

Denne rapport
tilhører: 99 525-274-7
STATOIL
L.NR. 12280380022
KODE Well. 34/10-7 nr. 19
Returneres etter bruk

RESERVOIR FLUID STUDY

for

STATOIL

WELL: 34/10-7

NORTH SEA NORWAY

34/10-7



WATERBURY & PARTNERS
100, QUEEN STREET, ABERDEEN
ABERDEEN SCOTLAND

RESERVOIR FLUID STUDY

for

STATOIL

WELL: 34/10-7

NORTH SEA NORWAY

CORE LABORATORIES UK LTD.
PETROLEUM RESERVOIR ENGINEERING
ABERDEEN, SCOTLAND
10th September, 1980

Statoil A/S
P.O. Box 300,
4001, Stavanger,
NORWAY.

Attention : Mr. Per Thomassen.

Subject : Reservoir Fluid Study.
Well : 34/10-7
North Sea, Norway.
Our File Number :
RFLA : 80081

Gentlemen:

A fluid sample from the subject well was sent to our Aberdeen laboratory for use in a reservoir fluid study. The results of this study are presented in the following report.

A portion of the reservoir fluid was examined in a high pressure visual cell at the reported reservoir temperature of 77.8°C . During a constant composition expansion at this temperature a bubble point of 238.2 Bar G was observed. The results of the pressure/volume relations are found on page three and the associated compressibility data is tabulated on page two.

A differential vaporization was then performed at the reservoir temperature of 77.8°C . During the differential pressure depletion the fluid evolved a total of 154.24 standard cubic metres of gas per barrel of residual oil at 15°C . The resulting relative oil volume factor was 1.458 cubic metres of saturated oil per cubic metre of residual oil at 15°C . The oil density and the properties of the evolved gases were measured at each point during the differential pressure depletion and these data are included in the summary of the differential depletion data on page four.

The viscosity of the reservoir fluid was measured over a wide range of pressures at 77.8°C in a rolling ball viscosimeter. The viscosity of the fluid was found to vary from a minimum of 0.442 milli pascal/second at the saturation pressure to a maximum of 1.653 milli pascal/second at atmospheric pressure. The results of the viscosity measurement are tabulated on page seven and graphically represented on page eight.

The hydrocarbon composition of the reservoir fluid was determined by low temperature fractional distillation and this composition in terms of both mole and weight percent are presented on page nine.

Continued/....

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Continued/....

Page Two.

A zero Bar G. separator test was then performed at 19.4°C. The results of this test are presented on page ten. The associated gas and liquid from this separator test were analysed for hydrocarbon composition. The gas was analysed using chromatographic procedures to heptanes plus and this data is presented on page eleven. The liquid sample was analysed for hydrocarbon composition by fractional distillation apparatus and the results of this test in terms of both mol percent and weight percent are presented on page twelve.

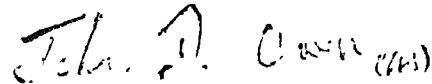
The composition of the reservoir fluid was then calculated utilizing the separator compositions and the gas/oil ratio. This composition may be found on page thirteen.

At conditions stipulated by Statoil A/S, a multistage separator test was performed in the laboratory. The factors and data derived from this test are presented on page fourteen of the report.

At each primary stage of separation, the gas evolved was collected and analysed for hydrocarbon composition by routine gas chromatography. These compositions are presented on page fifteen of the report.

As always, it is a pleasure to be of service to Statoil A/S. Should you have any questions concerning this study, please do not hesitate to contact us.

Very truly yours,
Core Laboratories U.K. Limited.



John D. Owen.
Manager-RFL.

JDO/pmg:
10cc/Addressee:

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Petroleum Reservoir Engineering
ABERDEEN, SCOTLAND

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Company STATOIL NORWAY..... Date Sampled

Well34/10-7..... CountyNORTH SEA.....

Field StateNORWAY.....

FORMATION CHARACTERISTICS

Formation Name

Date First Well Completed, 19.....

Original Reservoir PressurePSIG @Ft.

Original Produced Gas-Liquid Ratio SCF/Bbl

 Production Rate Bbl/Day

 Separator Pressure and TemperaturePSIG..... ° F.

 Oil Gravity at 60°F. ° API

Datum Ft. Subsea

Original Gas Cap

WELL CHARACTERISTICS

Elevation Ft.

Total Depth Ft.

Producing Interval Ft.

Tubing Size and DepthIn. to..... Ft.

Productivity IndexBbl/D/PSI @Bbl/Day

Last Reservoir PressurePSIG @Ft.

 Date, 19.....

 Reservoir Temperature77.8. ° C. @ Ft.

 Status of Well

 Pressure Gauge

Normal Production Rate Bbl/Day

 Gas-Oil Ratio SCF/Bbl

 Separator Pressure and TemperaturePSIG..... ° F.

 Base Pressure PSIA

Well Making Water % Cut

SAMPLING CONDITIONS

Sampled at Ft.

Status of Well

 Gas-Oil RatioSCF/Bbl

 Separator Pressure and TemperaturePSIG..... ° F.

 Tubing Pressure PSIG

 Casing Pressure PSIG

Sampled byFLOPETROL.....

Type SamplerFLOPETROL.....

REMARKS :

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Well ... 34/10-7

VOLUMETRIC DATA OF RESERVOIR FLUID..... SAMPLE

1. Saturation pressure (bubble-point pressure) .238.2.....BarG @ .77.8... °C.
2. Specific volume at saturation pressure : L/Kg .1.474.....BarG. @ .77.8... °C.
3. Thermal expansion of saturated oil @ .344.7...BarG = $\frac{V @ 77.8 \text{ } ^\circ\text{C}}{V @ 21 \text{ } ^\circ\text{C}} = 1.06505$
4. Compressibility of saturated oil @ reservoir temperature : Vol/Vol/Bar G
 - From ...344.7 BarG to .310.3 BarG = ... 16.20 x 10⁻⁵.....
 - From310.3 BarG to .275.8 BarG = .. 17.46 x 10⁻⁵.....
 - From275.8 BarG to .238.2 BarG = ... 17.88 x 10⁻⁵.....

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Pressure-Volume Relations at77.8. °C.

<u>Pressure</u> BarG	<u>Relative</u> <u>Volume (1)</u>	<u>Y</u> <u>Function (2)</u>
344.7	0.9817	
310.3	0.9872	
275.8	0.9932	
262.0	0.9958	
255.1	0.9970	
248.2	0.9983	
241.3	0.9995	
<u>238.2</u>	1.0000	
227.7	1.0116	3.940
212.2	1.0322	3.795
194.0	1.0631	3.601
175.1	1.1044	3.430
154.7	1.1658	3.237
135.1	1.2483	3.048
114.7	1.3764	2.837
96.5	1.5447	2.666
80.5	1.7672	2.520
62.7	2.1794	2.336
46.2	2.8667	2.178
33.0	3.8714	2.046

(1) Relative Volume : V/V_{sat} is barrels at indicated pressure per barrel at saturation pressure.

$$(2) \text{ Y Function} = \frac{(P_{sat}-P)}{(P_{abs})(V/V_{sat}-1)}$$

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 Well ...34/10-7.....

Differential Vaporization at 77.8 °C.

Pressure BarG	Solution Gas/Oil Ratio (1)	Relative Oil Volume (2)	Relative Total Volume (3)	Oil Density Kg/Litre.	Deviation Factor Z	Gas Formation Volume Factor (4)	Incremental Gas Gravity
238.2	154.24	1.458	1.458	0.6786			
220.6	141.95	1.428	1.487	0.6850	0.879	0.00488	0.708
193.1	123.43	1.384	1.554	0.6958	0.868	0.00551	0.693
165.5	106.33	1.343	1.648	0.7064	0.865	0.00640	0.684
137.9	89.59	1.303	1.801	0.7174	0.870	0.00771	0.677
110.3	73.56	1.265	2.053	0.7284	0.885	0.00978	0.675
82.7	57.88	1.229	2.509	0.7395	0.906	0.01332	0.678
55.2	42.57	1.192	3.473	0.7511	0.933	0.02045	0.696
27.6	26.54	1.154	6.456	0.7632	0.966	0.04160	0.756
13.8	17.99	1.130	12.256	0.7713	0.983	0.08166	0.862
6.9	13.00	1.105	22.876	0.7762	0.992	0.15407	1.026
0	0	1.053		0.7963	1.000		1.673
	At 15°C. =	1.000					

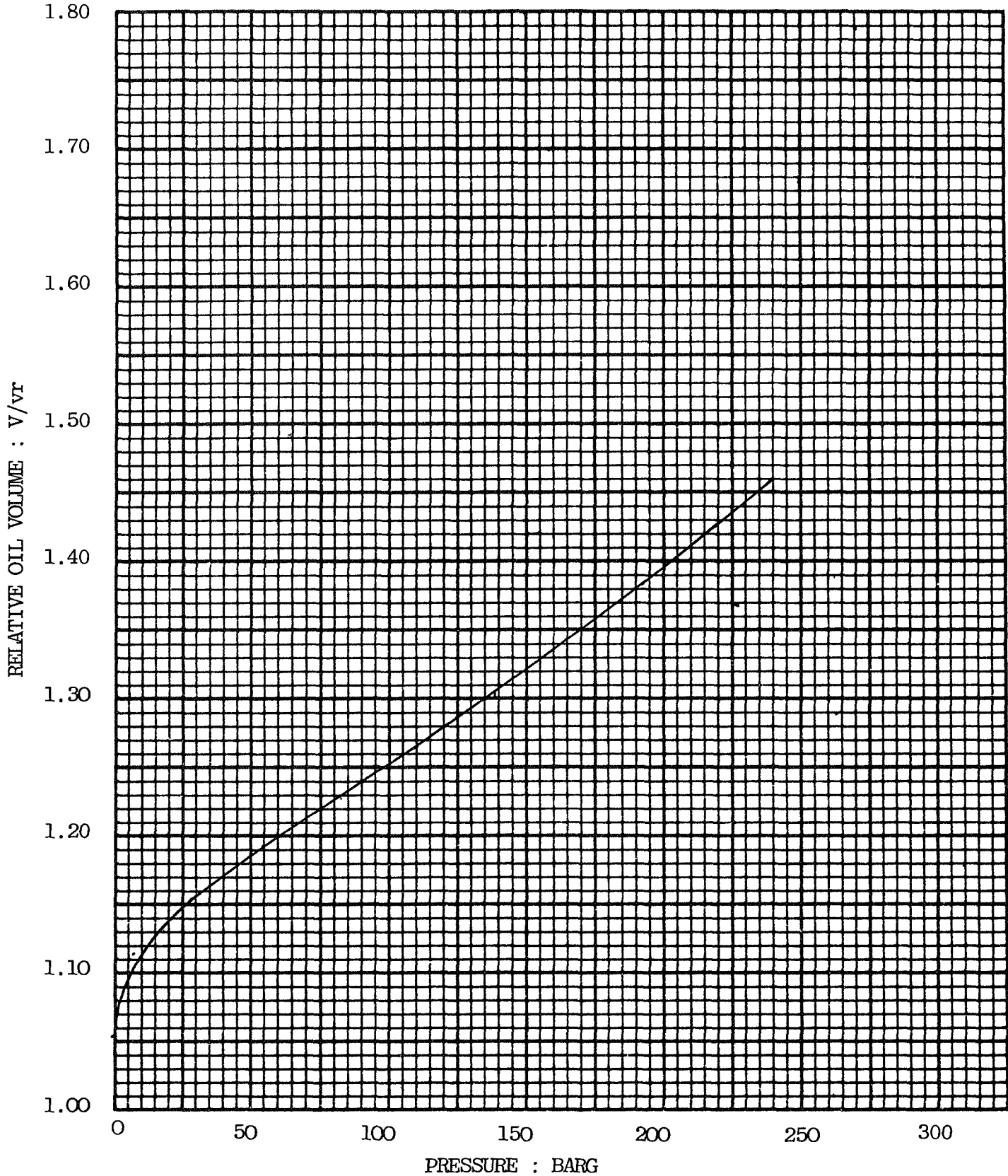
Density of residual oil = 0.8393 Kg/Litre at 15°C.

- 1) Cubic Metres of gas at 1.013 Bar and 15°C per cubic metre of residual oil at 15°C.
- 2) Cubic Metres of oil at indicated pressure and temperature per cubic metre of residual oil at 15°C.
- 3) Cubic Metres of oil plus liberated gas at indicated pressure and temperature per cubic metre of residual oil at 15°C.
- 4) Cubic Metres of gas at indicated pressure and temperature per cubic metre at 1.013 Bar and 15°C.

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Differential Vaporization of Reservoir Fluid at 77.8°C

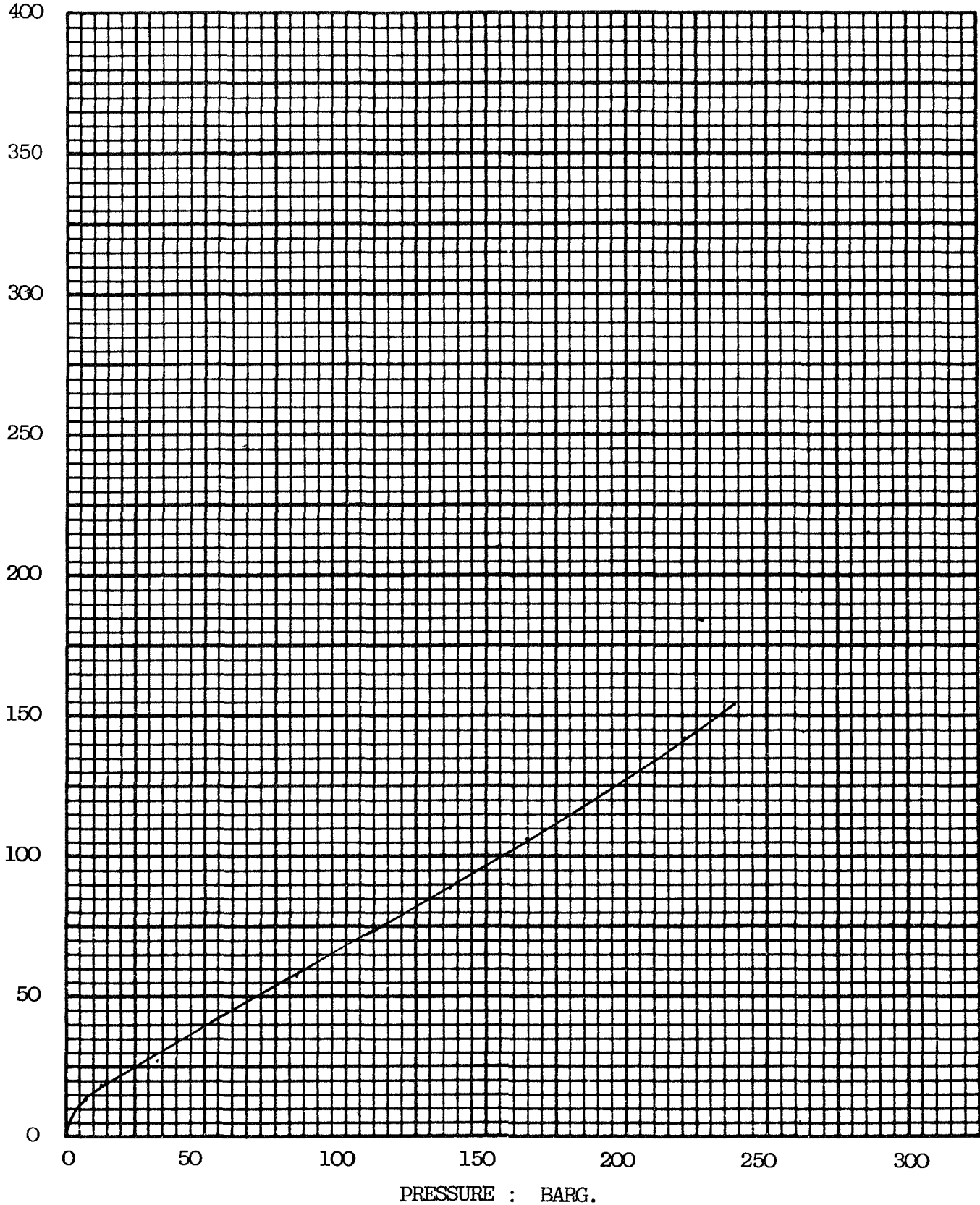
Company STATOIL Formation _____
Well 34/10-7 County NORTH SEA
Field _____ State NORWAY



Differential Vaporization of Reservoir Fluid at 77.8°C.

Company STATOIL Formation _____
Well 34/10-7 County NORTH SEA
Field _____ State NORWAY

GAS IN SOLUTION : CUBIC METRES PER CUBIC METRE OF RESIDUAL OIL



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ABERDEEN, SCOTLAND

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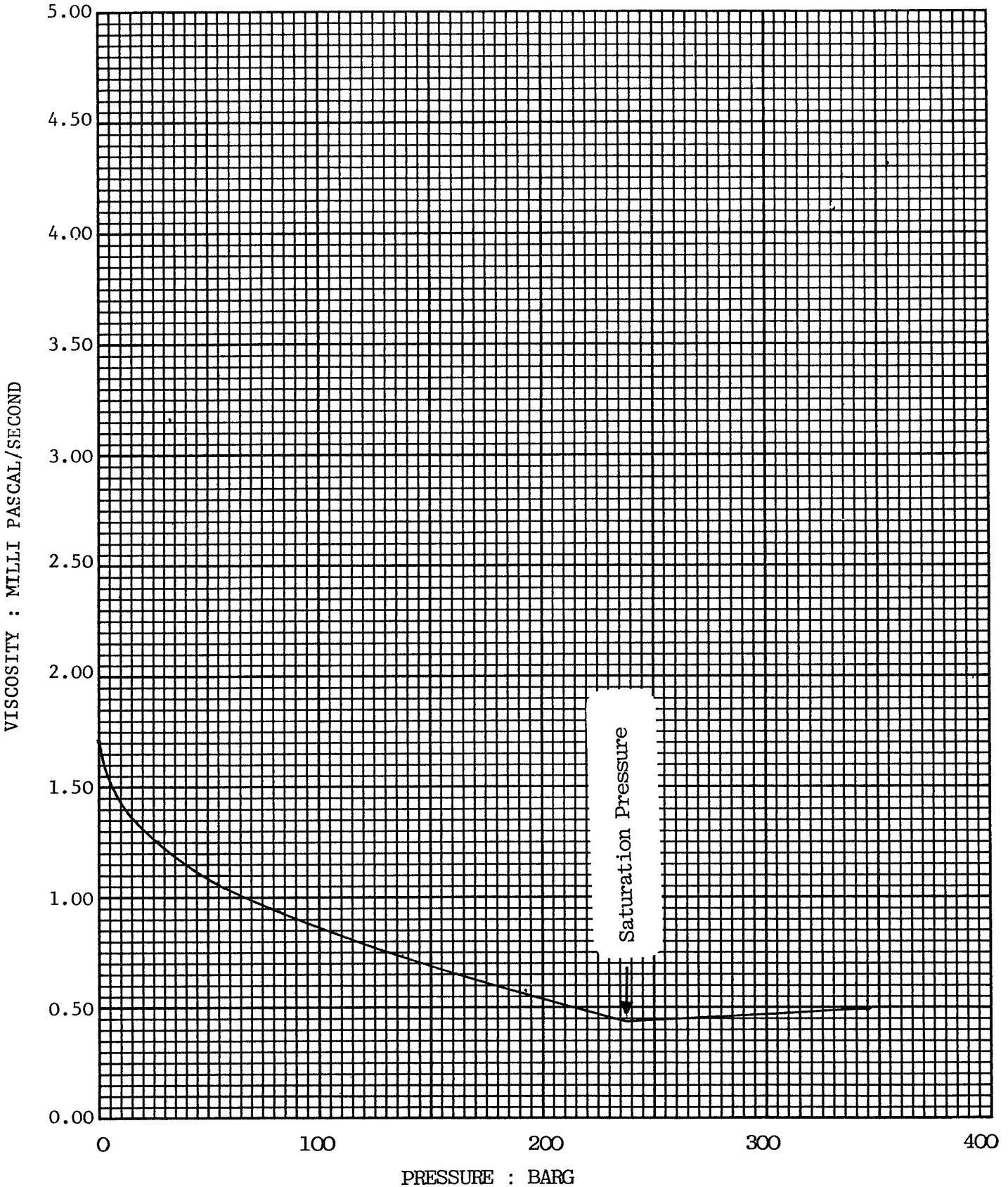
Viscosity Data at 77.8 °C.

<u>Pressure</u> BarG	<u>Oil Viscosity</u> Milli Pascal-Second	<u>Calculated</u> <u>Gas Viscosity</u> Milli Pascal-Second	<u>Oil/Gas</u> <u>Viscosity</u> <u>Ratio</u>
344.7	0.496		
310.3	0.478		
275.8	0.460		
262.0	0.453		
248.2	0.446		
238.3 Saturation	0.442		
220.6 Pressure	0.490	0.0219	22.37
193.1	0.570	0.0200	28.50
165.5	0.653	0.0184	35.49
137.9	0.740	0.0169	43.79
110.3	0.833	0.0157	53.06
82.7	0.940	0.0150	62.67
55.2	1.070	0.0137	78.10
27.6	1.250	0.0127	98.43
13.8	1.383	0.0120	115.25
6.9	1.479	0.0112	132.05
0	1.653		

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Viscosity of Reservoir Fluid at 77.8°C.

Company STATOIL Formation _____
Well 34/10-7 County NORTH SEA
Field _____ State NORWAY



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Company STATOIL Date Sampled
 Well 34/10-7 County NORTH SEA
 Field State NORWAY

HYDROCARBON ANALYSIS OF ... Reservoir Fluid ... SAMPLE

COMPONENT	MOL PERCENT	WEIGHT PERCENT	DENSITY @ 60° F. GRAMS PER CUBIC CENTIMETER	° API @ 60° F.	MOLECULAR WEIGHT
Hydrogen Sulfide	NIL	NIL			
Carbon Dioxide	0.56	0.26			
Nitrogen	0.86	0.26			
Methane	49.00	8.35			
Ethane	5.70	1.82			
Propane	4.36	2.04			
iso-Butane	0.83	0.51			
n-Butane	2.43	1.50			
iso-Pentane	0.80	0.62			
n-Pentane	1.23	0.94			
Hexanes	1.98	1.81			
Heptanes plus	32.25	81.89	0.8472	35.3	239
	----- 100.00	----- 100.00			

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ABERDEEN, SCOTLAND

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Well ..34/10-7.....

SEPARATOR TESTS OFRESERVOIR FLUID..... SAMPLE

SEPARATOR PRESSURE Bar G	SEPARATOR TEMPERATURE °C	SEPARATOR GAS/OIL RATIO (1)	STOCK TANK GAS/OIL RATIO (1)	STOCK TANK Density @ 15°C Kg/Litre	SHRINKAGE FACTOR VR/VSAT (2)	FORMATION VOLUME FACTOR (3)	SPECIFIC GRAVITY OF FLASHED GAS
0	19.4	149.79		0.834	0.686	1.458	0.775

- (1) Separator and stock tank Gas/Oil ratio in cubic metres of gas @ 15°C. and 1.013 Bar absolute per cubic metre of stock tank oil at 15°C.
- (2) Shrinkage factor : Vr/Vsat is cubic metres of stock tank oil @ 15°C. per cubic metre of saturated oil @ 238.2 Bar Gauge and 77.8°C.
- (3) Formation Volume Factor : Vsat/Vr is cubic metres of saturated oil @ 238.2 Bar Gauge and 77.8°C. per cubic metre of stock tank oil @ 15°C.

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ABERDEEN, SCOTLAND

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Company STATOIL NORWAY Date Sampled

Well 34/10-7 County NORTH SEA

Field State NORWAY

HYDROCARBON ANALYSIS OF SEPARATOR GAS SAMPLE

Component	Mol Percent	GPM
Hydrogen Sulfide	Nil	
Carbon Dioxide	0.31	
Nitrogen	1.46	
Methane	76.77	
Ethane	9.08	
Propane	6.25	1.715
iso-Butane	1.04	0.339
n-Butane	2.71	0.852
iso-Pentane	0.63	0.230
n-Pentane	0.79	0.268
Hexanes	0.53	0.216
Heptanes plus	0.43	0.195
	100.00	3.833

Calculated Gas Gravity = 0.775 (Air = 1.000)

Calculated Gross heating value = 1322 BTU per cubic foot of dry gas at
 14.696psia and 60 Deg F.

Collected at 0 Bar G.
 and 19.5 Deg. C.

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ABERDEEN, SCOTLAND

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Company ..STATOIL NORWAY..... Date Sampled

Well34/10-7..... County NORTH SEA

Field State NORWAY

HYDROCARBON ANALYSIS OFSTOCK TANK..... SAMPLE

COMPONENT	MOL PERCENT	WEIGHT PERCENT	DENSITY @ 60° F. GRAMS PER CUBIC CENTIMETER	° API @ 60° F.	MOLECULAR WEIGHT
Hydrogen Sulfide	Nil	Nil			
Carbon Dioxide	0.01	0.001			
Nitrogen	Nil	Nil			
Methane	Nil	Nil			
Ethane	0.01	0.001			
Propane	0.70	0.139			
iso-Butane	0.34	0.090			
n-Butane	1.77	0.462			
iso-Pentane	1.06	0.341			
n-Pentane	1.95	0.633			
Hexanes	4.43	1.705			
Heptanes Plus.	<u>89.73</u>	<u>96.628</u>	0.8484	35.2	240
	100.00	100.00			

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Petroleum Reservoir Engineering
ABERDEEN, SCOTLAND

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Company STATOIL NORWAY Date Sampled _____
 Well 34/10-7 County NORTH SEA
 Field _____ State NORWAY

HYDROCARBON ANALYSIS OF CALCULATED WELLSTREAM

Component	Mol Percent
Hydrogen Sulfide	Nil
Carbon Dioxide	0.20
Nitrogen	0.92
Methane	48.48
Ethane	5.23
Propane	4.20
iso-Butane	0.78
n-Butane	2.36
iso-Pentane	0.79
n-Pentane	1.22
Hexanes	1.97
Heptanes plus	33.35
	100.00

Properties of Heptanes Plus fraction.

Density @ 15°C. 0.8472 Kg/Litre.
 Molecular weight. 239

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ABERDEEN, SCOTLAND

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FileRELA.800&L.....

Well34/10-7.....

SEPARATOR TESTS OF RESERVOIR FLUID..... SAMPLE

SEPARATOR PRESSURE Bar A	SEPARATOR TEMPERATURE °C.	GAS/OIL RATIO (1)	GAS/OIL RATIO (2)	STOCK TANK Density @ 15°C Kg/Litre	FORMATION VOLUME FACTOR (3)	SEPARATOR VOLUME FACTOR (4)	SPECIFIC GRAVITY OF FLASHED GAS
68.9	41.2	76.4	91.8	515		1.202	0.635 *
TO							
22.4	85.6	31.5	36.5	205		1.159	0.786 *
TO							
1.7	77.9	22.6	23.9	134		1.056	1.449 *
TO							
1.013	15.0	0.4	0.4	2	0.8393	1.454	1.000 +

* Gas collected and analysed for hydrocarbon composition.

+ Insufficient gas for analysis.

(1) Gas/Oil ratio in cubic metres of gas @ 15°C. and 1.013 Bar absolute per cubic metre of oil @ indicated pressure and temperature.

(2) Gas/Oil ratio in cubic metres of gas @ 15°C. and 1.013 Bar absolute per cubic metre of stock tank oil @ 15°C.

(3) Formation volume factor is cubic metres of saturated oil @ 238.2 Bar Gauge and 77.8°C. per barrel of stock tank oil @ 60°F.

(4) Separator volume factor is cubic metres of oil @ indicated pressure and temperature per cubic metres of stock tank oil @ 15°C.

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ABERDEEN, SCOTLAND

File RFLA 80081

Well 34/10-7

ANALYSIS OF SEPARATOR GASES
FROM SEPARATOR TESTS

Separator Pressure, PSIG :	<u>68.9</u>		<u>22.4</u>		<u>1.7</u>
Separator Temperature, °F.	<u>41.2</u>		<u>85.6</u>		<u>77.9</u>
<u>Component :</u>	<u>MOL PERCENT</u>	<u>GPM</u>	<u>MOL PERCENT</u>	<u>GPM</u>	<u>MOL PERCENT</u> <u>GPM</u>
Hydrogen Sulphide	Nil		Nil		Nil
Carbon Dioxide	0.27		1.23		0.62
Nitrogen	2.16		0.82		0.08
Methane	88.60		74.41		30.93
Ethane	5.54		11.82		17.15
Propane	2.16	0.593	6.55	1.798	20.01 5.492
iso-Butane	0.25	0.082	0.88	0.287	3.99 1.302
n-Butane	0.56	0.176	2.10	0.660	11.16 3.509
iso-Pentane	0.11	0.040	0.42	0.153	2.84 1.037
n-Pentane	0.14	0.051	0.53	0.192	3.78 1.366
Hexanes	0.09	0.037	0.46	0.187	3.27 1.331
Heptanes Plus.	0.12	0.054	0.78	0.353	6.17 2.794
	<u>100.00</u>	<u>1.033</u>	<u>100.00</u>	<u>3.630</u>	<u>100.00</u> <u>16.831</u>
Calculated gas gravity :	<u>0.635</u>		<u>0.786</u>		<u>1.449</u>
Calculated gross heating value, BTU per SCF :	<u>1095</u>		<u>1326</u>		<u>2381</u>

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PETROLÉUM RÉSERVOIR ENGINEERING
ABERDEEN, SCOTLAND

STATOIL - NORWAY
RFLA: 80081

Core Laboratories U.K. Limited
Reservoir Fluid Analysis

A handwritten signature in black ink that reads "John D. Owen". The signature is written in a cursive style with a prominent horizontal line at the top.

John D. Owen.
Manager-RFL