

RESERVOIR FLUID STUDY  
FOR  
STATOIL

WELL 34/10-2  
DST NO. 5  
RECOMBINED SAMPLE

050 - P5.17.04

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RESERVOIR FLUID STUDY 34/10-2

Gentlemen,

This report presents the results of a reservoir fluid study performed on a sample collected from 34/10-2 production test No. 5.

Sample bottles marked Gas: A-7202, Oil:14068-70 taken towards the end of the test were selected. A recombination GOR of 18552 SCF/separator bbl's was estimated from Otis' production data.

The oil sample was flashed to stock tank condition and products analysed. Table 4. The composition of the separator gas-sample was analysed and this result was mathematically recombined with separator product analysis to yield wellstream composition, table 3. The recombined sample yielded a dew point of 396 BAR at 116,1°C. Subsequent max. liquid drop out was measured to be 5.3% of DP. vol.

Subsequent constant volume depletion experiment yielded max. liquid drop out of 4.5% and composition of produced wellstream as reported in table 6.

Fig. 1 gives a graphical presentation of the produced wellstream composition. In general the accuracy of composition data given are approx. 1% for  $C_1$  and decreases to about 7% for components having reported values of less than about 1 mol%.

No special problems arose during the experiment. The constant volume depletion overall molebalance came to 97%.

More detailed compositional analysis are available but not reported. This can be reported upon request.

Statoil Production Laboratory,  
Per Thomassen

A handwritten signature in black ink, appearing to read 'Per Thomassen', written in a cursive style.

Group leader PVT/chemistry

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Table 1. Reservoir and Sample Data

Well and formation Data

Producing zone	<u>Brent</u>
PERF interval	<u>3018 - 3028 m</u>
Initial static pressure	<u>6437 at 3012 m</u>
Reservoir temperature	<u>116.1°C, 241°F</u>
Last static pressure	<u>6430 at 3012 m</u>
Date	<u>5/8/79</u>
Well head pressure and temp.	<u>3880 psi, 155°F</u>
Flowing bottom hole pressure	<u>6286 psig</u>
Tubing size	<u>3½"</u>

Sample Data

Date sampled	<u>5/8/79</u>
Type of sample(s)	<u>Separator</u>
Separator pressure	<u>640 psig</u>
Separator temperature	<u>81°F</u>
Average flow rates during sampling	
First stage separator gas	<u>26 MMSCF/day</u>
Other separator gases	<u>-</u>
Separator oil	<u>1400 B/D (sep. bbl.)</u>
Water	<u>-</u>

Remarks

Samples used for the recombination were marked

Gas: A-7202  
Oil: 14068-70

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Table 2. Hydrocarbon Analysis of Separator Products and calculated Wellstream Composition (Test Separator).

Component	Separator Liquid mole %	Separator gas Mole %	Wellstream Mole %
Carbondioxide	0.68	1.61	1.57
Nitrogen	0.01	0.04	0.04
Methane	11.78	89.84	86.45
Ethane	4.24	5.14	5.10
Propane	5.17	2.12	2.25
iso-Butane	1.46	0.27	0.32
n-Butane	4.25	0.52	0.68
iso-Pentane	2.30	0.13	0.22
n-Pentane	3.36	0.14	0.28
Hexanes	5.57	0.09	0.42
Heptanes plus	61.17	0.10	2.67
	100.00	100.00	100.00

Properties of Heptane plus

Density at 15°C : 0,792 g/cc

Molecular weight: 151

Calculated separator gas gravity (air = 1.0000): 0.6408

Primary separator conditions: 640 psia, 81°F

Recombination ratio:

Primary separator gas/primary separator liquid: 18552 SCF/BBL at  
sep. cond.

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Table 3: Hydrocarbon Analysis of Separator Products from flash of Separator Oil

Component	Separator liquid Wt %	Separator liquid mole %	Separator gas mole %	Recombined Separator fluid mole %
Carbondioxide	-	-	2.81	0.68
Nitrogen	-	-	0.02	0.01
Methane	-	-	48.48	11.78
Ethane	0.08	0.39	16.24	4.24
Propane	0.50	1.68	16.06	5.17
iso-Butane	0.36	0.92	3.16	1.46
n-Butane	1.31	3.34	7.12	4.25
iso-Pentane	1.19	2.44	1.88	2.30
n-Pentane	1.85	3.79	2.02	3.36
Hexanes	4.06	6.97	1.18	5.57
Heptanes plus	90.64	80.47	1.04	61.17
	100.00	100.00	100.00	100.00

Properties of Heptanes plus.

Density at 15°C : 0.8075 g/cc

Molecular weight: 167

Properties of Stock Tank Liquid and result from Single Flash:

Density at 15°C : 0.7851 g/cc

Mean mol. weight : 148

GOR of sep. oil : 40.2 m<sup>3</sup>/m<sup>3</sup> (standard m<sup>3</sup> at 15°C/m<sup>3</sup>) (226 SCF/BBL)

Shrinkage of sep. oil: 1.140 m<sup>3</sup>/m<sup>3</sup>\*

\* m<sup>3</sup> of oil at separator conditions/m<sup>3</sup> of oil at stock tank conditions.

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Table 4. Constant Composition Expansion at 116.1°C.

Pressure (Bar)	Relative vol. (v/v sat)	Liquid dropout (% of Dp.vol)	Z-Factor
464	0.9169		1.172
448	0.9342		1.153
431	0.9531		1.133
416	0.9736		1.115
396 Dew pt.	1.0000	0	1.091
376	1.0053	0.14	
356	1.0326	0.53	
328	1.1273	1.8	
305	1.1925	2.4	
284	1.2568	2.9	
257	1.3523	3.6	
221	1.5406	4.3	
188	1.7780	4.8	
158	2.1165	5.1	
127	2.5950	5.3	
98	3.3392	5.3	
79	4.0934	5.3	
63		5.1	

Gas Formation volume factor at dew pt. pressure:  $265,5 \text{ m}^3/\text{m}^3$  (1.491)  
MSCF/BBL(res. fluid)

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Table 5. Retrograde liquid drop out during constant volume depletion at 116.1°C.

<u>Pressure</u> <u>(Bar)</u>	<u>Liquid volume</u> <u>% Hydrocarbon pore space</u>
396 Dew point	0
341 First depletion level	1.4
283	2.8
226	3.9
165	4.5
106	4.5
65	4.3
0	3.4



Table 6. Constant Volume Depletion Study at 116.1°C.

Hydrocarbon Analysis of Produced Wellstreams (mole percent).

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Component	Reservoir Pressure (Bar)							
	443*	396**	341	283	226	165	106	65
Carbondioxide	1.57	1.57	1.55	1.54	1.56	1.56	1.60	1.61
Nitrogen	0.04	0.04	0.19	0.21	0.23	0.24	0.67	0.31
Methane	86.45	86.45	86.35	86.70	87.37	87.48	88.52	87.57
Ethane	5.10	5.10	5.47	5.57	5.51	5.58	5.63	5.65
Propane	2.25	2.25	2.27	2.25	2.19	2.23	2.20	2.28
iso-Butane	0.32	0.32	0.32	0.31	0.31	0.32	0.31	0.33
n-Butane	0.68	0.68	0.71	0.69	0.64	0.69	0.64	0.70
iso-Pentane	0.22	0.22	0.23	0.23	0.21	0.23	0.20	0.23
n-Pentane	0.28	0.28	0.36	0.36	0.29	0.32	0.27	0.34
Hexanes	0.42	0.42	0.42	0.39	0.37	0.35	0.25	0.35
Heptanes plus	<u>2.67</u>	<u>2.67</u>	<u>2.13</u>	<u>1.75</u>	<u>1.32</u>	<u>1.00</u>	<u>0.30</u>	<u>0.64</u>
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Molecular weight of heptanes plus:	151	151	134	126	116	108	95	97
Specific gravity of " "	0.792	0.792	0.789	0.754	0.733	0.710	0.667	0.667
<u>Deviation factor - Z</u>								
Equilibrium gas	1.151	1.091	1.025	0.9685	0.9134	0.8952	0.9134	0.940
Well stream produced	0	0	9.1	10.5	14.0	16.8	17.2	12.3
Cumulative percent of initial	0	0	9.1	19.6	33.6	50.4	67.6	79.9

\* Reservoir pressure

\*\* Dew point pressure

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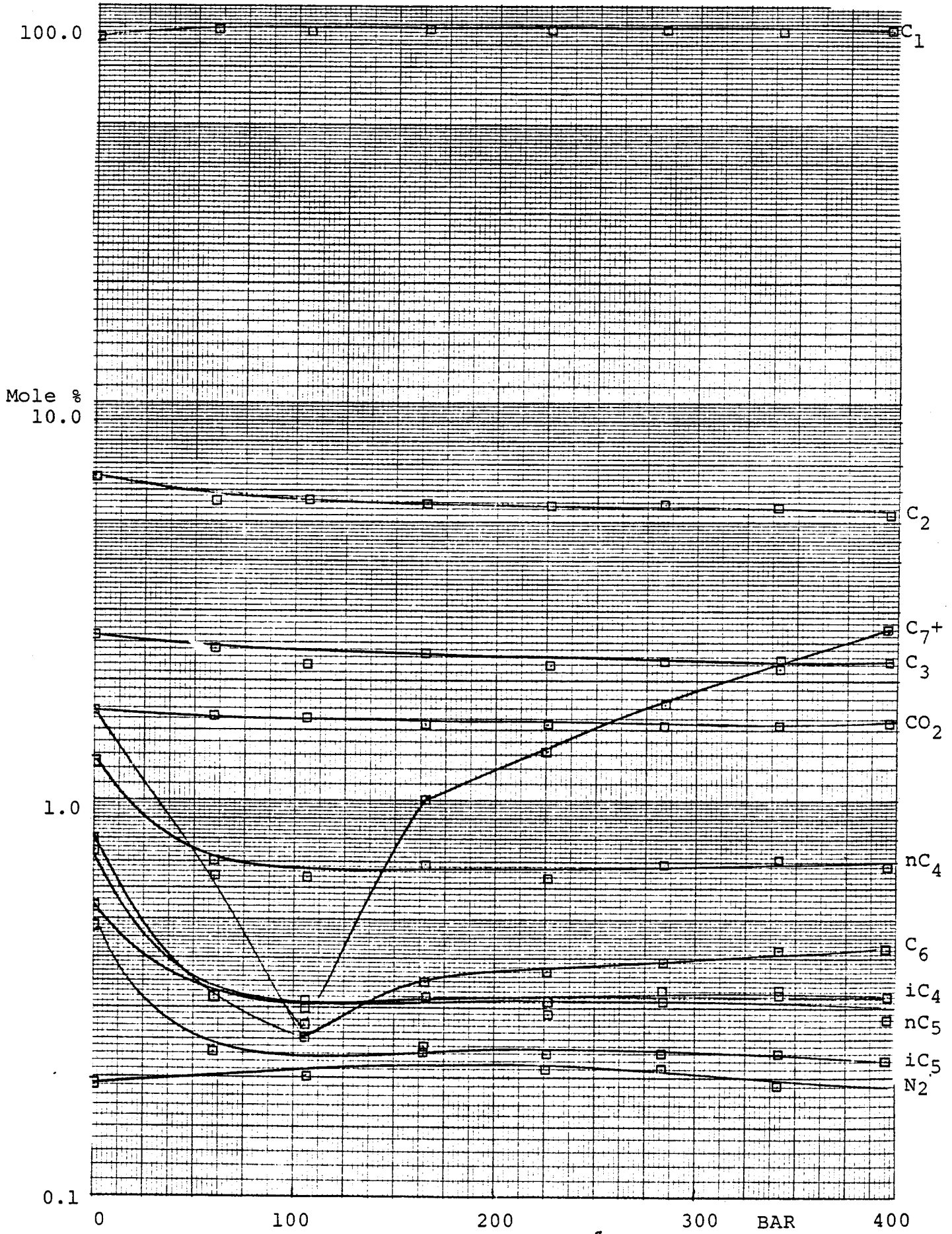
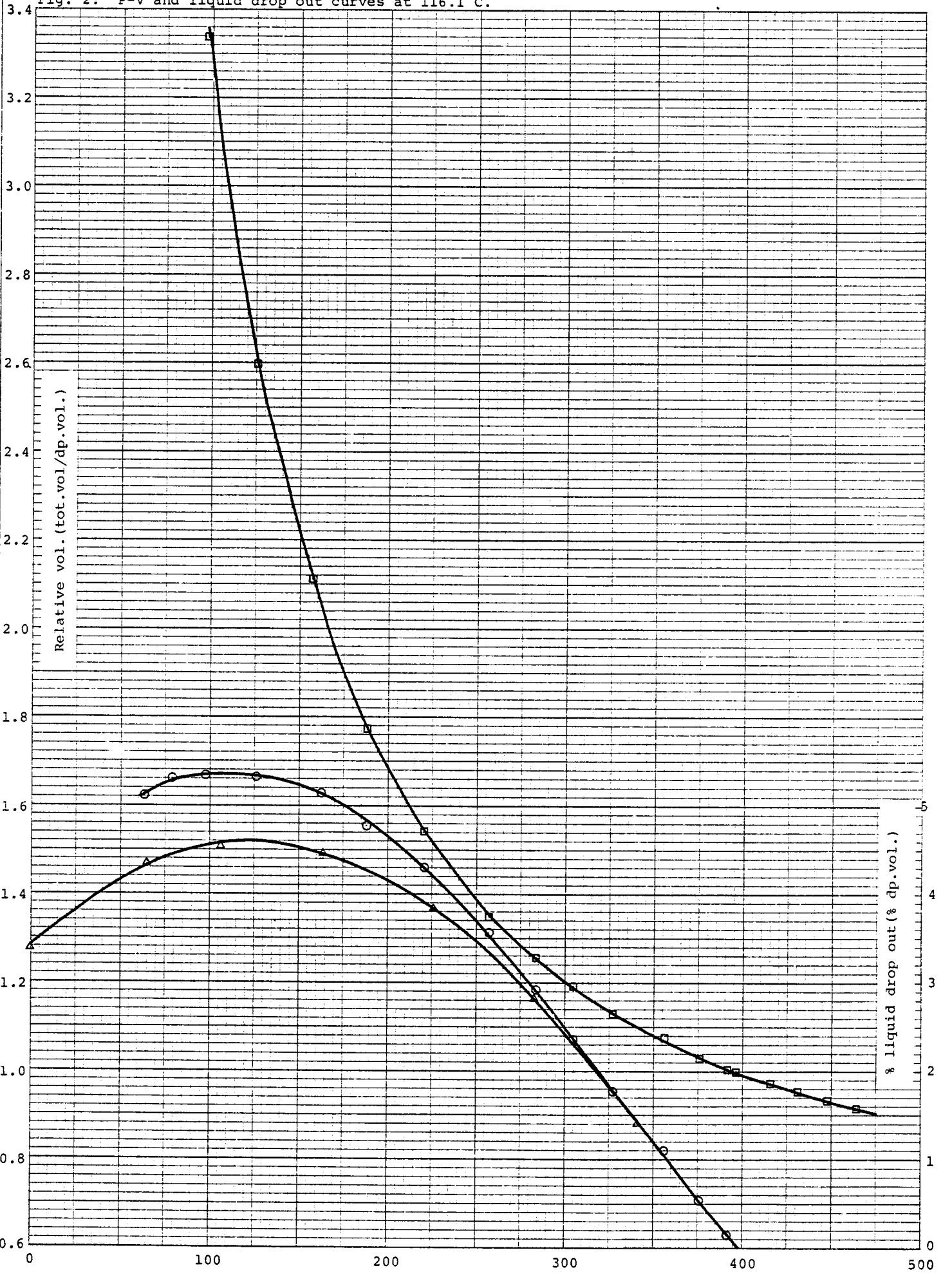


Fig. 1. Produced Well Stream Composition.

Fig. 2: P-V and liquid drop out curves at 116.1°C.



Bar (gauge)