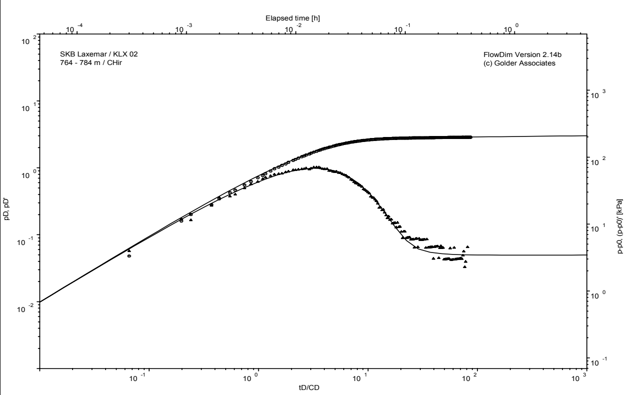
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	7532		
p_i (kPa) =	7474		
p_p(kPa) =	7672	p_F (kPa) =	7474
Q_p (m^3/s)=	1,65E-07		
tp (s) =	7200	t_F (s) =	1800
S el S^* (-)=	2,8E-06	S el S^* (-)=	1,0E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	18,3		
Derivative fact.=	0,10	Derivative fact.=	0,07
Results		**Results**	
Q/s (m^2/s)=	8,19E-09		
T_M (m^2/s)=	8,57E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	1,40	dt_1 (min) =	10,63
dt_2 (min) =	71,35	dt_2 (min) =	20,19
T (m^2/s) =	7,2E-09	T (m^2/s) =	3,8E-08
S (-) =	2,8E-06	S (-) =	1,0E-06
K_s (m/s) =	3,6E-10	K_s (m/s) =	1,9E-09
S_s (1/m) =	1,4E-07	S_s (1/m) =	5,0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	4,0E-11
C_D (-) =	NA	C_D (-) =	4,3E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.

dt_1 (min) =	10,63	C (m^3/Pa) =	4,0E-11
dt_2 (min) =	20,19	C_D (-) =	4,3E+01
T_T (m^2/s) =	3,8E-08	ξ (-) =	0
S (-) =	1,0E-06		
K_s (m/s) =	1,9E-09		
S_s (1/m) =	5,0E-08		

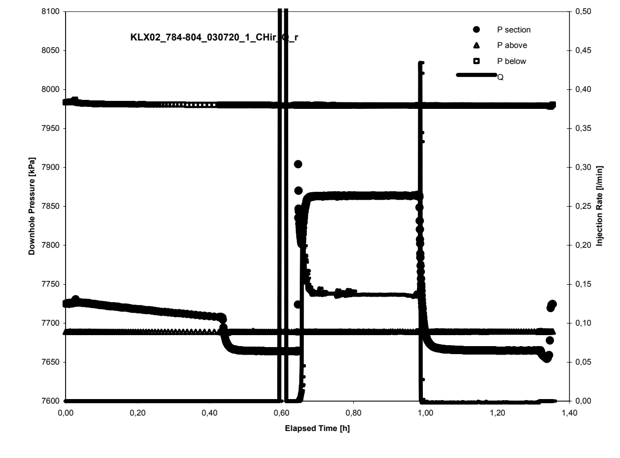
Comments:

The early time data is masked by wellbore storage, which is indicated by a unit slope derivative. At middle times the derivative becomes flat indicating radial flow in the vicinity of the borehole. At late times the derivative shows a downward slope of -1 which indicates a transition period to a zone of higher transmissivity, ending in a horizontal portion which is typical for radial flow geometry. Based on the derived composite radius (r1 = 0.57 m calculated assuming S = 1.0E-6) it is estimated that the outer composite zone is more representative for the formation properties.

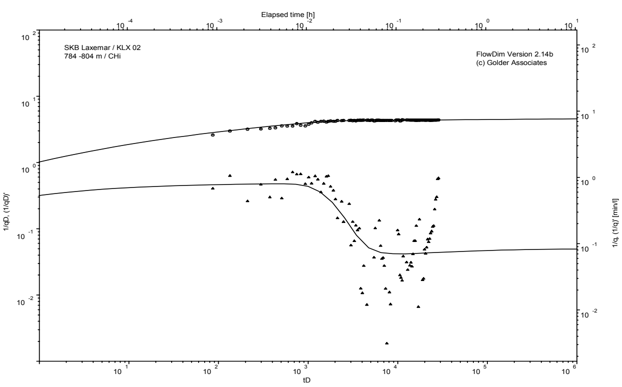
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	34
Borehole ID:	KLX 02	Test start:	030720 08:30
Test section from - to (m):	784 - 804 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

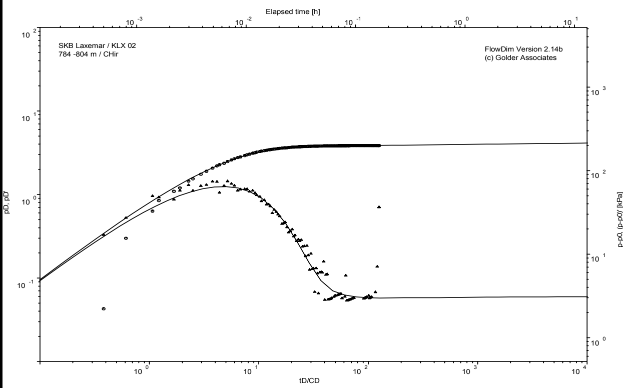
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	7726		
p_i (kPa) =	7664		
p_p(kPa) =	7864	p_F (kPa) =	7665
Q_p (m^3/s)=	2,24E-06		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	2,0E-06	S el S^* (-)=	2,3E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	18,6		
Derivative fact.=	0,26	Derivative fact.=	0,03
Results		**Results**	
Q/s (m^2/s)=	1,10E-07		
T_M (m^2/s)=	1,15E-07		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	4,30	dt_1 (min) =	3,88
dt_2 (min) =	12,82	dt_2 (min) =	8,40
T (m^2/s) =	7,8E-08	T (m^2/s) =	6,9E-08
S (-) =	2,0E-06	S (-) =	2,3E-06
K_s (m/s) =	3,9E-09	K_s (m/s) =	3,5E-09
S_s (1/m) =	1,0E-07	S_s (1/m) =	1,2E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	2,1E-10
C_D (-) =	NA	C_D (-) =	9,8E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.

dt_1 (min) =	3,88	C (m^3/Pa) =	2,1E-10
dt_2 (min) =	8,40	C_D (-) =	9,8E+01
T_T (m^2/s) =	6,9E-08	ξ (-) =	0
S (-) =	2,3E-06		
K_s (m/s) =	3,5E-09		
S_s (1/m) =	1,2E-07		

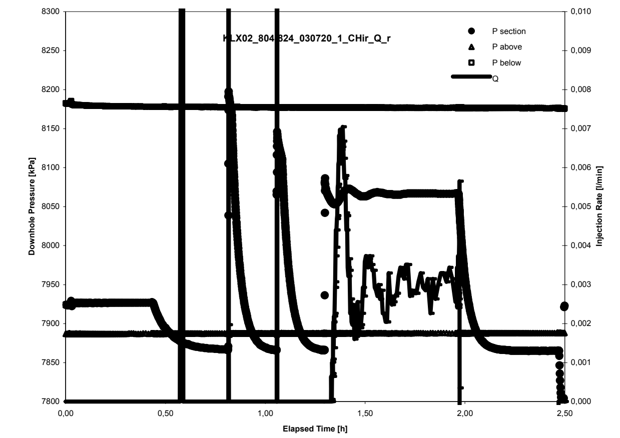
Comments:

The radial composite flow model selected for the analysis of the CHI and CHIR phases reflects the presence of a zone of lower transmissivity in the borehole vicinity. With a discontinuity radius of 1.52 m (calculated assuming S = 2.3E-6) the inner composite zone can be regarded as representative for the small to medium scale formation properties.

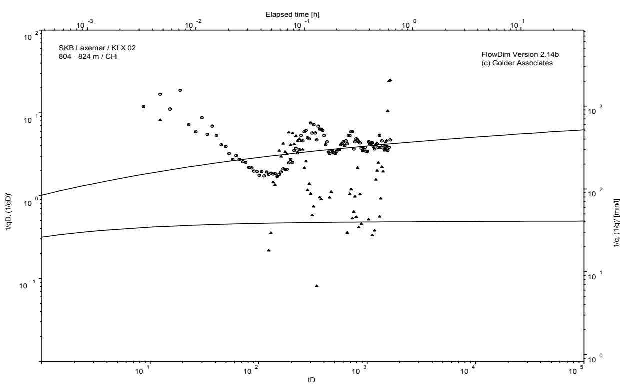
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	35
Borehole ID:	KLX 02	Test start:	030720 10:36
Test section from - to (m):	804 - 824 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

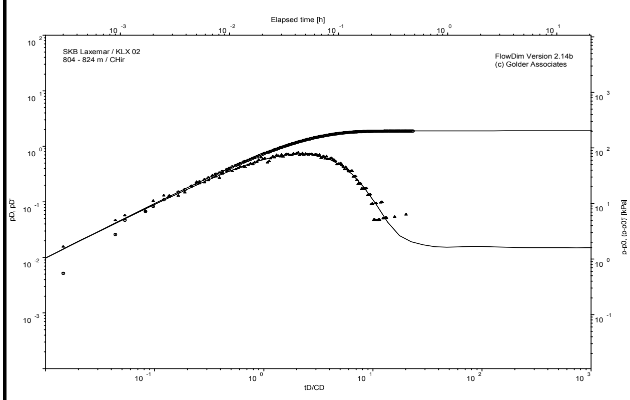
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	7924		
p_i (kPa) =	7866		
p_p(kPa) =	8066	p_F (kPa) =	7865
Q_p (m^3/s)=	5,00E-08		
tp (s) =	2400	t_F (s) =	1800
S el S^* (-)=	1,5E-06	S el S^* (-)=	1,5E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	18,9		
Derivative fact.=	0,20	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	2,45E-09		
T_M (m^2/s)=	2,57E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	16,72	dt_1 (min) =	*
dt_2 (min) =	26,83	dt_2 (min) =	*
T (m^2/s) =	1,6E-09	T (m^2/s) =	2,7E-08
S (-) =	1,5E-06	S (-) =	1,5E-06
K_s (m/s) =	8,0E-11	K_s (m/s) =	1,4E-09
S_s (1/m) =	7,5E-08	S_s (1/m) =	7,5E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	3,8E-11
C_D (-) =	NA	C_D (-) =	2,8E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.			
dt_1 (min) =	*	C (m^3/Pa) =	3,8E-11
dt_2 (min) =	*	C_D (-) =	2,8E+01
T_T (m^2/s) =	2,7E-08	ξ (-) =	0
S (-) =	1,5E-06		
K_s (m/s) =	1,4E-09		
S_s (1/m) =	7,5E-08		

Comments:

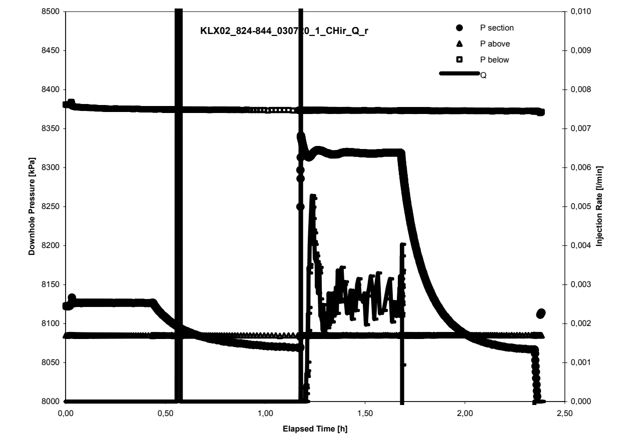
* : IARF not measured

An infinite acting radial composite flow model was identified chosen for the analysis. The downward sloping derivative at late times was interpreted as the transition to a higher transmissivity composite shell. This behaviour could also indicate transition to a higher flow dimension. Due to the small composite radius (r1 = 0.24 m calculated assuming S = 1.5E-6) the outer zone transmissivity is seen to be more representative for the formation properties.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	36
Borehole ID:	KLX 02	Test start:	030720 13:39
Test section from - to (m):	824 - 844 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

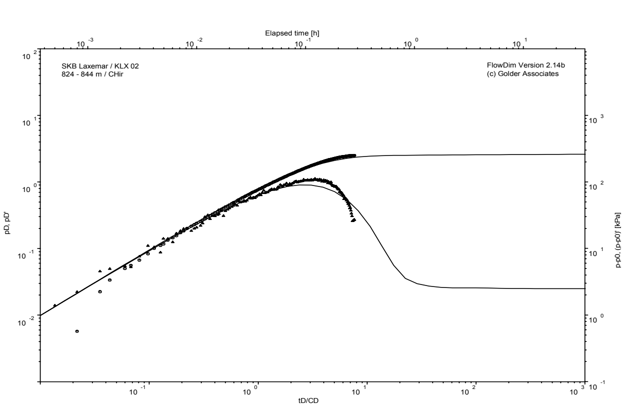


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	8122		
p_i (kPa) =	8069		
p_p(kPa) =	8319	p_F (kPa) =	8066
Q_p (m^3/s)=	4,14E-08		
tp (s) =	1800	t_F (s) =	2400
S el S^* (-)=	NA	S el S^* (-)=	7,3E-07
EC_w (mS/m)=			
$Temp_w$(gr C)=	19,2		
Derivative fact.=	NA	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	1,62E-09		
T_M (m^2/s)=	1,70E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	3,4E-09
S (-) =	NA	S (-) =	7,3E-07
K_s (m/s) =	NA	K_s (m/s) =	1,7E-10
S_s (1/m) =	NA	S_s (1/m) =	3,7E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	6,4E-11
C_D (-) =	NA	C_D (-) =	9,4E+01
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	*	C (m^3/Pa) =	6,4E-11
dt_2 (min) =	*	C_D (-) =	9,4E+01
T_T (m^2/s) =	3,4E-09	ξ (-) =	0
S (-) =	7,3E-07		
K_s (m/s) =	1,7E-10		
S_s (1/m) =	3,7E-08		

Comments:

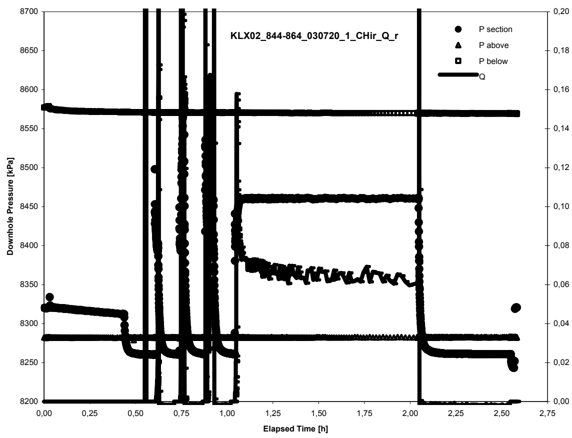
* : IARF not measured

An infinite acting radial composite flow model was chosen for the analysis. The downward sloping derivative at late times was interpreted as the transition to a higher transmissivity composite shell. This behaviour could also indicate transition to a higher flow dimension. It is unclear whether the inner composite zone should be regarded as a local skin or as being representative for the formation properties.

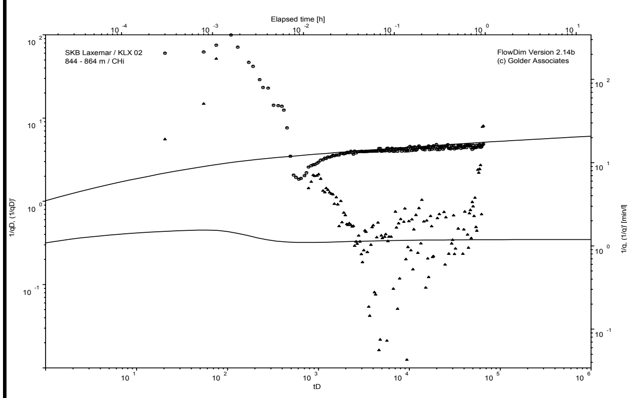
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	37
Borehole ID:	KLX 02	Test start:	030720 16:42
Test section from - to (m):	844 - 864 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

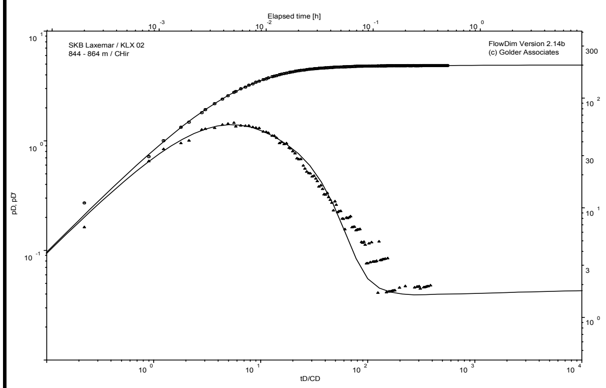
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	8320		
p_i (kPa) =	8261		
p_p(kPa) =	8461	p_F (kPa) =	8261
Q_p (m^3/s)=	1,00E-06		
tp (s) =	3600	t_F (s) =	1800
S el S^* (-)=	1,4E-06	S el S^* (-)=	4,3E-07
EC_w (mS/m)=			
$Temp_w$(gr C)=	19,6		
Derivative fact.=	0,22	Derivative fact.=	0,07
Results		**Results**	
Q/s (m^2/s)=	4,93E-08		
T_M (m^2/s)=	5,15E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	2,77	dt_1 (min) =	8,40
dt_2 (min) =	42,13	dt_2 (min) =	20,56
T (m^2/s) =	5,4E-08	T (m^2/s) =	4,8E-07
S (-) =	1,4E-06	S (-) =	4,3E-07
K_s (m/s) =	2,7E-09	K_s (m/s) =	2,4E-08
S_s (1/m) =	7,0E-08	S_s (1/m) =	2,2E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	8,4E-11
C_D (-) =	NA	C_D (-) =	2,1E+02
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.

dt_1 (min) =	8,40	C (m^3/Pa) =	8,4E-11
dt_2 (min) =	20,56	C_D (-) =	2,1E+02
T_T (m^2/s) =	4,8E-07	ξ (-) =	0
S (-) =	4,3E-07		
K_s (m/s) =	2,4E-08		
S_s (1/m) =	2,2E-08		

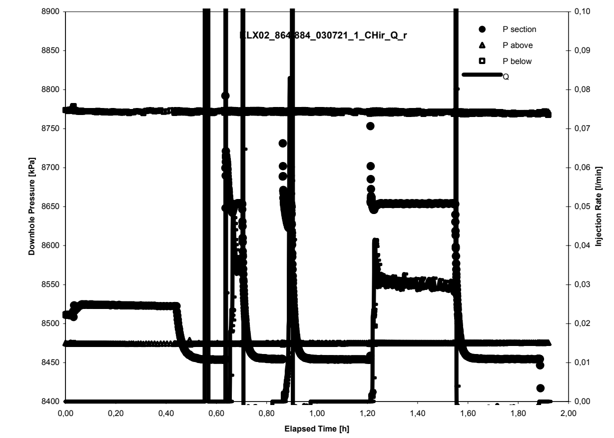
Comments:

The downward slope of the CHIR derivative at late times was interpreted as a transition to an outer composite shell of higher transmissivity. It is not clear which of the composite shells should be seen as representative of the formation properties.

Test Summary Sheet

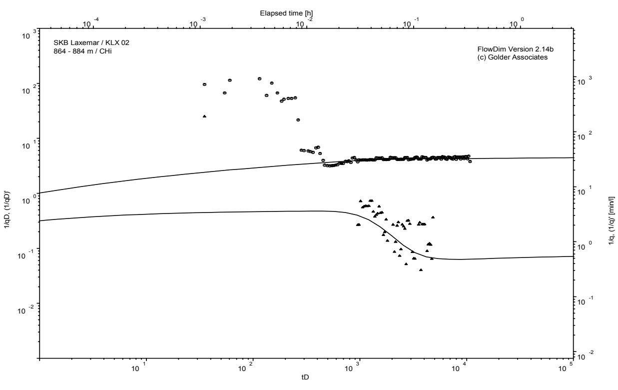
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	38
Borehole ID:	KLX 02	Test start:	030721 08:11
Test section from - to (m):	864 - 884 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

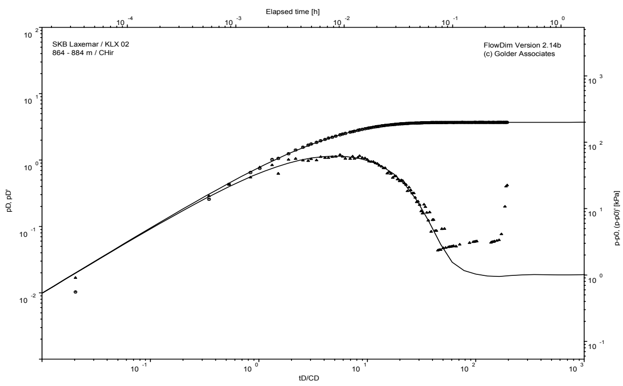


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	8511		
p_i (kPa) =	8454		
p_p(kPa) =	8654	p_F (kPa) =	8455
Q_p (m^3/s)=	4,65E-07		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1,3E-06	S el S^* (-)=	1,2E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	19,9		
Derivative fact.=	0,32	Derivative fact.=	0,05
Results		**Results**	
Q/s (m^2/s)=	2,28E-08		
T_M (m^2/s)=	2,38E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	*	dt_1 (min) =	*
dt_2 (min) =	*	dt_2 (min) =	*
T (m^2/s) =	1,1E-07	T (m^2/s) =	3,6E-07
S (-) =	1,3E-06	S (-) =	1,2E-06
K_s (m/s) =	5,5E-09	K_s (m/s) =	1,8E-08
S_s (1/m) =	6,5E-08	S_s (1/m) =	6,0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	5,5E-11
C_D (-) =	NA	C_D (-) =	4,9E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	5,5E-11
dt_2 (min) =	*	C_D (-) =	4,9E+01
T_T (m^2/s) =	3,6E-07	ξ (-) =	0
S (-) =	1,2E-06		
K_s (m/s) =	1,8E-08		
S_s (1/m) =	6,0E-08		

Comments:

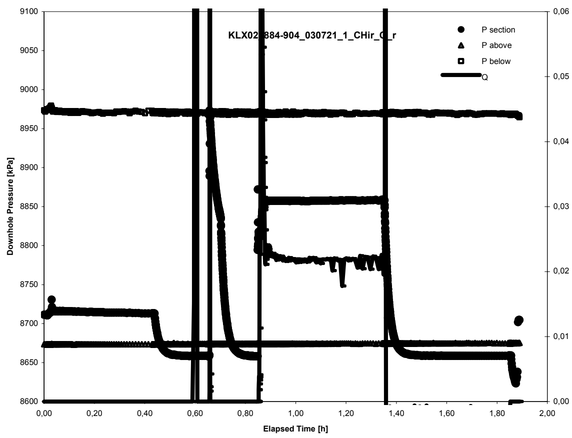
* : IARF not measured

The downward slope of the CHIR derivative at late times was interpreted as a transition to an outer composite shell of higher transmissivity. It is not clear which of the composite shells should be seen as representative of the formation properties.

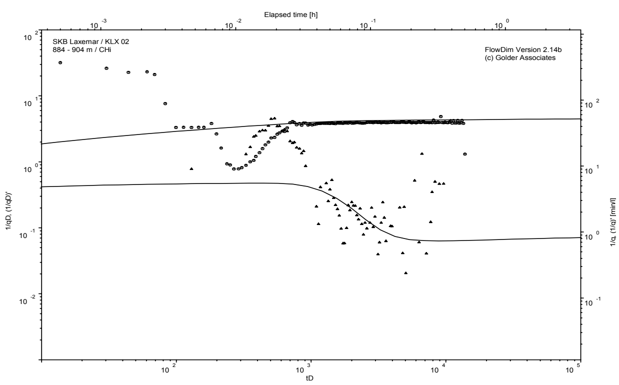
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	39
Borehole ID:	KLX 02	Test start:	030721 10:45
Test section from - to (m):	884 - 904 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

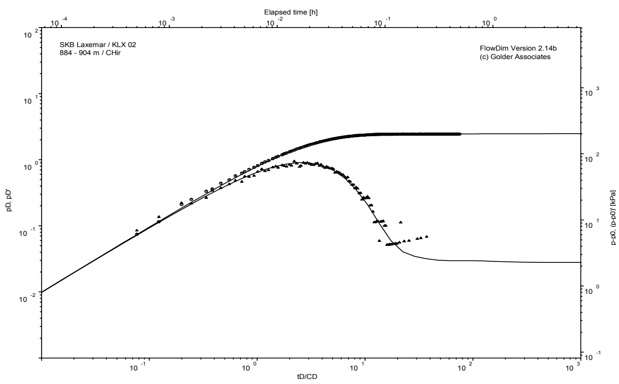
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	8711		
p_i (kPa) =	8658		
p_p(kPa) =	8858	p_F (kPa) =	8659
Q_p (m^3/s)=	3,50E-07		
tp (s) =	1800	t_F (s) =	1800
S el S^* (-)=	1,0E-06	S el S^* (-)=	1,1E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	20,2		
Derivative fact.=	0,13	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	1,72E-08		
T_M (m^2/s)=	1,80E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	10,40	dt_1 (min) =	*
dt_2 (min) =	15,56	dt_2 (min) =	*
T (m^2/s) =	7,5E-08	T (m^2/s) =	1,3E-07
S (-) =	1,0E-06	S (-) =	1,1E-06
K_s (m/s) =	3,8E-09	K_s (m/s) =	6,5E-09
S_s (1/m) =	5,0E-08	S_s (1/m) =	5,5E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,0E-10
C_D (-) =	NA	C_D (-) =	9,9E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.			
dt_1 (min) =	*	C (m^3/Pa) =	1,0E-10
dt_2 (min) =	*	C_D (-) =	9,9E+01
T_T (m^2/s) =	1,3E-07	ξ (-) =	0
S (-) =	1,1E-06		
K_s (m/s) =	6,5E-09		
S_s (1/m) =	5,5E-08		

Comments:

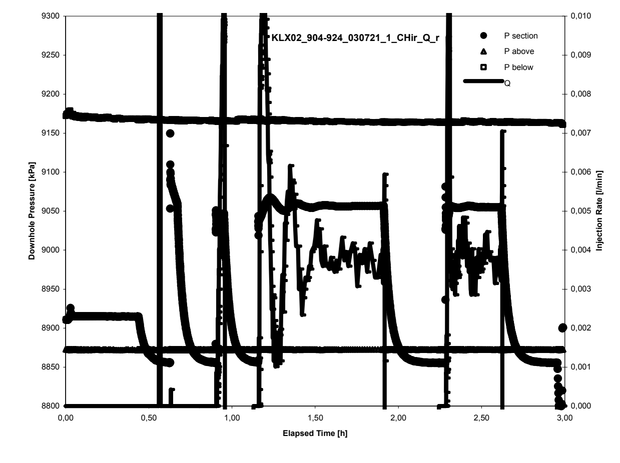
* : IARF not measured

The downward slope of the CHIR derivative at late times was interpreted as a transition to an outer composite shell of higher transmissivity. It is not clear which of the composite shells should be seen as representative of the formation properties.

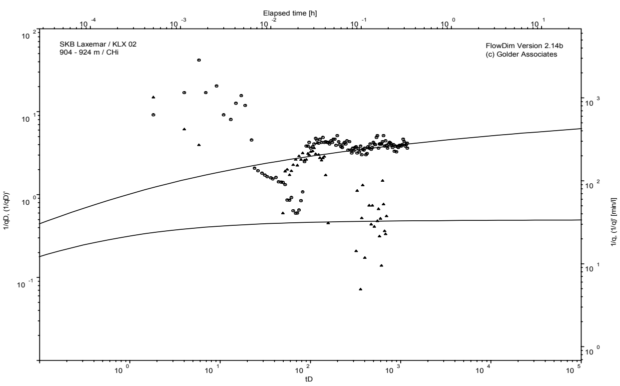
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	40
Borehole ID:	KLX 02	Test start:	030721 13:11
Test section from - to (m):	904 - 924 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, 2·r_w (m):	0,076	Responsible for test evaluation:	C. Enachescu

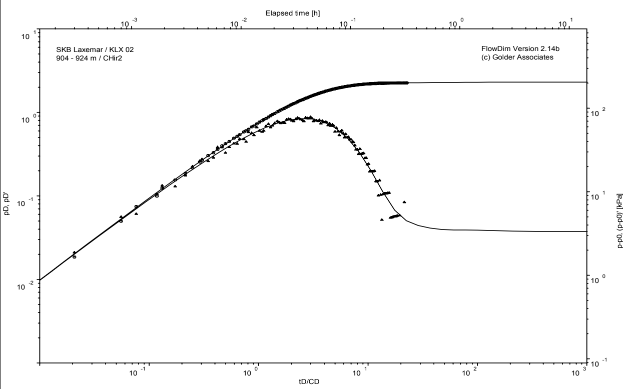
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	8911		
p_i (kPa) =	8855		
p_p(kPa) =	9055	p_F (kPa) =	8855
Q_p (m^3/s)=	5,83E-08		
tp (s) =	1200	t_F (s) =	1200
S el S* (-)=	1,3E-06	S el S* (-)=	1,2E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	20,6		
Derivative fact.=	0,23	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	2,86E-09		
T_M (m^2/s)=	2,99E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	6,08	dt_1 (min) =	*
dt_2 (min) =	11,48	dt_2 (min) =	*
T (m^2/s) =	1,9E-09	T (m^2/s) =	1,5E-08
S (-) =	1,3E-06	S (-) =	1,2E-06
K_s (m/s) =	9,6E-11	K_s (m/s) =	7,5E-10
S_s (1/m) =	6,5E-08	S_s (1/m) =	6,0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	3,8E-11
C_D (-) =	NA	C_D (-) =	3,4E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.			
dt_1 (min) =	*	C (m^3/Pa) =	3,8E-11
dt_2 (min) =	*	C_D (-) =	3,4E+01
T_T (m^2/s) =	1,5E-08	ξ (-) =	0
S (-) =	1,2E-06		
K_s (m/s) =	7,5E-10		
S_s (1/m) =	6,0E-08		

Comments:

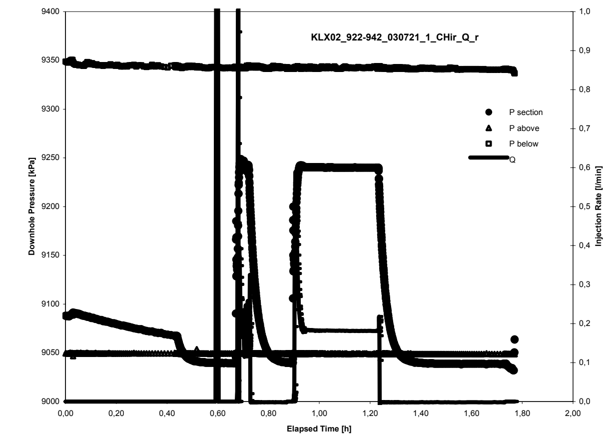
* : IARF not measured

The downward slope of the CHIR derivative at late times was interpreted as a transition to an outer composite shell of higher transmissivity. It is not clear which of the composite shells should be seen as representative of the formation properties.

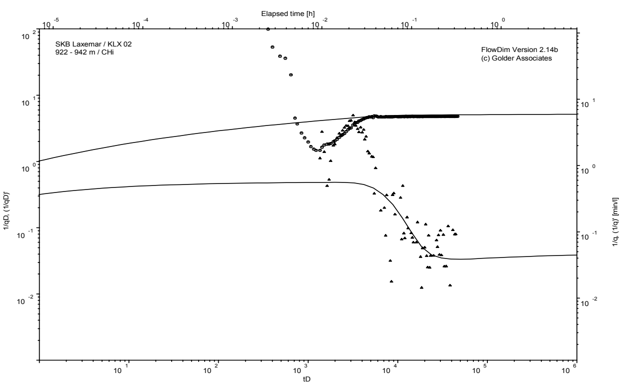
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	41
Borehole ID:	KLX 02	Test start:	030721 16:48
Test section from - to (m):	922 - 942 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

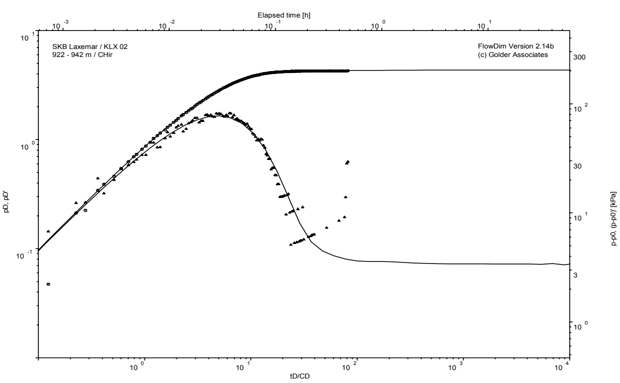
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	9087		
p_i (kPa) =	9040		
p_p(kPa) =	9240	p_F (kPa) =	9039
Q_p (m^3/s)=	2,81E-06		
tp (s) =	1200	t_F (s) =	1800
S el S^* (-)=	2,0E-06	S el S^* (-)=	1,4E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	20,9		
Derivative fact.=	0,02	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	1,38E-07		
T_M (m^2/s)=	1,44E-07		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	*	dt_1 (min) =	*
dt_2 (min) =	*	dt_2 (min) =	*
T (m^2/s) =	1,1E-07	T (m^2/s) =	1,0E-07
S (-) =	2,0E-06	S (-) =	1,4E-06
K_s (m/s) =	5,7E-09	K_s (m/s) =	5,1E-09
S_s (1/m) =	9,9E-08	S_s (1/m) =	7,0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,4E-09
C_D (-) =	NA	C_D (-) =	1,1E+03
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.			
dt_1 (min) =	*	C (m^3/Pa) =	1,4E-09
dt_2 (min) =	*	C_D (-) =	1,1E+03
T_T (m^2/s) =	1,0E-07	ξ (-) =	0
S (-) =	1,4E-06		
K_s (m/s) =	5,1E-09		
S_s (1/m) =	7,0E-08		

Comments:

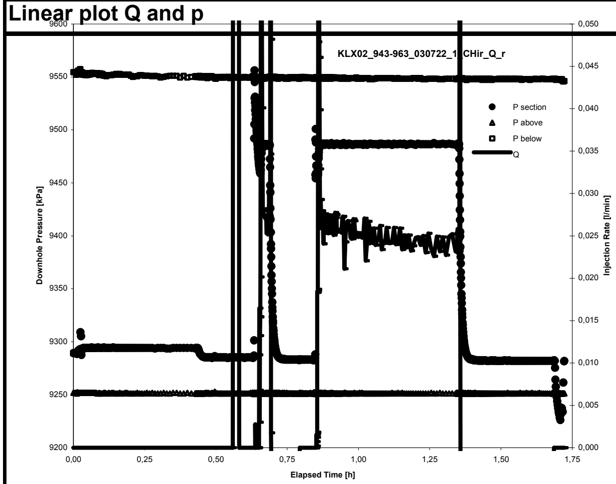
* : IARF not measured

The radial composite flow model selected for the analysis of the CHI and CHIR phases reflects the presence of a zone of lower transmissivity in the borehole vicinity. With a discontinuity radius of between 2.26 m and 5.51 m (calculated assuming a storativity of 1.4E-6 and 2.0E-6 respectively) the inner composite zone cannot be regarded as a skin. Therefore, the inner composite shell parameters are regarded as representative for the small to medium scale formation properties.

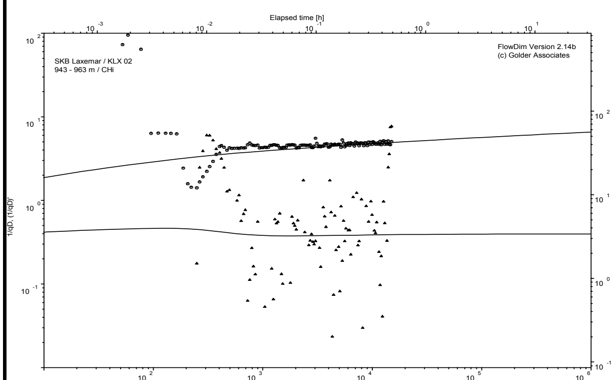
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	42
Borehole ID:	KLX 02	Test start:	030722 08:27
Test section from - to (m):	943 - 963 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, 2·r_w (m):	0,076	Responsible for test evaluation:	C. Enachescu

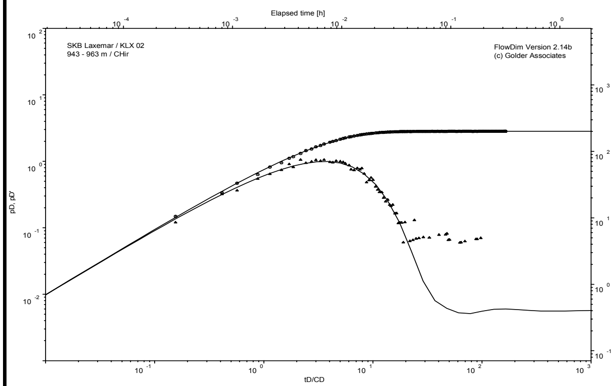
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	9289		
p_i (kPa) =	9285		
p_p(kPa) =	9486	p_F (kPa) =	9282
Q_p (m^3/s)=	3,91E-07		
tp (s) =	1800	t_F (s) =	1200
S el S^* (-)=	1,2E-06	S el S^* (-)=	1,3E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	21,2		
Derivative fact.=	0,10	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	1,91E-08		
T_M (m^2/s)=	2,00E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	2,60	dt_1 (min) =	*
dt_2 (min) =	20,89	dt_2 (min) =	*
T (m^2/s) =	1,9E-08	T (m^2/s) =	7,5E-07
S (-) =	1,2E-06	S (-) =	1,3E-06
K_s (m/s) =	9,5E-10	K_s (m/s) =	3,8E-08
S_s (1/m) =	6,2E-08	S_s (1/m) =	6,5E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	3,9E-11
C_D (-) =	NA	C_D (-) =	3,3E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	3,9E-11
dt_2 (min) =	*	C_D (-) =	3,3E+01
T_T (m^2/s) =	7,5E-07	ξ (-) =	0
S (-) =	1,3E-06		
K_s (m/s) =	3,8E-08		
S_s (1/m) =	6,5E-08		

Comments:

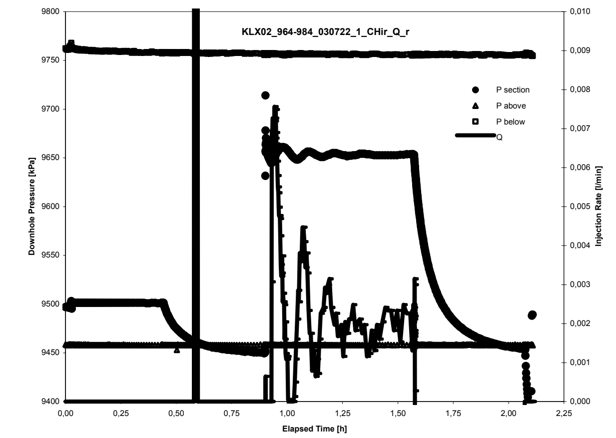
* : IARF not measured

The downward slope of the CHIR derivative at late times was interpreted as a transition to an outer composite shell of higher transmissivity. It is not clear which of the composite shells should be seen as representative of the formation properties.

Test Summary Sheet

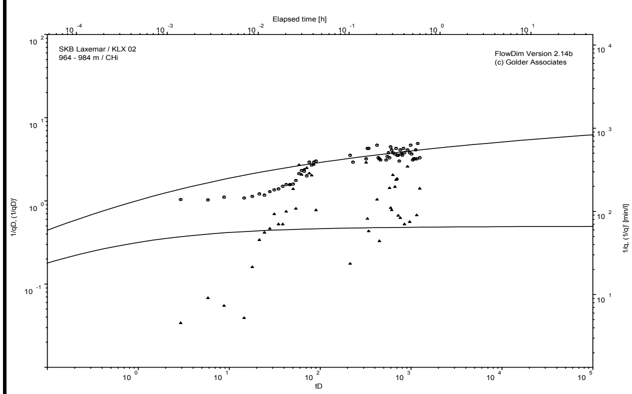
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	43
Borehole ID:	KLX 02	Test start:	030722 10:53
Test section from - to (m):	964 - 984 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

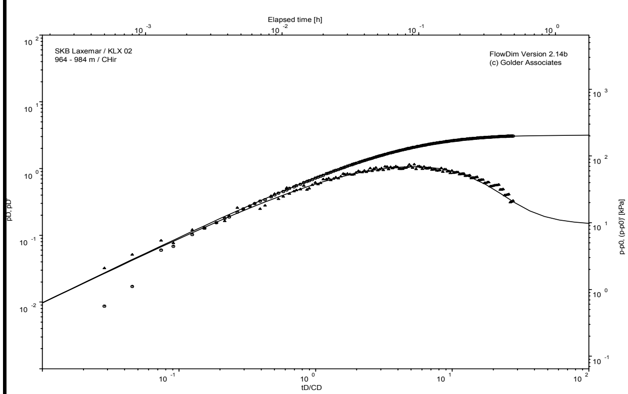


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	9497		
p_i (kPa) =	9450		
p_p(kPa) =	9653	p_F (kPa) =	9453
Q_p (m^3/s)=	2,33E-08		
tp (s) =	2400	t_F (s) =	1800
S el S^* (-)=	1,2E-06	S el S^* (-)=	1,5E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	21,5		
Derivative fact.=	0,11	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	1,13E-09		
T_M (m^2/s)=	1,18E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	9,52	dt_1 (min) =	*
dt_2 (min) =	27,75	dt_2 (min) =	*
T (m^2/s) =	9,7E-10	T (m^2/s) =	2,4E-09
S (-) =	1,2E-06	S (-) =	1,5E-06
K_s (m/s) =	4,9E-11	K_s (m/s) =	1,2E-10
S_s (1/m) =	5,8E-08	S_s (1/m) =	7,5E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	3,0E-11
C_D (-) =	NA	C_D (-) =	2,1E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	*	C (m^3/Pa) =	3,0E-11
dt_2 (min) =	*	C_D (-) =	2,1E+01
T_T (m^2/s) =	2,4E-09	ξ (-) =	0
S (-) =	1,5E-06		
K_s (m/s) =	1,2E-10		
S_s (1/m) =	7,5E-08		

Comments:

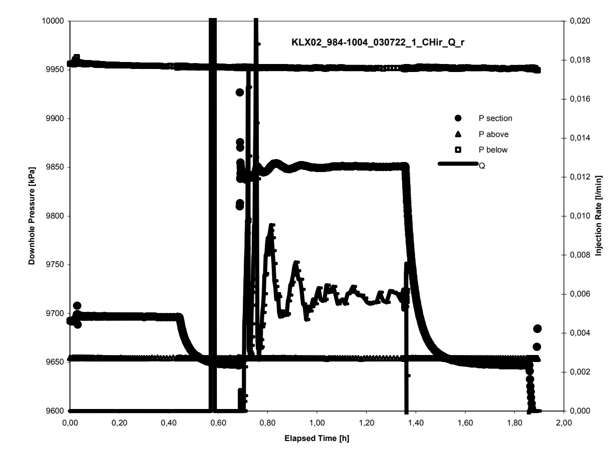
* : IARF not measured

An infinite acting radial composite flow model was chosen for the analysis. The downward sloping derivative at late times was interpreted as the transition to a higher transmissivity composite shell. This behaviour could also indicate transition to a higher flow dimension. It is unclear whether the inner composite zone should be regarded as a local skin or as being representative for the formation properties.

Test Summary Sheet

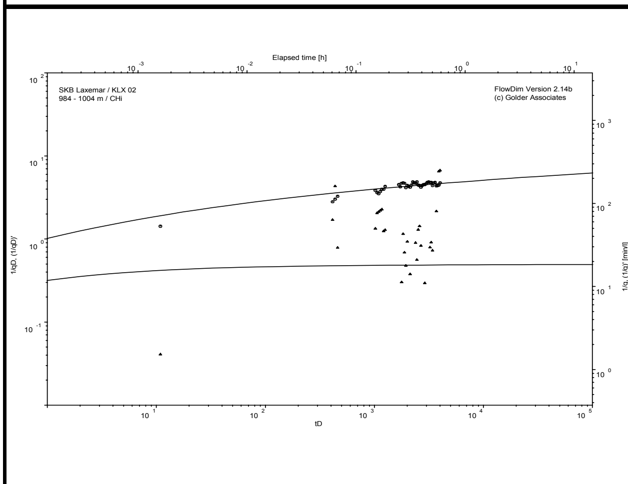
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	44
Borehole ID:	KLX 02	Test start:	030722 13:39
Test section from - to (m):	984 - 1004 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

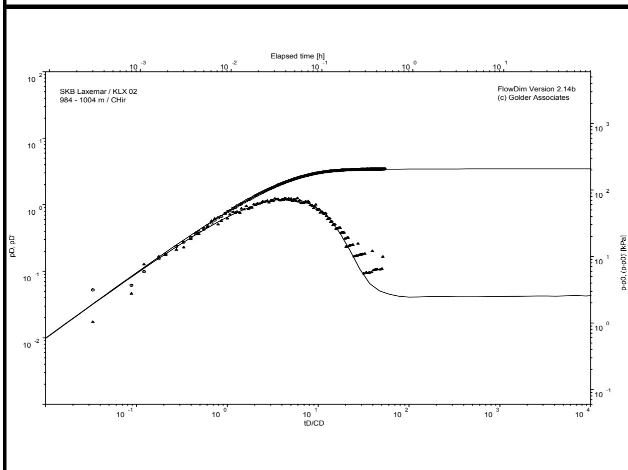


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	9692		
p_i (kPa) =	9648		
p_p(kPa) =	9850	p_F (kPa) =	9647
Q_p (m^3/s)=	9,29E-08		
tp (s) =	2400	t_F (s) =	1800
S el S^* (-)=	1,3E-06	S el S^* (-)=	8,8E-07
EC_w (mS/m)=			
$Temp_w$(gr C)=	21,9		
Derivative fact.=	0,08	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	4,51E-09		
T_M (m^2/s)=	4,72E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	16,65	dt_1 (min) =	*
dt_2 (min) =	30,08	dt_2 (min) =	*
T (m^2/s) =	3,5E-09	T (m^2/s) =	3,0E-08
S (-) =	1,3E-06	S (-) =	8,8E-07
K_s (m/s) =	1,7E-10	K_s (m/s) =	1,5E-09
S_s (1/m) =	6,4E-08	S_s (1/m) =	4,4E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	5,4E-11
C_D (-) =	NA	C_D (-) =	6,6E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	5,4E-11
dt_2 (min) =	*	C_D (-) =	6,6E+01
T_T (m^2/s) =	3,0E-08	ξ (-) =	0
S (-) =	8,8E-07		
K_s (m/s) =	1,5E-09		
S_s (1/m) =	4,4E-08		

Comments:

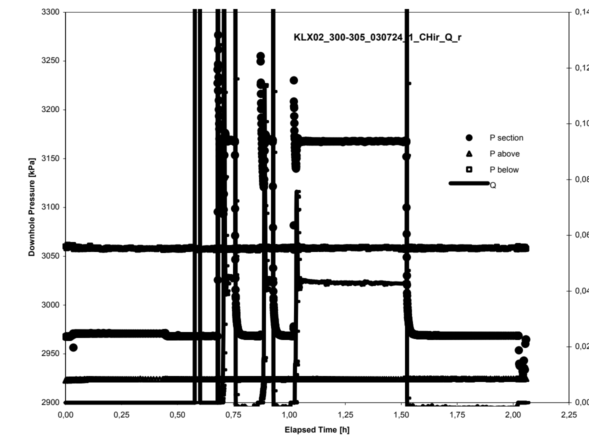
* : IARF not measured

The downward slope of the CHIR derivative at late times was interpreted as a transition to an outer composite shell of higher transmissivity. It is not clear which of the composite shells should be seen as representative of the formation properties.

Test Summary Sheet

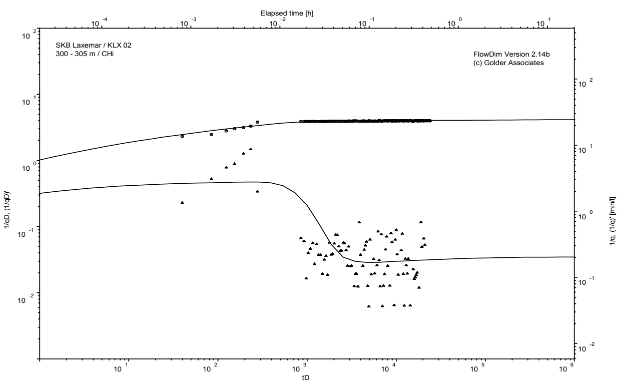
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	45
Borehole ID:	KLX 02	Test start:	030724 10:32
Test section from - to (m):	300 - 305 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

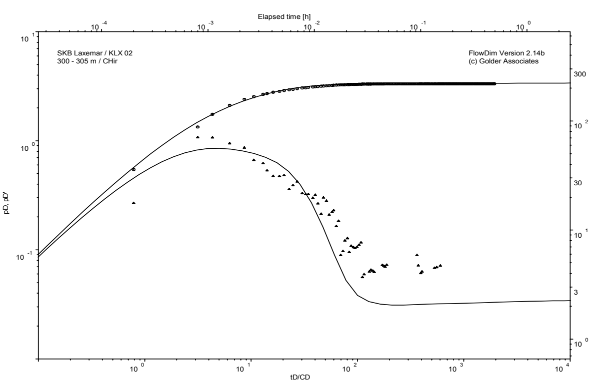


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	2967		
p_i (kPa) =	2968		
p_p(kPa) =	3168	p_F (kPa) =	2968
Q_p (m^3/s)=	7,11E-07		
tp (s) =	1800	t_F (s) =	1800
S el S^* (-)=	1,1E-06	S el S^* (-)=	9,6E-07
EC_w (mS/m)=			
$Temp_w$(gr C)=	11,3		
Derivative fact.=	0,22	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	3,49E-08		
T_M (m^2/s)=	2,88E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	3,82	dt_1 (min) =	*
dt_2 (min) =	16,52	dt_2 (min) =	*
T (m^2/s) =	3,2E-07	T (m^2/s) =	2,4E-07
S (-) =	1,1E-06	S (-) =	9,6E-07
K_s (m/s) =	6,4E-08	K_s (m/s) =	4,8E-08
S_s (1/m) =	2,2E-07	S_s (1/m) =	1,9E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	9,9E-12
C_D (-) =	NA	C_D (-) =	1,1E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	3,82	C (m^3/Pa) =	9,9E-12
dt_2 (min) =	16,52	C_D (-) =	1,1E+01
T_T (m^2/s) =	3,2E-07	ξ (-) =	0
S (-) =	1,1E-06		
K_s (m/s) =	6,4E-08		
S_s (1/m) =	2,2E-07		

Comments:

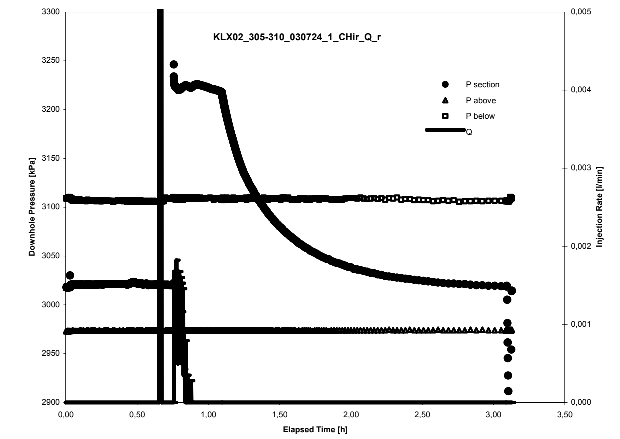
* : IARF not measured

In case of the present test there is ambiguity concerning the flow dimension in borehole vicinity. The CHIR derivative shows at middle times a slope of -0.5, which is indicative for spherical flow. At late times the derivative shows a negative unit slope (-1) which indicates a transition to a higher transmissivity zone. Generally, the derivative shows the picture of a "partially penetrating" interval, which is consistent with the small interval length (5 m). The downward slope of the CHIR derivative at late times was interpreted as a transition to an outer composite shell of higher transmissivity. It is not clear which of the composite shells should be seen as representative of the formation properties.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	46
Borehole ID:	KLX 02	Test start:	030724 13:01
Test section from - to (m):	305 - 310 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

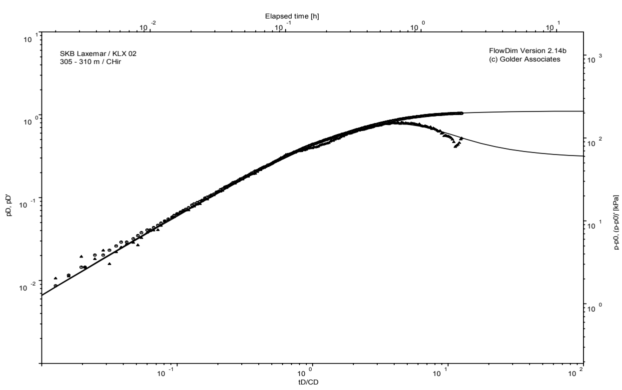


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3018		
p_i (kPa) =	3021		
p_p(kPa) =	3221	p_F (kPa) =	3019
Q_p (m^3/s)=	5,00E-09		
tp (s) =	1200	t_F (s) =	7200
S el S^* (-)=	NA	S el S^* (-)=	1,7E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	11,4		
Derivative fact.=	NA	Derivative fact.=	0,1
Results		**Results**	
Q/s (m^2/s)=	2,45E-10		
T_M (m^2/s)=	2,02E-10		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	8,1E-11
S (-) =	NA	S (-) =	1,7E-06
K_s (m/s) =	NA	K_s (m/s) =	1,6E-11
S_s (1/m) =	NA	S_s (1/m) =	3,4E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,7E-11
C_D (-) =	NA	C_D (-) =	1,1E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	1,7E-11
dt_2 (min) =	*	C_D (-) =	1,1E+01
T_T (m^2/s) =	8,1E-11	ξ (-) =	0
S (-) =	1,7E-06		
K_s (m/s) =	1,6E-11		
S_s (1/m) =	3,4E-07		

Comments:

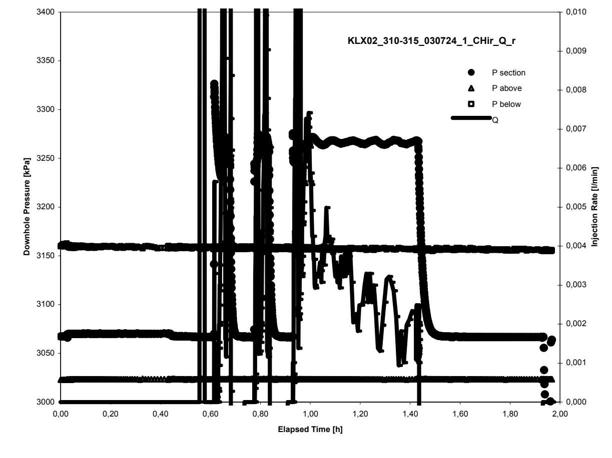
* : IARF not measured

IThe near borehole transmissivity derived from the transient analysis of the CHIR phase is lower or equal to 4.8E-11 m2/s. Further away from the borehole (r1 = 0.14 m, assuming S = 1.7E-6) the transmissivity seems to increase slightly (downward slope of the derivative); a value of 8.1E-11 m2/s was derived for the outer zone. Regarding the fact that the transmissivity is very low and the injection rate was below the measurement range of the flowmeter the derived transmissivities could be up to one order of magnitude lower than derived from the analysis. In the same time, due to the fact that the derivative does not reach infinite acting regime at late times, the outer zone transmissivity could be higher than calculated (estimated up to one order of magnitude).

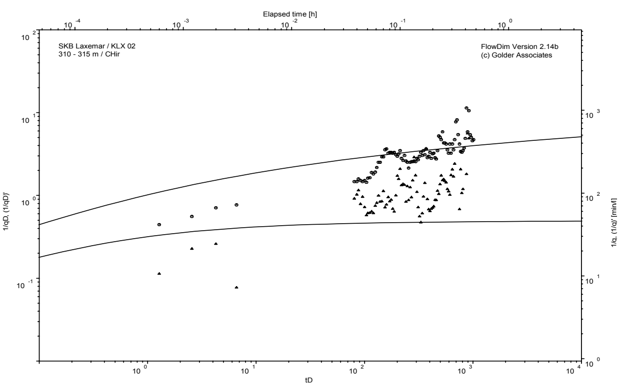
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	47
Borehole ID:	KLX 02	Test start:	030724 16:35
Test section from - to (m):	310 - 315 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

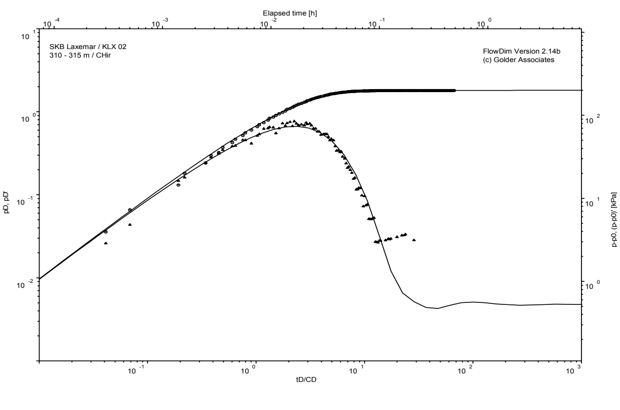
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	3067		
p_i (kPa) =	3067		
p_p(kPa) =	3267	p_F (kPa) =	3067
Q_p (m^3/s)=	2,50E-08		
tp (s) =	1800	t_F (s) =	1800
S el S^* (-)=	1,6E-06	S el S^* (-)=	1,4E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	11,5		
Derivative fact.=	0,38	Derivative fact.=	0,04
Results		**Results**	
Q/s (m^2/s)=	1,23E-09		
T_M (m^2/s)=	1,01E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	7,62	dt_1 (min) =	*
dt_2 (min) =	21,14	dt_2 (min) =	*
T (m^2/s) =	1,4E-09	T (m^2/s) =	7,4E-08
S (-) =	1,6E-06	S (-) =	1,4E-06
K_s (m/s) =	2,8E-10	K_s (m/s) =	1,5E-08
S_s (1/m) =	3,3E-07	S_s (1/m) =	2,7E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,2E-11
C_D (-) =	NA	C_D (-) =	9,6E+00
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.			
dt_1 (min) =	*	C (m^3/Pa) =	1,2E-11
dt_2 (min) =	*	C_D (-) =	9,6E+00
T_T (m^2/s) =	7,4E-08	ξ (-) =	0
S (-) =	1,4E-06		
K_s (m/s) =	1,5E-08		
S_s (1/m) =	2,7E-07		

Comments:

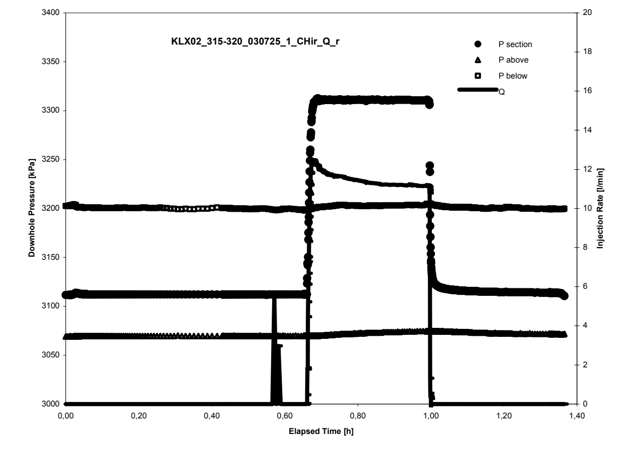
* : IARF not measured

The flow model identification was based on the shape of the semi-log derivative of the CHIR phase. An infinite acting radial composite flow model was identified chosen for the analysis. The downward sloping derivative at late times was interpreted as the transition to a higher transmissivity composite shell. This behaviour could also indicate transition to a higher flow dimension. Due to the small composite radius (r1 = 0.23 m calculated assuming S = 1.4E-6) the outer zone transmissivity is seen to be more representative for the formation properties.

Test Summary Sheet

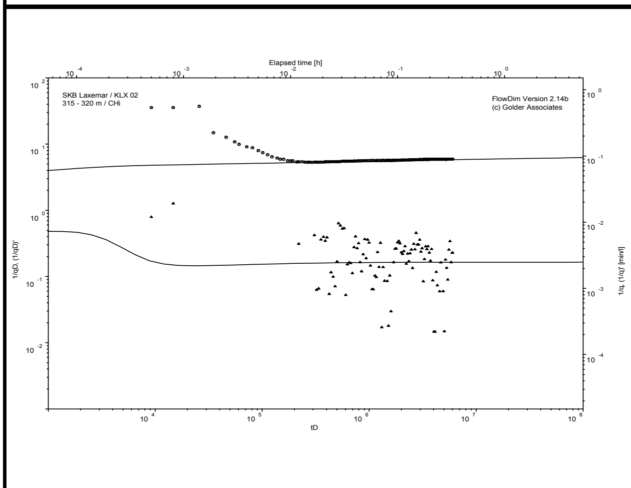
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	48
Borehole ID:	KLX 02	Test start:	030725 08:25
Test section from - to (m):	315 - 320 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	3112		
p_i (kPa) =	3112		
p_p(kPa) =	3310	p_F (kPa) =	3114
Q_p (m^3/s)=	1,82E-04		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1,2E-06	S el S^* (-)=	1,0E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	11,5		
Derivative fact.=	0,02	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	9,03E-06		
T_M (m^2/s)=	7,46E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	4,32	dt_1 (min) =	1,54
dt_2 (min) =	19,01	dt_2 (min) =	8,94
T (m^2/s) =	2,6E-05	T (m^2/s) =	4,1E-05
S (-) =	1,2E-06	S (-) =	1,0E-06
K_s (m/s) =	5,2E-06	K_s (m/s) =	8,2E-06
S_s (1/m) =	2,3E-07	S_s (1/m) =	2,0E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	6,4E-09
C_D (-) =	NA	C_D (-) =	6,9E+03
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

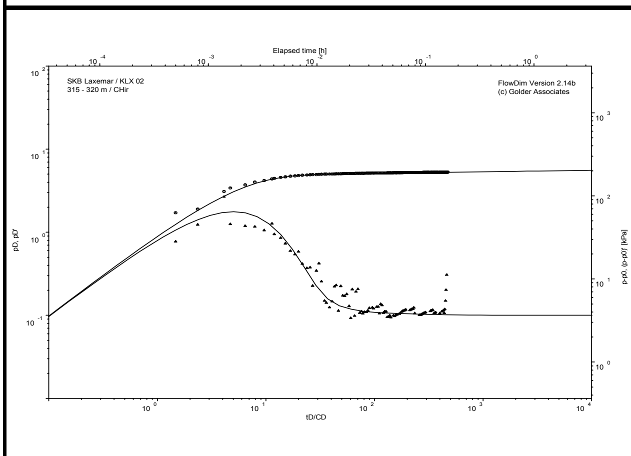
Log-Log plot incl. derivates- flow period



Selected representative parameters.

dt_1 (min) =	1,54	C (m^3/Pa) =	6,4E-09
dt_2 (min) =	8,94	C_D (-) =	6,9E+03
T_T (m^2/s) =	4,1E-05	ξ (-) =	0
S (-) =	1,0E-06		
K_s (m/s) =	8,2E-06		
S_s (1/m) =	2,0E-07		

Log-Log plot incl. derivatives- recovery period



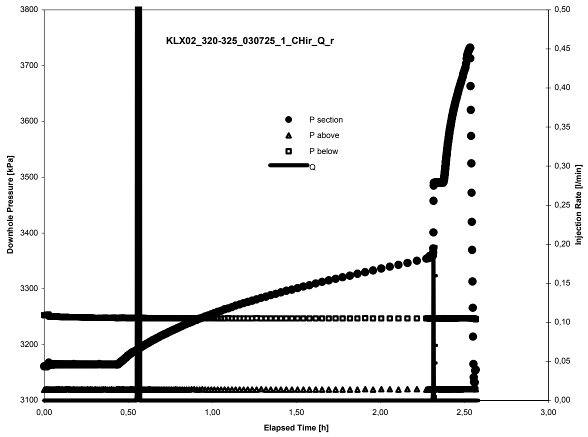
Comments:

The early time data of the CHI phase does not allow characterizing the inner composite zone; however, for a given storativity around 1E-6 the presence of a lower transmissivity zone around the borehole (inner zone) is a necessary assumption which allows matching the late times. The outer zone transmissivity is seen as representative for the interval transmissivity.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	49
Borehole ID:	KLX 02	Test start:	030725 10:12
Test section from - to (m):	320 - 325 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3161		
p_i (kPa) =	3359		
p_p(kPa) =	3491	p_F (kPa) =	3732
Q_p (m³/s)=	NA		
tp (s) =	300	t_F (s) =	480
S el S* (-)=	NA	S el S* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	11,5		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m²/s)=	NA		
T_M (m²/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m²/s) =	NA	T (m²/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m³/Pa) =	NA	C (m³/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m²/s) =		T_{GRF}(m²/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Selected representative parameters.

dt_1 (min) =	NA	C (m³/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m²/s) =	NA	ξ (-) =	0
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

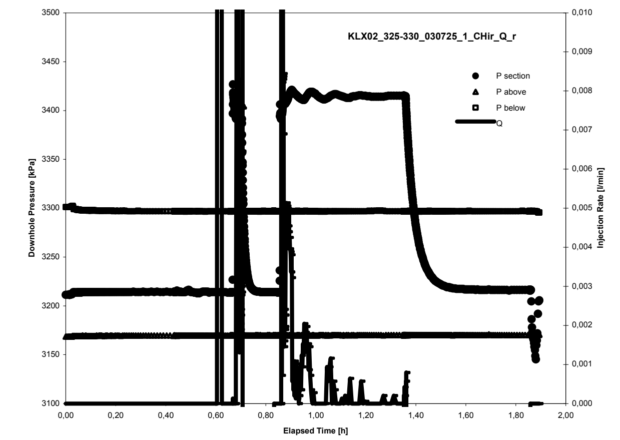
Comments:

The injection rate dropped below the measurement range of the flowmeter (q < 0.5 ml/min) almost instantaneously, indicating the very low transmissivity of the interval. In addition, due to hardware problems (possibly extended packer compliance) the pressure kept rising during the CHIR phase.
None of the test phases is analysable, but the low injection rates show that the interval transmissivity must be lower than 1E-10 m2/s. Based on the very low injection rates (below measurement range of flowmeter), the interval transmissivity is lower than 1E-10 m2/s.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	50
Borehole ID:	KLX 02	Test start:	030725 13:18
Test section from - to (m):	325 - 330 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

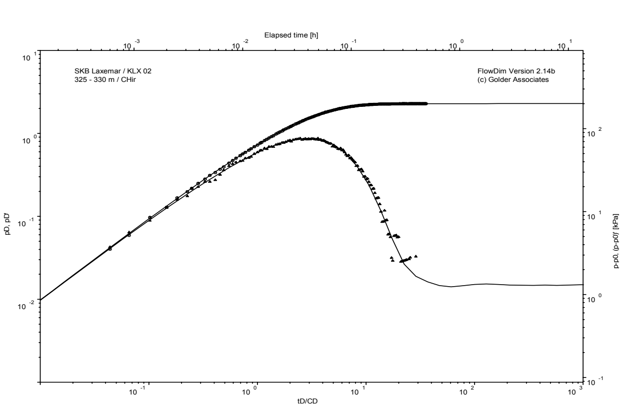


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3211		
p_i (kPa) =	3214		
p_p(kPa) =	3415	p_F (kPa) =	3216
Q_p (m^3/s)=	1,33E-08		
tp (s) =	1800	t_F (s) =	1800
S el S^* (-)=	NA	S el S^* (-)=	6,3E-07
EC_w (mS/m)=			
$Temp_w$(gr C)=	11,7		
Derivative fact.=	NA	Derivative fact.=	0,06
Results		**Results**	
Q/s (m^2/s)=	6,51E-10		
T_M (m^2/s)=	5,37E-10		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	1,3E-08
S (-) =	NA	S (-) =	6,3E-07
K_s (m/s) =	NA	K_s (m/s) =	2,6E-09
S_s (1/m) =	NA	S_s (1/m) =	1,3E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,2E-11
C_D (-) =	NA	C_D (-) =	2,1E+01
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	*	C (m^3/Pa) =	1,2E-11
dt_2 (min) =	*	C_D (-) =	2,1E+01
T_T (m^2/s) =	1,3E-08	ξ (-) =	0
S (-) =	6,3E-07		
K_s (m/s) =	2,6E-09		
S_s (1/m) =	1,3E-07		

Comments:

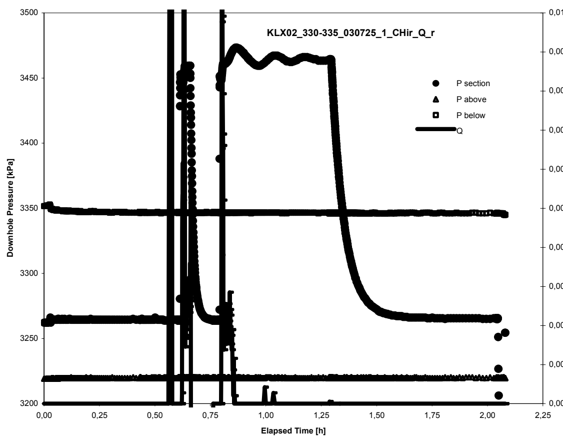
* : IARF not measured

An infinite acting radial 2 shell composite flow model was identified and chosen for the analysis. The downward sloping derivative at late times was interpreted as the transition to a higher transmissivity composite shell. This behaviour could also indicate transition to a higher floe dimension. Due to the small composite radius (r1 = 0.36 m calculated assuming S = 6.3E-7) the outer zone transmissivity is seen to be more representative for the formation properties.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	51
Borehole ID:	KLX 02	Test start:	030725 15:37
Test section from - to (m):	330 - 335 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

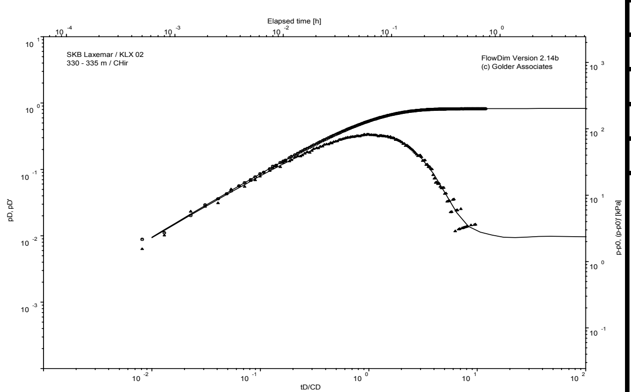


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3262		
p_i (kPa) =	3264		
p_p(kPa) =	3464	p_F (kPa) =	3265
Q_p (m^3/s)=	5,00E-09		
tp (s) =	1800	t_F (s) =	2700
S el S^* (-)=	NA	S el S^* (-)=	4,4E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	11,8		
Derivative fact.=	NA	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	2,45E-10		
T_M (m^2/s)=	2,02E-10		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	4,3E-09
S (-) =	NA	S (-) =	4,4E-06
K_s (m/s) =	NA	K_s (m/s) =	8,6E-10
S_s (1/m) =	NA	S_s (1/m) =	8,7E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,2E-11
C_D (-) =	NA	C_D (-) =	3,0E+00
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	1,2E-11
dt_2 (min) =	*	C_D (-) =	3,0E+00
T_T (m^2/s) =	4,3E-09	ξ (-) =	0
S (-) =	4,4E-06		
K_s (m/s) =	8,6E-10		
S_s (1/m) =	8,7E-07		

Comments:

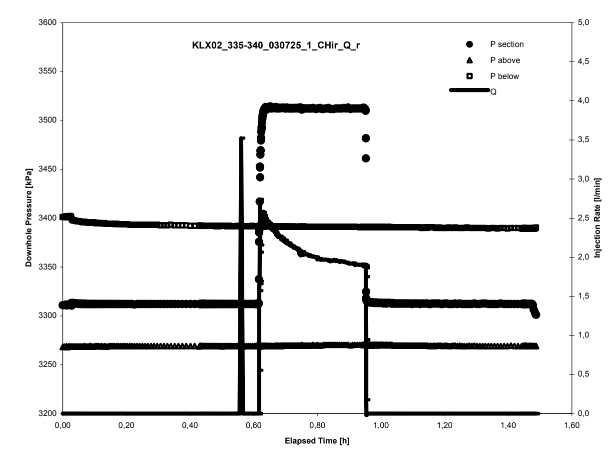
* : IARF not measured

An infinite acting radial 2 shell composite flow model was identified and chosen for the analysis. The downward sloping derivative at late times was interpreted as the transition to a higher transmissivity composite shell. This behaviour could also indicate transition to a higher flow dimension. Due to the small composite radius (r1 = 0.08 m calculated assuming S = 4.4E-6) the outer zone transmissivity is seen to be more representative for the formation properties.

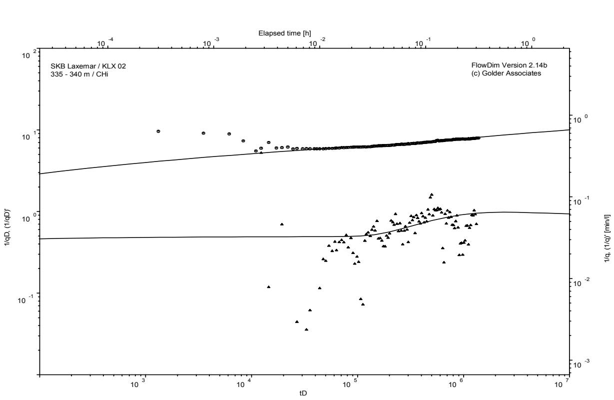
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	52
Borehole ID:	KLX 02	Test start:	030725 18:05
Test section from - to (m):	335 - 340 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

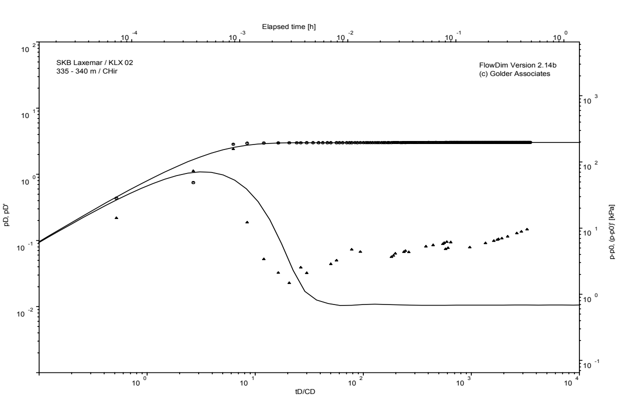
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	3311		
p_i (kPa) =	3312		
p_p(kPa) =	3512	p_F (kPa) =	3312
Q_p (m^3/s)=	3,11E-05		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1,1E-06	S el S^* (-)=	2,7E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	11,8		
Derivative fact.=	0,05	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	1,52E-06		
T_M (m^2/s)=	1,26E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0,83	dt_1 (min) =	*
dt_2 (min) =	2,23	dt_2 (min) =	*
T (m^2/s) =	2,0E-06	T (m^2/s) =	8,7E-07
S (-) =	1,1E-06	S (-) =	2,7E-06
K_s (m/s) =	3,9E-07	K_s (m/s) =	1,7E-07
S_s (1/m) =	2,2E-07	S_s (1/m) =	5,4E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	2,8E-10
C_D (-) =	NA	C_D (-) =	1,1E+02
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.

dt_1 (min) =	0,83	C (m^3/Pa) =	2,8E-10
dt_2 (min) =	2,23	C_D (-) =	1,1E+02
T_T (m^2/s) =	2,0E-06	ξ (-) =	0
S (-) =	1,1E-06		
K_s (m/s) =	3,9E-07		
S_s (1/m) =	2,2E-07		

Comments:

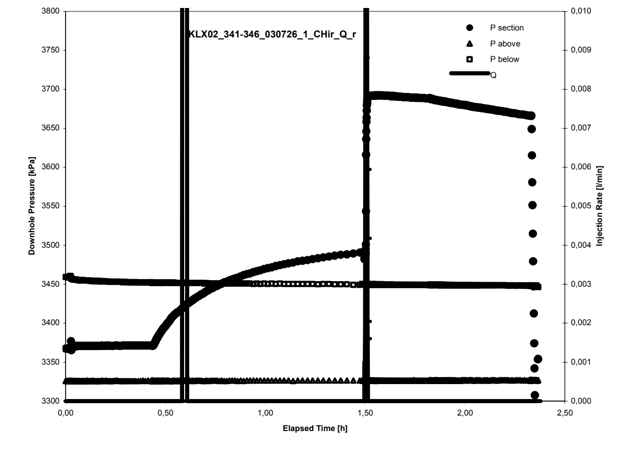
* : IARF not measured

The flow model identification was based on the shape of the semi-log derivative of the CHI phase. An infinite acting 2 shell radial composite flow model was identified. The CHIR phase was analysed using a 2 shell composite flow model as well, the CHIR results are however less reliable due to very fast recovery.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	PI (see table 6.1)
Area:	Laxemar	Test no:	53
Borehole ID:	KLX 02	Test start:	030726 08:19
Test section from - to (m):	341 - 346 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

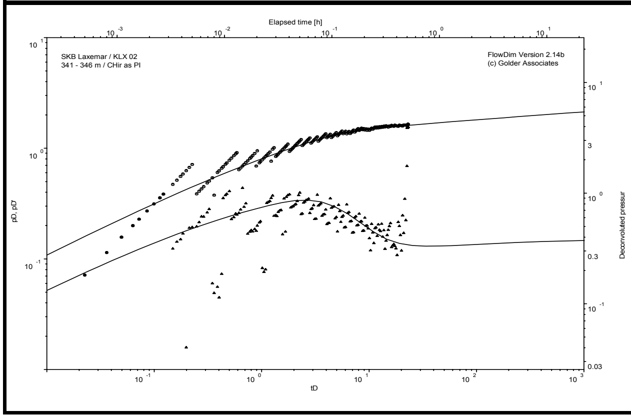


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3367		
p_i (kPa) =	3490		
p_p(kPa) =	3688	p_F (kPa) =	3666
Q_p (m^3/s)=	-		
tp (s) =	1200	t_F (s) =	1800
S el S^* (-)=	NA	S el S^* (-)=	1,0E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	11,9		
Derivative fact.=	NA	Derivative fact.=	0,26
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	6,1E-11
S (-) =	NA	S (-) =	1,0E-06
K_s (m/s) =	NA	K_s (m/s) =	1,2E-11
S_s (1/m) =	NA	S_s (1/m) =	2,0E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,1E-10
C_D (-) =	NA	C_D (-) =	1,2E+02
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	1,1E-10
dt_2 (min) =	*	C_D (-) =	1,2E+02
T_T (m^2/s) =	6,1E-11	ξ (-) =	0
S (-) =	1,0E-06		
K_s (m/s) =	1,2E-11		
S_s (1/m) =	2,0E-07		

Comments:

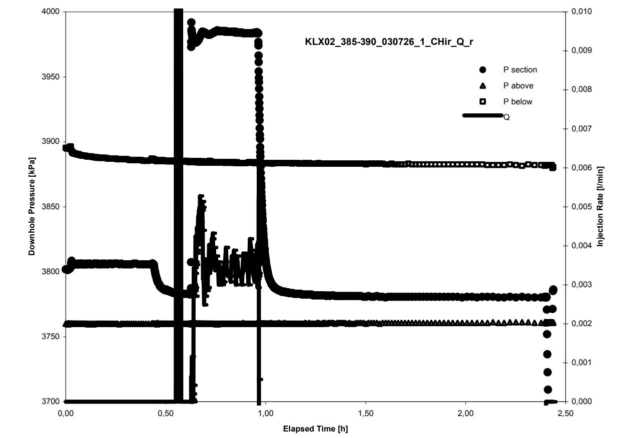
* : IARF not measured

The flow model identification is uncertain and mainly based on the shape of the semi-log derivative of the deconvolved CHIR phase. Due to the very small composite radius, it is believed that the outer composite zone is representative for the formation properties.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	54
Borehole ID:	KLX 02	Test start:	030726 11:20
Test section from - to (m):	385 - 390 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

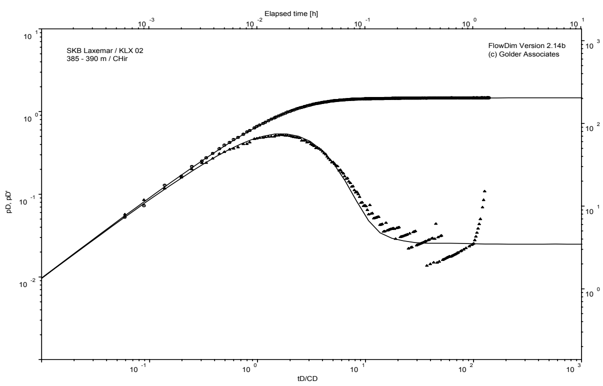


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3802		
p_i (kPa) =	3783		
p_p(kPa) =	3984	p_F (kPa) =	3780
Q_p (m^3/s)=	5,00E-08		
tp (s) =	1200	t_F (s) =	5160
S el S^* (-)=	NA	S el S^* (-)=	1,7E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	12,3		
Derivative fact.=	NA	Derivative fact.=	0,13
Results		**Results**	
Q/s (m^2/s)=	2,44E-09		
T_M (m^2/s)=	2,01E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	13,12
dt_2 (min) =	NA	dt_2 (min) =	61,17
T (m^2/s) =	NA	T (m^2/s) =	1,3E-08
S (-) =	NA	S (-) =	1,7E-06
K_s (m/s) =	NA	K_s (m/s) =	2,6E-09
S_s (1/m) =	NA	S_s (1/m) =	3,4E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,5E-11
C_D (-) =	NA	C_D (-) =	9,7E+00
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	13,12	C (m^3/Pa) =	1,5E-11
dt_2 (min) =	61,17	C_D (-) =	9,7E+00
T_T (m^2/s) =	1,3E-08	ξ (-) =	0
S (-) =	1,7E-06		
K_s (m/s) =	2,6E-09		
S_s (1/m) =	3,4E-07		

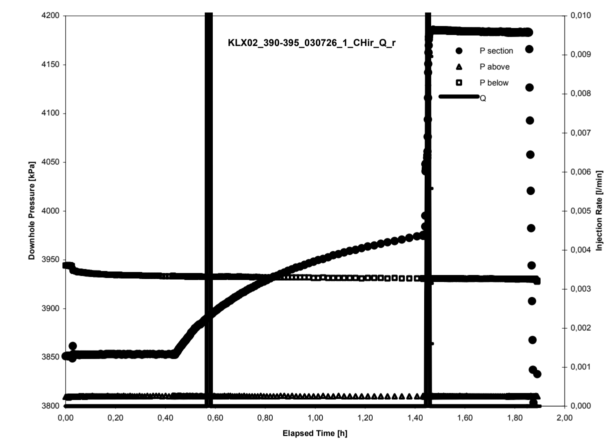
Comments:

An infinite acting radial composite flow model was identified chosen for the analysis. The downward sloping derivative at late times was interpreted as the transition to a higher transmissivity composite shell. This behaviour could also indicate transition to a higher flow dimension. Due to the small composite radius (r1 = 0.15 m calculated assuming S = 1.7E-6) the outer zone transmissivity is seen to be more representative for the formation properties.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	55
Borehole ID:	KLX 02	Test start:	030726 14:12
Test section from - to (m):	390 - 395 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3851		
p_i (kPa) =	3975		
p_p(kPa) =	4183	p_F (kPa) =	4183
Q_p (m^3/s)=	-		
tp (s) =	1200	t_F (s) =	300
S el S^* (-)=	NA	S el S^* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	11,8		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	< 1E-10	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Selected representative parameters.			
dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	< 1E-10	ξ (-) =	0
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

Comments:

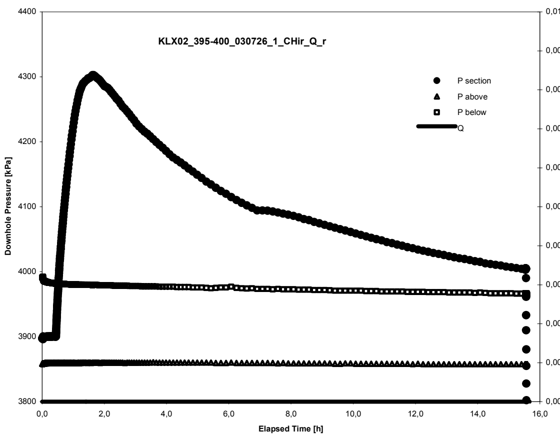
The injection rate dropped below the measurement range of the flowmeter (q < 0.5 ml/min) almost instantaneously, indicating the very low transmissivity of the interval. In addition (possibly due to hardware problems) the pressure did not show any reaction after closing the test valve (CHIR phase).

None of the test phases is analysable, but the low injection rates show that the interval transmissivity must be lower than 1E-10 m2/s.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	56
Borehole ID:	KLX 02	Test start:	030726 16:35
Test section from - to (m):	395 - 400 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	3897		
p_i (kPa) =			
p_p(kPa) =		p_F (kPa) =	
Q_p (m^3/s)=	-		
tp (s) =		t_F (s) =	
S el S^* (-)=	NA	S el S^* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	12,7		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	< 1E-11	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Selected representative parameters.

dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	< 1E-11	ξ (-) =	0
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

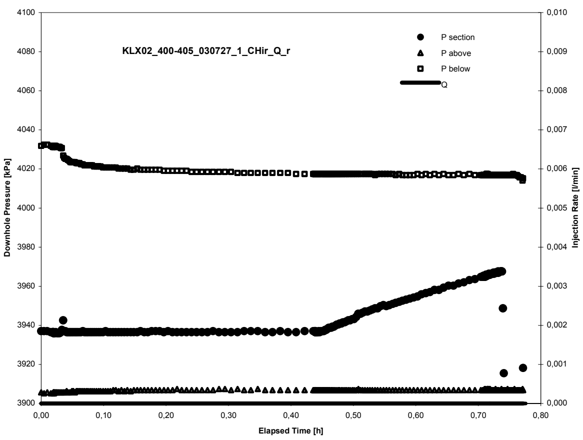
Comments:

After inflating the packers and closing the test valve, the pressure kept rising for 2 hours to start decreasing afterwards for 14 hours (overnight). This phenomenon is caused by prolongued packer expansion in a very tight section (T probably smaller than 1E-11 m2/s). None of the test phases is analysable.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	57
Borehole ID:	KLX 02	Test start:	030727 08:38
Test section from - to (m):	400 - 405 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3937		
p_i (kPa) =			
p_p(kPa) =		p_F (kPa) =	
Q_p (m^3/s)=	-		
tp (s) =		t_F (s) =	
S el S^* (-)=	NA	S el S^* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	12,8		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	< 1E-11	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Selected representative parameters.

dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	< 1E-11	ξ (-) =	0
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

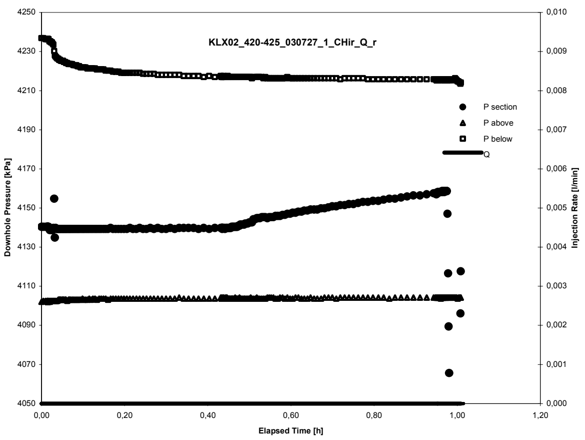
Comments:

After inflating the packers and closing the test valve, the pressure kept rising with approx. 27 kPa per 15 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E-11 m2/s. None of the test phases is analysable.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	58
Borehole ID:	KLX 02	Test start:	030727 09:55
Test section from - to (m):	420 - 425 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4140		
p_i (kPa) =			
p_p(kPa) =		p_F (kPa) =	
Q_p (m^3/s)=	-		
tp (s) =		t_F (s) =	
S el S^* (-)=	NA	S el S^* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,0		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	< 1E-11	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Selected representative parameters.			
dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	< 1E-11	ξ (-) =	0
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

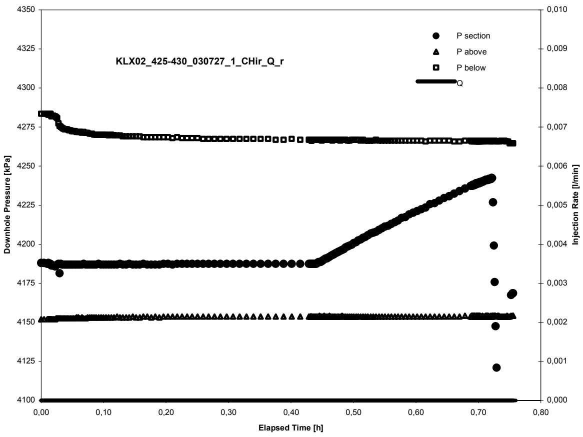
Comments:

After inflating the packers and closing the test valve, the pressure kept rising with approx. 17 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E-11 m2/s. None of the test phases is analysable.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	59
Borehole ID:	KLX 02	Test start:	030727 11:23
Test section from - to (m):	425 - 430 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	4188		
p_i (kPa) =			
p_p(kPa) =		p_F (kPa) =	
Q_p (m^3/s)=	-		
tp (s) =		t_F (s) =	
S el S^* (-)=	NA	S el S^* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,1		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	< 1E-11	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Selected representative parameters.

dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	< 1E-11	ξ (-) =	NA
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

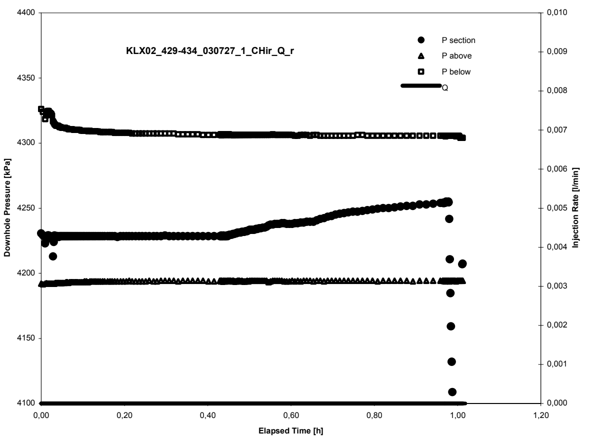
Comments:

After inflating the packers and closing the test valve, the pressure kept rising with approx. 45 kPa per 15 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E-11 m2/s. None of the test phases is analysable.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	60
Borehole ID:	KLX 02	Test start:	030727 13:20
Test section from - to (m):	429 - 434 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4229		
p_i (kPa) =			
p_p(kPa) =		p_F (kPa) =	
Q_p (m^3/s)=	-		
tp (s) =		t_F (s) =	
S el S^* (-)=	NA	S el S^* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,2		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	< 1E-11	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Selected representative parameters.

dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	< 1E-11	ξ (-) =	NA
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

Log-Log plot incl. derivatives- recovery period

Not Analysed

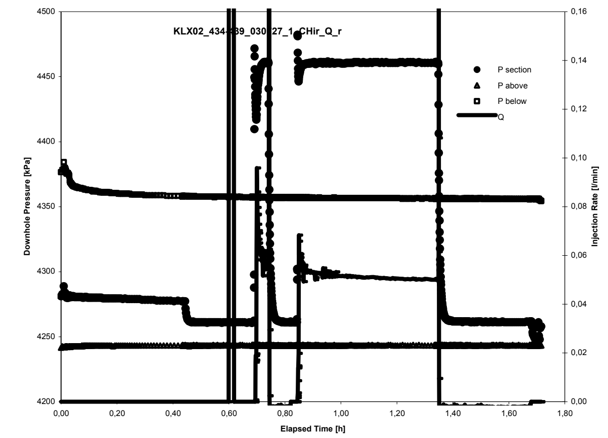
Comments:

After inflating the packers and closing the test valve, the pressure kept rising with approx. 25 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E-11 m2/s. None of the test phases is analysable.

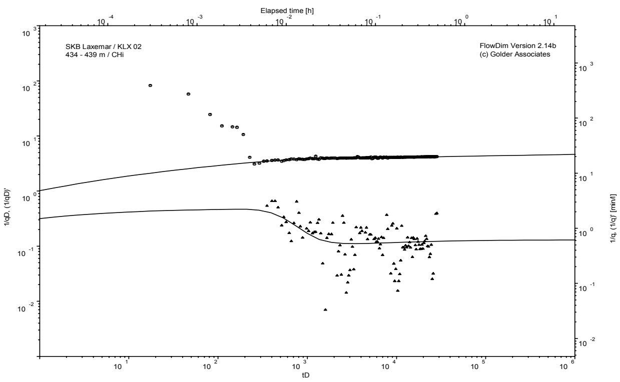
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	61
Borehole ID:	KLX 02	Test start:	030727 14:48
Test section from - to (m):	434 - 439 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

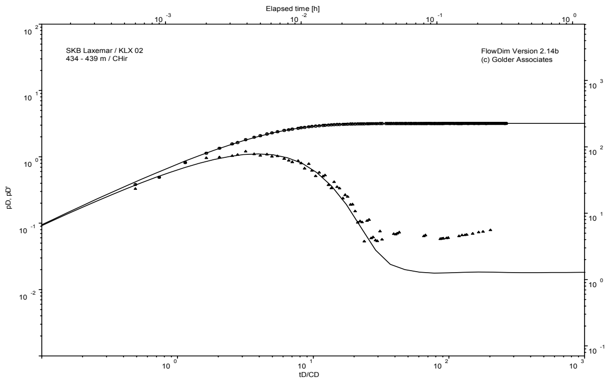
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	4283		
p_i (kPa) =	4261		
p_p(kPa) =	4461	p_F (kPa) =	4261
Q_p (m^3/s)=	8,35E-07		
tp (s) =	1800	t_F (s) =	1200
S el S^* (-)=	1,2E-06	S el S^* (-)=	1,0E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,3		
Derivative fact.=	0,15	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	4,10E-08		
T_M (m^2/s)=	3,38E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	2,40	dt_1 (min) =	*
dt_2 (min) =	21,43	dt_2 (min) =	*
T (m^2/s) =	1,1E-07	T (m^2/s) =	5,9E-07
S (-) =	1,2E-06	S (-) =	1,0E-06
K_s (m/s) =	2,2E-08	K_s (m/s) =	1,2E-07
S_s (1/m) =	2,4E-07	S_s (1/m) =	2,0E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	5,3E-11
C_D (-) =	NA	C_D (-) =	5,8E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	5,3E-11
dt_2 (min) =	*	C_D (-) =	5,8E+01
T_T (m^2/s) =	5,9E-07	ξ (-) =	0
S (-) =	1,0E-06		
K_s (m/s) =	1,2E-07		
S_s (1/m) =	2,0E-07		

Comments:

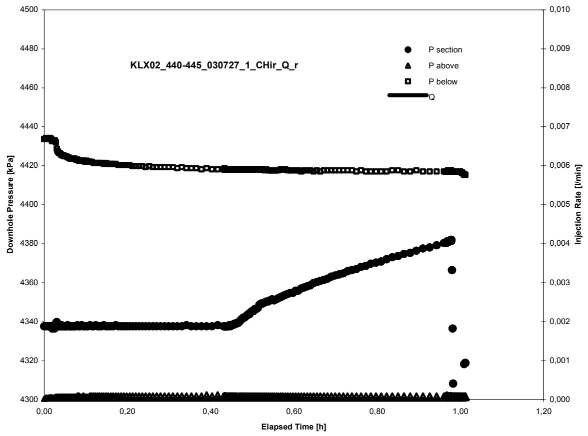
* : IARF not measured

The downward slope of the CHIR derivative at late times was interpreted as a transition to an outer composite shell of higher transmissivity. It is not clear which of the composite shells should be seen as representative of the formation properties.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	62
Borehole ID:	KLX 02	Test start:	030727 16:58
Test section from - to (m):	440 - 445 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	4338		
p_i (kPa) =			
p_p (kPa) =		p_F (kPa) =	
Q_p (m^3/s)=	-		
tp (s) =		t_F (s) =	
S el S^* (-)=	NA	S el S^* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,4		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	< 1E-11	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Selected representative parameters.			
dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	< 1E-11	ξ (-) =	NA
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

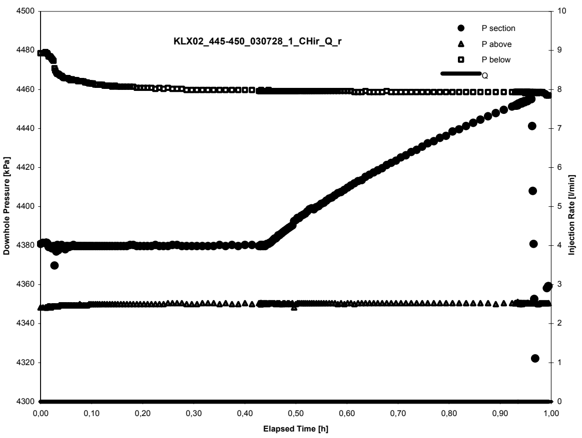
Comments:

After inflating the packers and closing the test valve, the pressure kept rising with approx. 42 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E-11 m2/s. None of the test phases is analysable.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	63
Borehole ID:	KLX 02	Test start:	030728 08:13
Test section from - to (m):	445 - 450 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4381		
p_i (kPa) =			
p_p(kPa) =		p_F (kPa) =	
Q_p (m^3/s)=	-		
tp (s) =		t_F (s) =	
S el S^* (-)=	NA	S el S^* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,4		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	< 1E-11	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Selected representative parameters.

dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	< 1E-11	ξ (-) =	NA
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

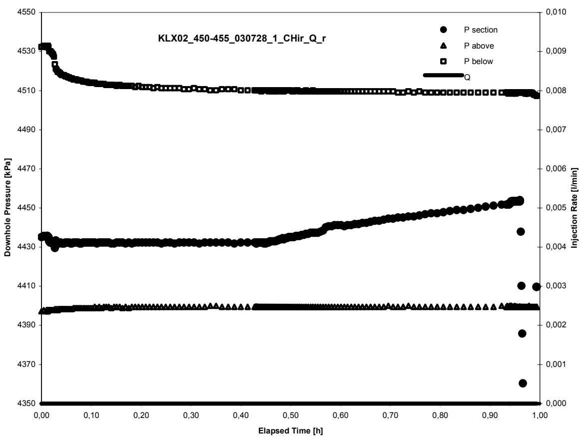
Comments:

After inflating the packers and closing the test valve, the pressure kept rising with approx. 72 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E-11 m2/s. None of the test phases is analysable.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	64
Borehole ID:	KLX 02	Test start:	030728 09:38
Test section from - to (m):	450 - 455 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4436		
p_i (kPa) =			
p_p(kPa) =		p_F (kPa) =	
Q_p (m^3/s)=	-		
tp (s) =		t_F (s) =	
S el S^* (-)=	NA	S el S^* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,5		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	< 1E-11	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Selected representative parameters.			
dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	< 1E-11	ξ (-) =	NA
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

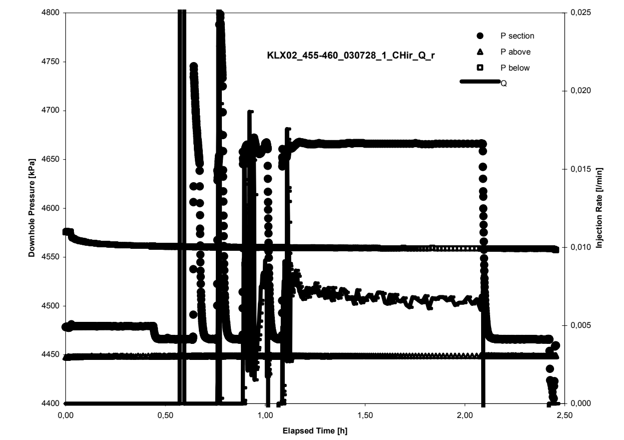
Comments:

After inflating the packers and closing the test valve, the pressure kept rising with approx. 20 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E-11 m2/s. None of the test phases is analysable.

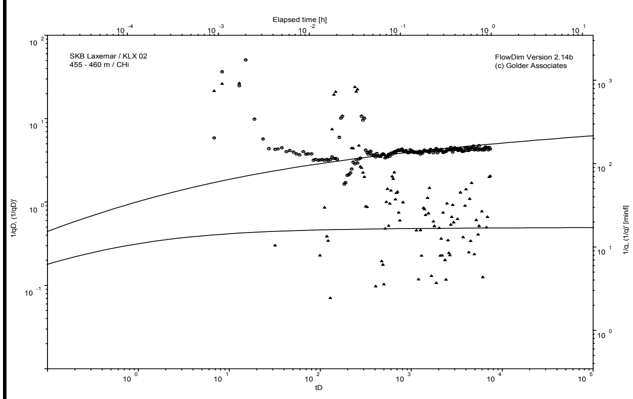
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	65
Borehole ID:	KLX 02	Test start:	030728 11:02
Test section from - to (m):	455 - 460 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

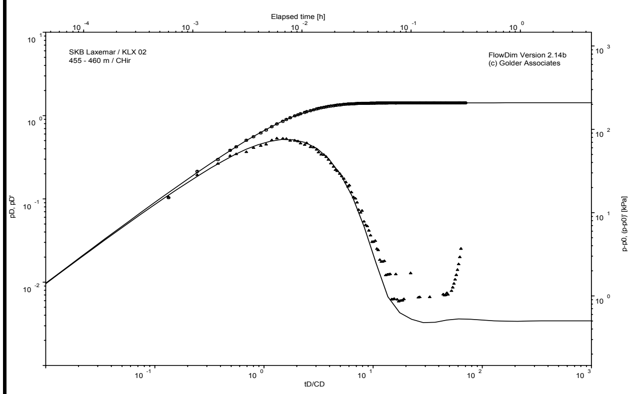
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	4478		
p_i (kPa) =	4466		
p_p(kPa) =	4666	p_F (kPa) =	4466
Q_p (m^3/s)=	1,09E-07		
tp (s) =	3600	t_F (s) =	1200
S el S^* (-)=	1,2E-06	S el S^* (-)=	1,5E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,5		
Derivative fact.=	0,07	Derivative fact.=	0,13
Results		**Results**	
Q/s (m^2/s)=	5,34E-09		
T_M (m^2/s)=	4,41E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	9,04	dt_1 (min) =	*
dt_2 (min) =	53,20	dt_2 (min) =	*
T (m^2/s) =	3,8E-09	T (m^2/s) =	1,8E-07
S (-) =	1,2E-06	S (-) =	1,5E-06
K_s (m/s) =	7,5E-10	K_s (m/s) =	3,6E-08
S_s (1/m) =	2,5E-07	S_s (1/m) =	3,1E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,3E-11
C_D (-) =	NA	C_D (-) =	9,1E+00
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.			
dt_1 (min) =	*	C (m^3/Pa) =	1,3E-11
dt_2 (min) =	*	C_D (-) =	9,1E+00
T_T (m^2/s) =	1,8E-07	ξ (-) =	0
S (-) =	1,5E-06		
K_s (m/s) =	3,6E-08		
S_s (1/m) =	3,1E-07		

Comments:

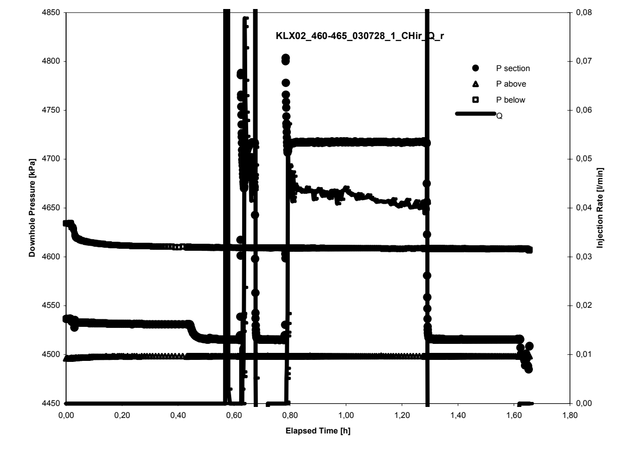
* : IARF not measured

The downward slope of the CHIR derivative at late times was interpreted as a transition to an outer composite shell of higher transmissivity. The small composite radius (r1 = 0.16 m calculated assuming a storativity of 1.5E-6) indicates that the outer composite zone transmissivity is more representative for the formation behaviour.

Test Summary Sheet

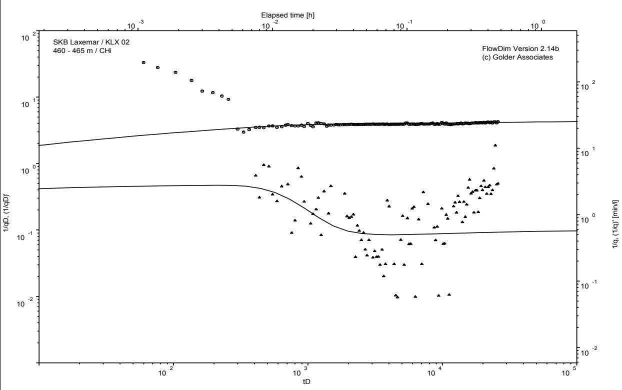
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	66
Borehole ID:	KLX 02	Test start:	030728 13:53
Test section from - to (m):	460 - 465 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

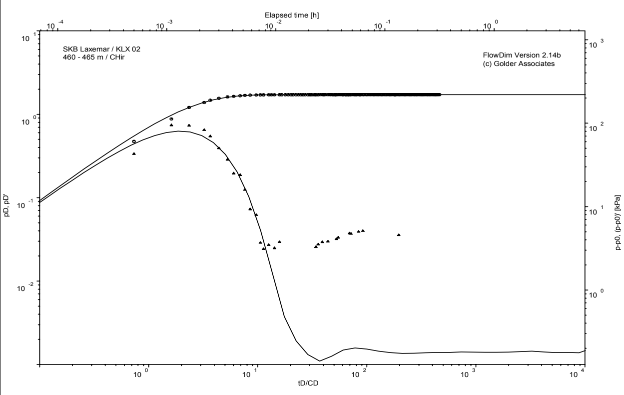


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4537		
p_i (kPa) =	4515		
p_p(kPa) =	4717	p_F (kPa) =	4515
Q_p (m^3/s)=	6,66E-07		
tp (s) =	1800	t_F (s) =	1200
S el S^* (-)=	1,0E-06	S el S^* (-)=	1,0E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,6		
Derivative fact.=	0,13	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	3,23E-08		
T_M (m^2/s)=	2,67E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	2,85	dt_1 (min) =	*
dt_2 (min) =	9,80	dt_2 (min) =	*
T (m^2/s) =	1,1E-07	T (m^2/s) =	3,0E-06
S (-) =	1,0E-06	S (-) =	1,0E-06
K_s (m/s) =	2,2E-08	K_s (m/s) =	6,0E-07
S_s (1/m) =	2,0E-07	S_s (1/m) =	2,0E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,3E-11
C_D (-) =	NA	C_D (-) =	1,4E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	2,85	C (m^3/Pa) =	1,3E-11
dt_2 (min) =	9,80	C_D (-) =	1,4E+01
T_T (m^2/s) =	1,1E-07	ξ (-) =	0
S (-) =	1,0E-06		
K_s (m/s) =	2,2E-08		
S_s (1/m) =	2,0E-07		

Comments:

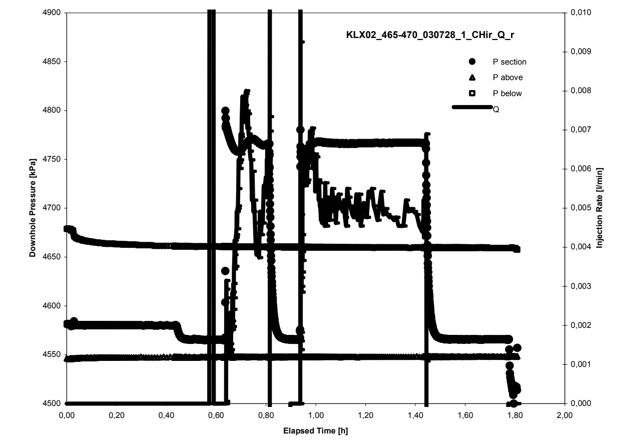
* : IARF not measured

The downward slope of the CHIR derivative at late times was interpreted as a transition to an outer composite shell of higher transmissivity, however due to the fact that the CHIR phase recovered very quickly, the late times derivative is very noisy and not adequate for flow model identification. Based on the CHI results, it is not clear which of the composite shells should be seen as representative of the formation properties.

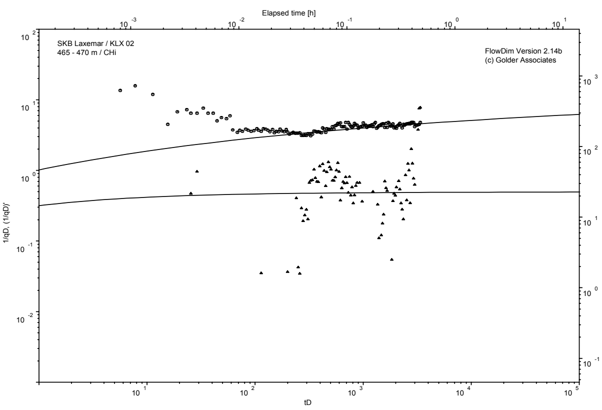
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	67
Borehole ID:	KLX 02	Test start:	030728 15:56
Test section from - to (m):	465 - 470 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

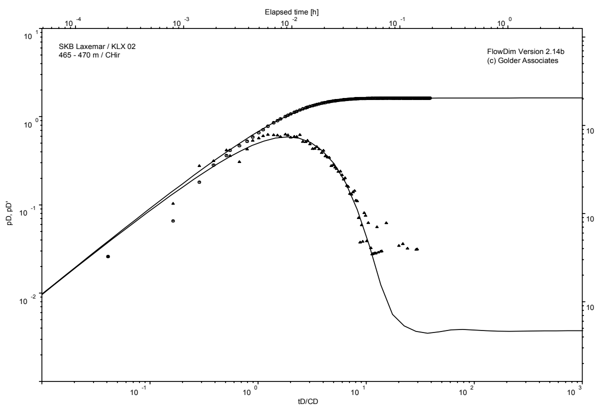
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	4581		
p_i (kPa) =	4565		
p_p(kPa) =	4766	p_F (kPa) =	4566
Q_p (m^3/s)=	7,57E-08		
tp (s) =	1800	t_F (s) =	1200
S el S^* (-)=	1,0E-06	S el S^* (-)=	1,2E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,8		
Derivative fact.=	0,24	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	3,70E-09		
T_M (m^2/s)=	3,05E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	4,16	dt_1 (min) =	*
dt_2 (min) =	21,48	dt_2 (min) =	*
T (m^2/s) =	2,8E-09	T (m^2/s) =	1,4E-07
S (-) =	1,0E-06	S (-) =	1,2E-06
K_s (m/s) =	5,7E-10	K_s (m/s) =	2,8E-08
S_s (1/m) =	2,0E-07	S_s (1/m) =	2,5E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,2E-11
C_D (-) =	NA	C_D (-) =	1,0E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.			
dt_1 (min) =	*	C (m^3/Pa) =	1,2E-11
dt_2 (min) =	*	C_D (-) =	1,0E+01
T_T (m^2/s) =	1,4E-07	ξ (-) =	0
S (-) =	1,2E-06		
K_s (m/s) =	2,8E-08		
S_s (1/m) =	2,5E-07		

Comments:

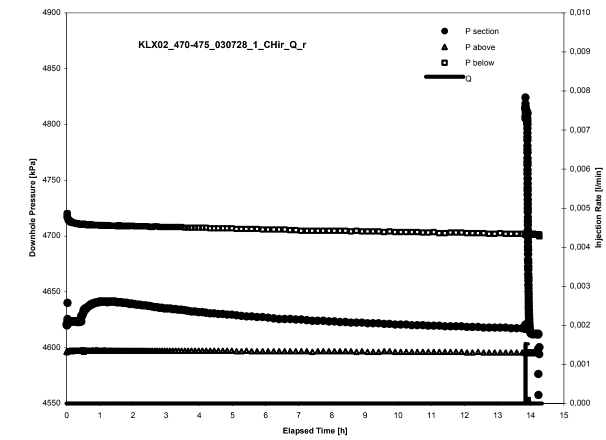
* : IARF not measured

The downward slope of the CHIR derivative at late times was interpreted as a transition to an outer composite shell of higher transmissivity. The small composite radius (r1 = 0.19 m calculated assuming a storativity of 1.2E-6) indicates that the outer composite zone transmissivity is more representative for the formation behaviour.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	PI (see table 6.1)
Area:	Laxemar	Test no:	68
Borehole ID:	KLX 02	Test start:	030728 18:07
Test section from - to (m):	470 - 475 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

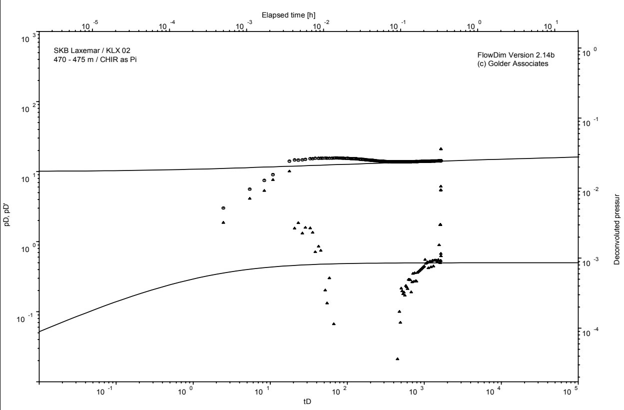


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4620		
p_i (kPa) =	4617		
p_p(kPa) =	4810	p_F (kPa) =	4612
Q_p (m^3/s)=	-		
tp (s) =	240	t_F (s) =	1200
S el S^* (-)=	NA	S el S^* (-)=	1,7E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,8		
Derivative fact.=	NA	Derivative fact.=	0,08
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	13,08
dt_2 (min) =	NA	dt_2 (min) =	19,61
T (m^2/s) =	NA	T (m^2/s) =	3,4E-09
S (-) =	NA	S (-) =	1,7E-06
K_s (m/s) =	NA	K_s (m/s) =	6,7E-10
S_s (1/m) =	NA	S_s (1/m) =	3,4E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,3E-13
C_D (-) =	NA	C_D (-) =	8,3E-02
ξ (-) =	NA	ξ (-) =	10
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	13,08	C (m^3/Pa) =	1,3E-13
dt_2 (min) =	19,61	C_D (-) =	8,3E-02
T_T (m^2/s) =	3,4E-09	ξ (-) =	10
S (-) =	1,7E-06		
K_s (m/s) =	6,7E-10		
S_s (1/m) =	3,4E-07		

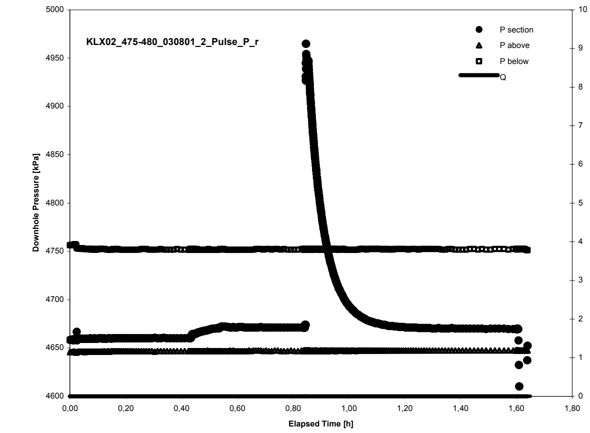
Comments:

The transmissivity derived from the transient analysis was 3.4E-9 m2/s. Because it was matched to the late time data, it is representative for a zone further away from the borehole. The transmissivity near the borehole is much lower, this being documented by the relatively high skin coefficient (10).

Test Summary Sheet

Project:	Site investigations	Test type:[1]	PI (see table 6.1)
Area:	Laxemar	Test no:	69
Borehole ID:	KLX 02	Test start:	030801 09:44
Test section from - to (m):	475 - 480 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

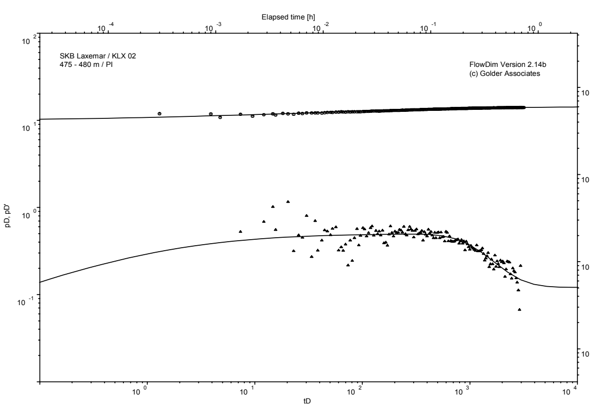


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4659		
p_i (kPa) =	4671		
p_p(kPa) =	4948	p_F (kPa) =	4670
Q_p (m^3/s)=	-		
tp (s) =	0	t_F (s) =	2700
S el S^* (-)=	NA	S el S^* (-)=	1,1E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,5		
Derivative fact.=	NA	Derivative fact.=	0,28
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	1,9E-09
S (-) =	NA	S (-) =	1,1E-06
K_s (m/s) =	NA	K_s (m/s) =	3,7E-10
S_s (1/m) =	NA	S_s (1/m) =	2,1E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,8E-13
C_D (-) =	NA	C_D (-) =	1,8E-01
ξ (-) =	NA	ξ (-) =	10
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	1,8E-13
dt_2 (min) =	*	C_D (-) =	1,8E-01
T_T (m^2/s) =	1,9E-09	ξ (-) =	10
S (-) =	1,1E-06		
K_s (m/s) =	3,7E-10		
S_s (1/m) =	2,1E-07		

Comments:

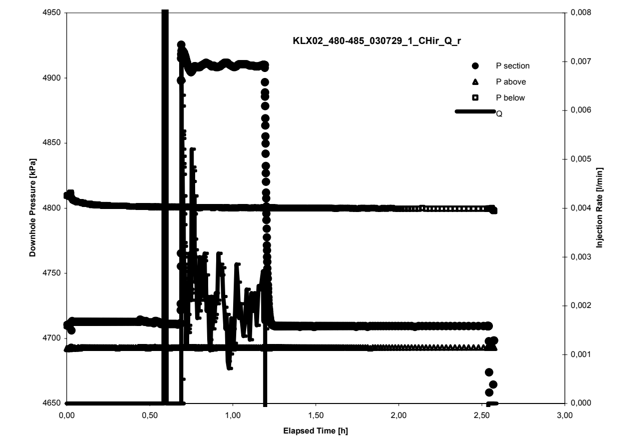
* : IARF not measured

The transmissivity derived from the transient analysis ranged between 1.9E-11 m2/s (inner zone) and 6.9E-11 m2/s (outer zone). The high skin factor (10) indicates a much lower transmissivity in the vicinity of the borehole.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	70
Borehole ID:	KLX 02	Test start:	030729 10:54
Test section from - to (m):	480 - 485 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

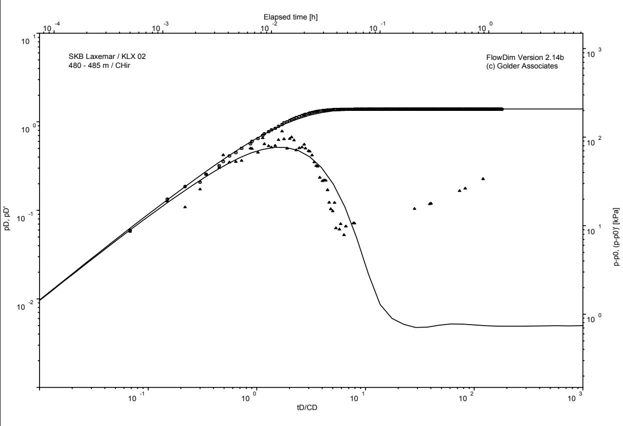


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4709		
p_i (kPa) =	4712		
p_p(kPa) =	4910	p_F (kPa) =	4709
Q_p (m^3/s)=	3,04E-08		
tp (s) =	1800	t_F (s) =	4860
S el S^* (-)=	NA	S el S^* (-)=	9,4E-07
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,0		
Derivative fact.=	NA	Derivative fact.=	0
Results		**Results**	
Q/s (m^2/s)=	1,50E-09		
T_M (m^2/s)=	1,24E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	4,1E-08
S (-) =	NA	S (-) =	9,4E-07
K_s (m/s) =	NA	K_s (m/s) =	8,2E-09
S_s (1/m) =	NA	S_s (1/m) =	1,9E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	6,9E-12
C_D (-) =	NA	C_D (-) =	7,9E+00
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	6,9E-12
dt_2 (min) =	*	C_D (-) =	7,9E+00
T_T (m^2/s) =	4,1E-08	ξ (-) =	0
S (-) =	9,4E-07		
K_s (m/s) =	8,2E-09		
S_s (1/m) =	1,9E-07		

Comments:

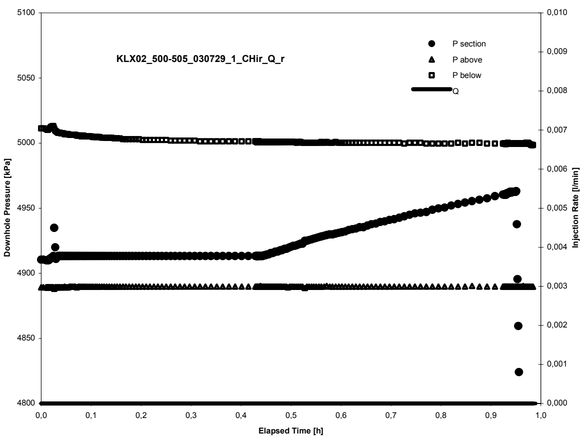
* : IARF not measured

The downward sloping derivative at late times was interpreted as the transition to a higher transmissivity composite shell. This behaviour could also indicate transition to a higher flow dimension. Due to the small composite radius (r1 = 0.15 m calculated assuming S = 9.4E-7) the outer zone transmissivity is seen to be more representative for the formation properties.

Test Summary Sheet

Project:	Sit investigations	Test type:[1]	3
Area:	Laxemar	Test no:	71
Borehole ID:	KLX 02	Test start:	030729 14:00
Test section from - to (m):	500 - 505 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4910		
p_i (kPa) =			
p_p(kPa) =		p_F (kPa) =	
Q_p (m^3/s)=	-		
tp (s) =		t_F (s) =	
S el S^* (-)=	NA	S el S^* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,2		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	< 1E-11	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Selected representative parameters.

dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	< 1E-11	ξ (-) =	NA
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

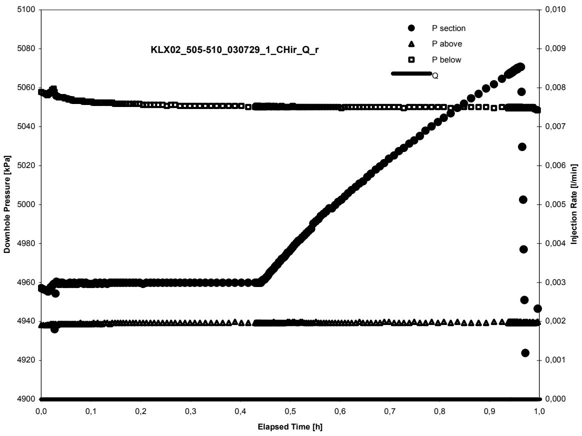
Comments:

After inflating the packers and closing the test valve, the pressure kept rising with approx. 47 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E-11 m2/s. None of the test phases is analysable.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	72
Borehole ID:	KLX 02	Test start:	030729 15:29
Test section from - to (m):	505 - 510 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4957		
p_i (kPa) =			
p_p(kPa) =		p_F (kPa) =	
Q_p (m^3/s)=	-		
tp (s) =		t_F (s) =	
S el S^* (-)=	NA	S el S^* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,3		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	< 1E-11	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Selected representative parameters.

dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	< 1E-11	ξ (-) =	NA
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

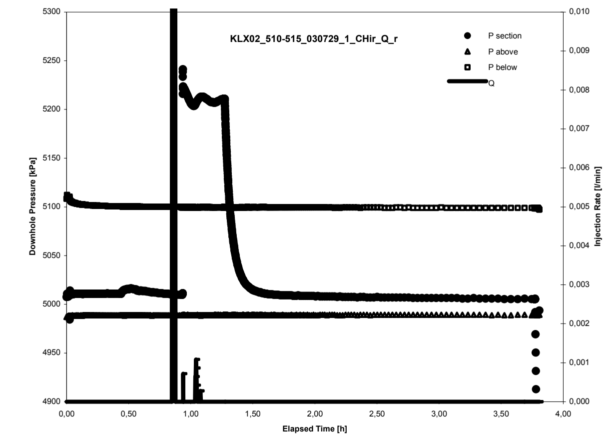
Comments:

After inflating the packers and closing the test valve, the pressure kept rising with approx. 106 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E-11 m2/s. None of the test phases is analysable.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	73
Borehole ID:	KLX 02	Test start:	030729 16:54
Test section from - to (m):	510 - 515 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

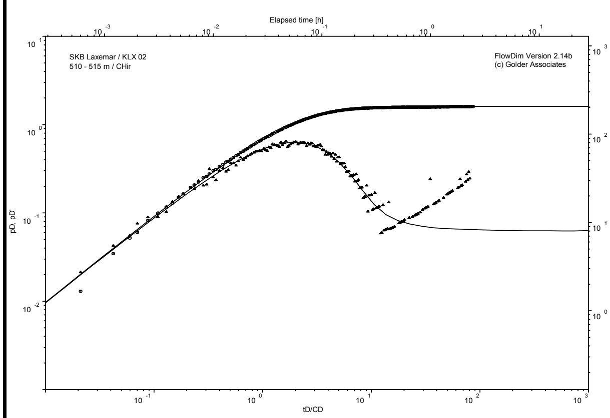


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	5009		
p_i (kPa) =	5010		
p_p(kPa) =	5210	p_F (kPa) =	5005
Q_p (m^3/s)=	8,33E-09		
tp (s) =	1200	t_F (s) =	9600
S el S^* (-)=	NA	S el S^* (-)=	1,0E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,4		
Derivative fact.=	NA	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	4,09E-10		
T_M (m^2/s)=	3,37E-10		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	1,6E-09
S (-) =	NA	S (-) =	1,0E-06
K_s (m/s) =	NA	K_s (m/s) =	3,2E-10
S_s (1/m) =	NA	S_s (1/m) =	2,0E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,3E-11
C_D (-) =	NA	C_D (-) =	1,4E+01
ξ (-) =	NA	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	*	C (m^3/Pa) =	1,3E-11
dt_2 (min) =	*	C_D (-) =	1,4E+01
T_T (m^2/s) =	1,6E-09	ξ (-) =	0
S (-) =	1,0E-06		
K_s (m/s) =	3,2E-10		
S_s (1/m) =	2,0E-07		

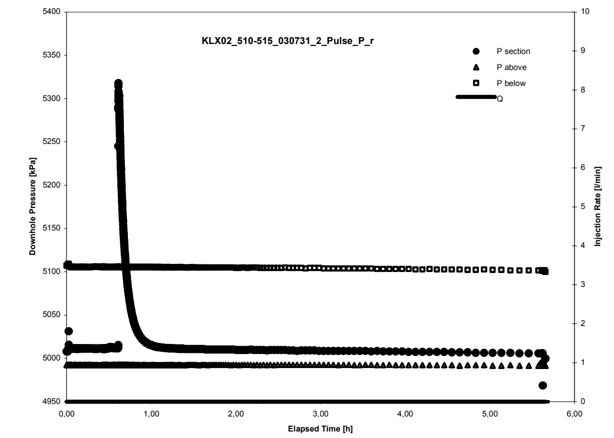
Comments:

* : IARF not measured
An infinite acting radial 2 shell composite flow model was identified and chosen for the analysis. The downward sloping derivative at late times was interpreted as the transition to a higher transmissivity composite shell. This behaviour could also indicate transition to a higher floe dimension. Due to the small composite radius (r1 = 0.16 m calculated assuming S = 1.0E-6) the outer zone transmissivity is seen to be more representative for the formation properties.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	PI (see table 6.1)
Area:	Laxemar	Test no:	73a
Borehole ID:	KLX 02	Test start:	030731 18:16
Test section from - to (m):	510 - 515 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

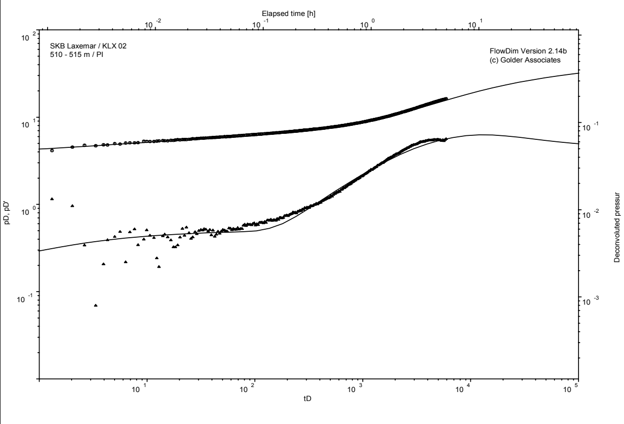


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	5009		
p_i (kPa) =	5012		
p_p(kPa) =	5302	p_F (kPa) =	5006
Q_p (m^3/s)=	-		
tp (s) =	1200	t_F (s) =	9600
S el S^* (-)=	NA	S el S^* (-)=	1,0E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,4		
Derivative fact.=	NA	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	*
dt_2 (min) =	NA	dt_2 (min) =	*
T (m^2/s) =	NA	T (m^2/s) =	5,5E-11
S (-) =	NA	S (-) =	1,0E-06
K_s (m/s) =	NA	K_s (m/s) =	1,1E-11
S_s (1/m) =	NA	S_s (1/m) =	2,0E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,3E-11
C_D (-) =	NA	C_D (-) =	1,4E+01
ξ (-) =	NA	ξ (-) =	3,5
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	*	C (m^3/Pa) =	1,3E-11
dt_2 (min) =	*	C_D (-) =	1,4E+01
T_T (m^2/s) =	5,5E-11	ξ (-) =	3,5
S (-) =	1,0E-06		
K_s (m/s) =	1,1E-11		
S_s (1/m) =	2,0E-07		

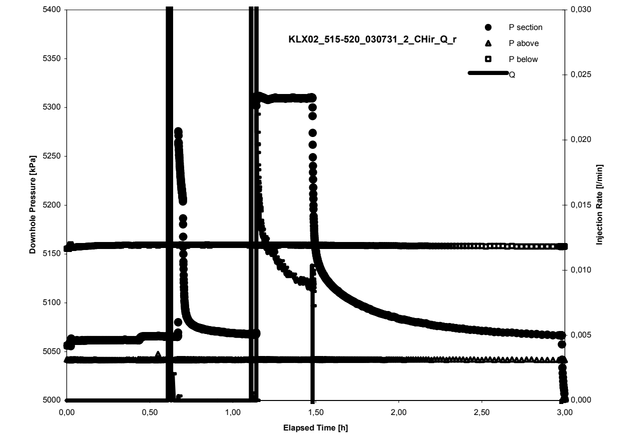
Comments:

The transmissivities derived from the transient analysis of the CHIR and PI phase range from 5.5E 11 to 1.6E-9 m2/s. Considering the inherent uncertainties related to the measurement (e.g. measured flow rates) and to the analysis process (e.g. numeric distortion when calculating the derivative and pressure history effects), the confidence range for the transmissivity is estimated to be 3E-11 to 3E-9 m2/s.

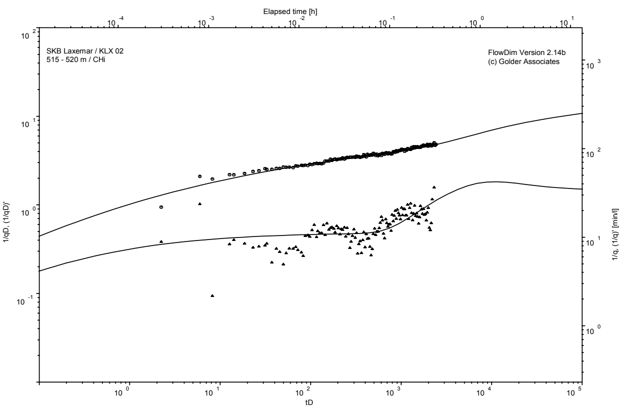
Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	74
Borehole ID:	KLX 02	Test start:	030731 14:49
Test section from - to (m):	515 - 520 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

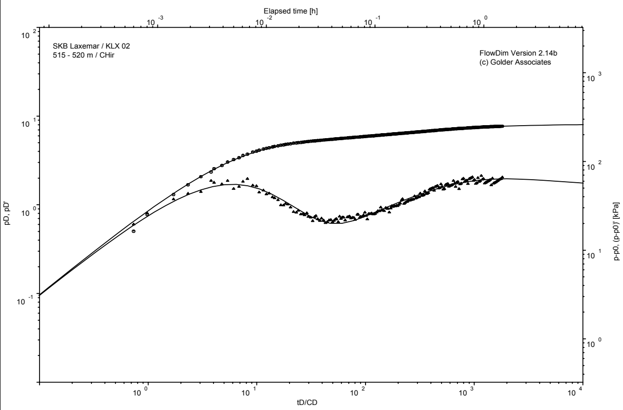
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	5057		
p_i (kPa) =	5067		
p_p(kPa) =	5309	p_F (kPa) =	5067
Q_p (m^3/s)=	1,49E-07		
tp (s) =	1200	t_F (s) =	5400
S el S^* (-)=	1,6E-06	S el S^* (-)=	1,0E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,5		
Derivative fact.=	0,22	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	6,05E-09		
T_M (m^2/s)=	5,00E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0,70	dt_1 (min) =	55,72
dt_2 (min) =	4,46	dt_2 (min) =	88,95
T (m^2/s) =	4,7E-09	T (m^2/s) =	9,3E-09
S (-) =	1,6E-06	S (-) =	1,0E-06
K_s (m/s) =	9,3E-10	K_s (m/s) =	1,9E-09
S_s (1/m) =	3,1E-07	S_s (1/m) =	2,0E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,8E-11
C_D (-) =	NA	C_D (-) =	1,9E+01
ξ (-) =	0	ξ (-) =	2
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Selected representative parameters.

dt_1 (min) =	55,72	C (m^3/Pa) =	1,8E-11
dt_2 (min) =	88,95	C_D (-) =	1,9E+01
T_T (m^2/s) =	9,3E-09	ξ (-) =	0
S (-) =	1,0E-06		
K_s (m/s) =	1,9E-09		
S_s (1/m) =	2,0E-07		

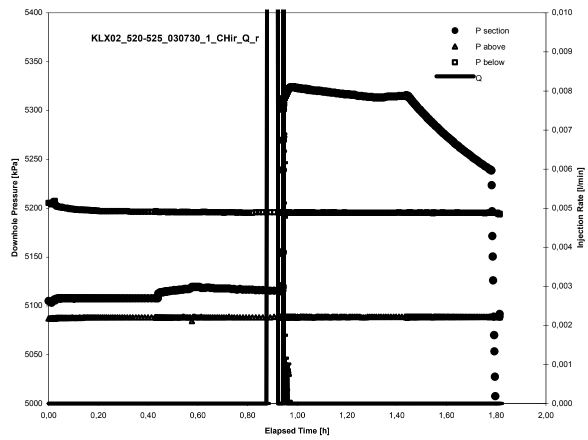
Comments:

The radial composite flow model reflects the presence of a zone of higher transmissivity in the borehole vicinity. With a discontinuity radius of 1.95 m (calculated assuming S = 1.0E-6) the inner composite zone cannot be regarded as a skin. Therefore, the inner composite shell parameters are regarded as representative for the small scale formation properties.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	PI (see table 6.1)
Area:	Laxemar	Test no:	75
Borehole ID:	KLX 02	Test start:	030730 13:23
Test section from - to (m):	520 - 525 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

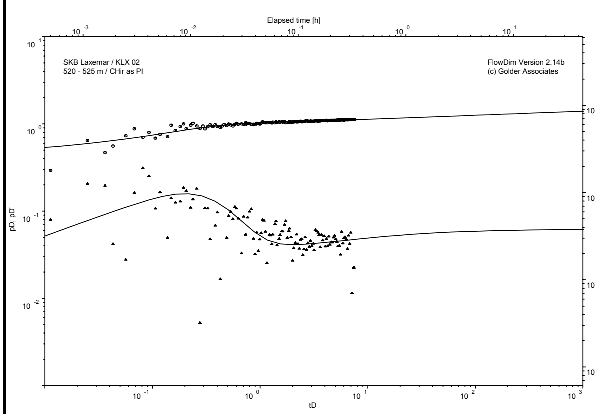


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	5103		
p_i (kPa) =	5116		
p_p(kPa) =	5314	p_F (kPa) =	5239
Q_p (m^3/s)=	-		
tp (s) =	1800	t_F (s) =	1200
S el S^* (-)=	NA	S el S^* (-)=	1,0E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,5		
Derivative fact.=	NA	Derivative fact.=	0,28
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	5,96
dt_2 (min) =	NA	dt_2 (min) =	16,75
T (m^2/s) =	NA	T (m^2/s) =	7,3E-11
S (-) =	NA	S (-) =	1,0E-06
K_s (m/s) =	NA	K_s (m/s) =	1,5E-11
S_s (1/m) =	NA	S_s (1/m) =	2,0E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,3E-10
C_D (-) =	NA	C_D (-) =	1,4E+02
ξ (-) =	NA	ξ (-) =	0,4
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	5,96	C (m^3/Pa) =	1,3E-10
dt_2 (min) =	16,75	C_D (-) =	1,4E+02
T_T (m^2/s) =	7,3E-11	ξ (-) =	0,4
S (-) =	1,0E-06		
K_s (m/s) =	1,5E-11		
S_s (1/m) =	2,0E-07		

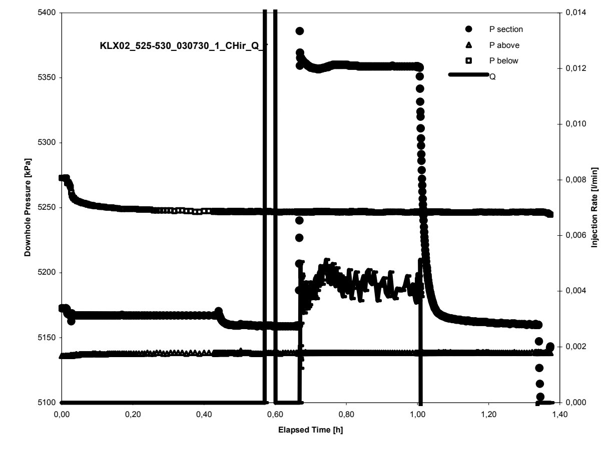
Comments:

The flow model identification is uncertain and based on the shape of the semi-log derivative of the deconvolved CHIR phase. Due to the very small composite radius, it is believed that the outer composite zone is representative for the formation properties.

Test Summary Sheet

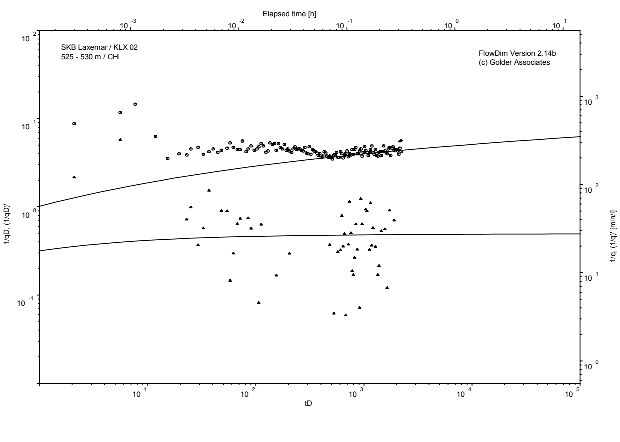
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	76
Borehole ID:	KLX 02	Test start:	030730 15:36
Test section from - to (m):	525 - 530 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

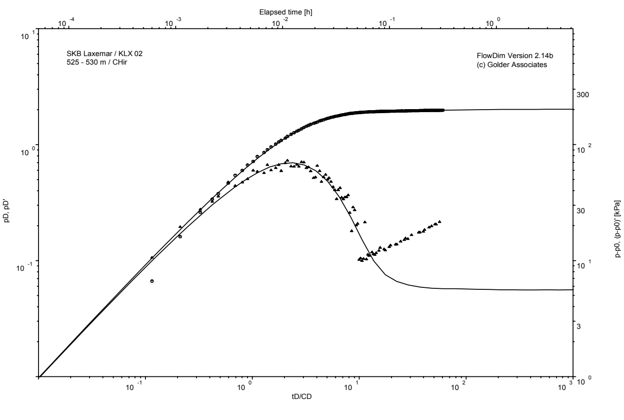


Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	5172		
p_i (kPa) =	5159		
p_p(kPa) =	5359	p_F (kPa) =	5160
Q_p (m^3/s)=	6,67E-08		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	8,4E-07	S el S^* (-)=	1,0E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,6		
Derivative fact.=	0,21	Derivative fact.=	0,02
Results		**Results**	
Q/s (m^2/s)=	3,27E-09		
T_M (m^2/s)=	2,70E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	5,08	dt_1 (min) =	*
dt_2 (min) =	17,68	dt_2 (min) =	*
T (m^2/s) =	2,3E-09	T (m^2/s) =	9,7E-09
S (-) =	8,4E-07	S (-) =	1,0E-06
K_s (m/s) =	4,7E-10	K_s (m/s) =	1,9E-09
S_s (1/m) =	1,7E-07	S_s (1/m) =	2,0E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,3E-11
C_D (-) =	NA	C_D (-) =	1,4E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	*	C (m^3/Pa) =	1,3E-11
dt_2 (min) =	*	C_D (-) =	1,4E+01
T_T (m^2/s) =	9,7E-09	ξ (-) =	0
S (-) =	1,0E-06		
K_s (m/s) =	1,9E-09		
S_s (1/m) =	2,0E-07		

Comments:

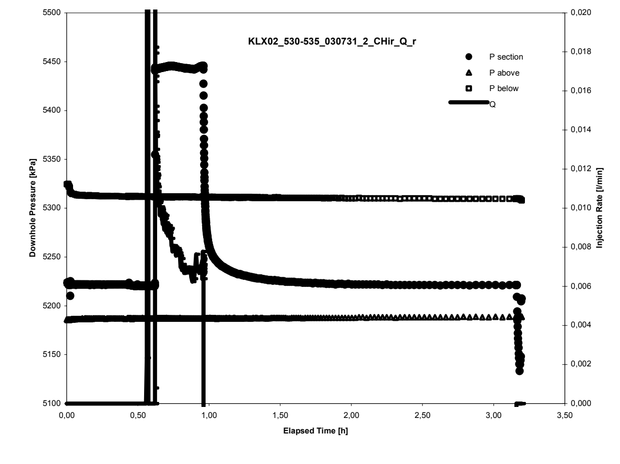
* : IARF not measured

An infinite acting radial composite flow model was identified chosen for the analysis. The downward sloping derivative at late times was interpreted as the transition to a higher transmissivity composite shell. This behaviour could also indicate transition to a higher flow dimension. Due to the small composite radius (r1 = 0.23 m calculated assuming S = 1.0E-6) the outer zone transmissivity is seen to be more representative for the formation properties.

Test Summary Sheet

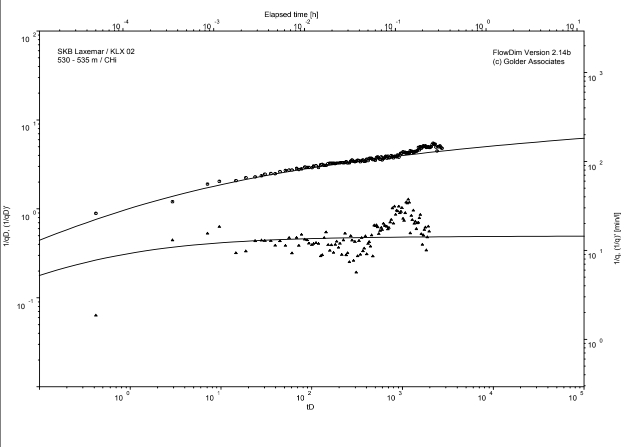
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	78
Borehole ID:	KLX 02	Test start:	030731 11:06
Test section from - to (m):	530 - 535 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

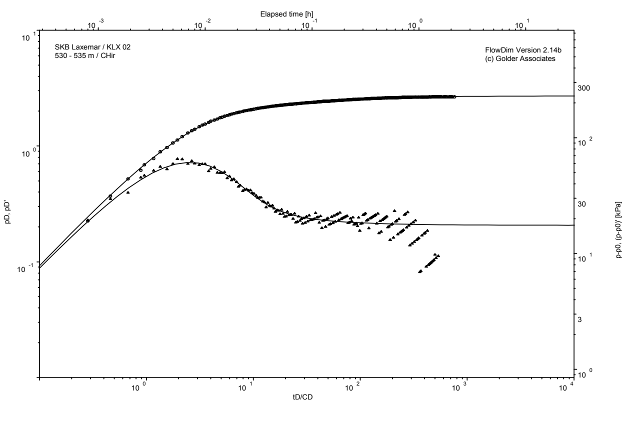


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	5224		
p_i (kPa) =	5221		
p_p(kPa) =	5445	p_F (kPa) =	5221
Q_p (m^3/s)=	1,06E-07		
tp (s) =	1200	t_F (s) =	7980
S el S^* (-)=	1,2E-06	S el S^* (-)=	1,0E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,7		
Derivative fact.=	0,28	Derivative fact.=	0,06
Results		**Results**	
Q/s (m^2/s)=	4,66E-09		
T_M (m^2/s)=	3,85E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0,64	dt_1 (min) =	6,83
dt_2 (min) =	3,94	dt_2 (min) =	53,08
T (m^2/s) =	4,0E-09	T (m^2/s) =	6,5E-09
S (-) =	1,2E-06	S (-) =	1,0E-06
K_s (m/s) =	8,0E-10	K_s (m/s) =	1,3E-09
S_s (1/m) =	2,4E-07	S_s (1/m) =	2,0E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,8E-11
C_D (-) =	NA	C_D (-) =	1,9E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	6,83	C (m^3/Pa) =	1,8E-11
dt_2 (min) =	53,08	C_D (-) =	1,9E+01
T_T (m^2/s) =	6,5E-09	ξ (-) =	0
S (-) =	1,0E-06		
K_s (m/s) =	1,3E-09		
S_s (1/m) =	2,0E-07		

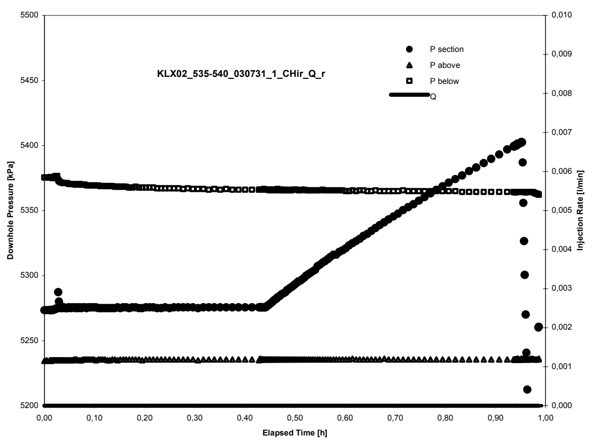
Comments:

An infinite acting radial composite flow model was identified chosen for the analysis. Due to the small composite radius (r1 = 0.19 m calculated assuming S = 1.0E-6) the outer zone transmissivity is seen to be more representative for the formation properties.
The analysis of the CHI phase was conducted using a radial homogeneous flow model. The derivative is noisy, such that no specific flow model identification is possible.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	79
Borehole ID:	KLX 02	Test start:	030731 08:09
Test section from - to (m):	535 - 540 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	5273		
p_i (kPa) =			
p_p(kPa) =		p_F (kPa) =	
Q_p (m^3/s)=	-		
tp (s) =		t_F (s) =	
S el S^* (-)=	NA	S el S^* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,7		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	< 1E-11	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Selected representative parameters.

dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	< 1E-11	ξ (-) =	NA
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

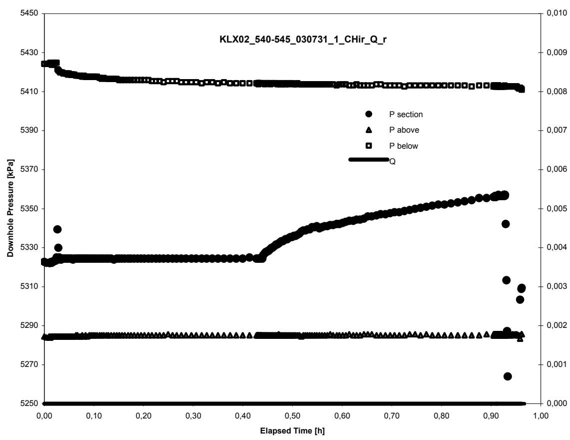
Comments:

After inflating the packers and closing the test valve, the pressure kept rising with approx. 123 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E-11 m2/s. None of the test phases is analysable.

Test Summary Sheet

Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	80
Borehole ID:	KLX 02	Test start:	030731 09:44
Test section from - to (m):	540 - 545 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	5322		
p_i (kPa) =			
p_p(kPa) =		p_F (kPa) =	
Q_p (m^3/s)=	-		
tp (s) =		t_F (s) =	
S el S^* (-)=	NA	S el S^* (-)=	NA
EC_w (mS/m)=			
$Temp_w$(gr C)=	14,8		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	< 1E-11	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Selected representative parameters.			
dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	< 1E-11	ξ (-) =	NA
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

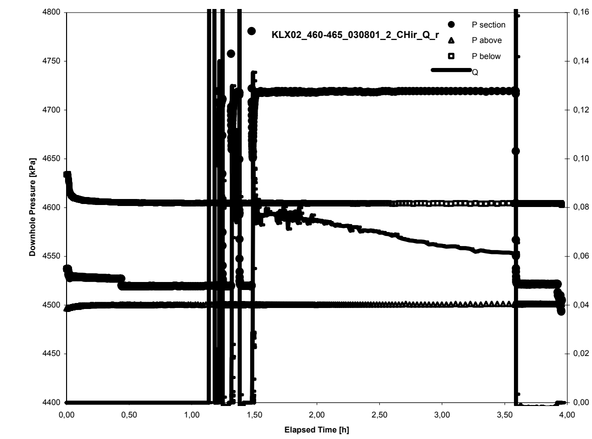
Comments:

After inflating the packers and closing the test valve, the pressure kept rising with approx. 30 kPa per 30 minutes. Based on this response it was recognized that the test section transmissivity must be very low and the test was stopped. T is probably smaller than 1E-11 m2/s. None of the test phases is analysable.

Test Summary Sheet

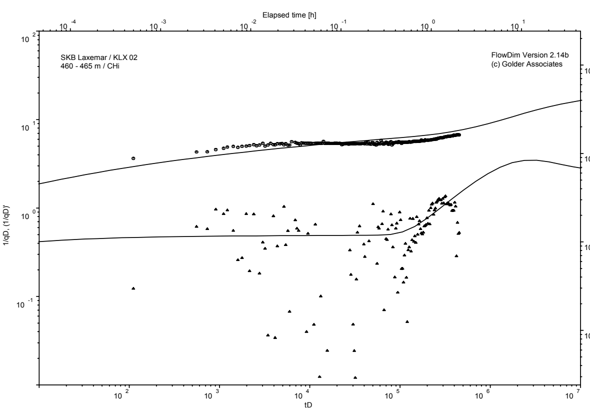
Project:	Site investigations	Test type:[1]	3
Area:	Laxemar	Test no:	81
Borehole ID:	KLX 02	Test start:	030801 11:51
Test section from - to (m):	460 - 465 m brp	Responsible for test execution:	R. v. d. Wall
Section diameter, $2 \cdot r_w$ (m):	0,076	Responsible for test evaluation:	C. Enachescu

Linear plot Q and p

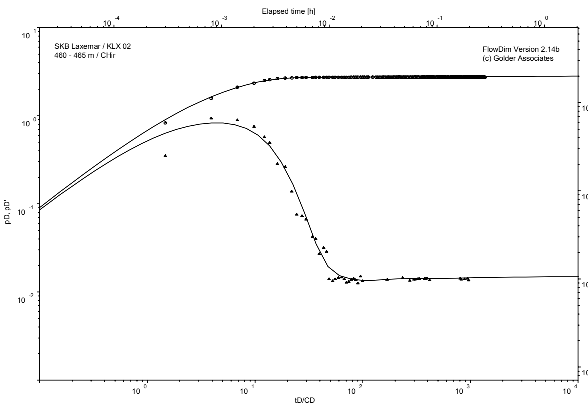


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4537		
p_i (kPa) =	4520		
p_p(kPa) =	4719	p_F (kPa) =	4521
Q_p (m^3/s)=	1,01E-06		
tp (s) =	7560	t_F (s) =	1200
S el S^* (-)=	6,1E-07	S el S^* (-)=	1,3E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	13,6		
Derivative fact.=	0,08	Derivative fact.=	0,11
Results		**Results**	
Q/s (m^2/s)=	4,99E-08		
T_M (m^2/s)=	4,12E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0,38	dt_1 (min) =	*
dt_2 (min) =	19,90	dt_2 (min) =	*
T (m^2/s) =	5,4E-08	T (m^2/s) =	2,6E-08
S (-) =	6,1E-07	S (-) =	1,3E-06
K_s (m/s) =	1,1E-08	K_s (m/s) =	5,1E-09
S_s (1/m) =	1,2E-07	S_s (1/m) =	2,6E-07
C (m^3/Pa) =	NA	C (m^3/Pa) =	1,2E-11
C_D (-) =	NA	C_D (-) =	1,0E+01
ξ (-) =	0	ξ (-) =	0
T_{GRF}(m^2/s) =		T_{GRF}(m^2/s) =	
S_{GRF}(-) =		S_{GRF}(-) =	
D_{GRF} (-) =		D_{GRF} (-) =	

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	0,38	C (m^3/Pa) =	1,2E-11
dt_2 (min) =	19,90	C_D (-) =	1,0E+01
T_T (m^2/s) =	5,4E-08	ξ (-) =	0
S (-) =	6,1E-07		
K_s (m/s) =	1,1E-08		
S_s (1/m) =	1,2E-07		

Comments:

* : IARF not measured

The downward slope of the CHIR derivative at late times was interpreted as a transition to an outer composite shell of higher transmissivity. The inner composite zone derived from the CHIR phase is interpreted as skin. The outer zone transmissivity derived from the CHIR phase is regarded as less reliable due too the very fast pressure recovery.

APPENDIX 4

Nomenclature

The following symbols are extracted from the more comprehensive list of symbols provided by SKB. Only the symbols that were used or deemed to be used in the future in the context of test analysis are presented.

Character	**Explanation**	**Dimension**	**Unit**
b	Aquifer thickness (Thickness of 2D formation)	[L]	m
L_w	Test section length.	[L]	m
r_w	Borehole, well or soil pipe radius in test section.	[L]	m
r_D	Dimensionless radius, r_D=r/r_w	-	-
Q_p	Flow in test section immediately before stop of flow. Stabilised pump flow in flow logging.	$[L^3/T]$	m^3/s
Q_m	Arithmetical mean flow during perturbation phase.	$[L^3/T]$	m^3/s
V	Volume	$[L^3]$	m^3
V_w	Water volume in test section.	$[L^3]$	m^3
V_p	Total water volume injected/pumped during perturbation phase.	$[L^3]$	m^3
t	Time	[T]	hour,min,s
t_0	Duration of rest phase before perturbation phase.	[T]	s
t_p	Duration of perturbation phase. (from flow start as far as p_p).	[T]	s
t_F	Duration of recovery phase (from p_p to p_F).	[T]	s
t_1, t_2 etc	Times for various phases during a hydro test.	[T]	hour,min,s
dt	Running time from start of flow phase and recovery phase respectively.	[T]	s
dt_e	$dt_e = (dt \cdot tp) / (dt + tp)$ Agarwal equivalent time with dt as running time for recovery phase.	[T]	s
t_D	$t_D = T \cdot t / (S \cdot r_w^2)$. Dimensionless time	-	-
p	Static pressure; including non-dynamic pressure which depends on water velocity. Dynamic pressure is normally ignored in estimating the potential in groundwater flow relations.	$[M/(LT)^2]$	kPa
p_a	Atmospheric pressure	$[M/(LT)^2]$	kPa
p_t	Absolute pressure; $p_t=p_a+p_g$	$[M/(LT)^2]$	kPa
p_g	Gauge pressure; Difference between absolute pressure and atmospheric pressure.	$[M/(LT)^2]$	kPa
p_0	Initial pressure before test begins, prior to packer expansion.	$[M/(LT)^2]$	kPa
p_i	Pressure in measuring section before start of flow.	$[M/(LT)^2]$	kPa
p_f	Pressure during perturbation phase.	$[M/(LT)^2]$	kPa
p_s	Pressure during recovery.	$[M/(LT)^2]$	kPa
p_p	Pressure in measuring section before flow stop.	$[M/(LT)^2]$	kPa
p_F	Pressure in measuring section at end of recovery.	$[M/(LT)^2]$	kPa
p_D	$p_D=2\pi \cdot T \cdot p/(Q \cdot \rho_w g)$, Dimensionless pressure	-	-
dp	Pressure difference, drawdown of pressure surface between two points of time.	$[M/(LT)^2]$	kPa
dp_f	$dp_f = p_i - p_f$ or $= p_f - p_i$, drawdown/pressure increase of pressure surface between two points of time during perturbation phase. dp_f usually expressed positive.	$[M/(LT)^2]$	kPa
dp_s	$dp_s = p_s - p_p$ or $= p_p - p_s$, pressure increase/drawdown of pressure surface between two points of time during recovery phase. dp_s usually expressed positive.	$[M/(LT)^2]$	kPa
dp_p	$dp_p = p_i - p_p$ or $= p_p - p_i$, **maximal** pressure increase/drawdown of pressure surface between two points of time during perturbation phase. dp_p expressed positive.	$[M/(LT)^2]$	kPa
dp_F	$dp_F = p_p - p_F$ or $= p_F - p_p$, **maximal** pressure increase/drawdown of pressure surface between two points of time during recovery phase. dp_F expressed positive.	$[M/(LT)^2]$	kPa

H	Total head; (potential relative a reference level) (indication of h for phase as for p). $H=h_e+h_p+h_v$	[L]	m
h	Groundwater pressure level (hydraulic head (piezometric head; possible to use for level observations in boreholes, static head)); (indication of h for phase as for p). $h=h_e+h_p$	[L]	m
h_e	Height of measuring point (Elevation head); Level above reference level for measuring point.	[L]	m
s_p	Drawdown in measuring section before flow stop.	[L]	m
h_0	Initial above reference level before test begins, prior to packer expansion.	[L]	m
h_i	Level above reference level in measuring section before start of flow.	[L]	m
h_f	Level above reference level during perturbation phase.	[L]	m
h_s	Level above reference level during recovery phase.	[L]	m
h_p	Level above reference level in measuring section before flow stop.	[L]	m
h_F	Level above reference level in measuring section at end of recovery.	[L]	m
dh	Level difference, drawdown of water level between two points of time.	[L]	m
dh_f	$dh_f = h_i - h_f$ or $= h_f – h_i$, drawdown/pressure increase of pressure surface between two points of time during perturbation phase. dh_f usually expressed positive.	[L]	m
dh_s	$dh_s = h_s – h_p$ or $= h_p – h_s$, pressure increase/drawdown of pressure surface between two points of time during recovery phase. dh_s usually expressed positive.	[L]	m
dh_p	$dh_p = h_i – h_p$ or $= h_p –h_i$, maximal pressure increase/drawdown of pressure surface between two points of time during perturbation phase. dh_p expressed positive.	[L]	m
dh_F	$dh_F = h_p – h_F$ or $= h_F – h_p$, maximal pressure increase/drawdown of pressure surface between two points of time during perturbation phase. dh_F expressed positive.	[L]	m
Te_w	Temperature in the test section (taken from temperature logging). Temperature		°C
Te_{w0}	Temperature in the test section during undisturbed conditions (taken from temperature logging). Temperature		°C
g	Constant of gravitation (9.81 $m*s^{-2}$) (Acceleration due to gravity)	[L/T^2]	m/s^2
π	Constant (approx 3.1416).	[-]	
r	Residual. $r= p_c-p_m$, $r= h_c-h_m$, etc. Difference between measured data (p_m, h_m, etc) and estimated data (p_c, h_c, etc)		
Q/s	Specific capacity $s=dp_p$ or $s=s_p=h_0-h_p$ (open borehole)	[L^2/T]	m^2/s
D	Interpreted flow dimension according to Barker, 1988.	[-]	-
dt_1	Time of starting for semi-log or log-log evaluated characteristic counted from start of flow phase and recovery phase respectively.	[T]	s
dt_2	End of time for semi-log or log-log evaluated characteristic counted from start of flow phase and recovery phase respectively.	[T]	s
T	Transmissivity	[L^2/T]	m^2/s
T_M	Transmissivity according to Moye (1967)	[L^2/T]	m^2/s
T_S	Transmissivity evaluated from slug test	[L^2/T]	m^2/s
T_{Sf}, T_{Lf}	Transient evaluation based on semi-log or log-log diagram for perturbation phase in injection or pumping.	[L^2/T]	m^2/s
T_{Ss}, T_{Ls}	Transient evaluation based on semi-log or log-log diagram for recovery phase in injection or pumping.	[L^2/T]	m^2/s

APPENDIX 5

Normalized derivative plots

Synthesis

NORMALIZED DERIVATIVE PLOTS

The tests conducted in borehole KLX02 were analysed using the normalized derivative plot method described in Section 5.4.8 of the main report. The advantage of the normalized derivative plots is that the user not only can "read" the interval transmissivity of a certain test on the Y-axis of the plot (see Section 5.4.8 for details), but he can also compare the shape of the derivative of different tests and thus assess how the flow geometry differs from one test section to another. Similar and overlapping derivatives of tests conducted in different test sections indicate either that the tests are responding to the same dominating hydraulic structure or that they are responding to structures that have similar hydraulic behaviour. Use of this analysis method helps to identify typical patterns of hydraulic behaviour.

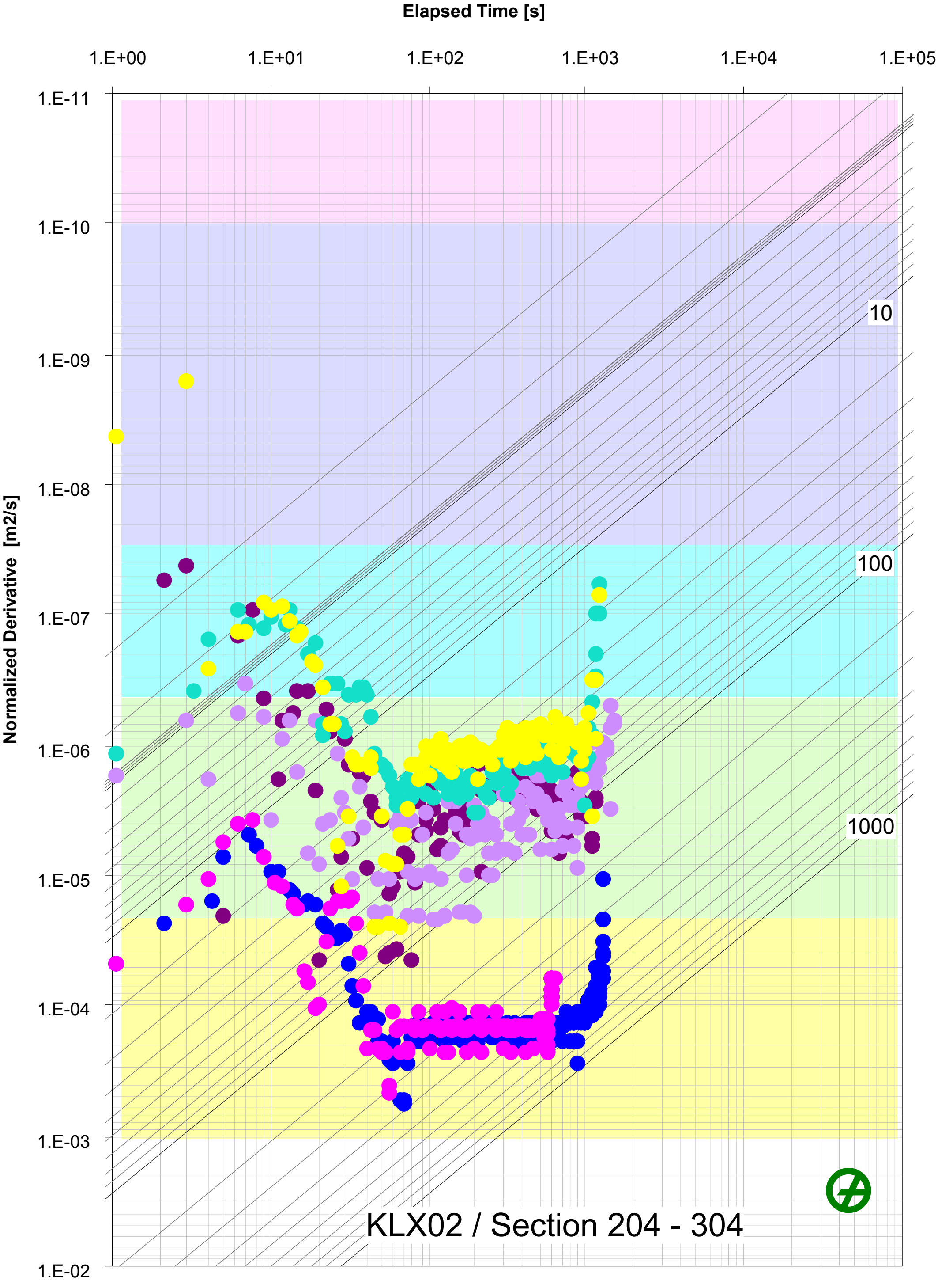
The derivatives of all tests were examined in the normalized plot and late test time transmissivity ranges were defined in which the results are clustered and behaviour is similar. The following transmissivity ranges were identified:

Colour	T_{MIN}	T_{MAX}
	2E-5	...
	4E-7	2E-5
	3E-8	4E-7
	1E-10	3E-8
	...	1E-10

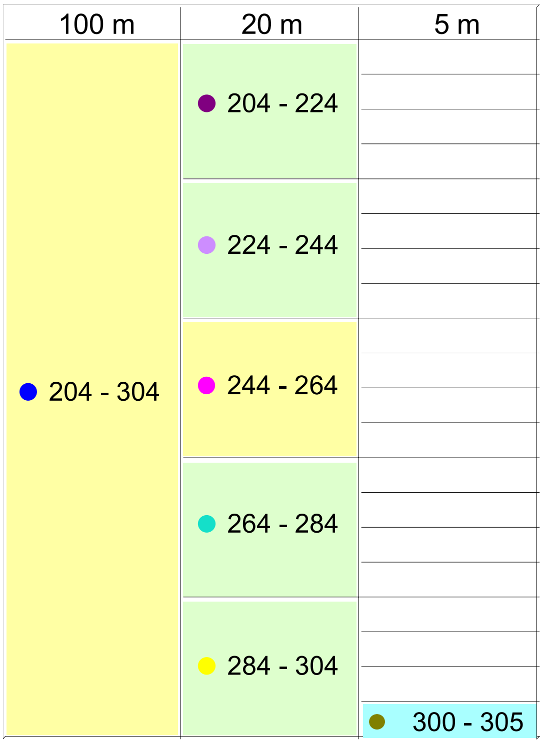
The individual tests were assigned to one of the transmissivity ranges. The further evaluation is concentrated on the five test groups, each of which is seen to be representative of a large number of observations made in this borehole. By considering the characteristics of each of the five groups it is possible to make a comprehensive appraisal of the complete set of results and of their implications for the hydraulic behaviour of the rock surrounding the borehole.

In the following each of the 100 m test sections is examined separately. All tests conducted in the respective 100 m section are plotted and the hydraulic behaviour of each of these sections is commented on.

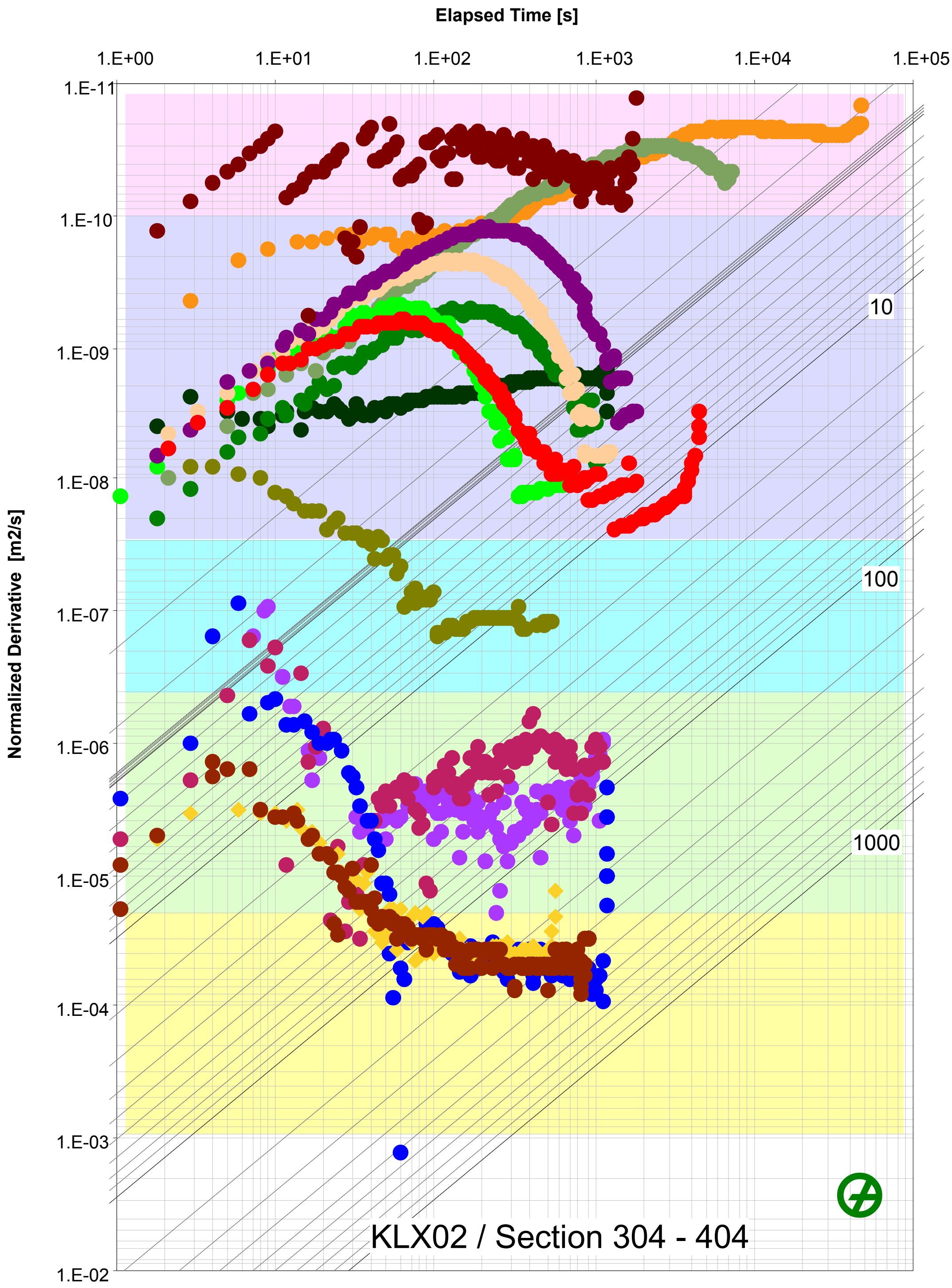
Test Section 204 to 304 m b TOC



The total transmissivity in the 204 to 304 m section is approximately 2E-4 m^2/s. As seen in the figure above this transmissivity seems to be mainly concentrated in the section between 244 and 264 m depth. All other tests display transmissivities that are around one order of magnitude smaller. All tests show a smaller transmissivity in the borehole vicinity; this behaviour was modelled as a high skin in the analysis. A more thorough comment on the high skins encountered is given in the Conclusions-Section of the main report. The following figure presents the legend of the normalized plot. In this legend, the individual tests were given colours that are consistent to the transmissivity group they have been assigned to.



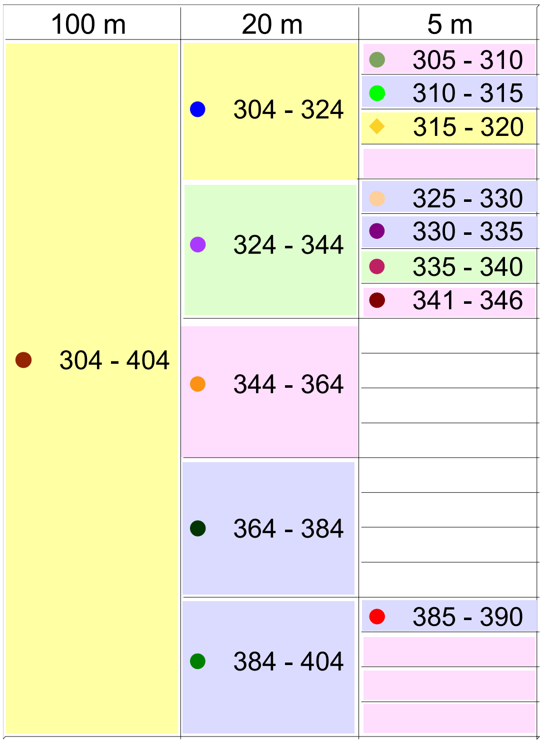
Test Section 304 to 404 m b TOC



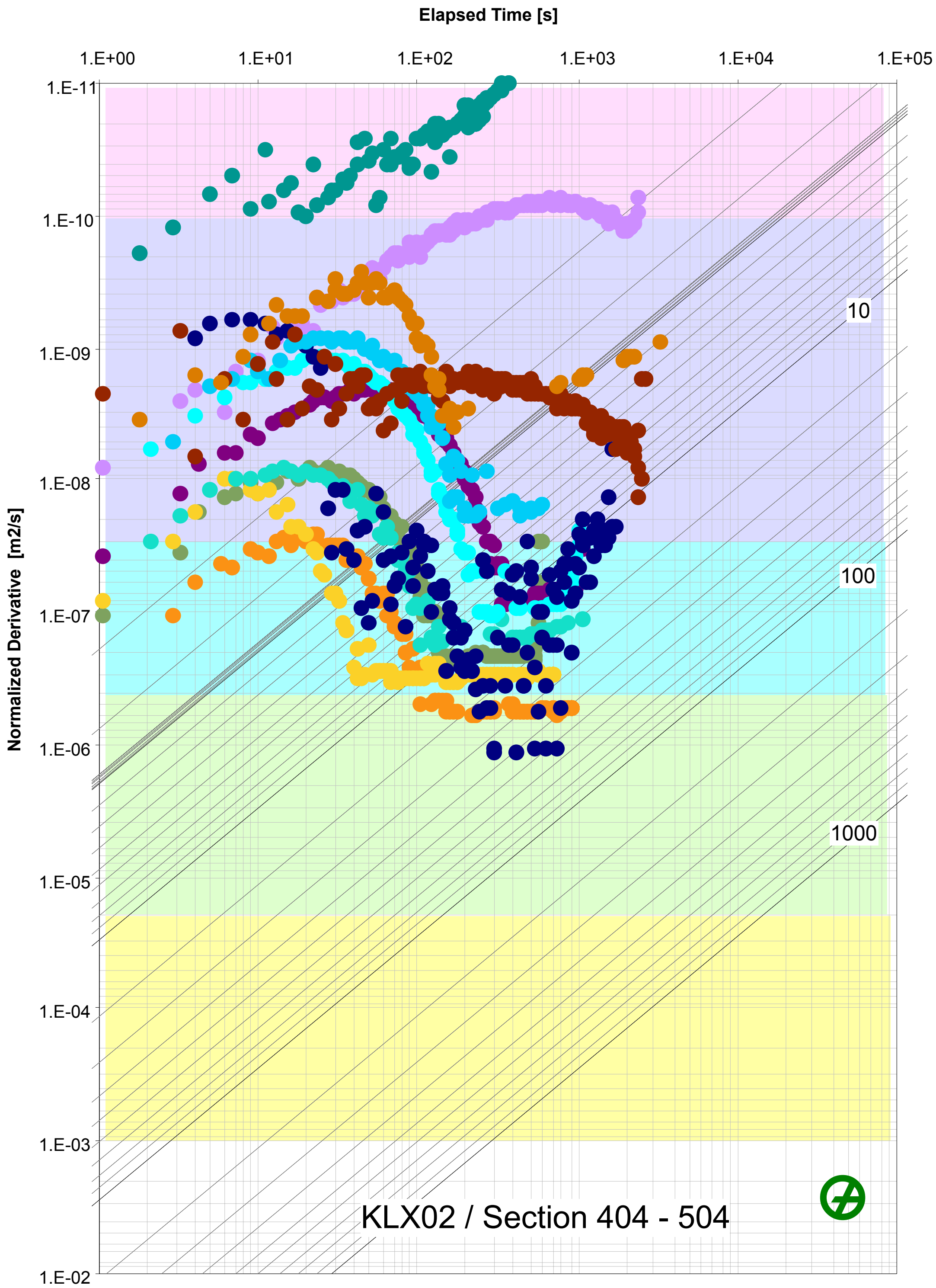
The total transmissivity in the 304 to 404 m section is approximately 5E-5 m^2/s. As seen in the figure above this transmissivity seems to be mainly concentrated in the section between 304 and 324 m depth and further in the 5 m section between 315 and 320 m depth. All three tests show very similar behaviour which indicates that the structure tested in the section 315 m to 320 m depth is hydraulically dominant for the entire 100 m interval. Within the 20 m section 324 m to 344 m, the dominant structure is located in the 5 m interval between 335 and 340 m, both showing a transmissivity around 2E-6 m^2/s.

The next highest transmissivity was tested in the 300 m to 305 m interval (approx. 1E-7 m^2/s).

All other tests display transmissivities lower than 3E-8 m^2/s. All tests show a smaller transmissivity in the borehole vicinity; this behaviour was modelled as a high skin in the analysis. A more thorough comment on the high skins encountered is given in the Conclusions-Section of the main report. The following figure presents the legend of the normalized plot. In this legend, the individual tests were given colours that are consistent to the transmissivity group they have been assigned to.

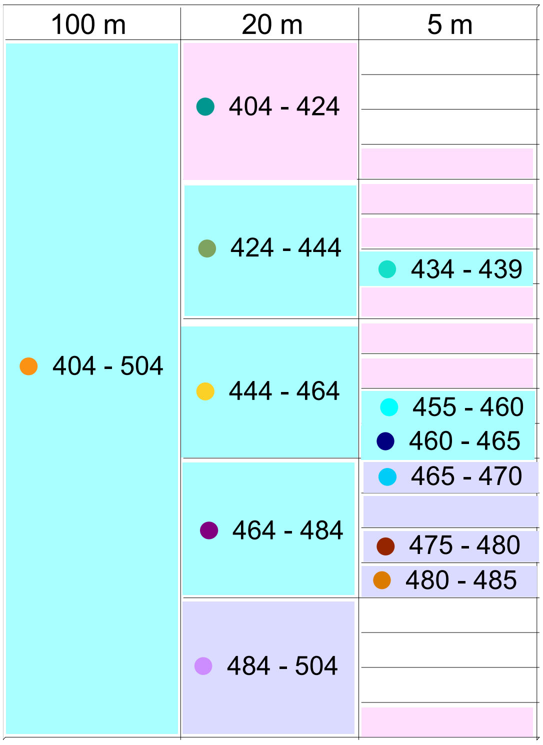


Test Section 404 to 504 m b TOC

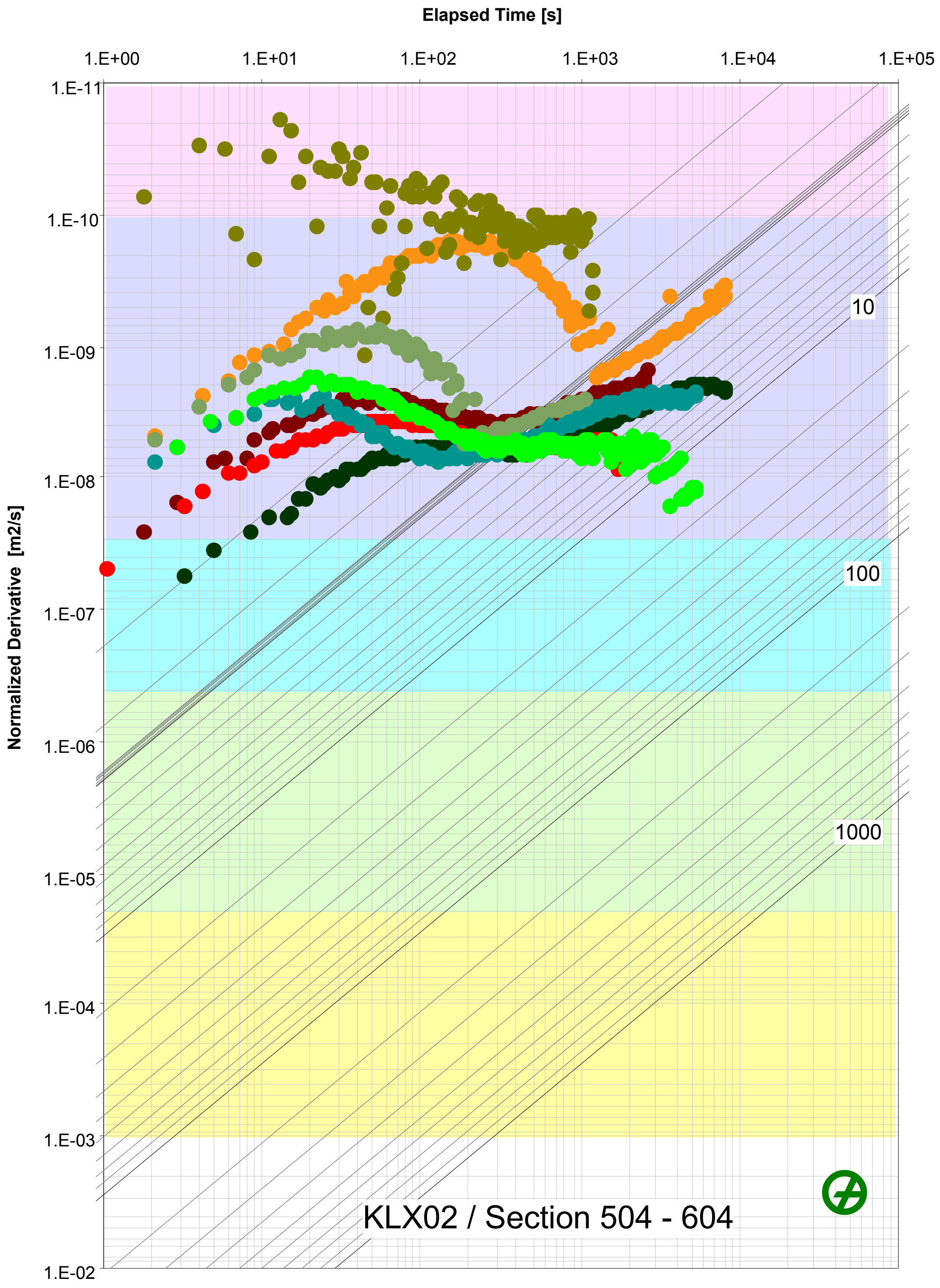


The total transmissivity in the 404 to 504 m section is approximately 5E-7 m^2/s. As seen in the figure above this transmissivity seems to be concentrated in the following 20 m sections: 424–444, 444–464 m and 464–484 m depth. Following 5 m sub-sections seem to dominate the hydraulic response: 434-439, 455-460 and 460-465 m depth.

All other tests display transmissivities lower than 3E-8 m^2/s. Most of the tests show a smaller transmissivity in the borehole vicinity; this behaviour was modelled as a high skin in the analysis. A more thorough comment on the high skins encountered is given in the Conclusions-Section of the main report. The following figure presents the legend of the normalized plot. In this legend, the individual tests were given colours that are consistent to the transmissivity group they have been assigned to.

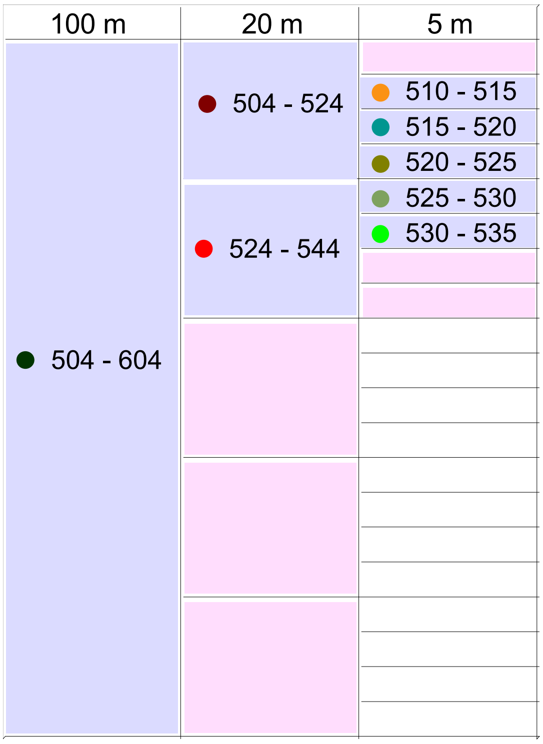


Test Section 504 to 604 m b TOC

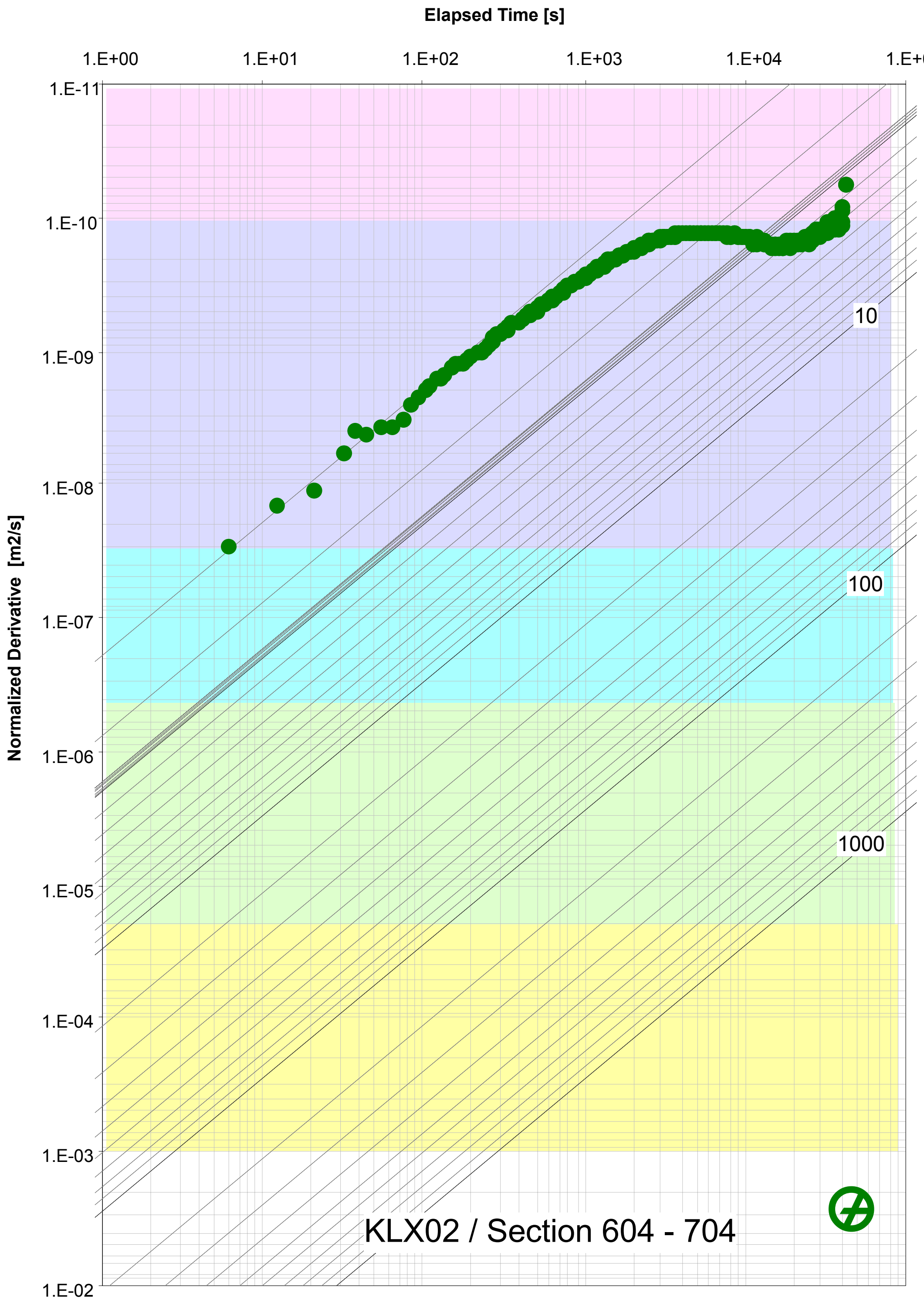


The total transmissivity in the 504 to 604 m section is approximately 2E-9 m^2/s. Most of the tests in this section show a clear two zone composite response, with the inner zone transmissivity slightly higher (factor of 3) than the outer zone transmissivity. The total transmissivity of the 504 to 604 m section seems to be concentrated in the interval between 510 m to 535 m depth (tested by several 5 m sections). All other test sections showed transmissivities lower than 1E-10 m^2/s.

The following figure presents the legend of the normalized plot. In this legend, the individual tests were given colours that are consistent to the transmissivity group they have been assigned to.



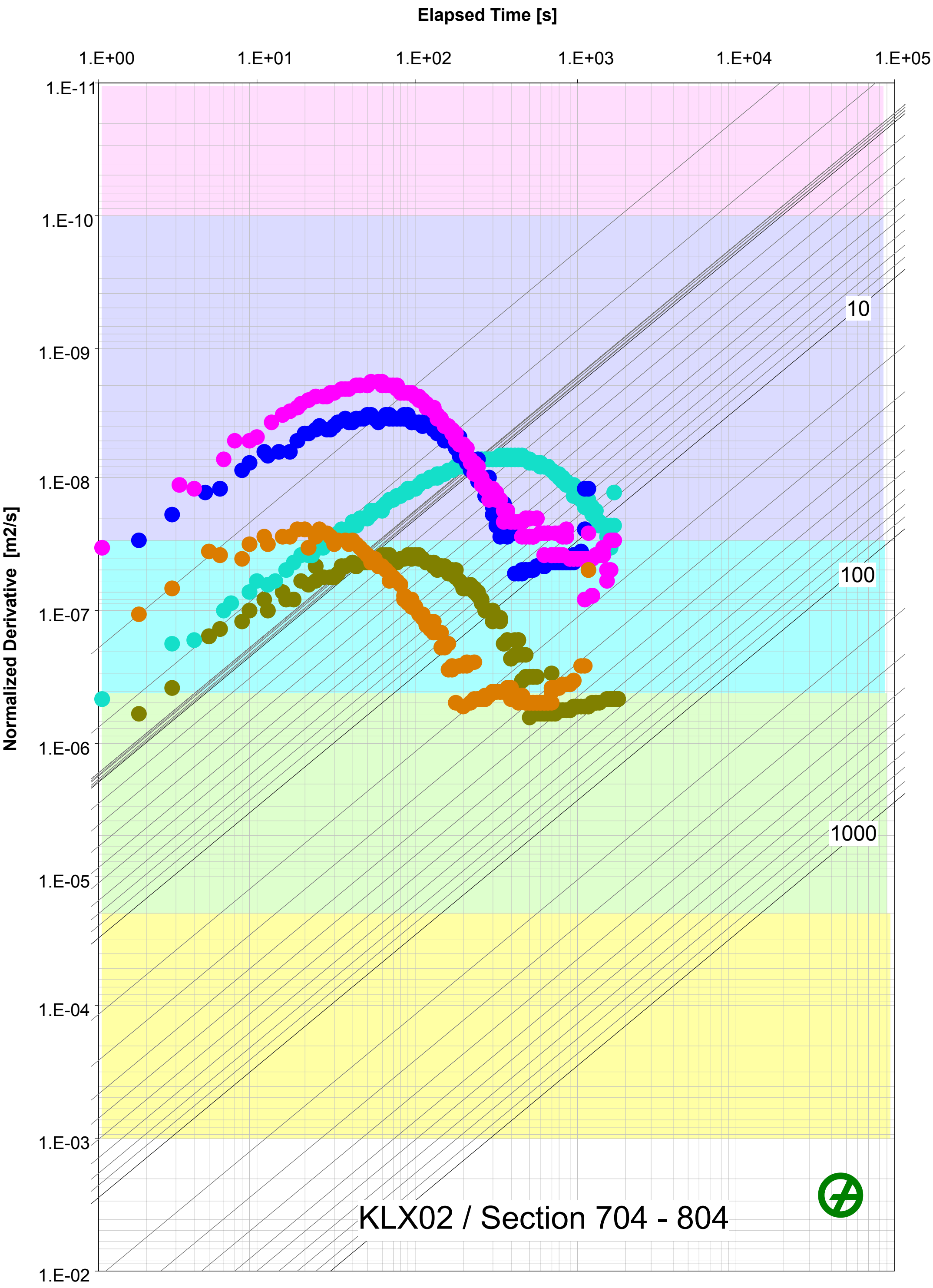
Test Section 604 to 704 m b TOC



The section 604 to 704 m depth was tested with only one 100 m interval which showed a transmissivity of approx. 2E-10 m^2/s and lower (clear two zone composite response). Due to the low transmissivity, no further tests were conducted.

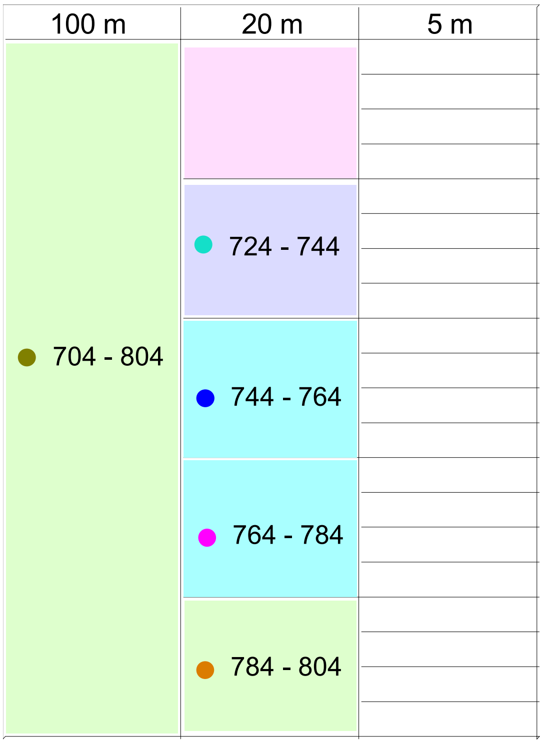
The following figure presents the legend of the normalized plot. In this legend, the individual tests were given colours that are consistent to the transmissivity group they have been assigned to.

Test Section 704 to 804 m b TOC

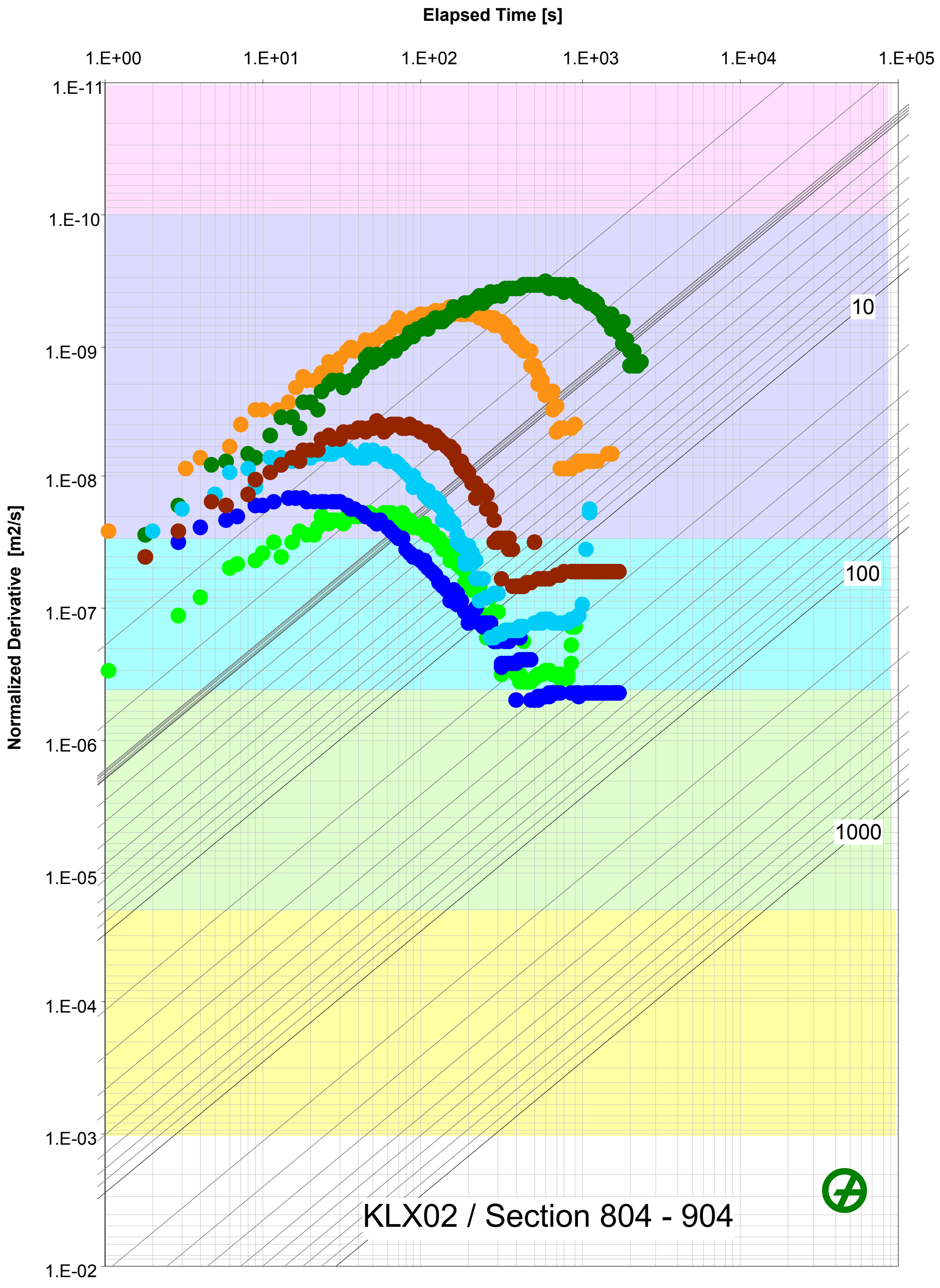


The test section 704 to 804 m depth shows a total transmissivity of approx. 6E-7 m^2/s. All transmissivity seems to be concentrated in the structure encompassed by the section 784 to 804 m depth. The transmissivities of all other tested sections are lower by approximately one order of magnitude or more.

All tests show a smaller transmissivity in the borehole vicinity; this behaviour was modelled as a high skin in the analysis. A more thorough comment on the high skins encountered is given in the Conclusions-Section of the main report. The following figure presents the legend of the normalized plot. In this legend, the individual tests were given colours that are consistent to the transmissivity group they have been assigned to.

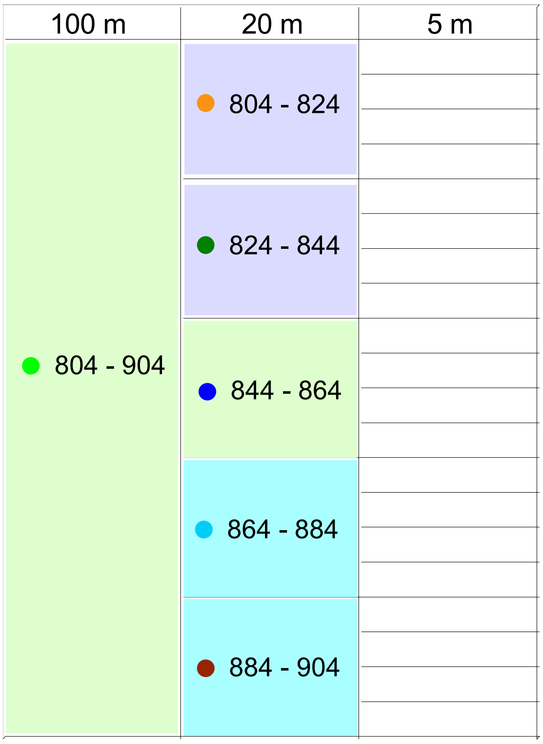


Test Section 804 to 904 m b TOC

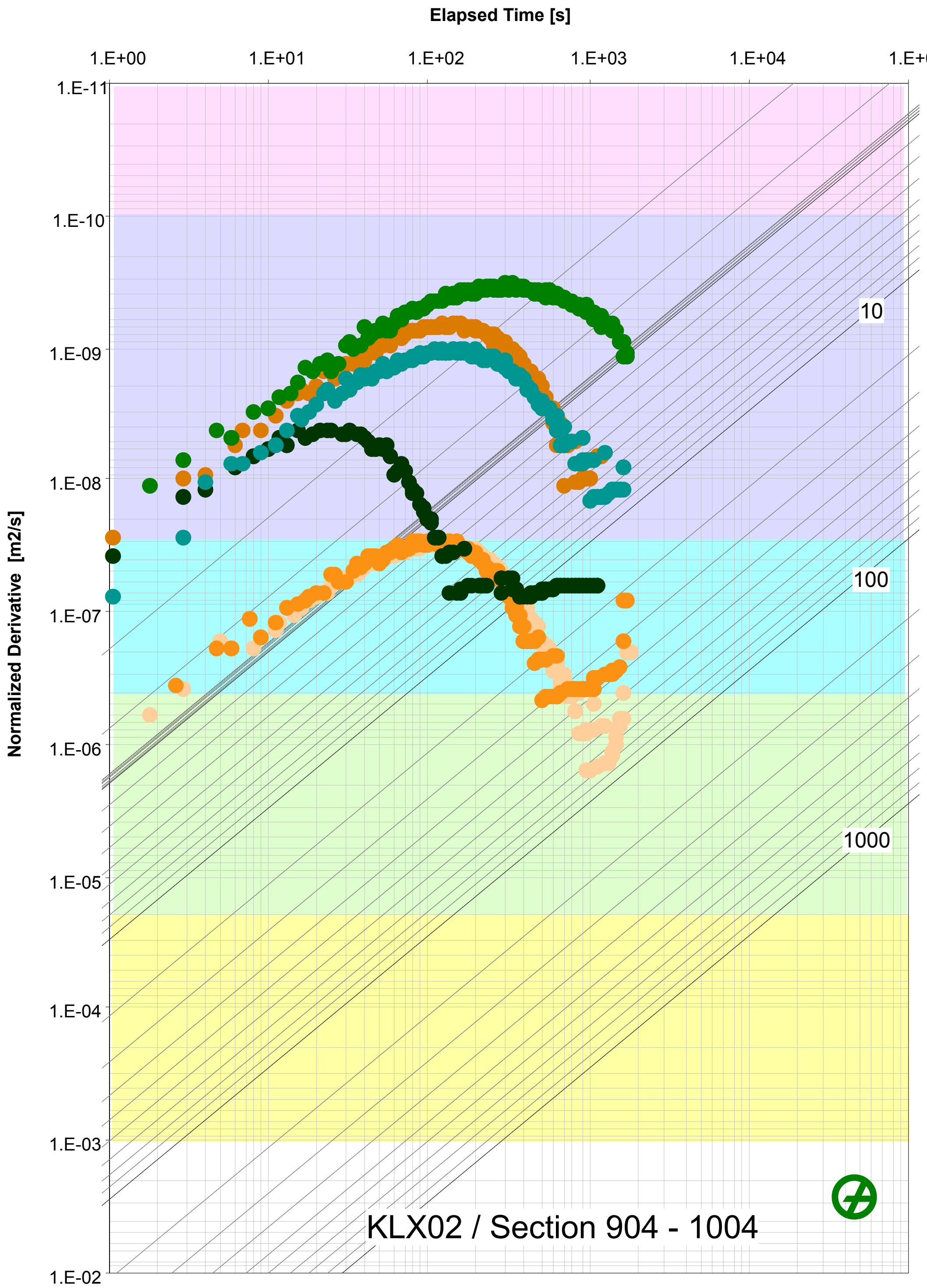


The total transmissivity of the section between 804 and 904 m depth is approx. 3E-7 m^2/s. Most of the transmissivity in this 100 m section seems to be concentrated in the 20 m interval between 844 and 864 m depth and to a lesser extent in the two intervals below, between 864 and 904 m depth. The intervals between 804 and 844 m depth show at least two orders of magnitude lower transmissivities.

All tests show a smaller transmissivity in the borehole vicinity; this behaviour was modelled as a high skin in the analysis. A more thorough comment on the high skins encountered is given in the Conclusions-Section of the main report. The following figure presents the legend of the normalized plot. In this legend, the individual tests were given colours that are consistent to the transmissivity group they have been assigned to.

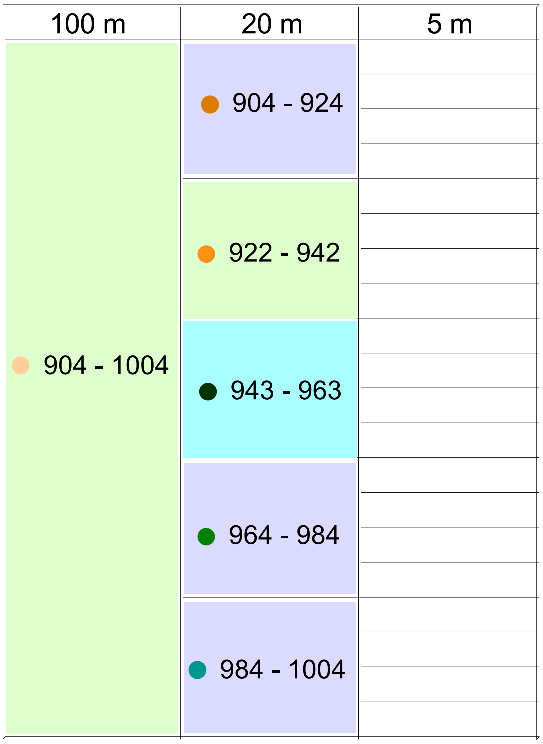


Test Section 904 to 1004 m b TOC



The total transmissivity of the section between 904 and 1004 m depth is approx. 7E-7 m^2/s. Most of the transmissivity in this 100 m section seems to be concentrated in the 20 m interval between 922 and 942 m depth and to a lesser extent in the interval below, between 943 and 963 m depth. The other test sections show at least two orders of magnitude lower transmissivities.

All tests show a smaller transmissivity in the borehole vicinity; this behaviour was modelled as a high skin in the analysis. A more thorough comment on the high skins encountered is given in the Conclusions-Section of the main report. The following figure presents the legend of the normalized plot. In this legend, the individual tests were given colours that are consistent to the transmissivity group they have been assigned to.



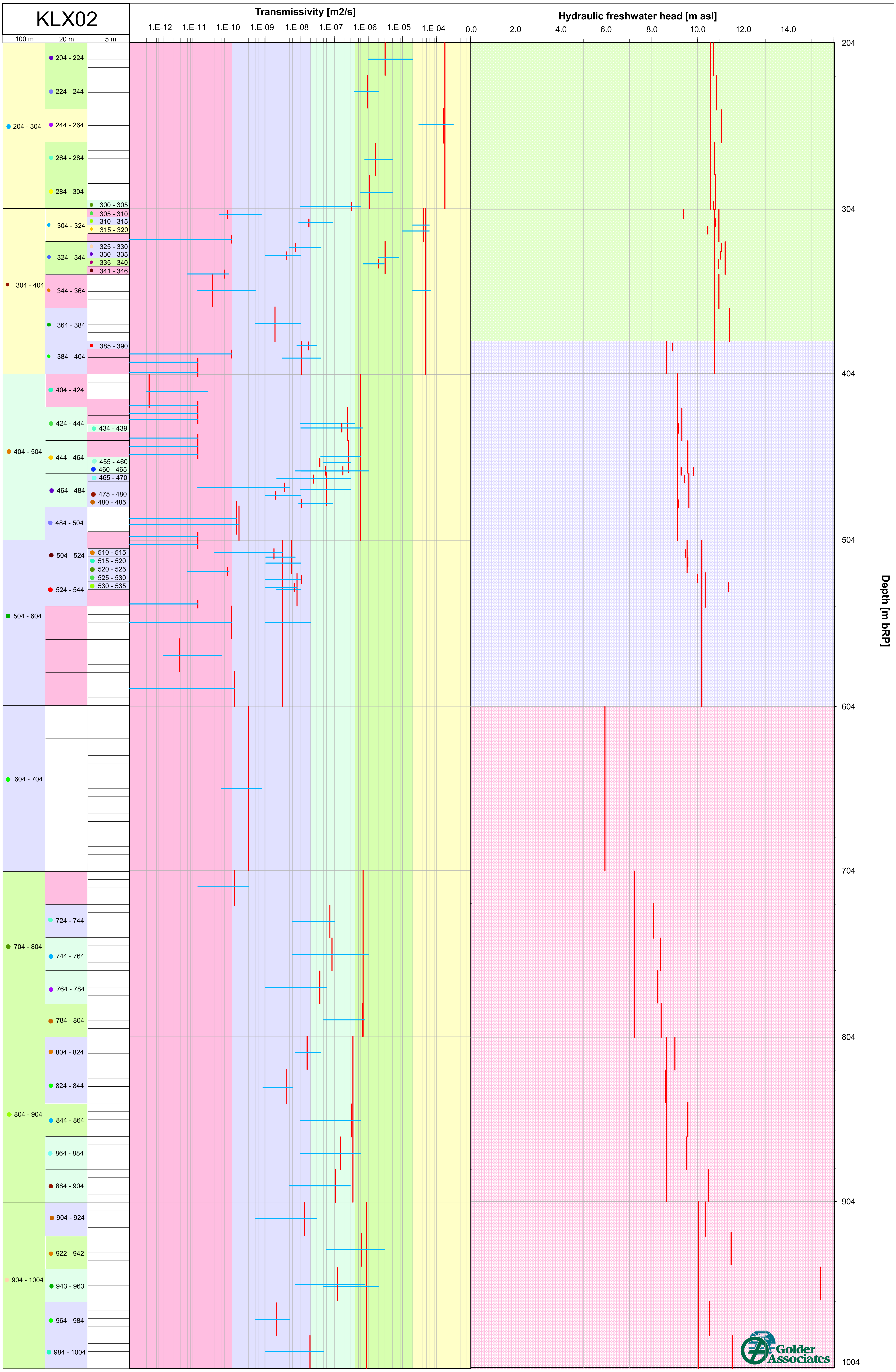
BOREHOLE SYNTHESIS PLOT

The plot on the following page synthesizes the findings of the tests conducted in borehole KLS02. The individual components of the plot are:

- A synopsis of all tests conducted, including their assignment to one of the five transmissivity groups. The fields in the synopsis that have been assigned to a transmissivity group but do not explicitly show a test section, belong to tests that were not analysable because the transmissivity was too low.

- A transmissivity profile showing the recommended transmissivity and confidence range of all tests.

- An equivalent freshwater head profile. The head profile shows three distinct zones. The first zone between 204 m and 384 m depth shows freshwater heads between 9 and 10 m asl. The second zone between 384 and 604 m depth shows freshwater heads between 7 and 8 m asl which is distinctly different from the heads derived from the upper zone. Finally, the third zone at depths below 604 m shows freshwater heads between 3 and 6 m asl and with increasing tendency towards greater depth. These three zones were highlighted with different colours in the profile.



KLX02
Transmissivity [m2/s]
Hydraulic freshwater head [m asl]
Depth [m bRP]
100 m
20 m
5 m
Golder Associates

APPENDIX 6

SICADA data tables

General Information

Borehole	Borehole secup (m)	Borehole seclow (m)	Test type (1-6)	Formation type (-)	Date for test, start YYYYMMDD	Start flow/ injection hhmmss	Qp (m**3/s)	tp (s)	t_F (s)	h_i (m)	h_p (m)	h_F (m)	p_i (kPa)	p_p (kPa)	p_F (kPa)	Te_w (° C)	EC_w (mS/m)	TDS_w (mg/ L)	TDS_{wm} (mg/ L)	Reference	Comments (-)
KLX02	204	304	1	1	20030710	094200	7.92E-04	2160	2040				2026	2227	2030	10					
KLX02	304	404	1	1	20030710	144600	2.20E-04	1980	1800				3011	3210	3010	11.5					
KLX02	404	504	1	1	20030710	183100	2.67E-06	1980	1920				3968	4167	3969	-					
KLX02	504	604	1	1	20030711	143600	2.67E-07	1800	8340				4987	5187	4975	14.5					
KLX02	604	704	1	1	20030711	193500	2.50E-08	1800	42300				5953	6149	5897	15.7					
KLX02	704	804	1	1	20030712	102300	3.32E-06	3600	1800				6874	7074	6876	17.3					
KLX02	804	904	1	1	20030712	151700	1.58E-06	1800	1980				7864	8063	7862	18.8					
KLX02	904	1004	1	1	20030712	184000	2.87E-06	1800	1800				8850	9048	8850	20.5					
KLX02	204	224	1	1	20030714	134600	5.34E-05	1200	1200				2030	2230	2030	10					
KLX02	224	244	1	1	20030714	162700	2.40E-05	1500	1200				2227	2427	2227	10					
KLX02	244	264	1	1	20030714	182800	7.31E-04	1200	1500				2423	2622	2427	10.5					
KLX02	264	284	1	1	20030715	091200	2.67E-05	1200	1200				2616	2817	2617	10.7					
KLX02	284	304	1	1	20030715	112600	1.75E-05	1200	1200				2813	3012	2813	11					
KLX02	304	324	1	1	20030715	140100	1.90E-04	1200	1200				3011	3210	3011	11.2					
KLX02	324	344	1	1	20030715	161500	3.97E-05	1200	1200				3207	3407	3407	11.5					
KLX02	344	364	1	1	20030715	181600	-	300	49440				3432	3666	3403	12					
KLX02	364	384	1	1	20030716	091600	-	120	1320				3600	3810	3604	12.2					
KLX02	384	404	1	1	20030716	130200	6.96E-08	1200	1200				3773	4022	3776	12.5					
KLX02	404	424	1	1	20030716	150300	-	180	1200				4010	4247	4246	12.8					
KLX02	424	444	1	1	20030716	164800	8.22E-07	1200	1200				4165	4364	4165	13.1					
KLX02	444	464	1	1	20030716	190600	1.47E-06	1200	1800				4363	4562	4363	13.4					
KLX02	464	484	1	1	20030717	092000	1.76E-07	1800	1200				4558	4755	4558	13.6					
KLX02	481	501	1	1	20030717	113900	3.33E-09[bml]	1800	1800				4744	4943	4759	14					
KLX02	484	504	1	1	20030717	135300	8.28E-09[bml]	1800	2400				477.6	4975	4774	14					
KLX02	504	524	1	1	20030717	172800	1.30E-07	1800	2700				4983	5183	4980	14.2					
KLX02	524	544	1	1	20030717	200000	1.17E-07	3600	1800				5165	5363	5184	14.5					
KLX02	544	564	1	1	20030718	120100	-	480	5400				5365	5555	5426	14.9					
KLX02	564	584	1	1	20030718	152100	-	180	3840				5614	5817	5794	15.2					
KLX02	584	604	1	1	20030718	174800	8.33E-09[bml]	1200	1800				5767	5963	5820	15.5					

Borehole	Borehole secup (m)	Borehole seclow (m)	Test type (1-6)	Formation type (-)	Date for test, start YYYYMMDD	Start flow/ injection hhmmss	Qp (m**3/s)	tp (s)	t_F (s)	h_i (m)	h_p (m)	h_F (m)	p_i (kPa)	p_p (kPa)	p_F (kPa)	Te_w (°C)	EC_w (mS/m)	TDS_w (mg/ L)	TDS_{wm} (mg/ L)	Reference	Comments (-)
KLX02	704	724	1	1	20030719	095500	-	1200	1800				6950	7147	7117	17.3					
KLX02	724	744	1	1	20030719	145300	6.33E-07	1200	1800				7081	7281	7081	17.6					
KLX02	744	764	1	1	20030719	171000	2.79E-07	1800	1200				7275	7475	7275	18					
KLX02	764	784	1	1	20030719	193500	1.65E-07	7200	1800				7474	7672	7474	18.2					
KLX02	784	804	1	1	20030720	090900	2.24E-06	1200	1200				7664	7884	7665	18.6					
KLX02	804	824	1	1	20030720	115400	5.00E-08	2400	1800				7866	8066	7865	18.9					
KLX02	824	844	1	1	20030720	144900	4.14E-08	1800	2400				8069	8319	8066	19.2					
KLX02	844	864	1	1	20030720	174500	1.00E-06	3600	1800				8261	8461	8261	20.1					
KLX02	864	884	1	1	20030721	092400	4.65E-07	1200	1200				8454	8654	8455	19.9					
KLX02	884	904	1	1	20030721	113600	3.50E-07	1800	1800				8658	8858	8659	20.2					
KLX02	904	924	1	1	20030721	152800	5.83E-08	1200	1200				8855	9055	8855	20.6					
KLX02	922	942	1	1	20030721	174200	2.81E-06	1200	1800				9040	9240	9039	20.9					
KLX02	943	963	1	1	20030722	091800	3.91E-07	1800	1200				9285	9486	9282	21.1					
KLX02	964	984	1	1	20030722	114700	2.23E-08	2400	1800				9450	9653	9453	21.5					
KLX02	984	1004	1	1	20030722	142000	9.29E-08	2400	1800				9648	9850	9647	21.8					
KLX02	300	305	1	1	20030724	113300	7.11E-07	1800	1800				2968	3168	2968	11.4					
KLX02	305	310	1	1	20030724	134700	5.00E-09 (bml)	1200	7200				3021	3221	3019	11.3					
KLX02	310	315	1	1	20030724	173100	2.50E-08	1800	1800				3067	3267	3067	11.5					
KLX02	315	320	1	1	20030725	090500	1.82E-04	1200	1200				3112	3310	3114	11.5					
KLX02	320	325	1	1	20030725	123000	-	300	420				3359	3491	3732	11.6					
KLX02	325	330	1	1	20030725	140900	1.33E-08 (bml	1800	1800				3214	3415	3216	11.7					
KLX02	330	335	1	1	20030725	162400	5.00E-09 (bml	1800	2700				3264	3464	3265	11.8					
KLX02	335	340	1	1	20030725	184200	3.11E-05	1200	1200				3312	3512	3312	11.7					
KLX02	341	346	1	1	20030726	095000	-	1200	1800				3490	3688	3666	11.9					
KLX02	385	390	1	1	20030726	115800	5.00E-08	1200	5160				3783	3984	3780	12.4					
KLX02	390	395	1	1	20030726	153900	-	1200	300				3975	4183	4183	12.6					
KLX02	395	400	1	1	20030726	-	-	-	-				-	-	-	12.7					
KLX02	400	405	1	1	20030727	-	-	-	-				-	-	-	12.8					
KLX02	420	425	1	1	20030727	-	-	-	-				-	-	-	13					
KLX02	425	430	1	1	20030727	-	-	-	-				-	-	-	13.1					
KLX02	429	434	1	1	20030727	-	-	-	-				-	-	-	13.2					
KLX02	434	439	1	1	20030727	153900	8.35E-07	1800	1200				4261	4461	4261	13.3					

Borehole	Borehole secup (m)	Borehole seclow (m)	Test type (1-6)	Formation type (-)	Date for test, start YYYYMMDD	Start flow/ injection hhmmss	Qp (m**3/s)	tp (s)	t_F (s)	h_i (m)	h_p (m)	h_F (m)	p_i (kPa)	p_p (kPa)	p_F (kPa)	Te_w (° C)	EC_w (mS/m)	TDS_w (mg/ L)	TDS_{wm} (mg/ L)	Reference	Comments (-)
KLX02	440	445	1	1	20030727	-	-	-	-				-	-	-	13.4					
KLX02	445	450	1	1	20030728	-	-	-	-				-	-	-	13.5					
KLX02	450	455	1	1	20030728	-	-	-	-				-	-	-	13.5					
KLX02	455	460	1	1	20030728	120700	1.09E-07	3600	1200				4466	4666	4466	13.6					
KLX02	460	465	1	1	20030728	144000	6.66E-07	1800	1200				4515	4717	4515	13.6					
KLX02	460	465	1	1	20030801	132000	1.01E-06	7560	1200				4520	4719	4521	13.7					
KLX02	465	470	1	1	20030728	165200	7.57E-08	1800	1200				4565	4766	4566	13.8					
KLX02	470	475	1	1	20030729	075700	-	240	1200				4617	4810	4612	13.8					
KLX02	475	480	1	1	20030801	103500	-	0	2700				4671	4948	4670	13.9					
KLX02	480	485	1	1	20030729	113500	3.04E-08	1800	4860				4712	4910	4709	14					
KLX02	500	505	1	1	20030729	-	-	-	-				-	-	-	14.2					
KLX02	505	510	1	1	20030729	-	-	-	-				-	-	-	14.3					
KLX02	510	515	1	1	20030729	171900	8.33E-09[bml]	1200	9600				5010	5210	5005	14.4					
KLX02	515	520	1	1	20030731	155700	1.49E-07	1200	5400				5067	5309	5067	14.5					
KLX02	520	525	1	1	20030730	141900	-	1800	1200				5116	5314	5239	14.5					
KLX02	525	530	1	1	20030730	161600	6.67E-08	1200	1200				5159	5359	5160	14.6					
KLX02	530	535	1	1	20030731	114300	1.06E-07	1200	7980				5221	5445	5221	14.7					
KLX02	535	540	1	1	20030731	-	-	-	-				-	-	-	14.8					
KLX02	540	545	1	1	20030731	-	-	-	-				-	-	-	14.8					

Basic Evaluation

Borehole	Borehole secup (m)	Borehole seclow (m)	Date for test, start YYYYMMDD	Q/s (m^2/ s)	T_Q (m^2/ s)	T_M (m^2/ s)	b (m)	B (m)	TB (1D) (m^3/ s)	TB-measl-L (1D) (m^3/ s)	TB-measl-U (1D) (m^3/ s)	SB (1D) (m)	SB* (1D) (m)	L (1D) (m)	T_T (2D) (m^2/ s)	T-measl-L (2D) (m^2/ s)	T-measl-U (2D) (m^2/ s)	S (2D) (-)	S* (2D) (-)	K´/b´ (2D) (1/s)	K_S (3D) (m/s)	K_S-measl-L (3D) (m/s)	K_S-measl-U (3D) (m/s)	S_S (3D) (1/m)	S_S* (3D) (1/m)	C (m**3/Pa)	C_D (-)	ξ (1,2 or 3D) (-)	w (-)	I (-)	dt_1 (min)	dt_2 (min)	Comments (-)
KLX02	204	304	20030710	3.86E-05		5.03E-05	100								1.80E-04	3.00E-05	3.00E-04		1.00E-06							3.00E-08		17.8			13.7	21.0	
KLX02	304	404	20030710	1.08E-05		1.41E-05	100								4.90E-05	2.00E-05	6.50E-05		1.00E-06							8.30E-09		18.5			2.3	13.3	
KLX02	404	504	20030710	1.31E-07		1.71E-07	100								5.90E-07	1.50E-07	6.00E-07		1.00E-06							3.00E-10		20.1			3.9	13.5	
KLX02	504	604	20030711	1.31E-08		1.70E-08	100								3.00E-09	1.00E-09	2.00E-08		1.00E-06							2.50E-10		0			1.7	52.0	
KLX02	604	704	20030711	1.25E-09		1.63E-09	100								3.00E-10	5.00E-11	7.00E-10		1.00E-06							1.40E-10		0			283.9	660.2	
KLX02	704	804	20030712	1.63E-07		2.12E-07	100								6.90E-07	3.00E-08	1.00E-06		1.00E-06							1.30E-09		19.4			7.0	47.4	
KLX02	804	904	20030712	7.80E-08		1.02E-07	100								3.50E-07	2.00E-08	5.00E-07		1.00E-06							4.20E-10		20			8.8	13.9	
KLX02	904	1004	20030712	1.42E-07		1.85E-07	100								9.10E-07	5.00E-08	2.00E-06		1.00E-06							1.60E-09		32.6			-	-	
KLX02	204	224	20030714	2.62E-06		2.74E-06	20								3.20E-06	1.00E-06	2.00E-05		1.00E-06							1.70E-10		0			3.1	17.0	
KLX02	224	244	20030714	1.18E-06		1.23E-06	20								9.70E-07	4.00E-07	2.00E-06		1.00E-06							1.90E-10		0			0.5	14.7	
KLX02	244	264	20030714	3.60E-05		3.77E-05	20								1.70E-04	8.00E-05	2.00E-04		1.00E-06							2.10E-08		18			1.1	9.5	
KLX02	264	284	20030715	1.31E-06		1.37E-06	20								1.70E-06	8.00E-07	5.00E-06		1.00E-06							2.40E-10		20.3			1.3	15.8	
KLX02	284	304	20030715	8.63E-07		9.02E-07	20								1.10E-06	6.00E-07	5.00E-06		1.00E-06							1.40E-10		38.3			2.3	11.8	
KLX02	304	324	20030715	9.36E-06		9.80E-06	20								4.20E-05	2.00E-05	6.00E-05		1.00E-06							6.50E-09		18.6			1.6	15.4	
KLX02	324	344	20030715	1.86E-06		1.95E-06	20								3.20E-06	2.00E-06	8.00E-06		1.00E-06							3.50E-10		20.1			1.1	12.4	
KLX02	344	364	20030715	#NV		#NV	20								2.60E-11	1.00E-11	5.00E-10		1.00E-06							2.70E-11		0			183.0	550.2	
KLX02	364	384	20030716	#NV		#NV	20								1.80E-09	5.00E-10	1.00E-08		1.00E-06							5.80E-11		0			0.6	17.4	
KLX02	384	404	20030716	2.74E-09		2.87E-09	20								1.10E-08	2.90E-09	4.00E-08		1.00E-06							4.30E-11		21.1			-	-	
KLX02	404	424	20030716	#NV		#NV	20								3.60E-13	3.00E-13	2.00E-11		1.00E-06							1.90E-10		0			-	-	
KLX02	424	444	20030716	4.05E-08		4.24E-08	20								2.40E-07	1.00E-08	4.00E-07		1.00E-06							8.80E-11		32.2			3.2	6.9	
KLX02	444	464	20030716	7.26E-08		7.60E-08	20								2.60E-07	4.00E-08	5.00E-07		1.00E-06							5.60E-11		21			5.3	17.9	
KLX02	464	484	20030717	8.78E-09		9.19E-09	20								5.70E-08	1.00E-08	3.00E-07		1.00E-06							4.40E-11		32.6			-	-	
KLX02	481	501	20030717	1.64E-10		1.72E-10	20								1.30E-10	1.00E-13	1.30E-10		1.00E-06							1.70E-11		0			-	-	
KLX02	484	504	20030717	4.08E-10		4.27E-10	20								1.60E-10	1.00E-13	1.60E-10		1.00E-06							1.20E-11		0.04			-	-	
KLX02	504	524	20030717	6.36E-09		6.66E-09	20								5.40E-09	1.00E-09	7.00E-09		1.00E-06							3.90E-11		0			3.6	6.9	
KLX02	524	544	20030717	5.78E-09		6.05E-09	20								8.20E-09	2.00E-09	1.00E-08		1.00E-06							6.30E-11		0			6.3	26.2	
KLX02	544	564	20030718	#NV		#NV	20								1.00E-10	1.00E-13	1.00E-10		1.00E-06							#NV		#NV			-	-	
KLX02	564	584	20030718	#NV		#NV	20								2.80E-12	1.00E-12	5.00E-11		1.00E-06							5.10E-11		0			-	-	
KLX02	584	604	20030718	4.17E-10		4.36E-10	20								1.20E-10	1.00E-13	1.20E-10		1.00E-06							3.40E-11		0			-	-	
KLX02	704	724	20030719	#NV		#NV	20								1.20E-10	1.00E-11	3.00E-10		1.00E-06							1.70E-10		2			-	-	
KLX02	724	744	20030719	3.11E-08		3.25E-08	20								7.60E-08	6.00E-09	1.00E-07		1.00E-06							1.00E-09		7.9			-	-	
KLX02	744	764	20030719	1.37E-08		1.43E-08	20								8.50E-08	6.00E-09	3.00E-07		1.00E-06							8.90E-11		32.3			-	-	
KLX02	764	784	20030719	8.19E-09		8.57E-09	20								3.70E-08	1.00E-09	6.00E-08		1.00E-06							4.60E-11		22.5			10.6	20.2	
KLX02	784	804	20030720	1.10E-07		1.15E-07	20								6.60E-07	5.00E-08	8.00E-07		1.00E-06							2.40E-10		32			3.9	8.4	
KLX02	804	824	20030720	2.45E-09		2.57E-09	20								1.60E-08	7.00E-09	4.00E-08		1.00E-06							3.80E-11		32.6			-	-	
KLX02	824	844	20030720	1.62E-09		1.70E-09	20								3.80E-09	8.00E-10	6.00E-09		1.00E-06							7.50E-11		9.25			-	-	
KLX02	844	864	20030720	4.93E-08		5.15E-08	20								3.20E-07	1.00E-08	6.00E-07		1.00E-06							1.10E-10		30.9			8.4	20.6	
KLX02	864	884	20030721	2.28E-08		2.38E-08	20								1.50E-07	1.00E-08	6.00E-07		1.00E-06							7.10E-11		32.5			-	-	
KLX02	884	904	20030721	1.72E-08		1.80E-08	20								1.10E-07	5.00E-09	3.00E-07		1.00E-06							1.10E-10		32.2			-	-	
KLX02	904	924	20030721	2.86E-09		2.99E-09	20								1.30E-08	5.00E-10	3.00E-08		1.00E-06							4.10E-11		21.1			-	-	
KLX02	922	942	20030721	1.38E-07		1.44E-07	20								6.10E-07	6.00E-08	3.00E-06		1.00E-06							1.40E-09		19.4			-	-	
KLX02	943	963	20030722	1.91E-08		2.00E-08	20								1.20E-07	7.00E-09	8.00E-07		1.00E-06							4.70E-11		32.6			-	-	
KLX02	964	984	20030722	1.13E-09		1.18E-09	20								2.00E-09	5.00E-10	5.00E-09		1.00E-06							3.70E-11		5			-	-	
KLX02	984	1004	20030722	4.51E-09		4.72E-09	20								1.90E-08	1.00E-09	5.00E-08		1.00E-06							6.90E-11		20.9			-	-	
KLX02	300	305	20030724	3.49E-08		2.88E-08	5								3.20E-07	1.00E-08	6.00E-07		1.00E-06							1.80E-11		21.5			3.8	16.5	
KLX02	305	310	20030724	2.45E-10		2.02E-10	5								7.40E-11	4.00E-11	7.00E-10		1.00E-06							1.70E-11		26.2			-	-	
KLX02	310	315	20030724	1.23E-09		1.01E-09	5								1.80E-08	9.00E-09	9.00E-08		1.00E-06							1.40E-11		39.1			-	-	
KLX02	315	320	20030725	9.03E-06		7.46E-06	5								4.20E-05	1.00E-05	6.00E-05		1.00E-06							6.00E-09		18.6			1.5	8.9	
KLX02	320	325	20030725	#NV		#NV	5								1.00E-10	1.00E-13	1.00E-10		1.00E-06							#NV		#NV			-	-	
KLX02	325	330	20030725	6.51E-10		5.37E-10	5								7.20E-09	5.00E-09	4.00E-08		1.00E-06							1.40E-11		38			-	-	

Borehole	Borehole secup (m)	Borehole seclow (m)	Date for test, start YYYYMMDD	Q/s (m^2/s)	T_Q (m^2/s)	T_M (m^2/s)	b (m)	B (m)	TB (1D) (m^3/s)	TB-measl-L (1D) (m^3/s)	TB-measl-U (1D) (m^3/s)	SB (1D) (m)	SB* (1D) (m)	L (1D) (m)	T_T (2D) (m^2/s)	T-measl-L (2D) (m^2/s)	T-measl-U (2D) (m^2/s)	S (2D) (-)	S* (2D) (-)	K´/b´ (2D) (1/s)	K_S (3D) (m/s)	K_S-measl-L (3D) (m/s)	K_S-measl-U (3D) (m/s)	S_S (3D) (1/m)	S_S* (3D) (1/m)	C (m**3/Pa)	C_D (-)	ξ (1,2 or 3D) (-)	w (-)	l (-)	dt_1 (min)	dt_2 (min)	Comments (-)
KLX02	330	335	20030725	2.45E-10		2.02E-10	5								3.90E-09	1.00E-09	1.00E-08		1.00E-06							1.30E-11		33.2			-	-	
KLX02	335	340	20030725	1.52E-06		1.26E-06	5								2.00E-06	7.00E-07	3.00E-06		1.00E-06							2.80E-10		34.1			0.8	2.2	
KLX02	341	346	20030726	#NV		#NV	5								6.10E-11	5.00E-12	8.00E-11		1.00E-06							1.10E-10		#NV			-	-	
KLX02	385	390	20030726	2.44E-09		2.01E-09	5								1.70E-08	8.00E-09	3.00E-08		1.00E-06							1.80E-11		33.1			13.1	61.2	
KLX02	390	395	20030726	#NV		#NV	5								1.00E-10	1.00E-13	1.00E-10		1.00E-06							#NV		#NV			-	-	
KLX02	395	400	20030726	#NV		#NV	5								1.00E-11	1.00E-13	1.00E-11		1.00E-06							#NV		#NV			-	-	
KLX02	400	405	20030727	#NV		#NV	5								1.00E-11	1.00E-13	1.00E-11		1.00E-06							#NV		#NV			-	-	
KLX02	420	425	20030727	#NV		#NV	5								1.00E-11	1.00E-13	1.00E-11		1.00E-06							#NV		#NV			-	-	
KLX02	425	430	20030727	#NV		#NV	5								1.00E-11	1.00E-13	1.00E-11		1.00E-06							#NV		#NV			-	-	
KLX02	429	434	20030727	#NV		#NV	5								1.00E-11	1.00E-13	1.00E-11		1.00E-06							#NV		#NV			-	-	
KLX02	434	439	20030727	4.10E-08		3.38E-08	5								1.70E-07	1.00E-08	7.00E-07		1.00E-06							6.00E-11		22.8			-	-	
KLX02	440	445	20030727	#NV		#NV	5								1.00E-11	1.00E-13	1.00E-11		1.00E-06							#NV		#NV			-	-	
KLX02	445	450	20030728	#NV		#NV	5								1.00E-11	1.00E-13	1.00E-11		1.00E-06							#NV		#NV			-	-	
KLX02	450	455	20030728	#NV		#NV	5								1.00E-11	1.00E-13	1.00E-11		1.00E-06							#NV		#NV			-	-	
KLX02	455	460	20030728	5.34E-09		4.41E-09	5								3.90E-08	5.00E-08	3.00E-07		1.00E-06							1.40E-11		39			-	-	
KLX02	460	465	20030728	3.23E-08		2.67E-08	5								1.80E-07	7.00E-09	3.00E-07		1.00E-06							1.40E-11		32			2.9	9.8	
KLX02	460	465	20030801	4.99E-08		4.12E-08	5								5.40E-08	1.00E-08	1.00E-06		1.00E-06							1.90E-11		39.1			0.4	19.9	
KLX02	465	470	20030728	3.70E-09		3.05E-09	5								2.40E-08	2.00E-09	3.00E-07		1.00E-06							1.30E-11		33.2			-	-	
KLX02	470	475	20030728	#NV		#NV	5								3.40E-09	1.00E-11	5.00E-09		1.00E-06							1.30E-13		10			13.1	19.6	
KLX02	475	480	20030801	#NV		#NV	5								1.90E-09	1.00E-09	1.00E-08		1.00E-06							1.80E-13		10			-	-	
KLX02	480	485	20030729	1.50E-09		1.24E-09	5								1.10E-08	9.00E-09	9.00E-08		1.00E-06							6.10E-12		33.4			-	-	
KLX02	500	505	20030729	#NV		#NV	5								1.00E-11	1.00E-13	1.00E-11		1.00E-06							#NV		#NV			-	-	
KLX02	505	510	20030729	#NV		#NV	5								1.00E-11	1.00E-13	1.00E-11		1.00E-06							#NV		#NV			-	-	
KLX02	510	515	20030729	#NV		#NV	5								1.70E-09	3.00E-11	3.00E-09		1.00E-06							1.40E-11		10.1			-	-	
KLX02	515	520	20030731	6.05E-09		5.00E-09	5								2.90E-09	1.00E-09	1.00E-08		1.00E-06							1.80E-11		2			55.7	89.0	
KLX02	520	525	20030730	#NV		#NV	5								7.30E-11	5.00E-12	8.00E-11		1.00E-06							1.30E-10		0.4			9.0	16.8	
KLX02	525	530	20030730	3.27E-09		2.70E-09	5								1.10E-08	1.00E-09	1.00E-08		1.00E-06							1.50E-11		15.9			-	-	
KLX02	530	535	20030731	4.66E-09		3.85E-09	5								6.60E-09	1.00E-09	8.00E-09		1.00E-06							1.80E-11		2			6.8	53.1	
KLX02	535	540	20030731	#NV		#NV	5								1.00E-11	1.00E-13	1.00E-11		1.00E-06							#NV		#NV			-	-	
KLX02	540	545	20030731	#NV		#NV	5								1.00E-11	1.00E-13	1.00E-11		1.00E-06							#NV		#NV			-	-	