

Reservoir Fluid Study
for
OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY
Eden-1, DST No.6, M-1
Eden-Yuturi Field

RFL 97014
21-Apr-97

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**CORE LABORATORIES
VENEZUELA, S.A.**

RFLC9704.020

Maracaibo, April 21, 1997

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY
Quito-Ecuador

Attention: *Eng. Fernando Albuja*

Subject: *Reservoir Fluid Study*
Eden-1 Well, DST No.6, M-1
Eden-Yuturi Field
RFL 97014

Gentlemen:

Two samples of subsurface reservoir fluid were collected from the subject well by representatives of Halliburton and Schlumberger on January 6, 1997. These samples were forwarded to our laboratory in Maracaibo, where they were used in the performance of a reservoir fluid study. The results of this study are summarized in the following report.

*Thank you for the opportunity to serve **OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY**. If we may answer any questions for you, or be of further service in any way, please do not hesitate to call upon us.*

Respectfully yours,

CORE LABORATORIES VENEZUELA, S.A.

John Fortner
Manager
Reservoir Fluids Laboratory
JF/sr

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LABORATORY PROCEDURES

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Reservoir Fluid Study

Eden-1, DST No.6, M-1

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On January 6, 1997, subsurface samples and separator gas and liquid samples were collected by Halliburton, Schlumberger and Core Laboratories representatives, and were delivered to our Maracaibo laboratory. When the samples arrived at the lab, the bubble point pressures at room temperature were measured as a quality check. These results were reported to Occidental Exploration and Production Company; we received instructions on March 10, 1997, to perform the a PVT study on the subsurface samples. A summary of the quality checks may be found on page four (4).

The composition of the reservoir fluid sample was measured through C_{20+} by the spikeflash/chromatographic technique. In this technique, the bottom hole sample is flashed at atmospheric pressure and the resulting gas and liquid compositions are determined. The subsurface fluid composition is then calculated by mathematically recombining the flashed gas and liquid compositions. The composition of the reservoir fluid is presented on page five (5).

A portion of the reservoir fluid was charged to a high pressure, windowed cell and then heated to the reported reservoir temperature of 188 °F. During the constant composition expansion at this temperature, a bubble point was observed at 270 psig. The results of the pressure-volume relations are reported on pages six (6) through nine (9).

During the differential vaporization at the reservoir temperature, the fluid evolved a total of 43 cubic feet of gas at 14.7 psia and 60 °F per barrel of residual oil at 60 °F. The resulting relative oil volume factor was 1.077 barrels of saturated fluid per barrel of residual oil at 60 °F. The oil density and the properties of the evolved gases were measured at each point during the differential pressure depletion. The data are included in the summary of the differential vaporization analysis on pages ten (10) through fifteen (15).

A portion of sample was charged to a rolling-ball viscosimeter to measure the viscosity of the reservoir fluid over a wide range of pressures at the reservoir temperature of 188 °F. The viscosity of the fluid at reservoir temperature was found to vary from a minimum of 30.3 centipoises at the saturation pressure to 62.1 centipoises at atmospheric pressure. The results of the viscosity measurements are presented on pages sixteen (16) through eighteen (18).

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After the viscosity test was performed, a heavy residue was noted covering some parts of the equipment. This material is asphaltenic in nature, and we feel that the material could cause problems of deposition in surface facilities, production tubing and possibly even in the reservoir, causing formation damage. We would be happy to assist with a further assessment of these potential problems, should you so desire.

Small portions of the reservoir fluid were subjected to four separator tests to determine the effects of separator pressure on gas/oil ratio, stock tank oil gravity and formation volume factor. These data can be found on page nineteen (19). The separator gases from the separator tests were collected and chromatographically analyzed in the laboratory. The results of the separator gas compositions are presented on pages twenty (20) through twenty-three (23).

The separator test data were then used to adjust the differential vaporization results. The adjusted differential vaporization data are presented on pages twenty-four (24) through twenty-nine (29).

A portion of the separator liquid sample was used in the performance of a crude oil characterization. This analysis was performed following ASTM, IP and UOP methods. These results may be found on pages thirty (30) through thirty-three (33).

Equations and nomenclature are included in the appendix of the report which extend and define the analytical expressions and data relationships presented in the study.

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SUMMARY OF PVT DATA

Reported Reservoir Conditions

Average Reservoir Pressure	2795	psig
Average Reservoir Temperature	188	°F

Pressure-Volume Relations

Saturation Pressure	270	psig
Avg Single-Phase Compressibility	5.30	E-6 v/v/psi (5000 to 270 psig)
Thermal Exp @ 5000 psig	1.04723	V at 188 °F / V at 60 °F

Differential Vaporization Data

(at 270 psig and 188 °F)

Solution Gas/Oil Ratio	43	scf / bbl of residual oil at 60 °F
Relative Oil Volume	1.077	bbl / bbl of residual oil at 60 °F
Density of Reservoir Fluid	0.8840	gm/cc

Reservoir Fluid Viscosity

30.3 cp at 270 psig and 188 °F

Separator Test Results

Separator Conditions		Formation Volume Factor (A)	Total Solution Gas/Oil Ratio (B)	Tank Oil Gravity (°API at 60 °F)
psig	°F			
125	97	1.066	30	19.5
95	97	1.065	29	19.6
65	97	1.064	28	19.7
30	97	1.064	27	19.7

(A) Barrels of saturated oil per barrel of stock tank oil at 60 °F.

(B) Total standard cubic feet of gas per barrel of stock tank oil at 60 °F.

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General Well Information

Company.....	OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY
Well Name.....	Eden-1, DST No.6, M-1
API Well Number.....	*
File Number.....	RFL 97014
Date Sample Collected.....	6-Jan-97
Sample Type.....	Bottom-Hole
Geographical Location.....	*
Field.....	Estructura Eden-Yututi

Well Description

Formation.....	Napo	
Pool (or Zone).....	M-1	
Date Completed.....	6-Jan-97	
Elevation.....	699	ft
Producing Interval.....	6556-6570	ft
Total Depth.....	7894	ft
Tubing Size.....	3.1/2	in
Tubing Depth.....	*	ft
Casing Size.....	7.5/8	in
Casing Depth.....	4750	ft

Pressure Survey Data

Data from Original Discovery Well

Date	*	
Reservoir Pressure	2795	psig
Gas / Oil Contact.....	*	ft
Oil / Water Contact.....	*	ft

Data at Sample Collection

Date.....	6-Jan-97	
Reservoir Pressure.....	2795	psig
Reservoir Temperature.....	188	°F
Pressure Tool.....	*	
Flowing Bottom-Hole Pressure.....	2251	psig
Gas / Oil Contact.....	*	ft
Oil / Water Contact.....	*	ft

* Data not forwarded to Core Laboratories.

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Production Data

Data from Original discovery Well

Location.....	Bloque 15	
Date.....	*	
Oil Gravity @ STP.....	19.8	°API
Separator Pressure.....	18	psig
Separator Temperature.....	90	°F
Production Rates		
Gas.....	16	Mscf/D
Liquid.....	675	STbbl/D
Gas/Liquid Ratio.....	24	scf/bbl

Data at Sample Collection

Sampling Date.....	6-Jan-97		
Production Rate.....	675	bbl/D	
Produced G.O.R.	24	scf/bbl	
Liquid Gravity at 60.0 °F.....	19.8	°API	
Productivity Index.....	*	bbl/D/psi at	°F
		and	bbl/D

Sampling Information

Sample Collected at.....	*	ft
Status of Well.....	Flowing	
Sampled By.....	Schlumberger	
Type Sampler.....	FASC + Botella	
Cylinder Names/Numbers	12689-11	
	9214-206	

* Data not forwarded to Core Laboratories.

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PRELIMINARY QUALITY CHECKS
 and Summary of Samples Received

Cylinder Number	Sampling Date	Bottom Hole Samples					
		Sampling Conditions		Bubblepoint Conditions		Approximate Sample Volume (cc)	Water Recovered (cc)
		psig	°F	psig	°F		
12689-11	6-Jan-97	2,795	188	230	66	554	0
9214-206*	6-Jan-97	2,795	188	230	67	559	0

Cylinder Number	Sampling Date	Separator Liquid Samples*					
		Sampling Conditions		Bubblepoint Conditions		Approximate Sample Volume (cc)	Water Recovered (cc)
		psig	°F	psig	°F		
DEN 5028	6-Jan-97	18	90	55	64	154	1
060	6-Jan-97	18	90	60	64	160	0
46	6-Jan-97	18	90	64	66	152	0
CV-03-0001	6-Jan-97	18	90	62	66	155	0

* Sample selected for the Study

** Samples used on Crude Oil Characterization

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COMPOSITION OF RESERVOIR FLUID SAMPLE

(by Flash/Extended Chromatography)

Component Name	Mol %	Wt %	Liquid Density (gm/cc)	MW
Hydrogen Sulfide	0.00	0.00	0.8006	34.08
Carbon Dioxide	0.35	0.05	0.8172	44.01
Nitrogen	0.37	0.04	0.8086	28.013
Methane	4.36	0.24	0.2997	16.043
Ethane	0.88	0.09	0.3562	30.07
Propane	2.36	0.35	0.5070	44.097
iso-Butane	1.10	0.22	0.5629	58.123
n-Butane	3.33	0.66	0.5840	58.123
iso-Pentane	1.51	0.37	0.6244	72.15
n-Pentane	1.71	0.42	0.6311	72.15
Hexanes	1.82	0.52	0.6850	84
Heptanes	2.90	0.94	0.7220	96
Octanes	5.13	1.86	0.7450	107
Nonanes	5.71	2.34	0.7640	121
Decanes	5.27	2.39	0.7780	134
Undecanes	4.94	2.46	0.7890	147
Dodecanes	4.44	2.42	0.8000	161
Tridecanes	4.71	2.79	0.8110	175
Tetradecanes	4.31	2.78	0.8220	190
Pentadecanes	4.35	3.03	0.8320	206
Hexadecanes	3.79	2.85	0.8390	222
Heptadecanes	3.45	2.77	0.8470	237
Octadecanes	3.35	2.85	0.8520	251
Nonadecanes	3.28	2.93	0.8570	263
Eicosanes plus	26.58	64.63	1.0273	718
Totals	100.00	100.00		

Total Sample Properties

Molecular Weight 295.32
 Equivalent Liquid Density, gm/scc 0.9237

Plus Fractions	Mol %	Wt %	Density	MW
Heptanes plus	82.21	97.04	0.9432	349
Undecanes plus	63.20	89.51	0.9630	418
Pentadecanes plus	44.80	79.06	0.9884	521
Eicosanes plus	26.58	64.63	1.0273	718

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VOLUMETRIC DATA
(at 188 °F)

Saturation Pressure (Psat) 270 psig
Density at Psat 0.8840 gm/cc
Thermal Exp @ 5000 psig 1.04723 V at 188 °F / V at 60 °F

AVERAGE SINGLE-PHASE COMPRESSIBILITIES

Pressure Range psig			Single-Phase Compressibility v/v/psi
5000	to	3500	4.89 E -6
3500	to	2000	5.24 E -6
2000	to	1000	5.70 E -6
1000	to	270	6.22 E -6

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PRESSURE-VOLUME RELATIONS

(at 188 °F)

Pressure psig	Relative Volume (A)	Y-Function (B)	Density gm/cc
5000	0.9750		0.9067
4500	0.9773		0.9046
4000	0.9797		0.9024
3500	0.9821		0.9001
3000	0.9846		0.8978
2500	0.9872		0.8955
2000	0.9898		0.8931
1500	0.9926		0.8906
1000	0.9955		0.8880
600	0.9979		0.8859
500	0.9985		0.8853
400	0.9992		0.8848
300	0.9998		0.8842
b»270	1.0000		0.8840
265	1.0025		
260	1.0052		
255	1.0081		
250	1.0112		
240	1.0181	6.498	
220	1.0354	6.015	
190	1.0739	5.291	
160	1.1379	4.566	
155	1.1525	4.445	
130	1.2519	3.841	
110	1.3821	3.358	
90	1.5980	2.875	
80	1.7619	2.633	
70	1.9872	2.392	
50	2.7814	1.909	
40	3.5220	1.667	
35	4.0576	1.546	

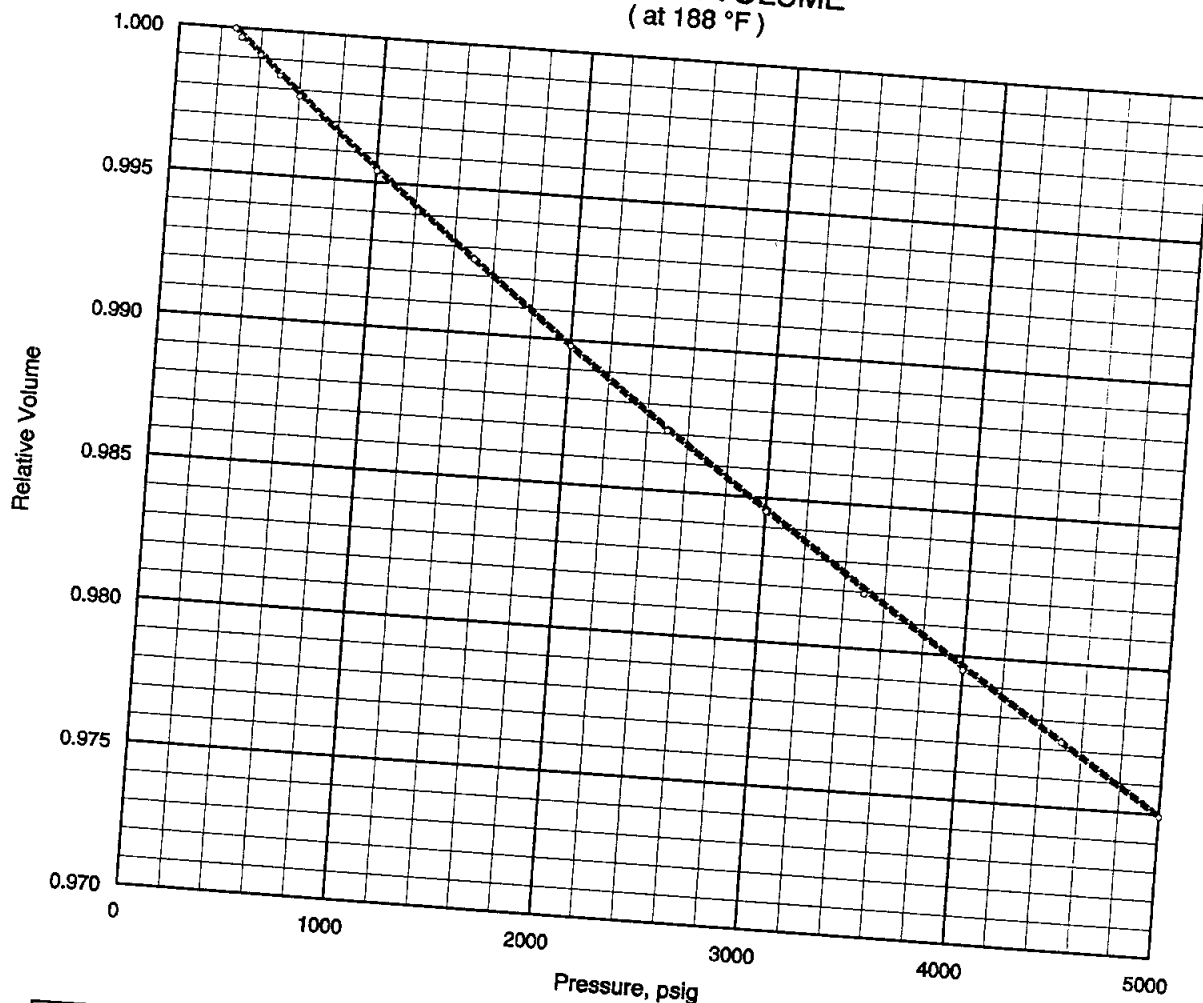
(A) Relative Volume: V/V_{sat} or volume at indicated pressure per volume at saturation pressure.

(B) Where: Y-Function =
$$\frac{(P_{sat} - P)}{(P_{abs}) * (V/V_{sat} - 1)}$$

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RELATIVE VOLUME (at 188 °F)



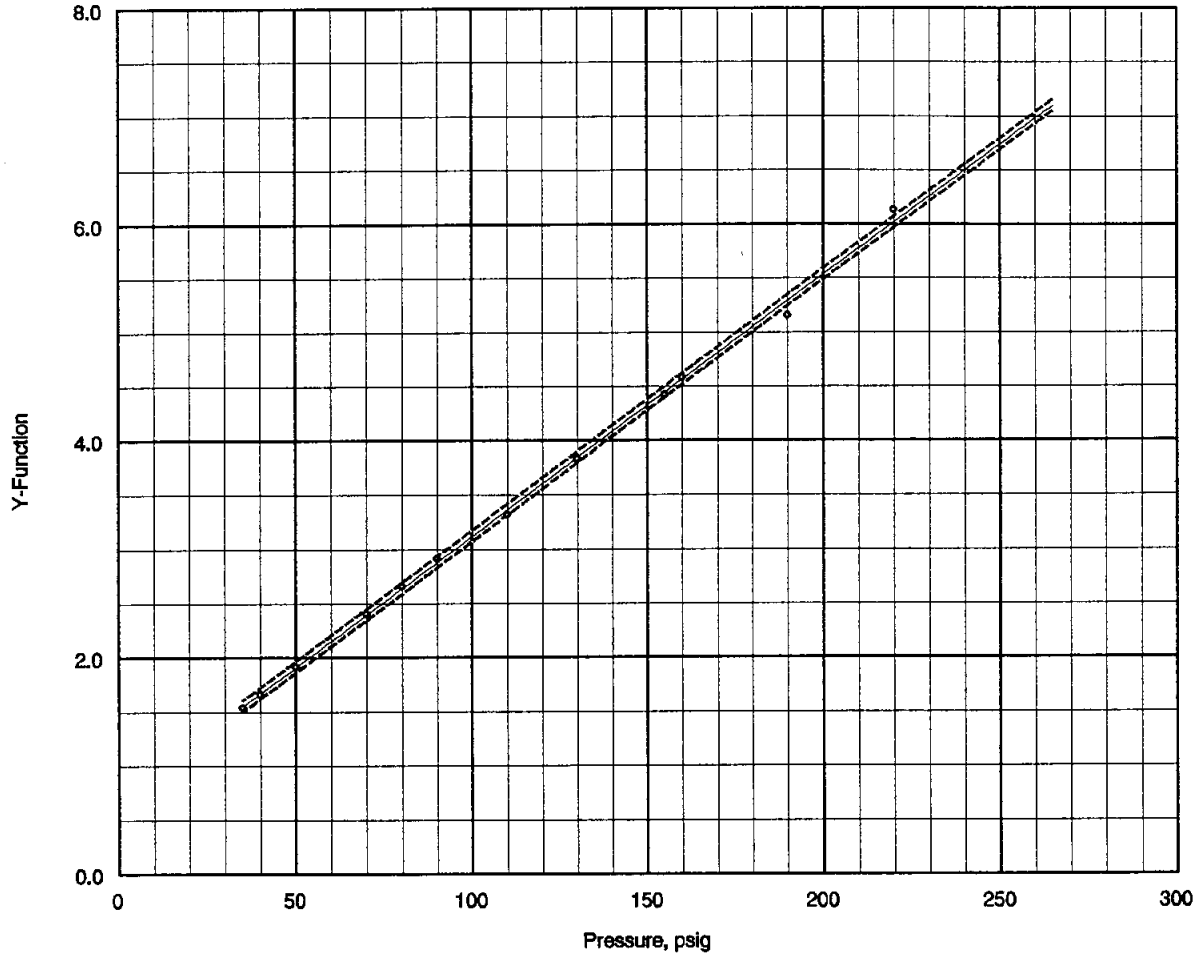
Relative Volume Expression: $y = a + b (X_d)^i + c (X_d)^j + d \log(X_d)$	LEGEND <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">○</div> Laboratory Data </div> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">-----</div> Confidence Limits </div> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">—————</div> Analytical Expression </div> <div style="margin-top: 10px;"> Saturation Pressure: 270 psig Current Reservoir Pressure: 2795 psig </div>
where: $a = 1.00174e+00$ $b = 2.58438e-03$ $c = -4.32324e-03$ $d = 5.41069e-04$ $i = 0.500$ $j = 0.750$ $k = 0.995$ Note: X_d (dimensionless 'X') = P_i / P_{sat}	
Confidence level: 99 % Confidence interval: ± 0.00008 'r squared': .999881	Pressure-Volume Relations Figure A-1

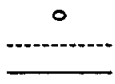
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Y-FUNCTION (at 188 °F)



Y-Function Expression: $y = a + b (X_d)^i$	LEGEND
where: $a = 7.00967e-01$ $b = 6.52212e+00$ $i = 1.000$ Note: X_d (dimensionless 'X') = P_i / P_{sat}	<div style="text-align: center;">  </div> <div style="text-align: center;"> Laboratory Data Confidence Limits Analytical Expression </div> <div style="text-align: center;"> Saturation Pressure: 270 psig Current Reservoir Pressure: 2795 psig </div>
Confidence level: 99 % Confidence interval: +/- 0.05189 'r squared': .998978	Pressure-Volume Relations Figure A-2

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DIFFERENTIAL VAPORIZATION

(at 188 °F)

Pressure psig	Solution Gas/Oil Ratio Rsd (A)	Relative Oil Volume Bod (B)	Relative Total Volume Btd (C)	Oil Density gm/cc	Deviation Factor Z	Gas Formation Volume Factor (D)	Incremental Gas Gravity (Air=1.000)
b»270	43	1.077	1.077	0.8840			
200	36	1.075	1.171	0.8848	0.976	0.08328	0.824
100	25	1.070	1.561	0.8865	0.980	0.15653	0.942
0	0	1.053		0.8915			1.886
@ 60 °F = 1.000							

Gravity of Residual Oil = 19.1 °API at 60 °F

Density of Residual Oil = 0.9386 gm/cc at 60 °F

(A) Cubic Feet of gas at 14.7 psia and 60 °F per Barrel of residual oil at 60 °F.

(B) Barrel of oil at indicated pressure and temperature per Barrel of residual oil at 60 °F.

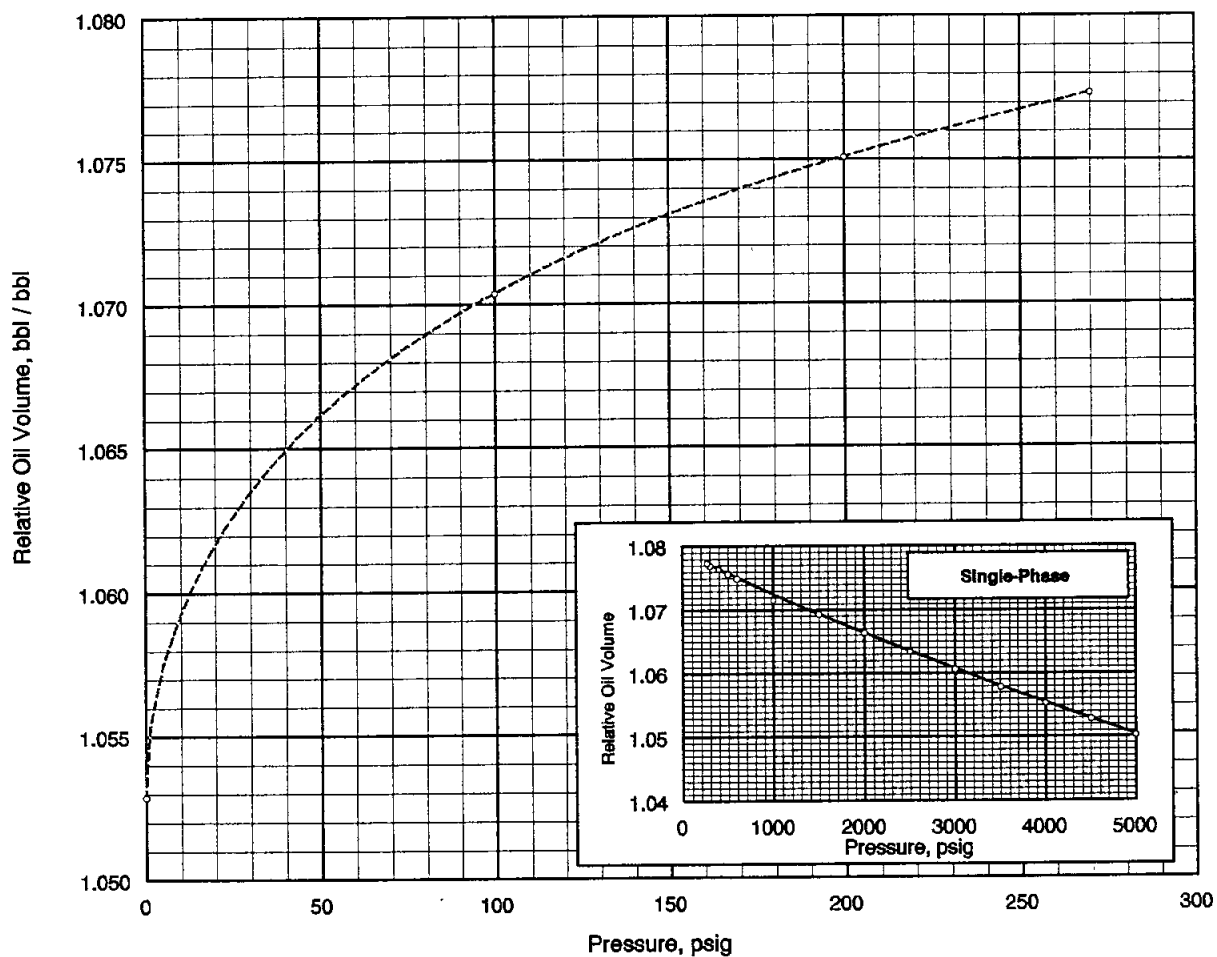
(C) Barrels of oil plus liberated gas at indicated pressure and temperature per Barrel of residual oil at 60 °F.

(D) Cubic Feet of gas at indicated pressure and temperature per Cubic Feet at 14.7 psia and 60 °F.

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RELATIVE OIL VOLUME (at 188 °F)



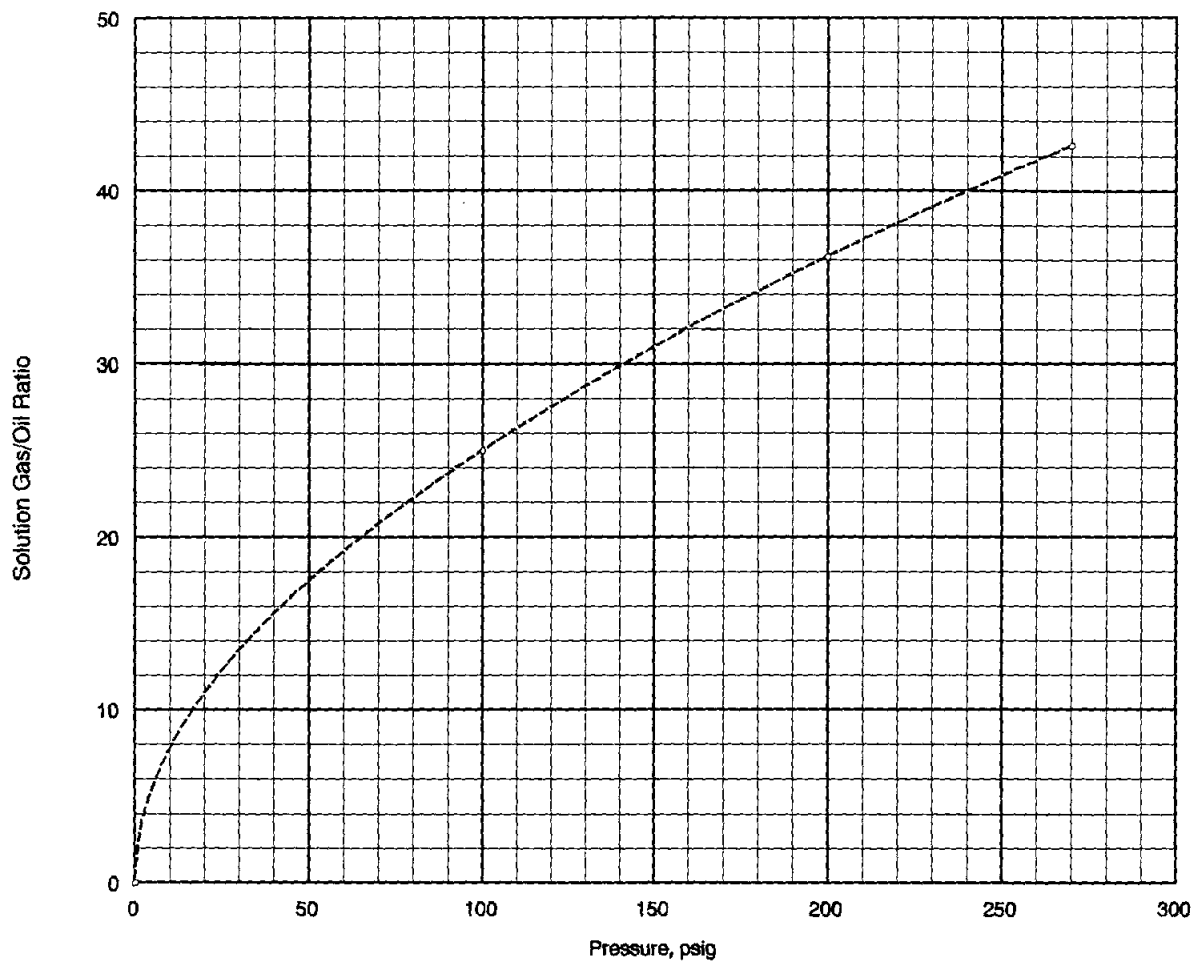
Relative Oil Volume Expression: $y = a + b (Xi)^i + c (Xi)^j + d (Xi)^k$	LEGEND
where: $a = 1.05287e+00$ $i = 0.500$ $b = 2.03940e-03$ $j = 1.500$ $c = -4.22423e-06$ $k = 2.000$ $d = 1.32668e-07$ Note: Xi (incremental 'X') = pressure, psig	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> \circ ----- _____ </div> <div> Laboratory Data Confidence Limits Analytical Expression </div> </div> <p style="text-align: center;">Saturation Pressure: 270 psig</p>
Confidence level: 99 % Confidence interval: +/- 0 'r squared': 1	Differential Vaporization Figure B-1

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SOLUTION GAS/OIL RATIO (scf/bbl at 188 °F)

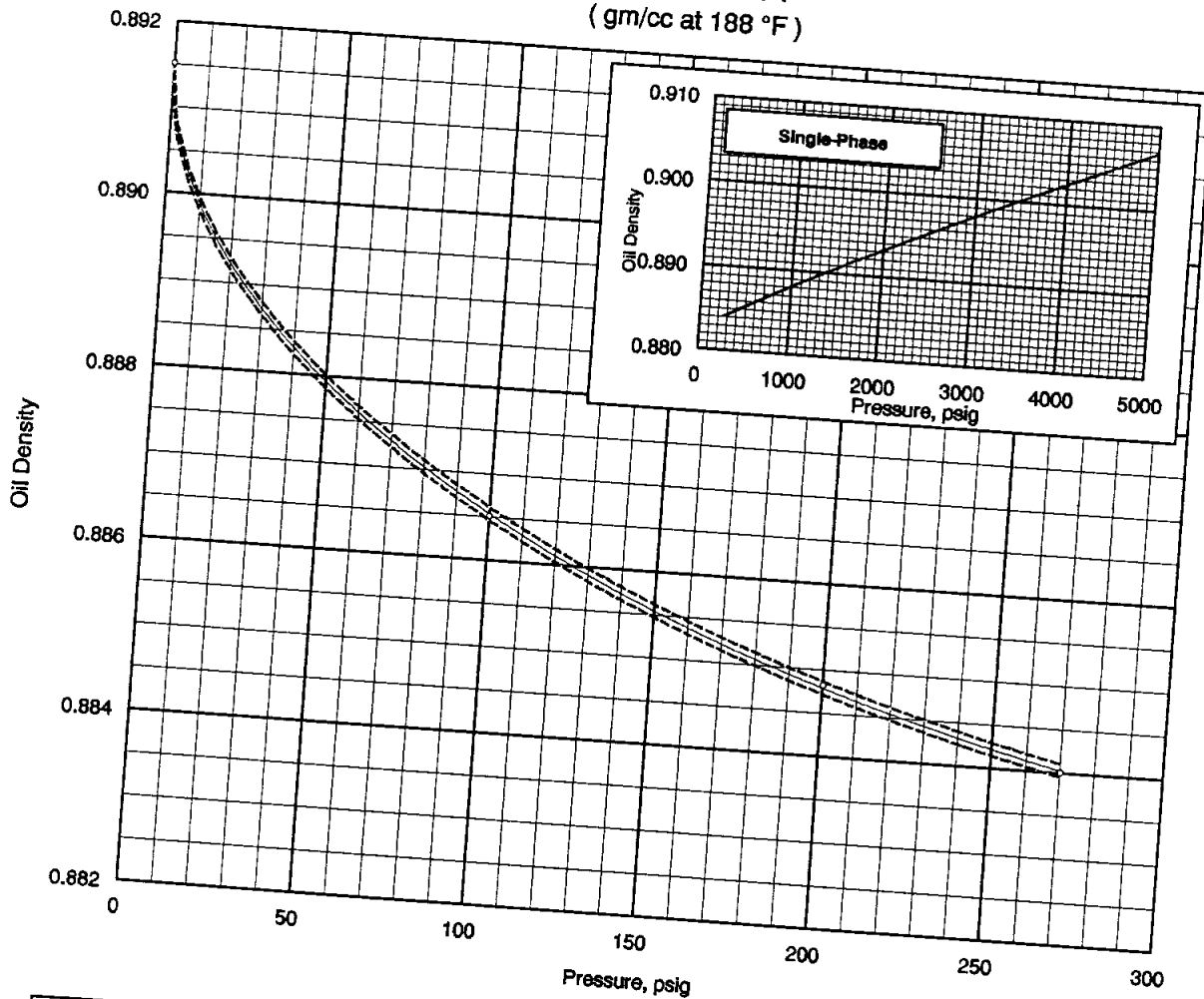


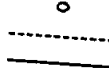
Solution Gas/Oil Ratio Expression: $y = a + b (Xi)^i + c (Xi)^j + d (Xi)^k$	LEGEND <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">○</div> Laboratory Data </div> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">-----</div> Confidence Limits </div> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">—————</div> Analytical Expression </div> <p>Saturation Pressure: 270 psig</p>
where: <div style="display: flex; justify-content: space-between;"> <div> a= 3.01932e- 14 b= 2.43009e+ 00 c= 8.33653e- 04 d= -1.40056e- 05 </div> <div> i= 0.500 j= 1.500 k= 2.000 </div> </div> <p>Note: Xi (incremental 'X') = pressure, psig</p>	
Confidence level: 99 % Confidence interval: +/- 0 scf/bbl 'r squared': 1	Differential Vaporization Figure B-2

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OIL DENSITY (gm/cc at 188 °F)



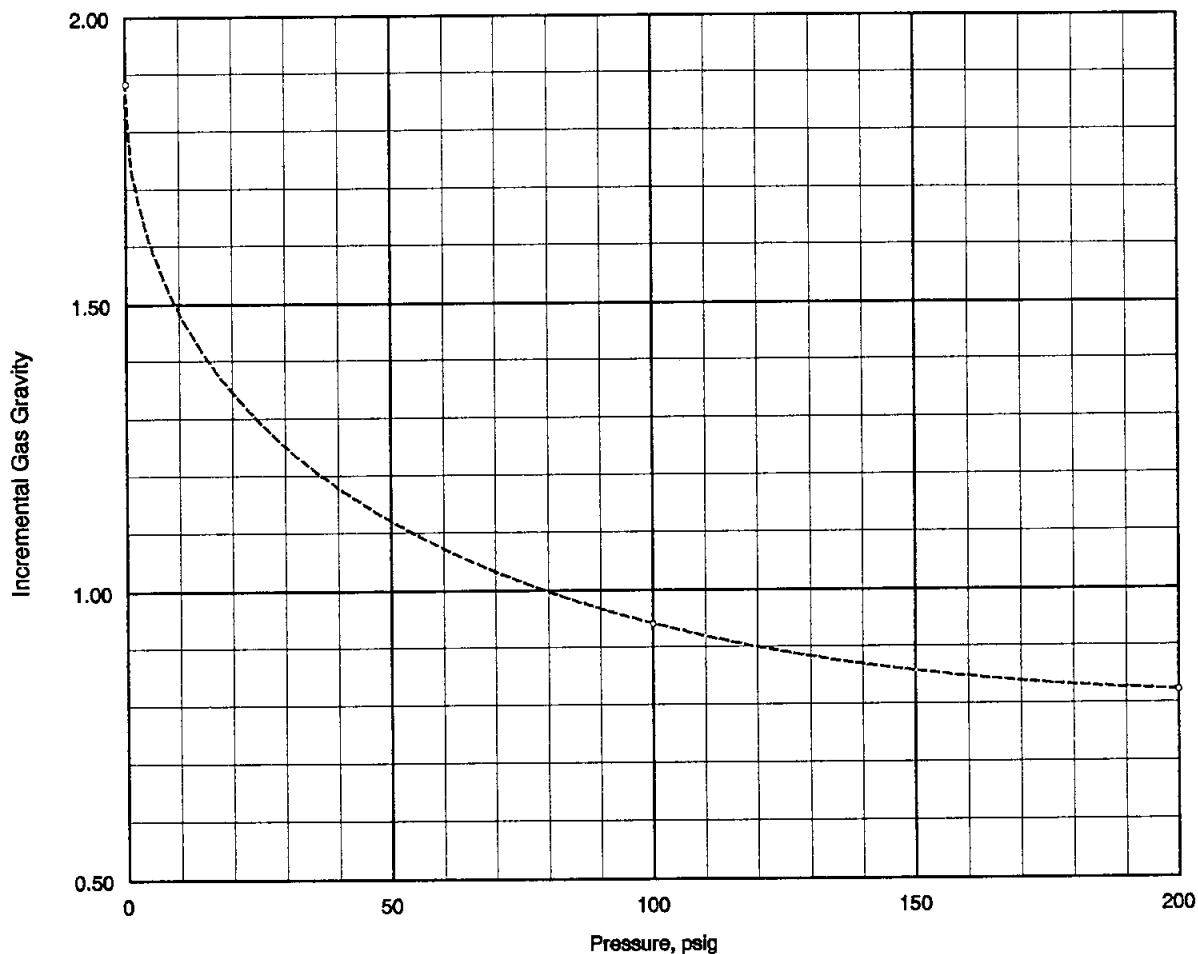
Oil Density Expression (below bubblepoint): $y = a + b (X_d)^i + c (X_d)^j$	LEGEND  Laboratory Data Confidence Limits Analytical Expression Saturation Pressure: 270 psig
where: $a = 8.91510e-01$ $b = -8.37343e-03$ $c = 8.87367e-04$ Note: X_d (dimensionless 'X') = P_i / P_{sat}	
Confidence level: 99 % Confidence interval: ± 0.00007 gm/cc 'r squared': .999943	Differential Vaporization Figure B-3

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GAS GRAVITY (at 188 °F)

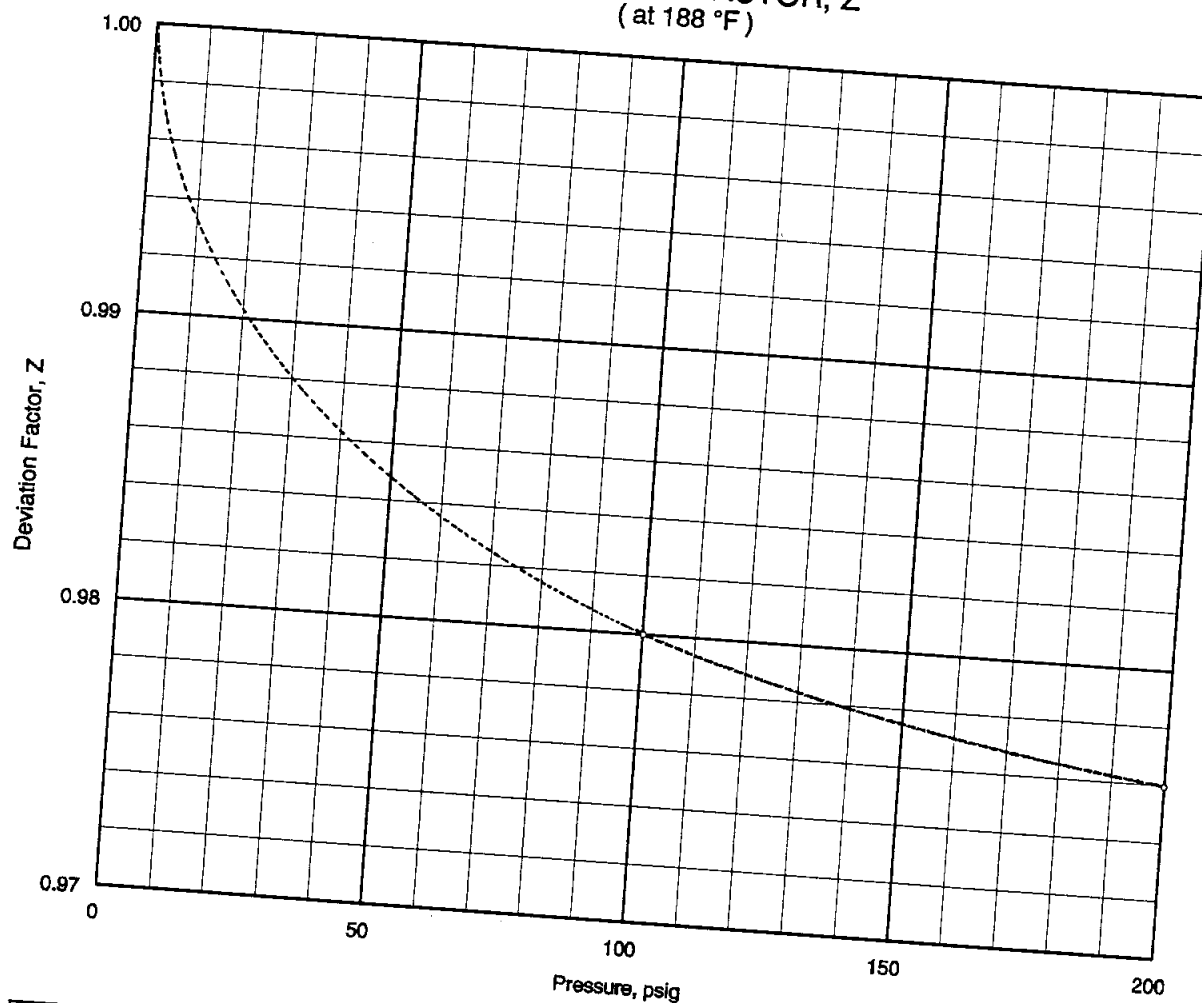


Gas Gravity Expression: $y = a + b (X_d)^i + c (X_d)^j$		LEGEND	
where: a= 1.88587e+ 00 i= 0.500 b= -2.31661e+ 00 j= 1.000 c= 1.25813e+ 00		Laboratory Data Confidence Limits Analytical Expression	Saturation Pressure: 270 psig
Note: X_d (dimensionless 'X') = P_i / P_{sat}		Differential Vaporization Figure B-4	
Confidence level:	99 %		
Confidence interval:	+/- 0		
'r squared':	1		

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DEVIATION FACTOR, Z (at 188 °F)



Deviation Factor Expression: $y = a + b (X_d)^i + c (X_d)^j$		LEGEND	
where: $a = 1.00000e+00$ $b = -4.48810e-02$ $c = 1.97470e-02$		$i = 0.500$ $j = 1.000$	<div><div>○</div><div>-----</div><div>_____</div></div> <div>Laboratory Data Confidence Limits Analytical Expression</div> <div>Saturation Pressure: 270 psig</div>
Note: X_d (dimensionless 'X') = P_i / P_{sat} ,			
Confidence level:		99 %	Differential Vaporization Figure B-5
Confidence interval:		+/- 0	
'r squared':		1	

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RESERVOIR FLUID VISCOSITY

(at 188 °F)

Pressure psig	Oil Viscosity cp	Gas Viscosity cp	Oil/Gas Viscosity ratio
5000	50.8		
4500	48.6		
4000	46.5		
3500	44.3		
3000	42.1		
2500	40.0		
2000	37.8		
1500	35.6		
1000	33.5		
500	31.3		
b»270	30.3		
200	32.4	0.0124	2,605
100	37.7	0.0118	3,186
0	62.1		

* Gas Viscosity data calculated from correlation of Lee A.L., Gonzalez M.H., and Eakin B.E., "The Viscosity of Natural Gases", Journal of Petroleum Technology, August, 1966, pp. 997-1000.

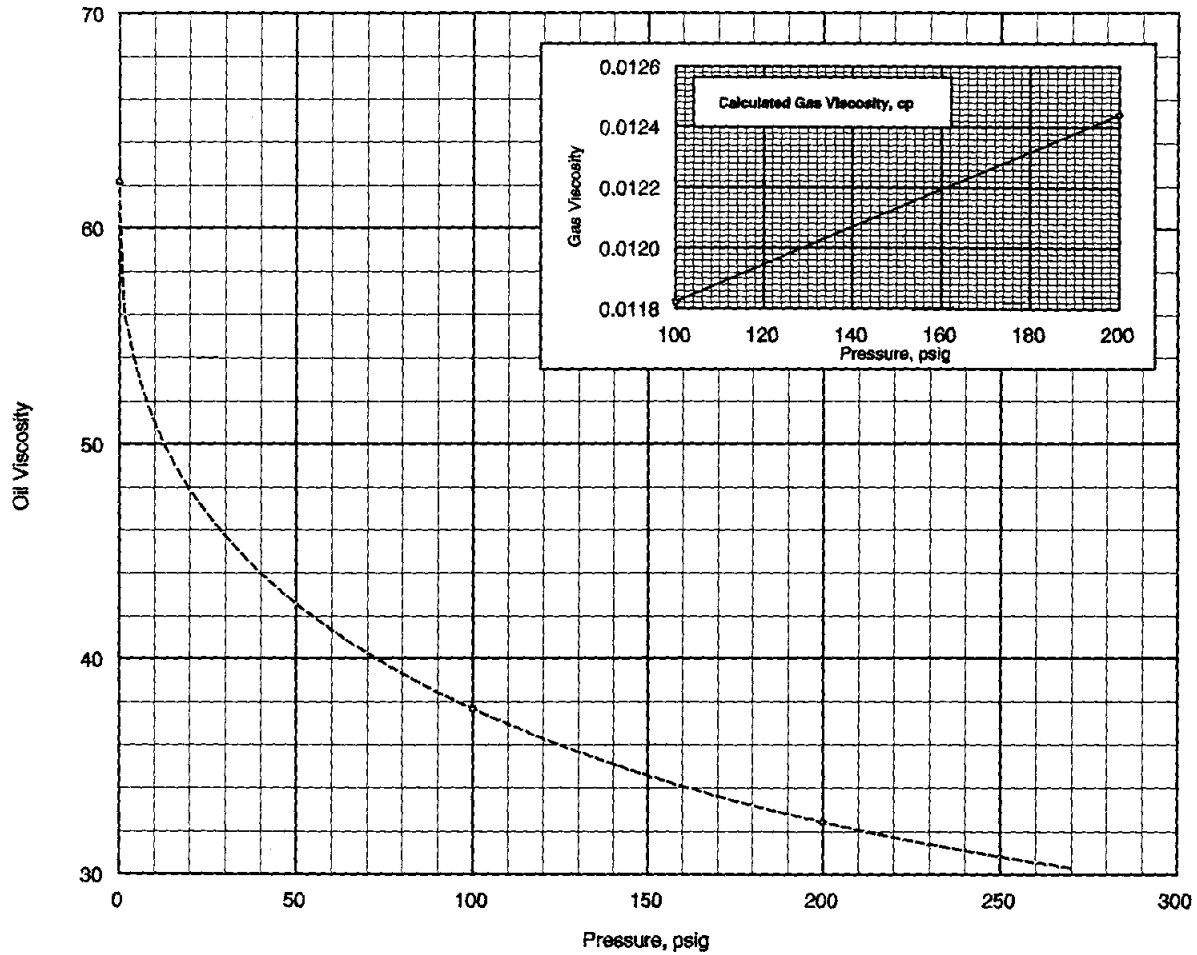
OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY

Eden-1, DST No.6, M-1

RFL 97014

RESERVOIR FLUID VISCOSITY

(cp at 188 °F)

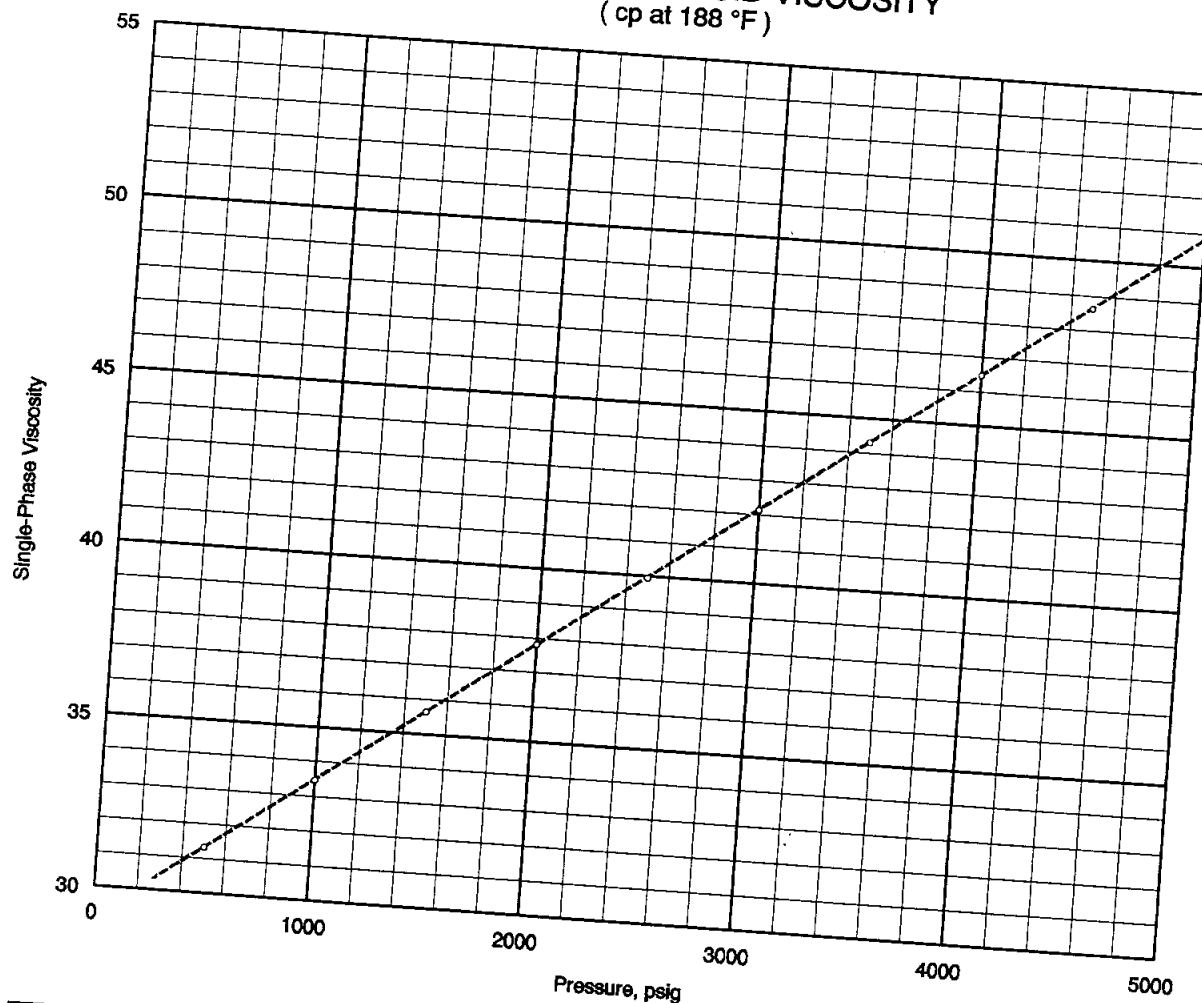


Oil Viscosity Expression: $y = a + b (X_d)^i + c (X_d)^j + d (X_d)^k$	LEGEND <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">○</div> Laboratory Data </div> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">-----</div> Confidence Limits </div> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">—————</div> Analytical Expression </div> <p style="text-align: center;">Saturation Pressure: 270 psig</p>	
where: <div style="display: flex; justify-content: space-between;"> <div> a= 6.21383e+ 01 b= -1.23219e+ 01 c= -3.20989e+ 01 d= 1.25909e+ 01 </div> <div> i= 0.250 j= 0.500 k= 1.000 </div> </div> <p>Note: X_d (dimensionless 'X') = P_i / P_{sat}</p>		
Confidence level: 99 % Confidence interval: +/- 0 cp 'r squared': 1	Rolling-Ball Viscosity Figure C-1	

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY

Eden-1, DST No.6, M-1
RFL 97014

SINGLE-PHASE FLUID VISCOSITY (cp at 188 °F)



Single-Phase Viscosity Expression: $y = a + b (dX)^i$	LEGEND	
where: $a = 3.03084e+01$ $b = 4.33310e-03$ $i = 1.000$ Note: $dX (\text{delta 'X'}) = P_{\text{sat}} - P_i , \text{psig}$	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> \circ <hr style="border-top: 1px dashed;"/> <hr style="border-top: 1px solid;"/> </div> <div> Laboratory Data Confidence Limits Analytical Expression Saturation Pressure: 270 psig </div> </div>	
Confidence level: Confidence interval: 'r squared':	<div style="display: flex; justify-content: space-between;"> <div> 99 % +/- 0.0087 cp .999998 </div> <div> Rolling-Ball Viscosity Figure C-2 </div> </div>	

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY

Eden-1, DST No.6, M-1

RFL 97014

SEPARATOR FLASH ANALYSIS

Flash Conditions		Gas/Oil Ratio (scf/bbl) (A)	Gas/Oil Ratio (scf/STbbl) (B)	Stock Tank Oil Gravity at 60 °F (°API)	Formation Volume Factor Bofb (C)	Separator Volume Factor (D)	Specific Gravity of Flashed Gas (Air=1.000)	Oil Phase Density (gm/cc)
psig	°F							
270	188							
125	97	8	8			1.026		0.8846
0	97	22	22	19.5	1.066	1.015	0.730 *	0.9180
			30				1.199	0.9226
			Rsfb =					

270	188							
95	97							
0	97	11	11			1.024		0.8843
		18	18	19.6	1.065	1.015	0.751 *	0.9184
			29				1.217	0.9220
			Rsfb =					

270	188							
65	97							
0	97	15	15			1.021		0.8844
		13	13	19.7	1.064	1.015	0.787 *	0.9191
			28				1.248	0.9214
			Rsfb =					

545	198							
30	97							
0	97	21	21			1.018		0.8843
		6	6	19.7	1.064	1.015	0.877 *	0.9200
			27				1.260	0.9216
			Rsfb =					

* Collected and analyzed in the laboratory by gas chromatography.

(A) Cubic Feet of gas at 14.7 psia and 60 °F per Barrel of oil at indicated pressure and temperature.

(B) Cubic Feet of gas at 14.7 psia and 60 °F per Barrel of Stock Tank Oil at 60 °F.

(C) Barrels of saturated oil at 270 psig and 188 °F per Barrel of Stock Tank Oil at 60 °F.

(D) Barrels of oil at indicated pressure and temperature per Barrel of Stock Tank Oil at 60 °F.

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY

Eden-1, DST No.6, M-1

RFL 97014

Composition of Separator Test Gas

(From Chromatographic Technique)

Component	Mol %	GPM	MW	Liq Dens (gm/cc)
Hydrogen Sulfide	0.00			
Carbon Dioxide	3.06		44.010	.8172
Nitrogen	10.00		28.013	.8086
Methane	76.05		16.043	.2997
Ethane	4.16	1.110	30.070	.3558
Propane	3.63	.998	44.097	.5065
iso-Butane	0.78	.255	58.123	.5623
n-Butane	1.59	.500	58.123	.5834
iso-Pentane	0.31	.113	72.150	.6241
n-Pentane	0.26	.094	72.150	.6305
Hexanes	0.10	.039	84.000	.6850
Heptanes	0.03	.013	96.000	.7220
Octanes	0.02	.009	107.00	.7450
Nonanes plus	0.01	.005	121.00	.7640
Totals	100.00	3.136		

Sampling Conditions

125 psig

97 °F

Sample Characteristics

Critical Pressure (psia)	655.4
Critical Temperature (°R)	371.0
Average Molecular Weight	21.14
Calculated Gas Gravity (air = 1.000)	0.730
Gas Gravity	
Factor, Fg	1.1706
Super Compressibility Factor, Fpv	
at sampling conditions	1.0088
Gas Z-Factor	
at sampling conditions *	0.983

at 14.7 psia and 60 °F

Gross Heating Value	
(BTU/scf dry gas)	1039

Properties of Plus Fractions

Component	Mol %	MW	Liq Dens (gm/cc)	API Gravity
Heptanes plus	0.06	103.8	0.737	60.3

Test Conditions

125 Psig	97 °F
0 Psig	97 °F

* From: Standing, M.B., "Volumetric and Phase Behavior of Oil Field Hydrocarbon Systems", SPE (Dallas), 1977, 8th Edition, Appendix II.

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY
Eden-1, DST No.6, M-1
RFL 97014

Composition of Separator Test Gas
(From Chromatographic Technique)

Component	Mol %	GPM	MW	Liq Dens (gm/cc)
Hydrogen Sulfide	0.00			
Carbon Dioxide	3.41		44.010	.8172
Nitrogen	8.74		28.013	.8086
Methane	74.70		16.043	.2997
Ethane	4.88	1.302	30.070	.3558
Propane	4.44	1.221	44.097	.5065
iso-Butane	0.97	.317	58.123	.5623
n-Butane	1.97	.620	58.123	.5834
iso-Pentane	0.38	.139	72.150	.6241
n-Pentane	0.32	.116	72.150	.6305
Hexanes	0.12	.046	84.000	.6850
Heptanes	0.04	.017	96.000	.7220
Octanes	0.02	.009	107.00	.7450
Nonanes plus	0.01	.005	121.00	.7640
Totals	100.00	3.792		

Sampling Conditions

95 psig
97 °F

Sample Characteristics

Critical Pressure (psia)	647.5
Critical Temperature (°R)	375.1
Average Molecular Weight	21.75
Calculated Gas Gravity (air = 1.000)	0.751
Gas Gravity Factor, Fg	1.1541
Super Compressibility Factor, Fpv at sampling conditions	1.0071
Gas Z-Factor at sampling conditions *	0.986

at 14.7 psia and 60 °F

Gross Heating Value (BTU/scf dry gas)	1068
GPM (C2+)	3.792
GPM (C3+)	2.49

Properties of Plus Fractions

Component	Mol %	MW	Liq Dens (gm/cc)	API Gravity
Heptanes plus	0.07	102.7	0.735	60.8

Test Conditions

95 Psig **97 °F**
0 Psig **97 °F**

* From: Standing, M.B., "Volumetric and Phase Behavior of Oil Field Hydrocarbon Systems", SPE (Dallas), 1977, 8th Edition, Appendix II.

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY

Eden-1, DST No.6, M-1

RFL 97014

Composition of Separator Test Gas

(From Chromatographic Technique)

Component	Mol %	GPM	MW	Liq Dens (gm/cc)
Hydrogen Sulfide	0.00			
Carbon Dioxide	3.82		44.010	.8172
Nitrogen	7.41		28.013	.8086
Methane	72.05		16.043	.2997
Ethane	5.87	1.567	30.070	.3558
Propane	5.76	1.584	44.097	.5065
iso-Butane	1.28	.418	58.123	.5623
n-Butane	2.62	.824	58.123	.5834
iso-Pentane	0.51	.186	72.150	.6241
n-Pentane	0.43	.155	72.150	.6305
Hexanes	0.16	.062	84.000	.6850
Heptanes	0.06	.025	96.000	.7220
Octanes	0.02	.009	107.00	.7450
Nonanes plus	0.01	.005	121.00	.7640
Totals	100.00	4.835		

Sampling Conditions

65 psig

97 °F

Sample Characteristics

Critical Pressure (psia)	668.2
Critical Temperature (°R)	399.0
Average Molecular Weight	22.79
Calculated Gas Gravity (air = 1.000)	0.787
Gas Gravity	
Factor, Fg	1.1273
Super Compressibility Factor, Fpv	
at sampling conditions	1.0060
Gas Z-Factor	
at sampling conditions *	0.988

at 14.7 psia and 60 °F

Gross Heating Value	
(BTU/scf dry gas)	1164
GPM (C2+)	4.835
GPM (C3+)	3.268

Test Conditions

65 Psig 97 °F
0 Psig 97 °F

Properties of Plus Fractions

Component	Mol %	MW	Liq Dens (gm/cc)	API Gravity
Heptanes plus	0.09	101.2	0.732	61.6

* From: Standing, M.B., "Volumetric and Phase Behavior of Oil Field Hydrocarbon Systems", SPE (Dallas), 1977, 8th Edition, Appendix II.

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY

Eden-1, DST No.6, M-1

RFL 97014

Composition of Separator Test Gas

(From Chromatographic Technique)

Component	Mol %	GPM	MW	Liq Dens (gm/cc)
Hydrogen Sulfide	0.00			
Carbon Dioxide	4.24		44.010	.8172
Nitrogen	5.87		28.013	.8086
Methane	65.03		16.043	.2997
Ethane	7.49	1.999	30.070	.3558
Propane	8.88	2.442	44.097	.5065
iso-Butane	2.09	.682	58.123	.5623
n-Butane	4.36	1.372	58.123	.5834
iso-Pentane	0.87	.318	72.150	.6241
n-Pentane	0.74	.267	72.150	.6305
Hexanes	0.27	.105	84.000	.6850
Heptanes	0.10	.042	96.000	.7220
Octanes	0.04	.018	107.00	.7450
Nonanes plus	0.02	.010	121.00	.7640
Totals	100.00	7.255		

Sampling Conditions

30 psig

97 °F

Sample Characteristics

Critical Pressure (psia)	698.5
Critical Temperature (°R)	446.2
Average Molecular Weight	25.41
Calculated Gas Gravity (air = 1.000)	0.877
Gas Gravity	
Factor, Fg	1.0676
Super Compressibility Factor, Fpv	
at sampling conditions	1.0045
Gas Z-Factor	
at sampling conditions *	0.991

at 14.7 psia and 60 °F

Gross Heating Value	
(BTU/scf dry gas)	1367
GPM (C2+)	7.255
GPM (C3+)	5.256

Properties of Plus Fractions

Component	Mol %	MW	Liq Dens (gm/cc)	API Gravity
Heptanes plus	0.16	101.9	0.733	61.4

Test Conditions

30 Psig 97 °F
0 Psig 97 °F

* From: Standing, M.B., "Volumetric and Phase Behavior of Oil Field Hydrocarbon Systems", SPE (Dallas), 1977, 8th Edition, Appendix II.

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY

Eden-1, DST No.6, M-1

RFL 97014

DIFFERENTIAL VAPORIZATION ADJUSTED TO SEPARATOR CONDITIONS*

Pressure psig	Solution Gas/Oil Ratio Rs (A)	Formation Volume Factor Bo (B)	Gas Formation Volume Factor (C)	Oil Density gm/cc	Oil/Gas Viscosity Ratio
5000	30	1.039		0.9067	
4500	30	1.042		0.9046	
4000	30	1.045		0.9024	
3500	30	1.047		0.9001	
3000	30	1.050		0.8978	
2500	30	1.053		0.8955	
2000	30	1.055		0.8931	
1500	30	1.058		0.8906	
1000	30	1.061		0.8880	
600	30	1.064		0.8859	
500	30	1.065		0.8853	
400	30	1.065		0.8848	
300	30	1.066		0.8842	
b» 270	30	1.066		0.8840	
200	24	1.064	0.08328	0.8848	2,605
100	12	1.059	0.15653	0.8865	3,186
0		1.042		0.8915	

*Separator Conditions	
First Stage Stock Tank	125 psig at 97 °F 0 psig at 97 °F

(A) Cubic Feet of gas at 14.7 psia and 60 °F per Barrel of Stock Tank Oil at 60 °F.

(B) Barrel of oil at indicated pressure and temperature per Barrel of Stock Tank Oil at 60 °F.

(C) Cubic Feet of gas at indicated pressure and temperature per Cubic Feet at 14.7 psia and 60 °F.

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY

Eden-1, DST No.6, M-1

RFL 97014

DIFFERENTIAL VAPORIZATION ADJUSTED TO SEPARATOR CONDITIONS*

Pressure psig	Solution Gas/Oil Ratio Rs (A)	Formation Volume Factor Bo (B)	Gas Formation Volume Factor (C)	Oil Density gm/cc	Oil/Gas Viscosity Ratio
5000	29	1.039		0.9067	
4500	29	1.041		0.9046	
4000	29	1.044		0.9024	
3500	29	1.046		0.9001	
3000	29	1.049		0.8978	
2500	29	1.052		0.8955	
2000	29	1.055		0.8931	
1500	29	1.058		0.8906	
1000	29	1.061		0.8880	
600	29	1.063		0.8859	
500	29	1.064		0.8853	
400	29	1.065		0.8848	
300	29	1.065		0.8842	
b» 270	29	1.065		0.8840	
200	23	1.063	0.08328	0.8848	2,605
100	12	1.059	0.15653	0.8865	3,186
0		1.041		0.8915	

*Separator Conditions	
First Stage Stock Tank	95 psig at 97 °F 0 psig at 97 °F

(A) Cubic Feet of gas at 14.7 psia and 60 °F per Barrel of Stock Tank Oil at 60 °F.

(B) Barrel of oil at indicated pressure and temperature per Barrel of Stock Tank Oil at 60 °F.

(C) Cubic Feet of gas at indicated pressure and temperature per Cubic Feet at 14.7 psia and 60 °F.

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY

Eden-1, DST No.6, M-1

RFL 97014

DIFFERENTIAL VAPORIZATION ADJUSTED TO SEPARATOR CONDITIONS*

Pressure psig	Solution Gas/Oil Ratio Rs (A)	Formation Volume Factor Bo (B)	Gas Formation Volume Factor (C)	Oil Density gm/cc	Oil/Gas Viscosity Ratio
5000	28	1.037		0.9067	
4500	28	1.040		0.9046	
4000	28	1.042		0.9024	
3500	28	1.045		0.9001	
3000	28	1.048		0.8978	
2500	28	1.050		0.8955	
2000	28	1.053		0.8931	
1500	28	1.056		0.8906	
1000	28	1.059		0.8880	
600	28	1.062		0.8859	
500	28	1.063		0.8853	
400	28	1.063		0.8848	
300	28	1.064		0.8842	
b» 270	28	1.064		0.8840	
200	22	1.062	0.08328	0.8848	2,605
100	11	1.057	0.15653	0.8865	3,186
0		1.040		0.8915	

*Separator Conditions	
First Stage Stock Tank	65 psig at 97 °F 0 psig at 97 °F

(A) Cubic Feet of gas at 14.7 psia and 60 °F per Barrel of Stock Tank Oil at 60 °F.

(B) Barrel of oil at indicated pressure and temperature per Barrel of Stock Tank Oil at 60 °F.

(C) Cubic Feet of gas at indicated pressure and temperature per Cubic Feet at 14.7 psia and 60 °F.

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY

Eden-1, DST No.6, M-1

RFL 97014

DIFFERENTIAL VAPORIZATION ADJUSTED TO SEPARATOR CONDITIONS*

Pressure psig	Solution Gas/Oil Ratio Rs (A)	Formation Volume Factor Bo (B)	Gas Formation Volume Factor (C)	Oil Density gm/cc	Oil/Gas Viscosity Ratio
5000	27	1.037		0.9067	
4500	27	1.040		0.9046	
4000	27	1.042		0.9024	
3500	27	1.045		0.9001	
3000	27	1.048		0.8978	
2500	27	1.050		0.8955	
2000	27	1.053		0.8931	
1500	27	1.056		0.8906	
1000	27	1.059		0.8880	
600	27	1.062		0.8859	
b» 270	27	1.064		0.8840	
200	21	1.062	0.08328	0.8848	2,605
100	10	1.057	0.15653	0.8865	3,186
0		1.040		0.8915	

*Separator Conditions	
First Stage Stock Tank	30 psig at 97 °F 0 psig at 97 °F

(A) Cubic Feet of gas at 14.7 psia and 60 °F per Barrel of Stock Tank Oil at 60 °F.

(B) Barrel of oil at indicated pressure and temperature per Barrel of Stock Tank Oil at 60 °F.

(C) Cubic Feet of gas at indicated pressure and temperature per Cubic Feet at 14.7 psia and 60 °F.

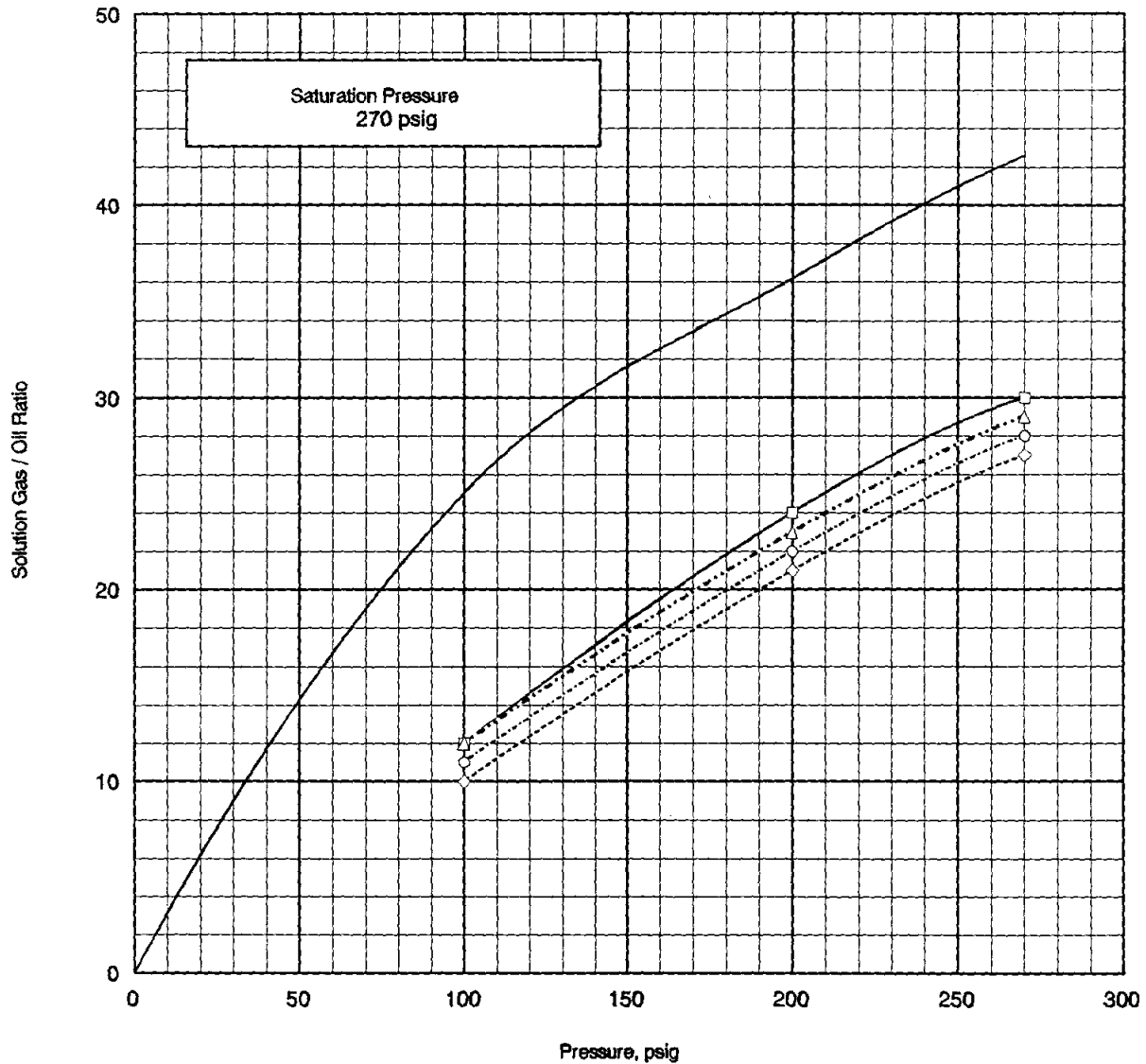
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Eden-1, DST No.6, M-1

RFL 97014

SOLUTION GAS/OIL RATIO

(scf/STbbl)



LEGEND

- Differential Vaporization
- 125 psig at 97 °F
- △ 95 psig at 97 °F
- 65 psig at 97 °F
- ◇ 30 psig at 97 °F

DV Adjusted to Separator
Figure D-1

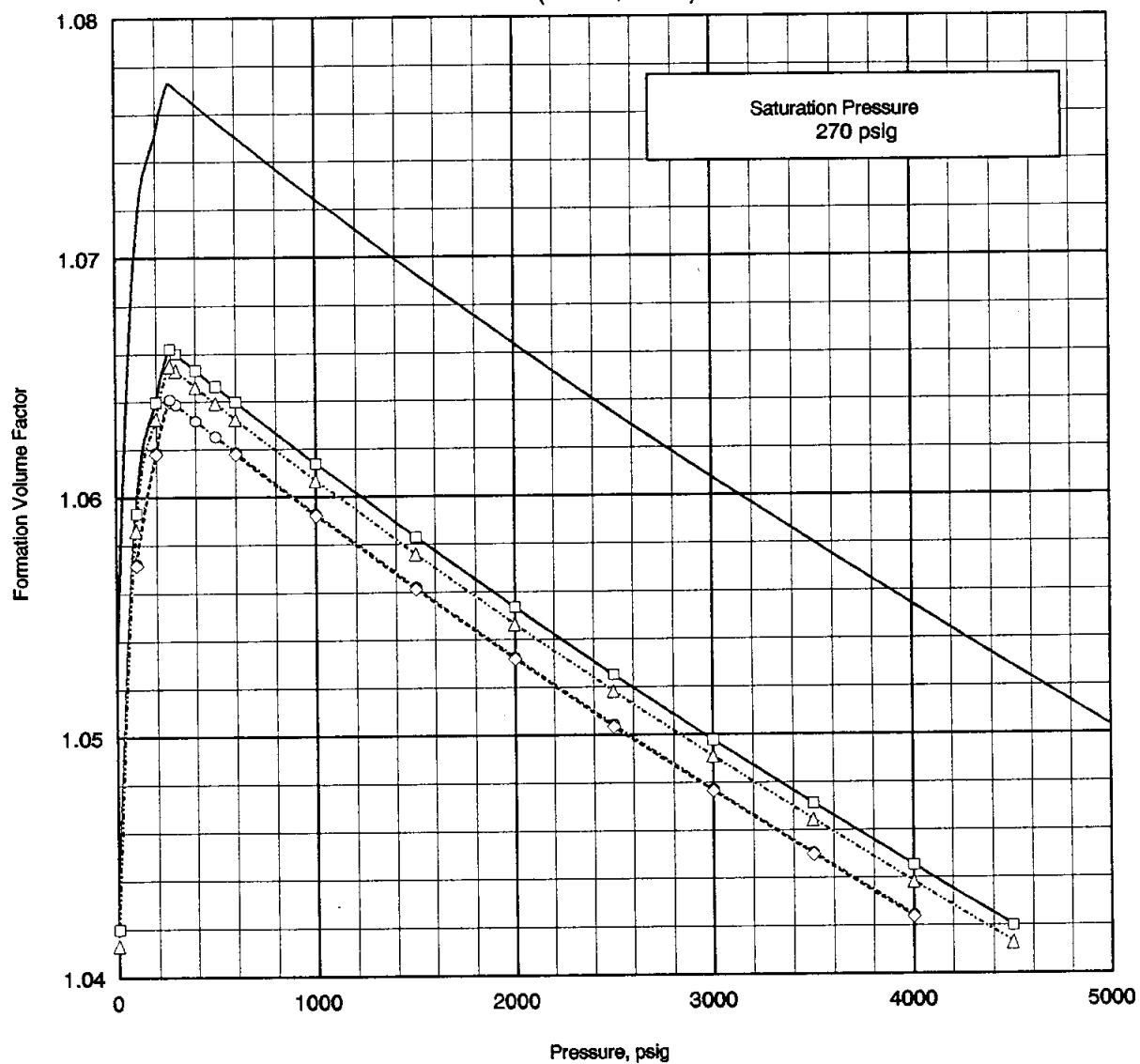
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Eden-1, DST No.6, M-1

RFL 97014

FORMATION VOLUME FACTOR

(bl res / STbl)



LEGEND

- Differential Vaporization
- 125 psig at 97 °F
- △ 95 psig at 97 °F
- 65 psig at 97 °F
- ◇ 30 psig at 97 °F

DV Adjusted to Separator
 Figure D-2



CORE LABORATORIES

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY

Atmospheric Crude Oil Analysis

Well..... : Eden-1

DST..... : No.6

Laboratory I.D..... : RFL-97014

Field..... : Eden-Yuturi

TEST DESCRIPTION	RESULT	UNITS OF MEASURE	TEST METHOD	TECHN	DATE
API Gravity @ 60°F	19.8		ASTM D 287	PC	17/03/97
Specific Gravity @ 60/60°F	0.9352		ASTM D 1298	PC	17/03/97
Water by Distillation	0.8	volume%	ASTM D 4006	PC	17/03/97
Reid Vapor Pressure	2.5	psi	ASTM D 323	PC	26/03/97
Flash Point	130	°F	ASTM D 93	PC	31/03/97
Pour Point	20	°F	ASTM D 97	PC	17/03/97
Sediments by Extraction	0.013	wt%	ASTM D 473	PC	17/03/97
Asphaltenes	16.58	wt%	IP 143	PC	18/03/97
Paraffins	5.23	wt%	UOP 46	LO	01/04/97
Sulfur Content	1.78	wt%	ASTM D 1552	LO	18/03/97
Salt content	61.86	Lb/1000bbls	UOP-588	LO	15/04/97
Nickel	47.05	mg/l	SM18 3500-Ni B	LO/RM	11/04/97
Vanadium	210.03	mg/l	SM18 3500-V B	LO/RM	11/04/97
Kinematic Viscosity @ 100 °F	397.44	cSt	ASTM D 445	PC	10/04/97
Kinematic Viscosity @ 122 °F	202.96	cSt	ASTM D 445	PC	10/04/97
Kinematic Viscosity @ 210 °F	33.25	cSt	ASTM D 445	PC	10/04/97

All analyses were performed with original sample

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY

WELL: Eden-1, DST-6

File: RFL 97014

ASTM D341

Viscosity - Temperature Correlation

Toolbox

API Gravity (at 60 °F): 19.8

Laboratory Measured Data

Temp °F	Viscosity cp	Density gm/cc	Viscosity cSt	ASTM Correlation Constants						
				c	d	e	f	g	h	z
100	365.500	0.9196	397.439	0	0	0	0	0	0	398.14
122	185.000	0.9115	202.959	0	0	0	0	0	0	203.66
210	29.220	0.8787	33.254	0	0	0	0	0	0	33.954
				0	0	0	0	0	0	
				0	0	0	0	0	0	
				0	0	0	0	0	0	
				0	0	0	0	0	0	

Regression Constants: A = 2.944013
 B = 8.504667

ASTM Predicted Data

Temp °F	Viscosity cp	Density gm/cc	Viscosity cSt	Predicted ASTM Correlation Constants						
				c	d	e	f	g	h	z
				0	0	0	0	0	0	
				0	0	0	0	0	0	
				0	0	0	0	0	0	
				0	0	0	0	0	0	
				0	0	0	0	0	0	
				0	0	0	0	0	0	
				0	0	0	0	0	0	

Viscosity Corrections from: 1980 ASTM Petroleum Products and Lubricants (II), Part 23, D341.

Density Corrections from: 1980 ASTM Petroleum Measurement Tables, Volume Correction Factors, Vol VI, Table 24C, D1250.

Regression Results and Statistical Summary

r squared 0.999382
 Confidence Level 99 %
 Confidence Interval (+/-), cSt* 31.7981

* Confidence interval calculated using a biased distribution based on the Student "t" density for the given population.

CORE LABORATORIES

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY

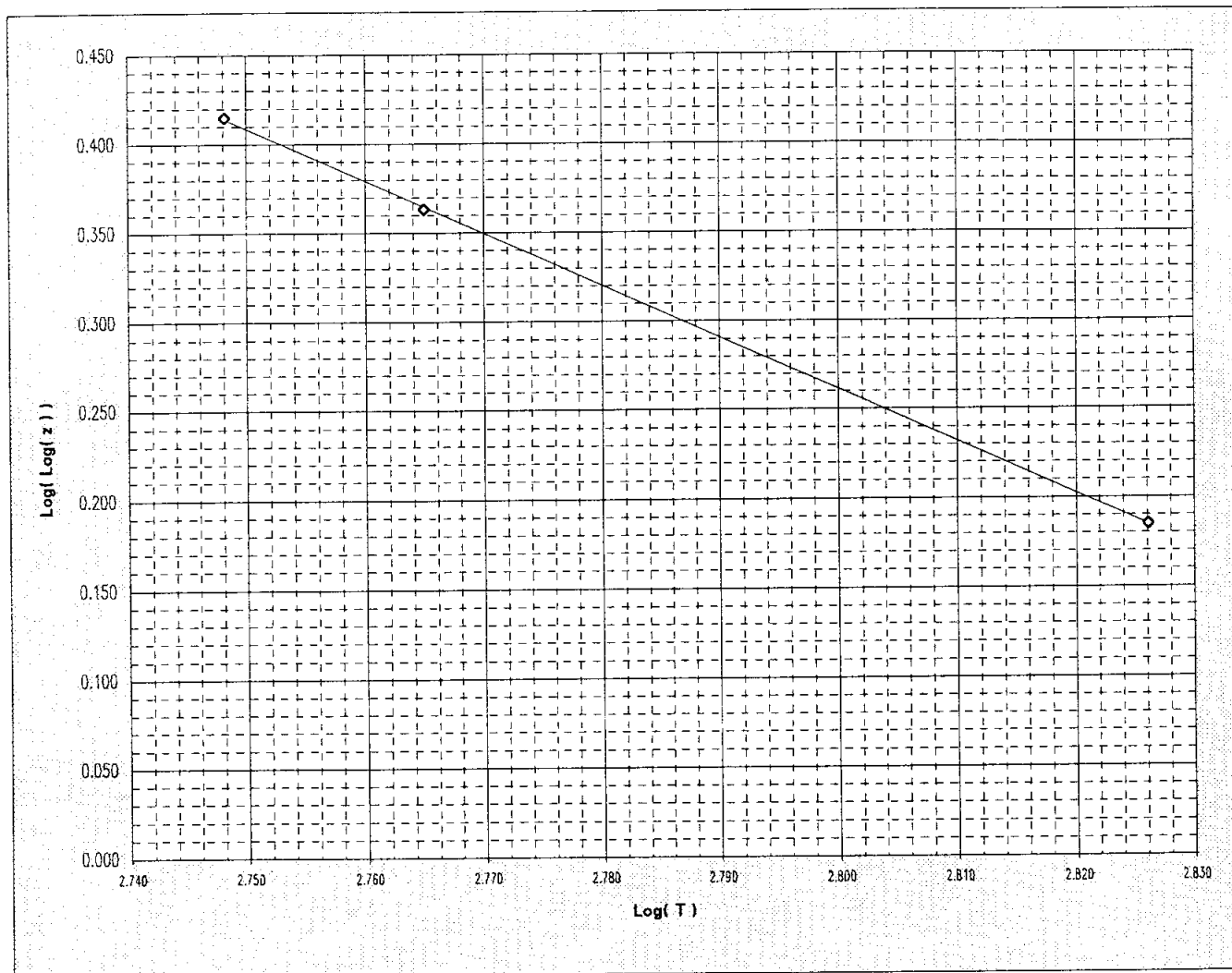
WELL: Eden-1, DST-6

File: RFL 97014

ASTM D341

Viscosity - Temperature Correlation

Toolbox



General Equation -

$$\text{Log(Log(z))} = A + B \text{ Log(T)}$$

Where: $z = v + 0.7 + C - D + E - F + G - H$
 v = viscosity at T, cSt
 T = temperature, °R

CORE LABORATORIES

OCCIDENTAL EXPLORATION AND PRODUCTION COMPANY

Well: Eden-1, DST No.6

Field: Eden-Yuturi

File: RFL 97014

ASTM D-86 ATMOSPHERIC DISTILLATION

Initial Boiling Point	161 °F
5 % Recovered	286 °F
10 % Recovered	407 °F
15 % Recovered	475 °F
20 % Recovered	520 °F
25 % Recovered	543 °F
30 % Recovered	552 °F
35 % Recovered	558 °F
40 % Recovered	581 °F
45 % Recovered	586 °F
50 % Recovered	589 °F
55 % Recovered	592 °F
60 % Recovered	595 °F
65 % Recovered	598 °F

Final Boiling Point	605 °F
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Distillate, %	67.0
Residue, %	30.0
Loss, %	3.0

Appendix
Nomenclature and Equations

PRESSURE-VOLUME RELATIONS

Nomenclature and Equations

P_b = Bubblepoint Pressure

X_d = Dimensionless Pressure (P_i/P_b)

dP = Pressure Difference (P_i/P_b)

Y_f = Y-Function (dimensionless compressibility)

RV = PV Relative Volume

C_{sp} = Average Single-Phase Compressibility of Reservoir Fluid

For Relative Volume below bubblepoint pressure:

$$RV_i = (P_b - P_i)/P_i \cdot Y_f$$

For Average Single-Phase Compressibility above bubblepoint pressure:

$$C_{sp} = (RV_i - RV_{i-1})/[RV_i(P_{i-1} - P_i)]$$

DIFFERENTIAL VAPORIZATION

Nomenclature and Equations

<i>P_b</i>	=	<i>Bubblepoint Pressure</i>
<i>P_{base}</i>	=	<i>Base Pressure</i>
<i>T_{base}</i>	=	<i>Base Temperature</i>
<i>T_{res}</i>	=	<i>Reservoir Temperature</i>
<i>X_d</i>	=	<i>Dimensionless Pressure (P_i/P_b)</i>
<i>dP</i>	=	<i>Pressure Difference (P_i-P_b)</i>
<i>RV</i>	=	<i>Relative Volume from Pressure-Volume Relations</i>
<i>Dens</i>	=	<i>Single-Phase Oil Density</i>
<i>Dens_b</i>	=	<i>Oil Density at Bubblepoint Pressure</i>
<i>ROV</i>	=	<i>Relative Oil Volume</i>
<i>ROV_b</i>	=	<i>Relative Oil Volume at Bubblepoint Pressure</i>
<i>B_g</i>	=	<i>Gas Formation Volume Factor</i>

For Oil Density above bubblepoint pressure:

$$\mathbf{Dens_i = Dens_b / RV_i}$$

For Relative Oil Volume above bubblepoint pressure:

$$\mathbf{ROV_i = ROV_b * RV_i}$$

For Gas Formation Factor below bubblepoint pressure:

$$\mathbf{B_g = P_{base} * Z_i * T_{res} / (P_i * T_{base})}$$

DIFFERENTIAL VAPORIZATION ADJUSTED TO SURFACE CONDITIONS

Nomenclature and Equations

<i>P_b</i>	=	<i>Bubblepoint Pressure</i>
<i>B_o</i>	=	<i>Oil Formation Volume Factor</i>
<i>B_{ofb}</i>	=	<i>Formation Volume Factor from field conditions or optimum separator flash test</i>
<i>B_{od}</i>	=	<i>Relative Oil Volume from differential vaporization test</i>
<i>B_{odb}</i>	=	<i>Value of B_{od} at bubblepoint pressure</i>
<i>RV</i>	=	<i>Relative Volume from Pressure-Volume Relations</i>

For B_o above bubblepoint pressure:

$$B_o = RV * B_{ofb}$$

For B_o below bubblepoint pressure:

$$B_o = (B_{od}) * (B_{ofb}/B_{odb})$$

<i>R_s</i>	=	<i>Gas in solution</i>
<i>B_o</i>	=	<i>Sum of separator gas and the stock tank gas from field conditions (or optimum) separator flash test</i>
<i>R_{sd}</i>	=	<i>Gas in solution from the differential vaporization test</i>
<i>R_{sdb}</i>	=	<i>R_{sd} at bubblepoint pressure</i>

$$R_s = R_{sfb} - [(R_{sdb} - R_{sd}) * (B_{ofb}/B_{odb})]$$