V.2 TESTING

REPEAT FORMATION TESTER

Turonian Limestone

4 runs of RFT were performed on this section using different probe and packer configurations. RFT pressure tests (29) and samplings (2) over

this zone were unsucessful, due mainly to seal failure, indicating a rather tight formation confirmed by both CST and log analysis. Results are listed in tables 3 and 4.

Brent Group

The main object of RFT programme was to determine the nature and characteristics of the formation fluids.
RFT pressure tests were performed to cover the complete Brent section, and are listed in table 5. The stabilized corrected pressures are plotted vs depth in figure 7; gas gradient, water gradient and GWC are well identified on this graph. Five RFT samplings were performed, both in hydrocarbon and waterbearing zones and detailed results listed in table 6a/c can be summarized as follows:

RFT	TMD (m)	RESULTS	REMARKS
5/2	4514.3	gas + tr. condensate	
5/8	4512	gas + tr. condensate	
6/15	4787.5	inconclusive (mud filtrate)	
6/18	4706	contaminated formation water	
7/9	4592	formation water	segregated sample

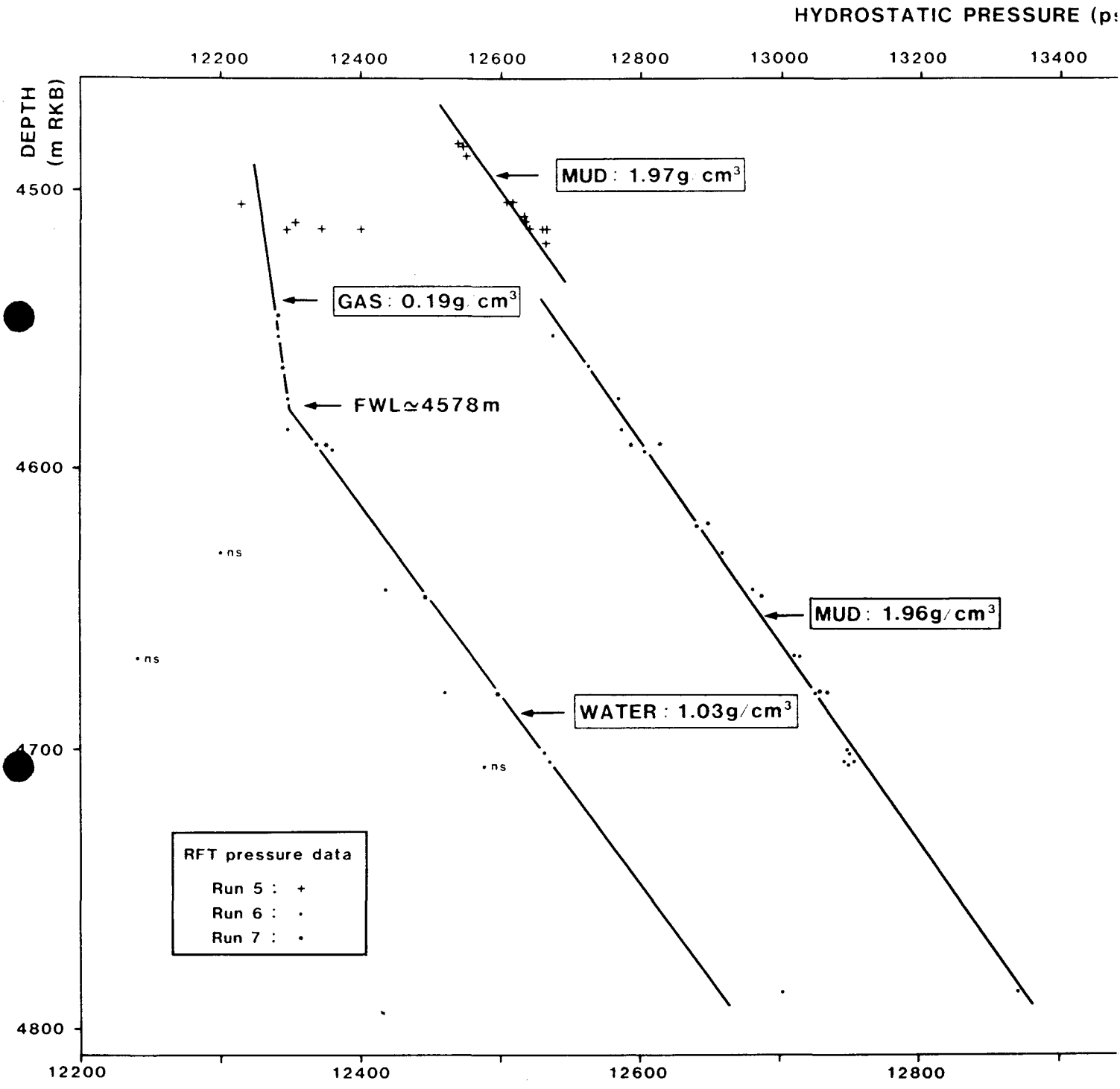
All samplings show unusual high oil filtrate recovery due to unexpected deep invasion by the oil base mud.

DRILL STEM TESTING

Based on log interpretation and conclusive RFT samplings within the Brent section, only one DST was performed in the hydrocarbon zone and flowed 422000 m^3/d gas and 72 m^3/d condensate (GCR 5890 m^3/m^3) on a 20/64" choke. DST 1 results are summarized in table 7.

Testing results for the Brent section are illustrated on figure 2.

24/6-1
PRESSURE PROFILE
BRENT RESERVOIR



TOTAL MARINE NORSK A/S	Date Feb. 1986	Fig. 7

Table 3

SUMMARY OF RFT PRESSURE RESULTS
TURONIAN LIMESTONE

RUN No	TEST No	DEPTH (m) RKB	DEPTH (m) MSL	HYDROSTATIC PRESSURE psi	HYDROSTATIC PRESSURE kg/cm²	HYDROSTATIC PRESSURE g/cm³	FORMATION PRESSURE psi	FORMATION PRESSURE kg/cm²	FORMATION PRESSURE g/cm³	REMARKS
	1	3678.5	3651.0	8720	613.2	1.667	—			Tight
	2	3678.9	3651.4	8724	613.5	1.668	—			Seal failure
1	3	3677.5	3650.0	8714	612.8	1.666	—			Abnormal PBU
	4	3683.8	3656.3	8732	614.1	1.667	—			Seal failure
	5	3705.0	3677.5	8786	617.9	1.668	—			Seal failure
	1	3678.0	3650.5	8725	613.6	1.668	—			
2	2	3678.5	3651.0	8722	613.4	1.667	—			Seal failure
	3	3683.7	3656.2	8737	614.4	1.668	—			
	1	3678.5	3651.0	8730	613.9	1.669	—			
	2	3683.7	3656.2	8744	614.9	1.669	—			
	3	3747.5	3720.0	8897	625.7	1.670	—			
	4	3747.0	3719.5	8898	625.7	1.670	—			
3	5	3746.5	3719.0	8898	625.7	1.670	—			Seal failure
	6	3748.0	3720.5	8903	626.1	1.671	—			
	7	3740.5	3713.0	8884	624.8	1.670	—			
	8	3820.0	3792.5	9073	638.0	1.670	—			
	9	3858.5	3831.0	9163	644.4	1.670	—			
	1	3678.5	3651.0	8745	615.0	1.672	—			Sampling
	2	3679.0	3651.5	8734	614.2	1.669	—			
	3	3678.5	3651.0	8735	614.3	1.670	—			
	4	3683.7	3656.2	8754	615.6	1.671	—			
	5	3706.4	3678.9	8812	619.7	1.672	—			
	6	3705.0	3677.5	8811	619.6	1.672	—			
	7	3718.0	3690.5	8838	621.5	1.672	—			
4	8	3717.5	3690.0	8835	621.3	1.671	—			Seal failure
	9	3747.5	3720.0	8908	626.4	1.672	—			
	10	3747.0	3719.5	8902	626.0	1.671	—			
	11	3747.3	3719.8	8906	626.3	1.671	—			
	12	3748.0	3720.5	8907	626.4	1.671	—			
	13	3740.5	3713.0	8886	624.9	1.671	—			
	14	3706.0	3678.5	8794	618.4	1.669	—			Attempts samp

RFT RESULTS

TOTAL MARINE NORSK A.S

PL 088 | Well: 24/6 -1

RFT NUMBER Run/Test	DEPTH TMD / SS	STRATIGRAPHIC ATTRIBUTION	CHAMBER gal / choke	MUD WEIGHT (g/cm³)	PRESSURES (kg/cm²) Hydrost. s.g	Shut in eq.d	Surface chamber	Sampling Time (min)	RECOVERY DATA GAS (dm³)	GAS COMPOSITION (%) C1	C2	C3	iC4	nC4	iC5
4/1	3678.5 / 3651	TURONIAN	6 / 0.01"	1.66	615.0 / 1.672	-	-	120							

INTERPRETATION :	RECOVERY DATA CONDENSATE (cm³)	ρh g/cm³	API	T°C	OIL (cm³)	ρh g/cm³	API	T°C	Pour Point °C	MUD / FILTRATE / WATER (cm³)	Rmf 75°F	Sal. ppm	Rrf 75°F	Sal. ppm	Titration ppm
TIGHT FORMATION											-	-			

REMARKS : Pressure build-up very slow (stopped after 2 hours around 77kg/cm^2); may show a leakage around the packer - No recovery: probably plugged probe.

RFT NUMBER Run/Test	DEPTH TMD / SS	STRATIGRAPHIC ATTRIBUTION	CHAMBER gal / choke	MUD WEIGHT (g/cm³)	PRESSURES (kg/cm²) Hydrost. s.g	Shut in eq.d	Surface chamber	Sampling Time (min)	RECOVERY DATA GAS (dm³)	GAS COMPOSITION (%) C1	C2	C3	iC4	nC4	iC5
4/14	3706 / 3678.5	TURONIAN	2 3/4 / 0.01"	1.66	618.4 / 1.669	-	-	8 + 46							

INTERPRETATION :	RECOVERY DATA CONDENSATE (cm³)	ρh g/cm³	API	T°C	OIL (cm³)	ρh g/cm³	API	T°C	Pour Point °C	MUD / FILTRATE / WATER (cm³)	Rmf 75°F	Sal. ppm	Rrf 75°F	Sal. ppm	Titration ppm
TIGHT FORMATION										NM	-	-			

REMARKS : 3 attempts: 3706m, decreasing pressure during 8' - 3705.5m, very slow build up (stabilized pressure around 8 kg/cm^2) - 3704.7m, seal failure. Small quantity of mud recovered.

Table 4

Table 5

SUMMARY OF RFT PRESSURE RESULTS
BRENT GROUP

RUN No	TEST No	DEPTH (m) RKB	DEPTH (m) MSL	HYDROSTATIC PRESSURE psi	HYDROSTATIC PRESSURE kg/cm²	HYDROSTATIC PRESSURE g/cm³	FORMATION PRESSURE psi	FORMATION PRESSURE kg/cm²	FORMATION PRESSURE g/cm³	REMARKS
	1	4514.5	4486.5	12665	890.6	1.973	12400	872.0	1.944	Not stabilized
	2	4514.3	4486.3	12658	890.2	1.972	12371	870.0	1.939	Sampling
	3	4519.5	4491.5	12663	890.5	1.970	-			Seal failure
	4	4510.0	4482.0	12630	888.2	1.969	-			Tight
	5	4510.3	4482.3	12629	888.1	1.969	-			Tight
	6	4510.0	4482.0	12632	888.3	1.970	-			Tight
5	7	4514.5	4486.5	12640	888.9	1.969	12347	868.3	1.935	
	8	4512.0	4484.0	12633	888.4	1.969	12353	868.7	1.937	Sampling
	9	4505.0	4477.0	12607	886.6	1.968	-			Tight
	10	4505.5	4477.5	12614	887.1	1.969	12314	866.0	1.934	Not stabilized
	11	4485.0	4457.0	12545	882.2	1.967	-			Seal failure
	12	4485.5	4457.5	12550	882.6	1.968	-			Seal failure
	13	4484.5	4456.5	12545	882.2	1.967	-			Seal failure
	1	4594.0	4566.0	12805	900.5	1.960	12380	870.6	1.907	
	2	4586.5	4558.5	12772	898.2	1.958	-			Tight
	3	4586.8	4558.8	12772	898.2	1.958	12348	868.4	1.905	Test doubtful
	4	4552.4	4524.4	12675	891.4	1.958	12341	867.9	1.918	
	5	4664.0	4536.0	12725	894.9	1.961	12345	868.1	1.914	
	6	4575.5	4547.5	12766	897.7	1.962	12348	868.4	1.909	
	7	4630.5	4602.5	12915	908.2	1.961	-			Not stabilized
	8	4643.5	4615.5	12960	911.4	1.963	12418	873.3	1.892	
	9	4667.1	4639.1	13025	916.0	1.963	-			Not stabilized
6	10	4666.9	4638.9	13020	915.6	1.962	-			Tight
	11	4680.4	4680.4	13050	917.7	1.961	12460		876.2	1.883
	12	4701.0	4673.0	13116	922.4	1.962	-			Tight
	13	4702.0	4674.0	13119	922.6	1.962	12533	881.4	1.886	
	14	4705.0	4677.0	13125	923.0	1.962	12535	881.5	1.885	Uncuccessful sampling
	15	4787.5	4759.5	13342	938.3	1.960	12702	893.2	1.877	Sampling
	16	4705.0	4677.0	13090	920.5	1.957	-			Tight
	17	4704.4	4676.4	13088	920.4	1.957	-			Not stabilized
	18	4706.0	4678.0	13096	921.0	1.957	12488	878.2	1.877	Sampling
	1	4545.0	4517.0	12662	890.4	1.959	12341	867.9	1.921	
	2	4592.0	4564.0	12827	902.0	1.964	12375	870.3	1.907	
	3	4620.5	4592.5	12895	906.8	1.963	-			Tight
	4	4620.9	34592.9	12880	905.8	1.960	-			Tight
7	5	4620.7	4592.7	12880	905.8	1.960	-			Tight
	6	4646.0	4618.0	12973	912.3	1.964	12447	875.3	1.895	
	7	4680.1	4652.1	13066	918.8	1.963	-			Tight
	8	4680.2	4652.2	13052	917.9	1.961	12500	879.0	1.889	
	9	4592.0	4564.0	12785	899.1	1.958	12370	869.9	1.906	Segregated sample

RFT RESULTS

RFT NUMBER Run/Test	DEPTH TMD / SS	STRATIGRAPHIC ATTRIBUTION	CHAMBER gal / choke	MUD WEIGHT (g/cm³)	PRESSURES (kg/cm²) Hydrost. s.g	Shut in eq.d	Surface chamber	Sampling Time (min)	RECOVERY DATA GAS (dm³)	GAS COMPOSITION (%) C1	C2	C3	iC4	nC4	iC5
5/2	4514.3 / 4486.3	BRENT	6 / 0.01"	1.96	890.2 / 1.972	870.0 / 1.939	351.6	105	4432	97.5	1.95	0.50	0.01	0.01	-

INTERPRETATION :	RECOVERY DATA CONDENSATE (cm³)	ρh g/cm³	API	T°C	OIL (cm³)	ρh g/cm³	API	T°C	Pour Point °C	MUD / FILTRATE / WATER (cm³)	Rmf 75°F	Sal. ppm	Rrf 75°F	Sal. ppm	Titration ppm
GAS + trace CONDENSATE	tr									8000	-	-	2.0	2600	

REMARKS : 8000 cm³ fluid recovered: 70% oil base mud + 30% water emulsion (water cushion)

RFT NUMBER Run/Test	DEPTH TMD / SS	STRATIGRAPHIC ATTRIBUTION	CHAMBER gal / choke	MUD WEIGHT (g/cm³)	PRESSURES (kg/cm²) Hydrost. s.g	Shut in eq.d	Surface chamber	Sampling Time (min)	RECOVERY DATA GAS (dm³)	GAS COMPOSITION (%) C1	C2	C3	iC4	nC4	iC5
5/8	4512 / 4484	BRENT	2 3/4 / 0.01"	1.96	888.4 / 1.969	868.7 / 1.937	189.9	114	1274	97.9	1.58	0.44	0.01	0.01	-

INTERPRETATION :	RECOVERY DATA CONDENSATE (cm³)	ρh g/cm³	API	T°C	OIL (cm³)	ρh g/cm³	API	T°C	Pour Point °C	MUD / FILTRATE / WATER (cm³)	Rmf 75°F	Sal. ppm	Rrf 75°F	Sal. ppm	Titration ppm
GAS + trace CONDENSATE	tr									2000	-	-	-	-	

REMARKS : 2000 cm³ fluid recovered: oil base mud

Table 6a

RFT RESULTS

TOTAL MARINE NORSK A.S

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RFT NUMBER Run/Test	DEPTH TMD / SS	STRATIGRAPHIC ATTRIBUTION	CHAMBER gal / choke	MUD WEIGHT (g/cm³)	PRESSURES (kg/cm²) Hydrost. s.g	PRESSURES (kg/cm²) Shut in eq.d	PRESSURES (kg/cm²) Surface chamber	Sampling Time (min)	RECOVERY DATA GAS (dm³)	GAS COMPOSITION (%) C1	C2	C3	iC4	nC4	iC5
6/15	4787.5 / 4759.5	BRENT	2 3/4 / 0.01"	1.95	938.3 / 1.960	893.2 / 1.877	21.1	101	N/A						

INTERPRETATION :	RECOVERY DATA CONDENSATE (cm³)	ρh g/cm³	ρh API	ρh T°C	OIL (cm³)	ρh g/cm³	ρh API	ρh T°C	Pour Point °C	MUD / FILTRATE / WATER (cm³)	Rmf 75°F	Sal. ppm	Rrf 75°F	Sal. ppm	Titration ppm
INCONCLUSIVE										8000	-	-	.09	78000	

REMARKS : Seal valve failure on chamber allowed a few dm^3 gas to escape. 8000cm^3 fluid recovered: 99% oil base mud + 1% water. PBU starts very slowly

RFT NUMBER Run/Test	DEPTH TMD / SS	STRATIGRAPHIC ATTRIBUTION	CHAMBER gal / choke	MUD WEIGHT (g/cm³)	PRESSURES (kg/cm²) Hydrost. s.g	PRESSURES (kg/cm²) Shut in eq.d	PRESSURES (kg/cm²) Surface chamber	Sampling Time (min)	RECOVERY DATA GAS (dm³)	GAS COMPOSITION (%) C1	C2	C3	iC4	nC4	iC5
6/18	4706 / 4678	BRENT	2 3/4 / 0.01"	1.95	921.0 / 1.957	878.2 / 1.877 (*)	21.1	121	109	96.6	2.82	0.56	tr	tr	

INTERPRETATION :	RECOVERY DATA CONDENSATE (cm³)	ρh g/cm³	ρh API	ρh T°C	OIL (cm³)	ρh g/cm³	ρh API	ρh T°C	Pour Point °C	MUD / FILTRATE / WATER (cm³)	Rmf 75°F	Sal. ppm	Rrf 75°F	Sal. ppm	Titration ppm
Contaminated FORMATION WATER										8500	-	-	.11	62000	

REMARKS : 8500 cm^3 fluid recovered: 88% oil base mud + 12% water emulsion
(*) SIP not stabilized - PBU very slow

Table 6b

RFT RESULTS

TOTAL MARINE NORSK A.S

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RFT NUMBER Run/Test	DEPTH TMD / SS	STRATIGRAPHIC ATTRIBUTION	CHAMBER gal / choke	MUD WEIGHT (g/cm³)	PRESSURES (kg/cm²) Hydrost. s.g	Shut in eq.d	Surface chamber	Sampling Time (min)	RECOVERY DATA GAS (dm³)	GAS COMPOSITION (%) C1	C2	C3	iC4	nC4	iC5
7/9a	4592 / 4564	BRENT	6 / 0.01"	1.95	899.1 / 1.958	869.9 / 1.906	24.6	40	48	96.8	2.35	0.58	tr	tr	-

INTERPRETATION :	RECOVERY DATA CONDENSATE (cm³)	ρh g/cm³	API	T°C	OIL (cm³)	ρh g/cm³	API	T°C	Pour Point °C	MUD / FILTRATE / WATER (cm³)	Rmf 75°F	Sal. ppm	Rrf 75°F	Sal. ppm	Titration ppm
Contaminated FORMATION WATER										21000	-	-	.083	85000	

REMARKS : 21000 cm^3 fluid recovered: 80% oil base mud + 20% water emulsion

RFT NUMBER Run/Test	DEPTH TMD / SS	STRATIGRAPHIC ATTRIBUTION	CHAMBER gal / choke	MUD WEIGHT (g/cm³)	PRESSURES (kg/cm²) Hydrost. s.g	Shut in eq.d	Surface chamber	Sampling Time (min)	RECOVERY DATA GAS (dm³)	GAS COMPOSITION (%) C1	C2	C3	iC4	nC4	iC5
7/9b	4592 / 4564	BRENT	2 3/4 / 0.01"	1.95	899.1 / 1.958	869.9 / 1.906	21.1	14	37	N/A					

INTERPRETATION :	RECOVERY DATA CONDENSATE (cm³)	ρh g/cm³	API	T°C	OIL (cm³)	ρh g/cm³	API	T°C	Pour Point °C	MUD / FILTRATE / WATER (cm³)	Rmf 75°F	Sal. ppm	Rrf 75°F	Sal. ppm	Titration ppm
FORMATION WATER										9000	-	-	.080	9000	108000

REMARKS : 9000 cm^3 fluid recovered: 20% oil base mud + 80% water emulsion

Table 6c

Table 7

DST 1 RESULTS

Formation	:	Brent
Packer set at	:	4498.5 m
Perforated intervals	:	4502m - 4516m 4517.5m - 4522m ref.log : DIL-BHC-GR run 4531.5m - 4537 m

Timing

Initial flow	:	5 mn
Initial build up	:	65 mn
Main flow through 20/64" fixed choke	:	864 mn
Main build up	:	1470 mn

Production data

Choke	:	20/64"
Gas flow. Separator	:	421 968 m^3/d (14.9 MMSCFD)
Condensate flow	:	71.6 m^3/d (450 BCPD)
Gas condensate ratio	:	5890 m^3/m^3 (33100 SCF/STB)
BSW	:	0
Wellhead pressure	:	494.0 kg/cm^2 (7025 psi)
Wellhead temperature	:	65.6°C (150°F)
Separator pressure	:	36.9 kg/cm^2 (525 psi)
Separator temperature	:	15.6°C (60°F)
Fluid properties		
- gas .specific gravity(air=1)	:	0.640
.composition (%)		C_1:92%, C_2:3.2%, C_3:1.6%, iC_4:0.5%, nC_4:0.7% CO_2:2% H_2S:Nil
- condensate specific gravity	:	0.785 (48.8°API)

Pressures(*)-Temperatures

Gauge depth for pressure measurements	:	4509.9 m
Initial flow	:	830.3 kg/cm^2 (11806.6 psi)
Initial build up	:	875.5 kg/cm^2 (12449.5 psi)
Main flow	:	665.8 kg/cm^2 (9467.4 psi)
Main build-up	:	866.9 kg/cm^2 (12328.0 psi)
Extrapolated pressure	:	874.8 kg/cm^2 (12440.0 psi)
Bottom hole temperature	:	145°C (293°F) at 4512.5 m

Analysis results

$Bg = 2.8 \times 10^{-3} m^3/m^3$
Kh = 65 mdm
K = 1.47 md
Skin = 7.1

Radius of investigation : 63 m

- All depths in mRKB

* Pressure measurements inaccurate