OR-550

THYLACINE-2

CORE LABORATORIES AUSTRALIA PTY LTD

COPY 1

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Reservoir Fluid Analysis of Sub-Surface Samples from Thylacine - 2 Otway Basin, Victoria

Prepared for
Woodside Energy Limited

February 2002

File: AFL 2001-045

Reservoir Fluid Laboratory
Core Laboratories Australia Pty Ltd
Perth
Western Australia

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Core Lab
PETROLEUM SERVICES

CORE LABORATORIES AUSTRALIA PTY LTD

8 February, 2002

Woodside Energy Limited
1 Adelaide Terrace
Perth
Western Australia, 6000

Attention: Mr Werner Ribul

Subject:	**Reservoir Fluid Analysis**
Well:	**Thylacine-2**
Location:	**Otway Basin**
File:	**AFL 2001-045**

Dear Werner,

Four sub-surface MDT sample chambers, collected on the Thylacine-2 well, were shipped to our Perth laboratory for validity checks and use in a reservoir fluid analysis study. Presented in the following report are the results of these analyses.

Core Laboratories Australia Pty Ltd appreciates this opportunity to be of service to Woodside Energy Limited. Should you have any questions regarding this report, or if we may be of any further assistance, please feel free to contact me at your convenience.

Yours Faithfully,
For **CORE LABORATORIES AUSTRALIA PTY LTD**

Kevin R. Daken
Laboratory Supervisor

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Thylacine-2
AFL 2001-045

TABLE OF CONTENTS

	Page
Laboratory Procedures	a
Well Information Pages	1-2
Sample Validity Checks	3
Compositional Analyses of MDT Gas Samples	4-7
Pressure Volume Relations – SN-193	8
Pressure Volume Relations – SN-157	9

LIST OF FIGURES

	Fig.
Pressure-Volume Relations – SN-193	
Relative Volume	A-1
Y - Function	A-2
Liquid Phase Volume	A-3
Pressure-Volume Relations – SN-157	
Relative Volume	A-4
Y - Function	A-5
Liquid Phase Volume	A-6

LABORATORY PROCEDURES

Sample Receipt and Validation

Four MDT sample chambers, with reservoir gas samples, were received in our Perth laboratory for use in a compositional and PVT analysis study. As a preliminary quality check, the opening pressure of each sample was determined. The results, summarised on page 3, indicated that all samples were reasonably consistent and were used for compositional analysis.

Compositional Analysis

The hydrocarbon compositions of the reservoir fluid samples were determined by flash/separation techniques where a reservoir fluid sub-sample was flashed and separated into liquid and gas phases. Flashed gas was analysed by gas chromatography using the GPA 2286 method and the flash liquid by temperature programmed capillary chromatography. These flash compositions were mathematically recombined to the measured flash gas-liquid ratio and an original reservoir fluid composition was calculated. The resulting reservoir fluid compositions are reported on pages 4 through 7. Samples in chambers SN-157 and SN-193 were selected for PVT analysis.

Note: Processing of the flashed liquid chromatograms revealed low level contamination from the synthetic oil based drilling fluid.

Pressure Volume Relations

A known volume of the SN-193 reservoir fluid sample was charged to the large volume Sloane-type, high-pressure visual cell and thermally expanded to 114 °C. Once equilibrated in single phase, the fluid was subjected to the constant composition expansion procedure. During this procedure, a trace of liquid was observed at 3200 psig. During subsequent pressure stages, this liquid level remained very constant (indicating probable contamination from the drilling fluid) until 2200 psig where a significant increase in retrograde liquid volume indicated the dew point for the reservoir gas. The pressure volume relations and a retrograde liquid curve were then completed with the resulting volumetric data, pressure volume relation and retrograde liquid measurements presented on page 8. Graphical representations are depicted in figures A-1 through A-3.

An additional constant composition expansion procedure was performed on sample SN-157. A known volume of this reservoir fluid was charged to the Sloane-type cell and thermally expanded to 109 °C, equilibrated in single phase and subjected to the constant composition expansion procedure. Again, a trace of (contamination) liquid was observed from 3400 psig until 2800 psig where the significant increase in retrograde liquid volume indicated dew point for the reservoir gas. The pressure volume relations and a retrograde liquid curve were then completed and the resulting volumetric data, pressure volume relation and retrograde liquid measurements tabulated on page 9. Graphical representations are depicted in figures A-4 through A-6.

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AFL 2001-045

General Well Information

Company	**Woodside Energy Limited**
Well Name	**Thylacine-2**
API Well Number	**Not Aplicable**
File Number	**AFL 2001-045**
Date Sample Collected	**10-Sep-01**
Sample Type	**Bottom-Hole**
Geographical Location	**Otway Basin**
Field	**Thylacine**

Well Description

Formation	*	
Pool (or Zone)	*	
Date Completed	*	
Elevation	*	m
Producing Interval	*	m
Total Depth	*	m
Tubing Size	*	in
Tubing Depth	*	m
Casing Size	*	in
Casing Depth	*	m

Pressure Survey Data

Data from Original Discovery Well

Date	*	
Reservoir Pressure	*	psig
Gas / Oil Contact	*	m
Oil / Water Contact	*	m

Data at Sample Collection

Date	**10-Sep-01**	
Reservoir Pressure	*	psig
Reservoir Temperature	*	°C
Pressure Tool	**MDT**	
Flowing Bottom-Hole Pressure	*	psig
Gas / Oil Contact	*	m
Oil / Water Contact	*	m

* Data not forwarded to Core Laboratories.

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Thylacine-2

AFL 2001-045

Production Data

Data from Original Discovery Well

Location	*		
Date	*		
Oil Gravity @ STP	*	°API	
Separator Pressure	*	psig	
Separator Temperature	*	°F	
Production Rates			
Gas	*	Mscf/D	
Liquid	*	STbbl/D	
Gas/Liquid Ratio	*	scf/bbl	

Data at Sample Collection

Sampling Date	*		
Production Rate	*	bbl/D	
Produced G.O.R.	*	scf/bbl	
Liquid Gravity at 60.0 °F	*	°API	
Productivity Index	*	bbl/D/psi at	°F
		and	bbl/D

Sampling Information

Sample Collected at	*	m MDBRT
Status of Well	*	
Sampled By	**Schlumberger**	
Type Sampler	**MPSR**	
Cylinder Names/Numbers	**SN-157 (2144.0 m MDBRT)**	
	SN-186 (2144.0 m MDBRT)	
	SN-187 (2296.8 m MDBRT)	
	SN-193 (2296.8 m MDBRT)	

* Data not forwarded to Core Laboratories.

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Thylacine-2
AFL 2001-045

PRELIMINARY QUALITY CHECKS
of Gas Samples Received in Laboratory

Cylinder Number	Sample Number	Depth (m) MDBRT	Reservoir Condition		Shipping Condition		Lab Opening Condition		Dew Point Pressure		Approximate Sample Volume (cc)
			psia	°C	psig	°C	psig	°C	psig	°C	
SN-157(700cc)	1	2144.0	3266	100.2	-	-	3020	17.6	2800	109	235
SN-186	2	2144.0	3266	100.2	-	-	2677	17.6	-	-	265
SN-187	3	2296.8	3399	109.5	-	-	3265	17.8	-	-	250
SN-193	4	2296.8	3399	109.5	-	-	3195	17.8	2200	114	260

Note 1 : Reservoir conditions were obtained from Oilphase sample transfer data sheet.
Note 2 : Laboratory opening conditions were measured on the glycol (non-sample) end.
Note 3 : Reported dew point pressures were measured during PVT analyses.

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Thylacine-2

AFL 2001-045

COMPOSITION OF RESERVOIR FLUID SAMPLE : SN-157

(by Flash/Extended Chromatography)

Component Name	Mol %	Wt %	Density (gm/cc)	MW
Hydrogen Sulfide	0.00	0.00	0.8006	34.08
Carbon Dioxide	8.22	16.99	0.8172	44.01
Nitrogen	1.39	1.83	0.8086	28.013
Methane	80.60	60.75	0.2997	16.043
Ethane	5.56	7.86	0.3562	30.07
Propane	2.09	4.32	0.5070	44.097
iso-Butane	0.41	1.12	0.5629	58.123
n-Butane	0.51	1.39	0.5840	58.123
iso-Pentane	0.21	0.71	0.6244	72.15
n-Pentane	0.15	0.51	0.6311	72.15
Hexanes	0.19	0.75	0.6850	84
Heptanes	0.26	1.19	0.7220	96
Octanes	0.22	1.11	0.7450	107
Nonanes	0.06	0.36	0.7640	121
Decanes	0.03	0.18	0.7780	134
Undecanes	0.02	0.14	0.7890	147
Dodecanes *plus*	0.08	0.79	0.8311	205
Totals	100.00	100.00		

Total Sample Properties

Molecular Weight	21.28
Theoretical Liquid Density, gm/scc	0.3721

CGR from Flash : 2.36 bbls/MMscf

Plus Fractions	Mol %	Wt %	Density	MW
Heptanes *plus*	0.67	3.77	0.7586	118
Dodecanes plus	0.08	0.79	0.8311	205

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Thylacine-2

AFL 2001-045

COMPOSITION OF RESERVOIR FLUID SAMPLE : SN-186

(by Flash/Extended Chromatography)

Component Name	Mol %	Wt %	Density (gm/cc)	MW
Hydrogen Sulfide	0.00	0.00	0.8006	34.08
Carbon Dioxide	8.21	16.95	0.8172	44.01
Nitrogen	1.38	1.81	0.8086	28.013
Methane	80.47	60.59	0.2997	16.043
Ethane	5.63	7.95	0.3562	30.07
Propane	2.17	4.48	0.5070	44.097
iso-Butane	0.42	1.14	0.5629	58.123
n-Butane	0.51	1.39	0.5840	58.123
iso-Pentane	0.21	0.71	0.6244	72.15
n-Pentane	0.15	0.51	0.6311	72.15
Hexanes	0.19	0.75	0.6850	84
Heptanes	0.25	1.15	0.7220	96
Octanes	0.21	1.06	0.7450	107
Nonanes	0.06	0.36	0.7640	121
Decanes	0.04	0.24	0.7780	134
Undecanes	0.02	0.14	0.7890	147
Dodecanes plus	0.08	0.77	0.8351	212
Totals	100.00	100.00		

Total Sample Properties

Molecular Weight	21.31
Theoretical Liquid Density, gm/scc	0.3723

CGR from Flash : 2.35 bbls/MMscf

Plus Fractions	Mol %	Wt %	Density	MW
Heptanes plus	0.66	3.72	0.7608	120
Dodecanes plus	0.08	0.77	0.8351	212

COMPOSITION OF RESERVOIR FLUID SAMPLE : SN-187

(by Flash/Extended Chromatography)

Component Name	Mol %	Wt %	Density (gm/cc)	MW
Hydrogen Sulfide	0.00	0.00	0.8006	34.08
Carbon Dioxide	8.54	18.42	0.8172	44.01
Nitrogen	1.29	1.77	0.8086	28.013
Methane	84.24	66.27	0.2997	16.043
Ethane	3.58	5.29	0.3562	30.07
Propane	1.01	2.18	0.5070	44.097
iso-Butane	0.17	0.48	0.5629	58.123
n-Butane	0.26	0.74	0.5840	58.123
iso-Pentane	0.10	0.35	0.6244	72.15
n-Pentane	0.07	0.25	0.6311	72.15
Hexanes	0.10	0.41	0.6850	84
Heptanes	0.19	0.91	0.7220	96
Octanes	0.21	1.10	0.7450	107
Nonanes	0.08	0.49	0.7640	121
Decanes	0.04	0.23	0.7780	134
Undecanes	0.03	0.19	0.7890	147
Dodecanes plus	0.09	0.92	0.8332	209
Totals	100.00	100.00		

Total Sample Properties

Molecular Weight	20.40
Theoretical Liquid Density, gm/scc	0.3655

CGR from Flash : 2.38 bbls/MMscf

Plus Fractions	Mol %	Wt %	Density	MW
Heptanes plus	0.64	3.84	0.7656	123
Dodecanes plus	0.09	0.92	0.8332	209

Woodside Energy Limited

Thylacine-2

AFL 2001-045

COMPOSITION OF RESERVOIR FLUID SAMPLE : SN-193

(by Flash/Extended Chromatography)

Component Name	Mol %	Wt %	Density (gm/cc)	MW
Hydrogen Sulfide	0.00	0.00	0.8006	34.08
Carbon Dioxide	8.80	18.89	0.8172	44.01
Nitrogen	1.25	1.71	0.8086	28.013
Methane	83.90	65.62	0.2997	16.043
Ethane	3.64	5.35	0.3562	30.07
Propane	1.07	2.30	0.5070	44.097
iso-Butane	0.18	0.51	0.5629	58.123
n-Butane	0.26	0.74	0.5840	58.123
iso-Pentane	0.10	0.35	0.6244	72.15
n-Pentane	0.07	0.25	0.6311	72.15
Hexanes	0.11	0.45	0.6850	84
Heptanes	0.19	0.90	0.7220	96
Octanes	0.21	1.09	0.7450	107
Nonanes	0.08	0.49	0.7640	121
Decanes	0.03	0.23	0.7780	134
Undecanes	0.02	0.18	0.7890	147
Dodecanes plus	0.09	0.94	0.8346	211
Totals	100.00	100.00		

Total Sample Properties

Molecular Weight	20.48
Theoretical Liquid Density, gm/scc	0.3667

CGR from Flash : 2.36 bbls/MMscf

Plus Fractions	Mol %	Wt %	Density	MW
Heptanes plus	0.62	3.83	0.7654	123
Dodecanes plus	0.09	0.94	0.8346	211

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Thylacine-2

AFL 2001-045

PRESSURE-VOLUME RELATIONS (Sample #4-MPSR-193)

(at 114 °C)

Pressure psig	Relative Volume (A)	Liquid Volume Percent (B)	Deviation Factor Z	Instantaneous Compressibility v/v/psi (C)
6000	0.4316		1.052	111.95 E -6
5500	0.4573		1.022	120.98 E -6
5000	0.4877		0.991	137.98 E -6
4500	0.5258		0.962	164.15 E -6
4000	0.5757		0.936	200.80 E -6
3600	0.6284		0.920	238.58 E -6
3384	0.6633		0.913	262.41 E -6
3200	0.6976		0.909	284.75 E -6
2800	0.7902		0.901	340.50 E -6
2600	0.8486		0.899	372.68 E -6
2400	0.9175		0.898	408.78 E -6
2300	0.9567		0.897	429.33 E -6
d»2200	1.0000	0.00	0.897	
2100	1.0475	0.00		
2000	1.1001	0.01		
1900	1.1586	0.01		
1800	1.2240	0.02		
1600	1.3802	0.02		
1408	1.5733	0.02		
1234	1.8011	0.02		
1074	2.0760	0.02		
895	2.4997	0.02		
763	2.9381	0.02		
589	3.8100	0.01		

(A) Relative Volume: V/Vsat or volume at indicated pressure per volume at saturation pressure.

(B) Percent of the total volume of gas and liquid at the indicated pressure and 114 °C.

(C) Where: Instantaneous Compressibility = -dV / dP

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Thylacine-2

AFL 2001-045

PRESSURE-VOLUME RELATIONS (Sample #1-MPSR-157)

(at 109 °C)

Pressure psig	Relative Volume (A)	Liquid Volume Percent (B)	Deviation Factor Z	Instantaneous Compressibility v/v/psi (C)
6000	0.5578		1.047	99.99 E -6
5500	0.5878		1.011	111.29 E -6
5000	0.6242		0.977	130.45 E -6
4500	0.6707		0.945	158.40 E -6
4000	0.7326		0.918	196.10 E -6
3600	0.7982		0.900	233.92 E -6
3400	0.8382		0.893	255.64 E -6
3251	0.8718		0.888	273.20 E -6
3000	0.9375		0.882	306.22 E -6
2900	0.9674		0.880	321.57 E -6
d»2800	1.0000	0.00	0.878	
2700	1.0354	0.01		
2600	1.0739	0.02		
2500	1.1157	0.03		
2400	1.1615	0.04		
2200	1.2667	0.05		
2000	1.3947	0.05		
1600	1.7530	0.06		
1200	2.3607	0.05		
950	3.0050	0.04		
795	3.6082	0.04		
677	4.2509	0.03		
593	4.8619	0.03		
522	5.5285	0.02		

(A) Relative Volume: V/Vsat or volume at indicated pressure per volume at saturation pressure.

(B) Percent of the total volume of gas and liquid at the indicated pressure and 109 °C.

(C) Where: Instantaneous Compressibility = -dV / dP

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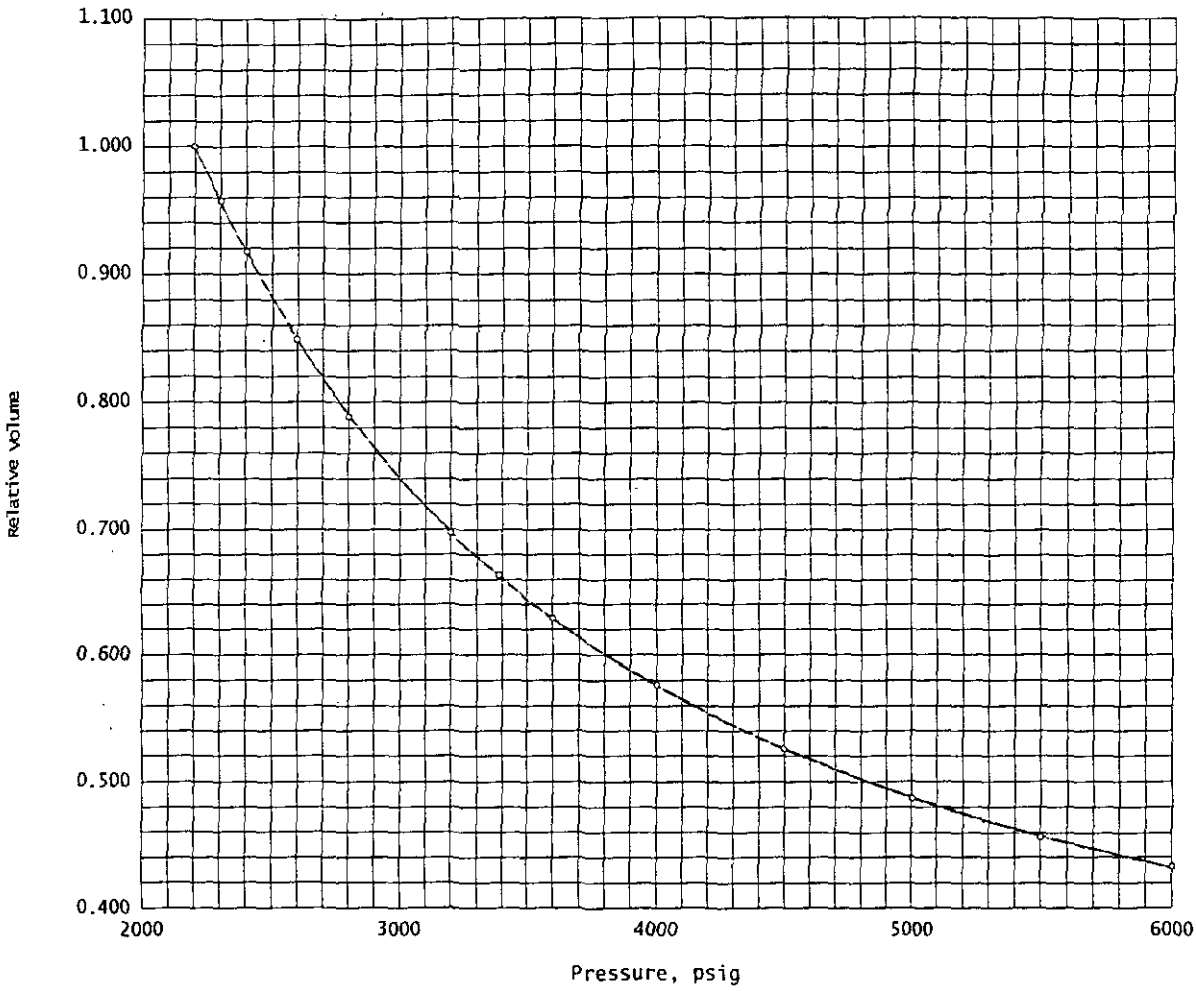
AFL 2001-045

RELATIVE VOLUME (MPSR-193)

(at 114 °C)



Relative Volume Expression:				LEGEND
y= a + b (Xd)^i + c (Xd)^j + d (log(Xd))^k				
where:				o Laboratory Data
a=	-4.46569e+ 00	i=	0.500	Confidence Limits
b=	5.69123e+ 00	j=	1.500	Analytical Expression
c=	-2.25537e- 01	k=	0.998	
d=	-7.98311e+ 00			Saturation Pressure: 2200 psig
Note: Xd (dimensionless 'X') = Pi / Psat, psig				
Confidence level:			99 %	Pressure-Volume Relations
Confidence interval:			+/- 0.00064	Figure A-1
'r squared':			.999985	

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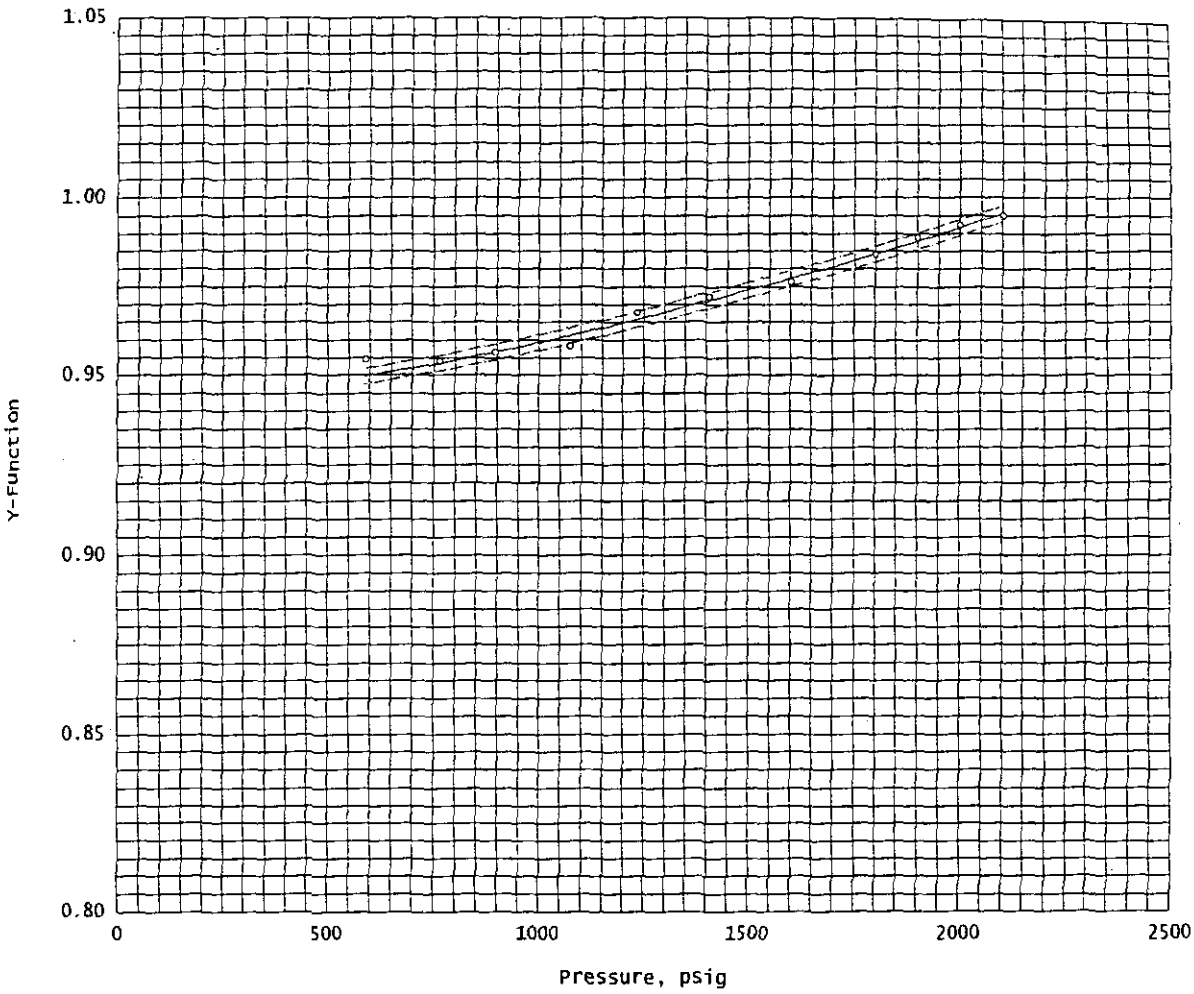
Y-FUNCTION (MPSR-193)

(at 114 °C)



Y-Function Expression:	LEGEND
y= a + b (Xd)^i	
where: a= 9.41935e- 01 i= 1.521 b= 5.73156e- 02 Note: Xd (dimensionless 'X') = Pi / Psat, psig	o Laboratory Data ------ Confidence Limits _____ Analytical Expression Saturation Pressure: 2200 psig
Confidence level: 99 % Confidence interval: +/- 0 'r squared': .984302	**Pressure-Volume Relations** **Figure A-2**

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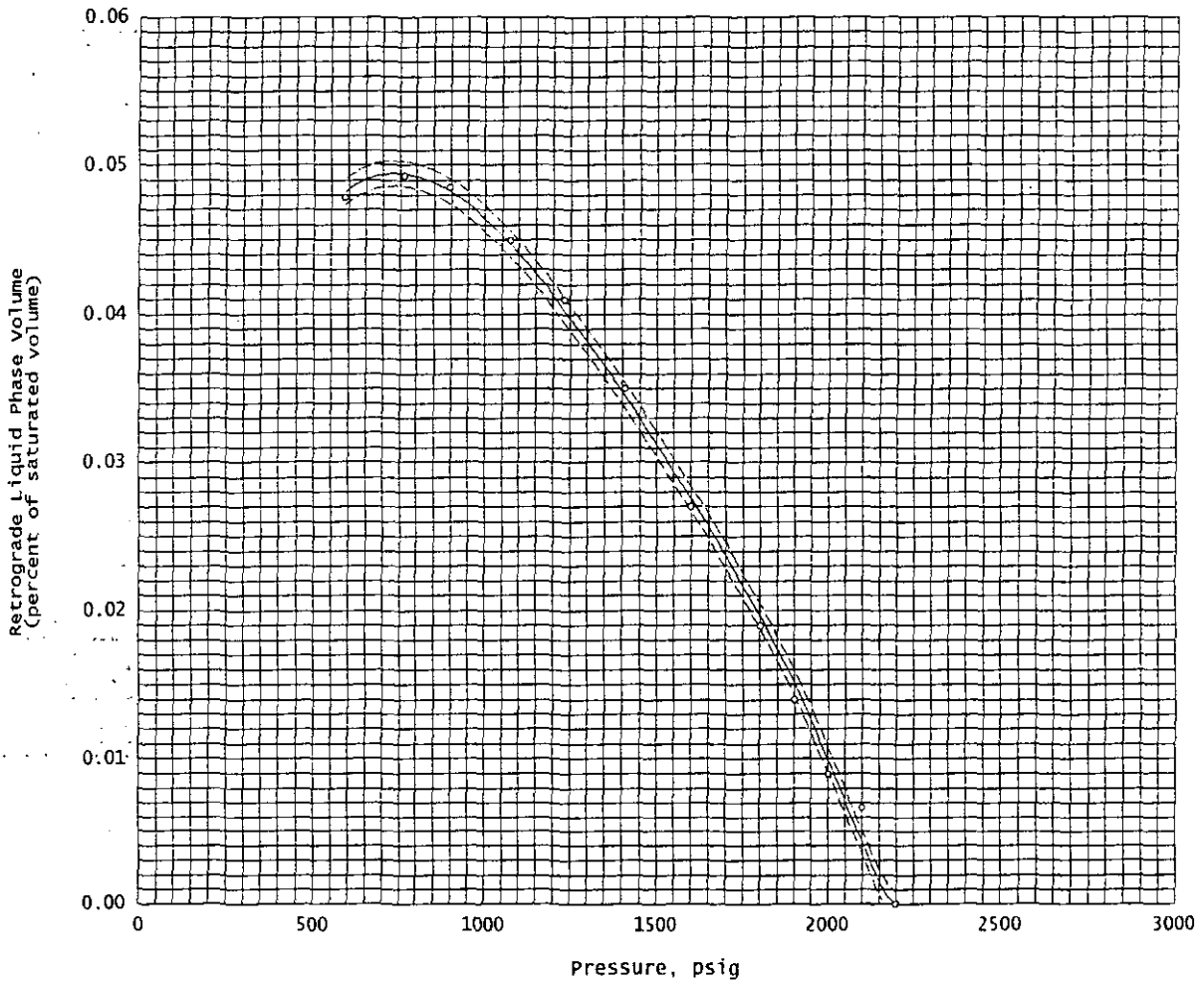
LIQUID PHASE VOLUME (MPSR-193)

(at 114 °C)



Retrograde Liquid Curve Expression:	LEGEND
sqrt y= a + b (Xd)^i + c (Xd)^j + d (10^Xd)^k	
where: a= -4.07842e- 02 i= 0.800 b= -1.89514e+ 00 j= 0.600 c= 2.02988e+ 00 k= 7.000 d= -8.78110e- 09 Note: Xd (dimensionless 'X') = Pi / Psat, psig	o Laboratory Data ------ Confidence Limits ——— Analytical Expression Saturation Pressure: 2200 psig
Confidence level: 99 % Confidence interval: +/- 0 'r squared': .99727	**Pressure-Volume Relations** **Figure A-3**

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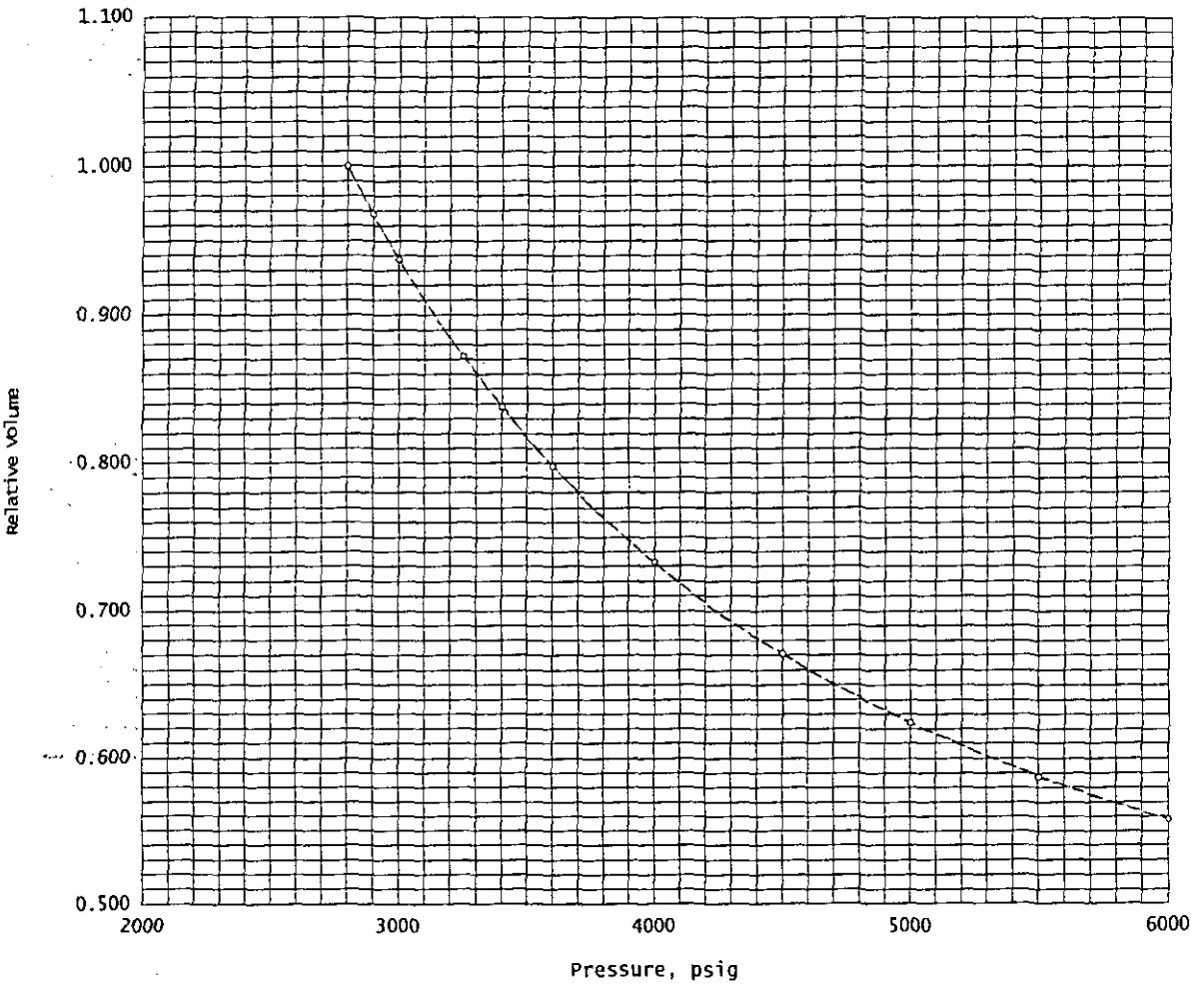
AFL 2001-045

RELATIVE VOLUME (MPSR-157)

(at 109 °C)



Relative Volume Expression:	LEGEND
y= a + b (Xd)^i + c (Xd)^j + d (log(Xd))^k	
where: a= -1.46681e+ 00 i= 0.900 b= 3.16542e+ 00 j= 1.500 c= -6.98579e- 01 k= 0.996 d= -6.22452e+ 00 Note: Xd (dimensionless 'X') = Pi / Psat, psig	o Laboratory Data Confidence Limits Analytical Expression Saturation Pressure: 2800 psig
Confidence level: 99 % Confidence interval: +/- 0.00029 'r squared': .999996	Pressure-Volume Relations **Figure A-4**

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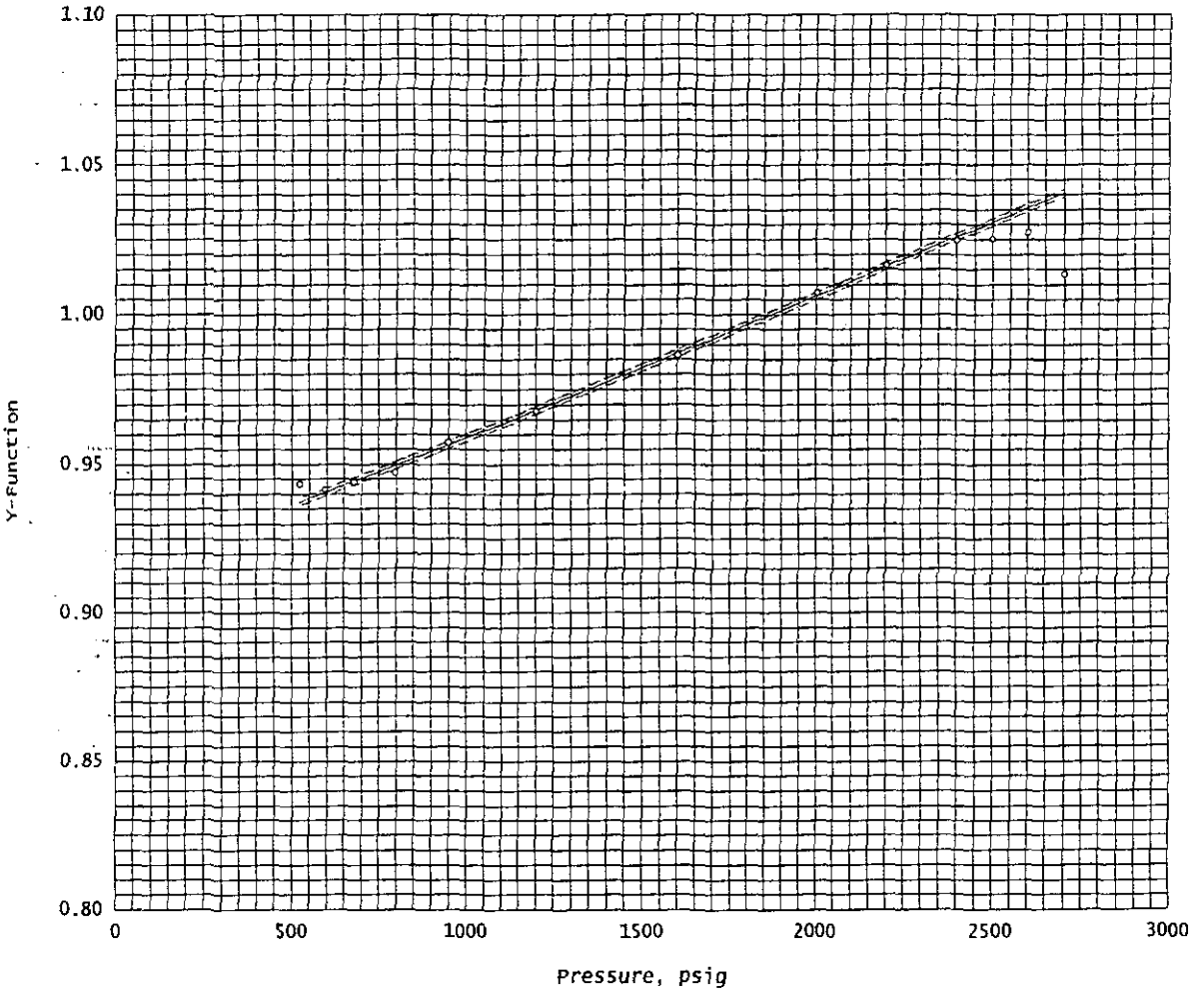
AFL 2001-045

Y-FUNCTION (MPSR-157)

(at 109 °C)



Y-Function Expression:	LEGEND
y= a + b (Xd)^i	
where: a= 9.16161e- 01 i= 1.079 b= 1.29394e- 01	o Laboratory Data ------ Confidence Limits _____ Analytical Expression
	Saturation Pressure: 2800 psig
Note: Xd (dimensionless 'X') = Pi / Psat, psig	
Confidence level: 99 % Confidence interval: +/- 0 'r squared': .998964	**Pressure-Volume Relations** **Figure A-5**

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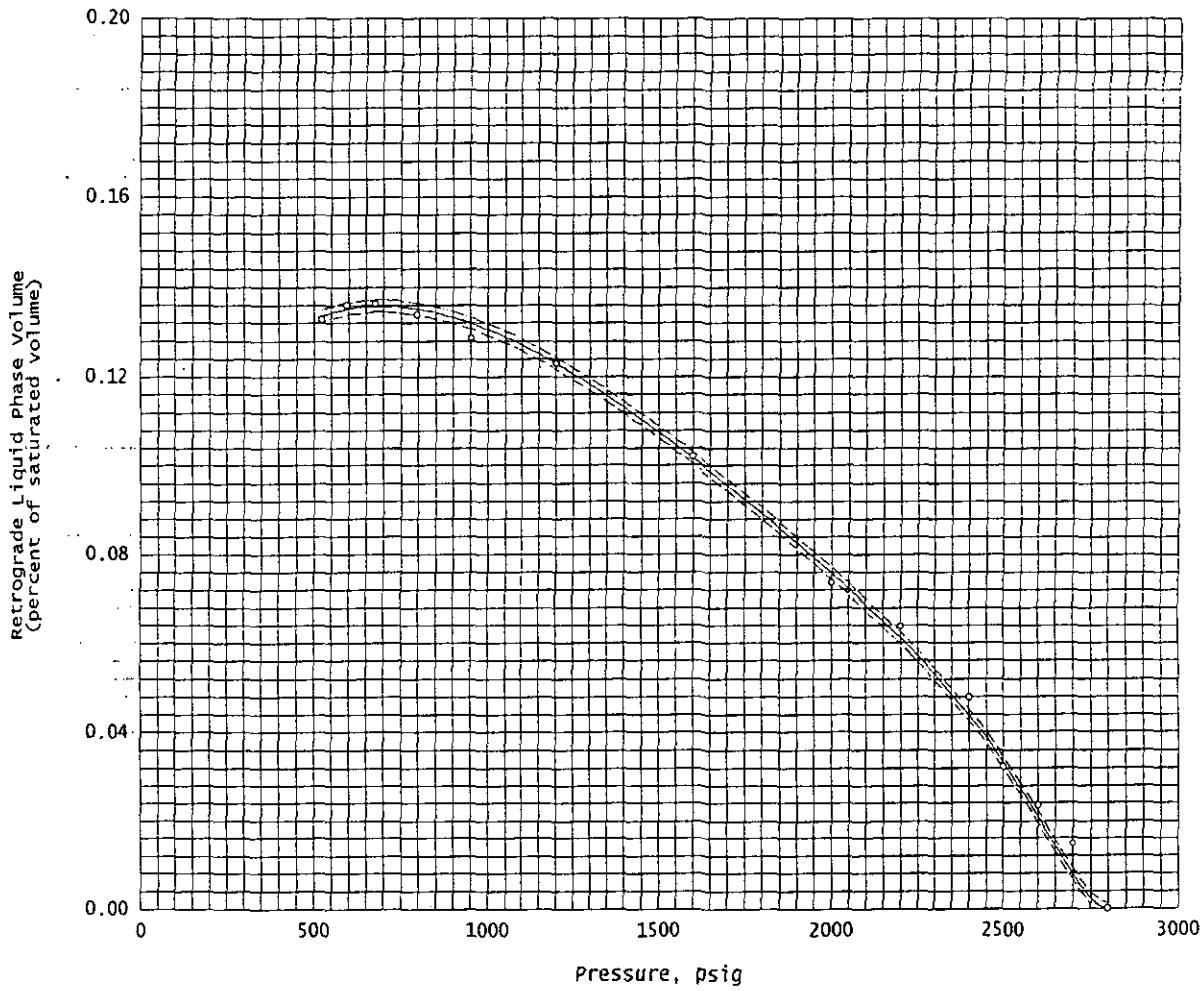
LIQUID PHASE VOLUME (MPSR-157)

(at 109 °C)



Retrograde Liquid Curve Expression:	LEGEND
sqrt y= a + b (Xd)^i + c (Xd)^j + d (10^Xd)^k	
where: a= -2.05004e- 01 i= 0.100 b= 7.06621e- 01 j= 1.500 c= -3.33527e- 01 k= 7.000 d= -1.68373e- 08 Note: Xd (dimensionless 'X') = Pi / Psat, psig	o Laboratory Data ------ Confidence Limits _____ Analytical Expression Saturation Pressure: 2800 psig
Confidence level: 99 % Confidence interval: +/- 0 'r squared': .999341	**Pressure-Volume Relations** **Figure A-6**

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