

CORE LABORATORIES-CANADA, LTD.



1982-04-07

Omega Hydrocarbons Ltd.  
630, 330 - 5th Ave. S.W.  
Calgary, Alberta  
T2P 0L4

Attention: Mr. Ed Wyse

Reservoir Fluid Study

Omega Waskada 8-24-1-26 (W1M)  
Waskada Field, Manitoba, Canada  
Our File Number: 7013-82-34

Gentlemen:

Subsurface samples of reservoir oil were taken from the above subject well by a representative of Core Laboratories-Canada Ltd. on 1982-02-03. The samples were then submitted to our laboratory for a complete reservoir fluid study.

A portion of the reservoir fluid was transferred at high pressure to a high pressure-windowed cell and then heated at constant pressure to the reported reservoir temperature of 45.0°C. The pressure-volume relations of the fluid were measured during a constant expansion down to 1 241 kPa (gauge). The saturation pressure was determined to be 3 158 kPa (gauge) at 45.0°C. The results of this test are shown on pages 1 and 2 of this report.

During differential pressure depletion at 45.0°C, the fluid evolved a total of 45.40 cubic metres of gas at 101.325 kPa (absolute) and 15°C per unit of residual oil at 15°C. The associated formation volume factor was 1.150 units of saturated fluid at 3 158 kPa (gauge) and 45.0°C per unit of residual oil. The density of the liquid phase and the properties of the evolved gases were determined at several pressure levels below the saturation pressure during this depletion. The data obtained from these tests are summarized on page 3. The viscosity of the fluid was measured under similar depletion conditions at 45.0°C, from pressures exceeding the saturation pressure down to atmospheric pressure. The

1982-04-07

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Omega Waskada 8-24-1-26 (W1M)

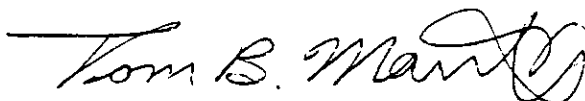
viscosity of the liquid phase varied from a minimum of 1.154 mPa•s at the saturation pressure to a maximum of 2.581 mPa•s at atmospheric pressure. The viscosity data is summarized on page 4.

The composition of the reservoir fluid was determined by low temperature, fractional distillation and is shown on pages 5 and 6.

Thank you for the opportunity to perform this study for you. Should you have any questions concerning the data, please contact us.

Yours truly,

CORE LABORATORIES-CANADA LTD.

A handwritten signature in black ink, appearing to read "Tom B. Martin", with a stylized flourish at the end.

Tom B. Martin

TG:cd

Page 1 of 15  
 File 7013-82-34  
 Well Omega Waskada  
8-24-1-26 (W1M)

VOLUMETRIC DATA OF RESERVOIR FLUID SAMPLE

1. Saturation pressure (bubble point pressure) 3 158 kPa (gauge) @ 45.0 °C
2. Thermal expansion of saturated oil @ 34 474 kPa (gauge) =  $\frac{V@ 45.0\text{ °C}}{V@ 22.2\text{ °C}}$  = 1.02196
3. Density at saturation pressure: 780.40 kg/m<sup>3</sup> @ 45.0 °C
4. Compressibility of saturated oil @ reservoir temperature: Vol/ Vol/MPa:
 

From	<u>3 158</u>	kPa to	<u>6 895</u>	kPa =	<u><math>11.29 \times 10^{-4}</math></u>
From	<u>6 895</u>	kPa to	<u>10 342</u>	kPa =	<u><math>10.82 \times 10^{-4}</math></u>
From	<u>10 342</u>	kPa to	<u>13 790</u>	kPa =	<u><math>9.97 \times 10^{-4}</math></u>
From	<u>13 790</u>	kPa to	<u>20 684</u>	kPa =	<u><math>9.45 \times 10^{-4}</math></u>
From	<u>20 684</u>	kPa to	<u>27 579</u>	kPa =	<u><math>8.91 \times 10^{-4}</math></u>
From	<u>27 579</u>	kPa to	<u>34 474</u>	kPa =	<u><math>8.37 \times 10^{-4}</math></u>

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Page 2 of 15  
File 7013-82-34  
Well Omega Waskada  
8-24-1-26 (W1M)

PRESSURE-VOLUME RELATIONS AT 45.0 °C

<u>Gauge Pressure, kPa</u>	<u>Relative Volume, V/Vsat (1)</u>	<u>Y Function (2)</u>
34 474	0.9707	
31 026	0.9734	
27 579	0.9763	
24 132	0.9792	
20 684	0.9823	
17 237	0.9854	
13 790	0.9887	
10 342	0.9921	
6 895	0.9958	
5 516	0.9974	
4 826	0.9982	
4 137	0.9989	
3 447	0.9997	
<u>3 158</u>	<u>1.0000</u>	
3 068	1.0121	2.356
2 965	1.0273	2.308
2 703	1.0742	2.188
2 448	1.1343	2.073
2 206	1.2103	1.962
1 931	1.3287	1.837
1 689	1.4759	1.724
1 448	1.6838	1.614
1 241	1.9389	1.521

(1) Cubic metres at indicated pressure and temperature per cubic metre of saturated oil.

(2)  $Y = \frac{(P_{sat}-P)}{(P + 101.325)(\text{Relative Volume}-1)}$

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Page 3 of 15  
 File 7013-82-34  
 Well Omega Waskada  
8-24-1-26 (W1M)

**DIFFERENTIAL VAPORIZATION AT 45.0 °C**

Gauge Pressure, kPa	Oil Density, kg/m <sup>3</sup>	Relative Oil Volume (1)	Relative Total Volume (2)	Solution Gas/Oil Ratio (3)	Incremental Gas Density*	Cumulative Gas Density*	Deviation Factor Z	Gas Formation Volume Factor (4)	Gas Expansion Factor (5)
3 158	780.4	1.150	1.150	45.40					
2 772	781.6	1.145	1.226	43.22	0.877	0.877	0.946	0.03691	27.09
2 075	784.1	1.136	1.450	38.95	0.858	0.864	0.946	0.04873	20.52
1 407	787.4	1.124	1.932	33.97	0.878	0.870	0.951	0.07068	14.15
862	791.5	1.110	3.012	28.46	0.962	0.900	0.965	0.11229	8.91
0	817.4	1.025	51.252	0.00	1.175	1.073	1.000	1.10632	0.90

Gravity of Residual Oil = 37.3° API at 15.56°C

Density of Residual Oil = 837.4 kg/m<sup>3</sup> at 15.56°C

\* Relative Density (AIR = 1.000)

- (1) Cubic metres of oil at indicated pressure and temperature per cubic metre of residual oil at 15°C.
- (2) Cubic metres of oil plus liberated gas at indicated pressure and temperature per cubic metre of residual oil at 15°C.
- (3) Cubic metres of gas at 101.325 kPa (absolute) and 15°C per cubic metre of residual oil at 15°C.
- (4) Cubic metres of gas at indicated pressure and temperature per cubic metre at 101.325 kPa (absolute) and 15°C.
- (5) Cubic metres of gas at 101.325 kPa (absolute) and 15°C per cubic metre at indicated pressure and temperature.

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Page 4 of 15  
 File 7013-82-34  
 Well Omega Waskada  
8-24-1-26 (W1M)

VISCOSITY AT 45.0°C

<u>kPa Pressure, (gauge)</u>	<u>Oil Viscosity mPa•s</u>	<u>Gas Viscosity mPa•s</u>	<u>Oil/Gas Viscosity Ratio</u>
34 474	1.752		
31 026	1.685		
27 579	1.619		
24 132	1.554		
20 684	1.487		
17 237	1.422		
13 790	1.356		
10 342	1.290		
6 895	1.224		
<u>3 158</u>	<u>1.154</u>		
2 772	1.260	0.0113	111.50
2 075	1.532	0.0111	138.02
1 407	1.791	0.0109	164.81
862	2.070	0.0105	197.14
0	2.581	0.0095	271.68



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Petroleum Reservoir Engineering  
CALGARY ALBERTA



SS481

HYDROCARBON LIQUID ANALYSIS

7013-82-34

CONTAINER IDENTITY

LABORATORY NUMBER

Omega Hydrocarbons Ltd.

5 of 15

OPERATOR

PAGE

LSD 8-24-1-26 W1M

Omega Waskada 8-24-1-26

LOCATION

WELL OR SAMPLE LOCATION NAME

KB ELEV., m

GRD. ELEV., m

Waskada, Manitoba

Lower Alida

Core Laboratories

FIELD OR AREA

POOL OR ZONE

SAMPLER

TEST TYPE & NO.

TEST RECOVERY

Bottom Hole

@

°C

POINT OF SAMPLE

AMT. & TYPE CUSHION

MUD RESISTIVITY

PUMPING

FLOWING

GAS LIFT

SWAB

WATER

m<sup>3</sup>/d

OIL

m<sup>3</sup>/d

GAS

m<sup>3</sup>/d

TEST INTERVALS OR PERFS., m

Approx. 20 000

@

°C

@

°C

45.0

SEPARATOR RESERVOIR

CONTAINER  
WHEN SAMPLED

CONTAINER  
WHEN RECEIVED

SEPARATOR

PRESSURES, kPa (gauge)

TEMPERATURES, °C

1982-02-03

1982-03-31

DA

DATE SAMPLED (Y/M/D)

DATE RECEIVED (Y/M/D)

DATE ANALYSED (Y/M/D)

ANALYST

REMARKS

COMPONENT	MOLE FRACTION	MASS FRACTION	LIQUID VOL FRACTION
N <sub>2</sub>	.0056	.0011	.0011
CO <sub>2</sub>	.0034	.0010	.0010
H <sub>2</sub> S	.0000	.0000	.0000
C <sub>1</sub>	.0814	.0092	.0240
C <sub>2</sub>	.0881	.0187	.0410
C <sub>3</sub>	.1072	.0333	.0514
C <sub>4</sub>	.0184	.0075	.0105
C <sub>4</sub>	.0600	.0246	.0329
C <sub>5</sub>	.0265	.0135	.0169
C <sub>5</sub>	.0278	.0141	.0176
C <sub>6</sub> <sup>+</sup>	.5816	.8770	.8036
TOTAL	1.0000	1.0000	1.0000

OBSERVED PROPERTIES OF C<sub>6</sub><sup>+</sup> RESIDUE (15/15° C)

855.0  
DENSITY kg/m<sup>3</sup>

.8558  
RELATIVE DENSITY

33.9  
API @ 15.5° C

214  
RELATIVE MOLECULAR MASS

CALCULATED PROPERTIES OF TOTAL SAMPLE (15/15° C)

783.6  
DENSITY kg/m<sup>3</sup>

.7843  
RELATIVE DENSITY

49.0  
API @ 15.5° C

141.92  
RELATIVE MOLECULAR MASS

REMARKS

COMPANY  
LOCATION  
SAMPLED FROM

Omega Hydrocarbons Ltd.  
LSD 8-24-1-26 W1M  
Bottom Hole

PAGE  
FILE

6 of 15  
7013-82-34

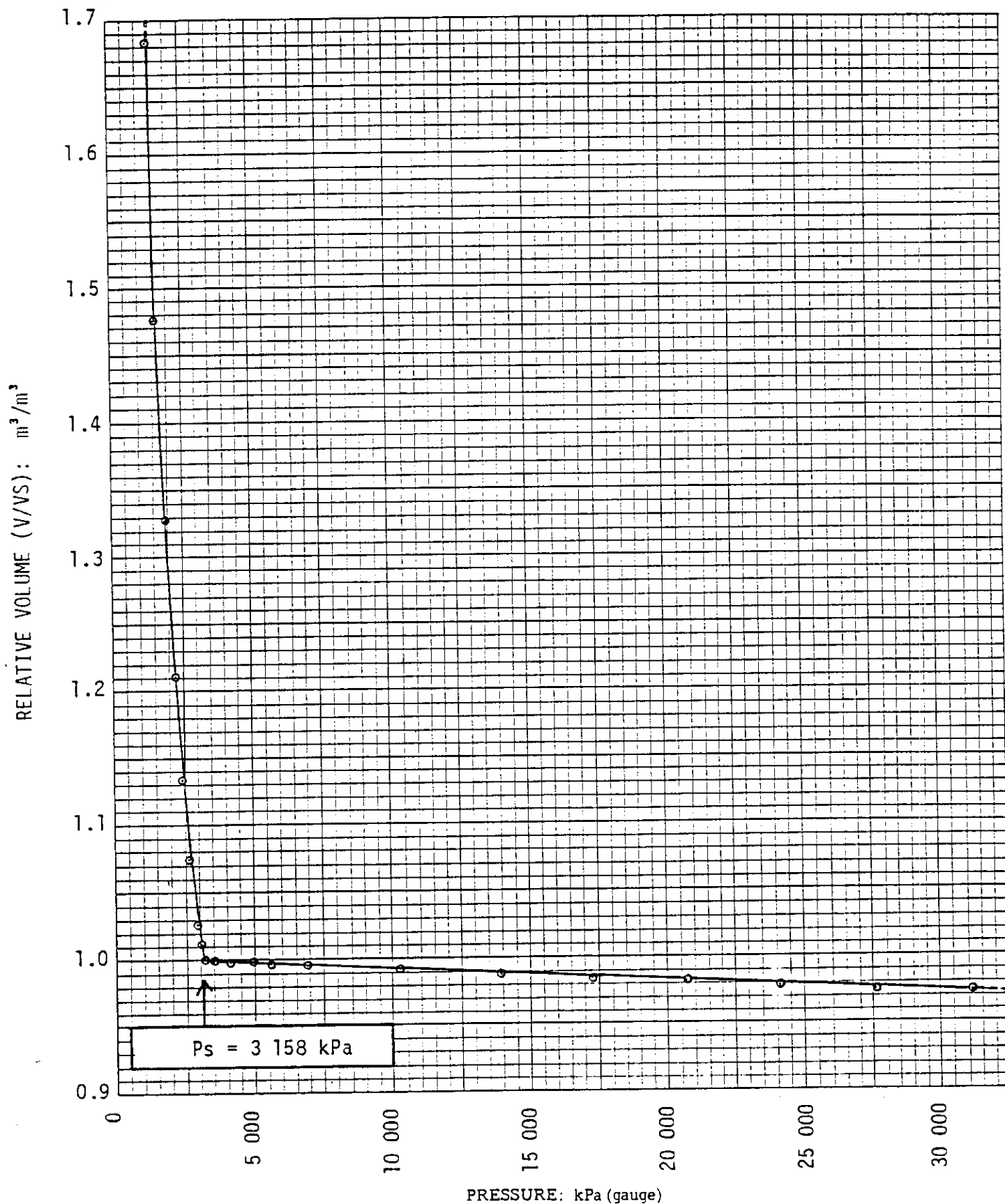
Analysis of C<sub>6</sub>+ Fraction to C<sub>30</sub>+

<u>Boiling Point Range (°C)</u>	<u>Component</u>	<u>Carbon Number</u>	<u>Mole Fraction</u>	<u>Mass Fraction</u>
36.1- 68.9	Hexanes	C <sub>6</sub>	.0325✓	.0210
68.9- 98.3	Heptanes	C <sub>7</sub>	.0468✓	.0352
98.3-125.6	Octanes	C <sub>8</sub>	.0489✓	.0419
125.6-150.6	Nonanes	C <sub>9</sub>	.0397✓	.0382
150.6-173.9	Decanes	C <sub>10</sub>	.0386	.0412
173.9-196.1	Undecanes	C <sub>11</sub>	.0359	.0421
196.1-215.0	Dodecanes	C <sub>12</sub>	.0282	.0360
215.0-235.0	Tridecanes	C <sub>13</sub>	.0274	.0378
235.0-252.2	Tetradecanes	C <sub>14</sub>	.0229	.0341
252.2-270.6	Pentadecanes	C <sub>15</sub>	.0197	.0314
270.6-287.8	Hexadecanes	C <sub>16</sub>	.0177	.0301
287.8-302.8	Heptadecanes	C <sub>17</sub>	.0161	.0290
302.8-317.2	Octadecanes	C <sub>18</sub>	.0137	.0261
317.2-330.0	Nonadecanes	C <sub>19</sub>	.0114	.0230
330.0-344.4	Eicosanes	C <sub>20</sub>	.0099	.0211
344.4-357.2	Heneicosanes	C <sub>21</sub>	.0091	.0201
357.2-369.4	Docosanes	C <sub>22</sub>	.0085	.0198
369.4-380.0	Tricosanes	C <sub>23</sub>	.0073	.0179
380.0-391.1	Tetracosanes	C <sub>24</sub>	.0068	.0173
391.1-401.7	Pentacosanes	C <sub>25</sub>	.0063	.0166
401.7-412.2	Hexacosanes	C <sub>26</sub>	.0053	.0145
412.2-422.2	Heptacosanes	C <sub>27</sub>	.0048	.0138
422.2-431.7	Octacosanes	C <sub>28</sub>	.0044	.0130
431.7-441.1	Nonacosanes	C <sub>29</sub>	.0040	.0123
441.1 Plus	triacontanes Plus	C <sub>30</sub> +	.0422	.1904
<u>AROMATICS</u>				
80.0	Benzene	C <sub>6</sub> H <sub>6</sub>	.0019✓	.0011
110.6	Toluene	C <sub>7</sub> H <sub>8</sub>	.0101✓	.0070
136.1-138.9	Ethylbenzene, p + m-Xylene	C <sub>8</sub> H <sub>10</sub>	.0108✓	.0086
144.4	o-Xylene	C <sub>8</sub> H <sub>10</sub>	.0057✓	.0046
168.9	1,2,4 Trimethylbenzene	C <sub>9</sub> H <sub>12</sub>	.0061✓	.0055
<u>NAPHTHENES</u>				
68.9	Cyclopentane	C <sub>5</sub> H <sub>10</sub>	.0004✓	.0002
72.2	Methylcyclopentane	C <sub>6</sub> H <sub>12</sub>	.0100✓	.0063
81.1	Cyclohexane	C <sub>6</sub> H <sub>12</sub>	.0124✓	.0079
101.1	Methylcyclohexane	C <sub>7</sub> H <sub>14</sub>	.0161✓	.0119
	TOTAL		.5816	.8770
	Mole Fraction of C <sub>7</sub> +			.5244
	Mass Fraction of C <sub>7</sub> +			.8405
	Calculated Relative Molecular Mass of C <sub>7</sub> +			228.
	Calculated Relative Density of C <sub>7</sub> +			.8636
	Calculated Density of C <sub>7</sub> + (kg/m <sup>3</sup> )			862.8

The above boiling point ranges refer to the normal paraffin hydrocarbon boiling in that range. Other hydrocarbons (aromatics, olefins, naphthenes and branched hydrocarbons) may have higher or lower carbon numbers, but are grouped and reported according to their boiling point.

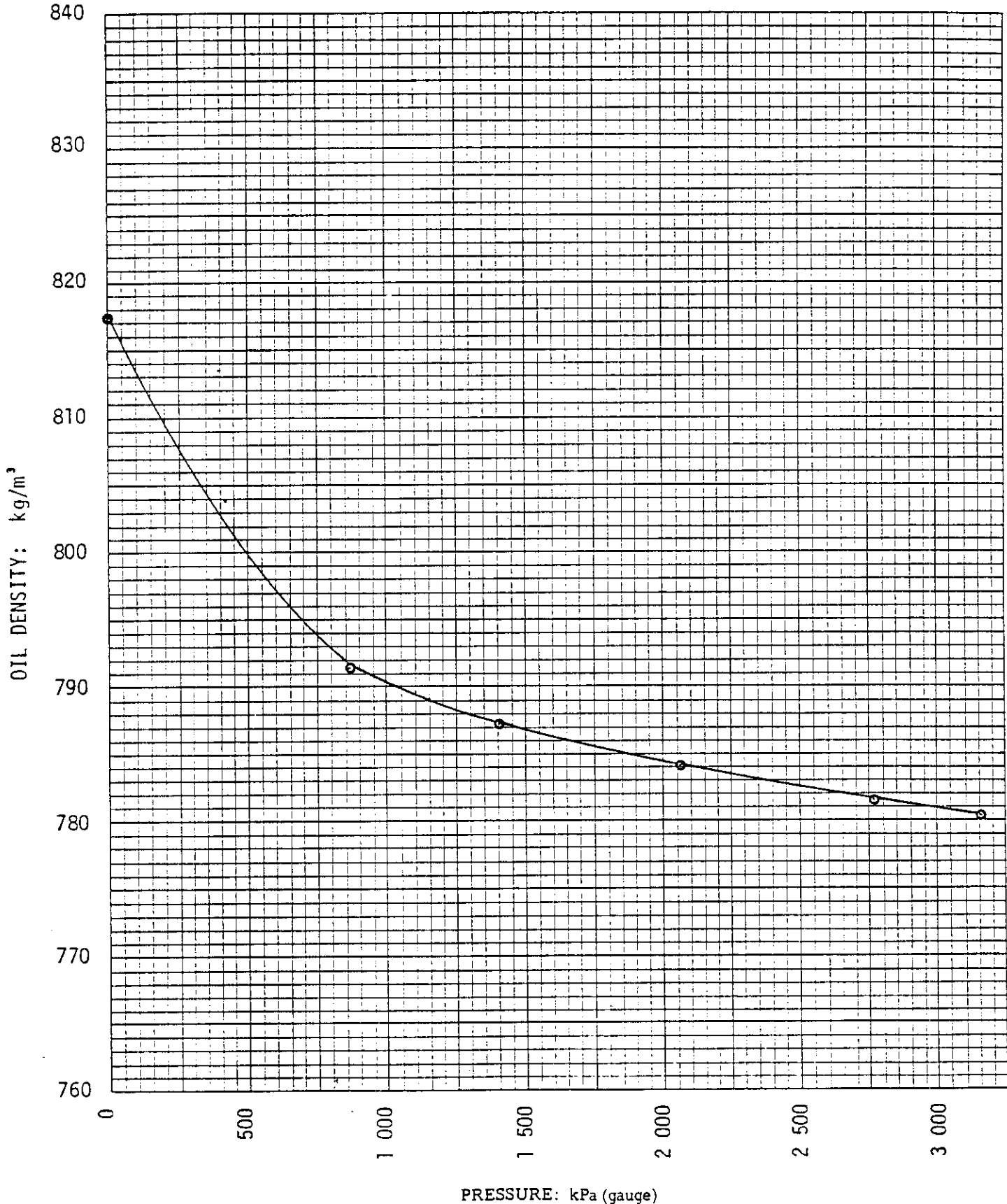


Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
Well	Omega Waskada 8-24-1-26 (WIM)	Province	Manitoba
Field	Waskada	Country	Canada



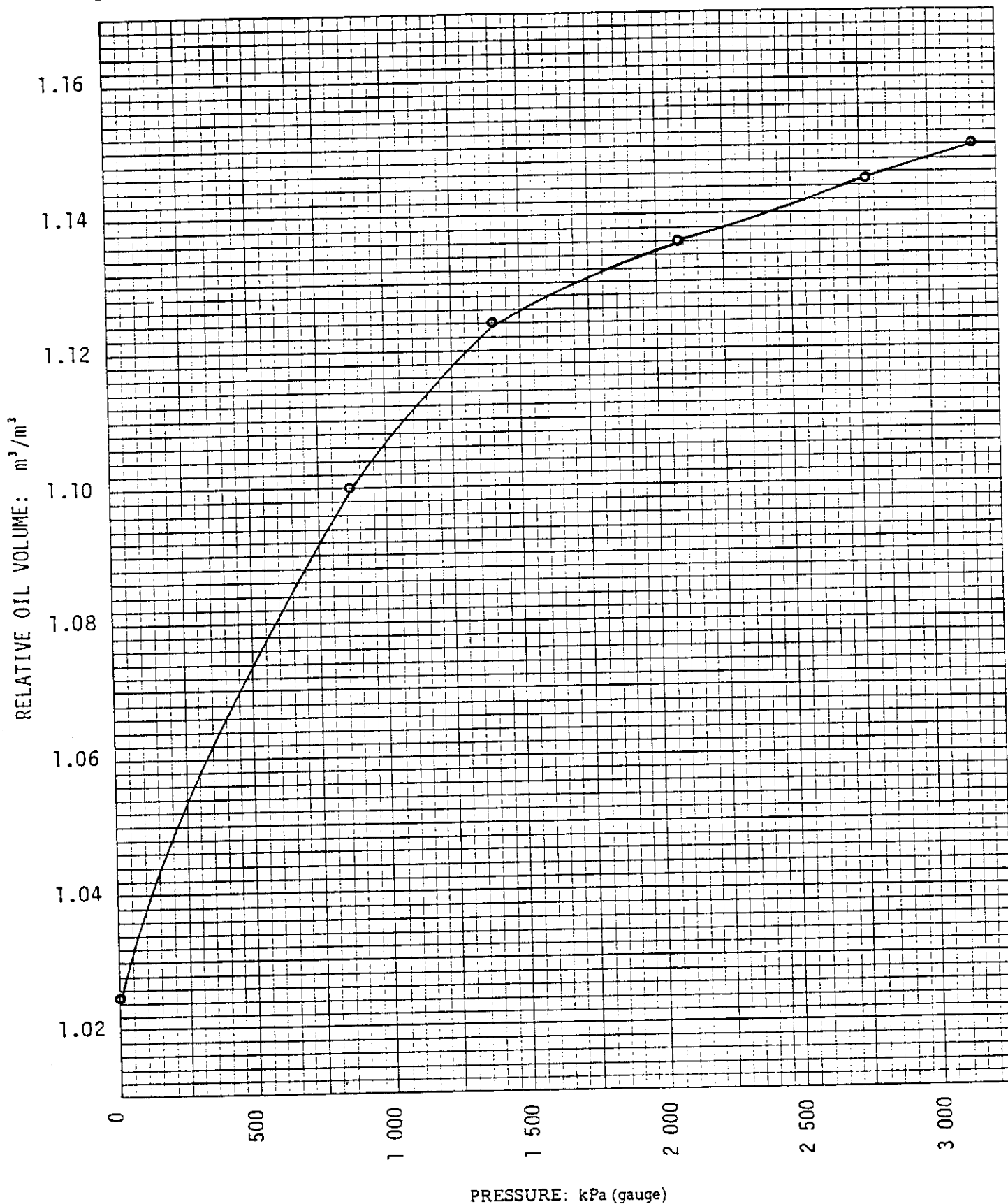
OIL DENSITY

Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
Well	Omega Waskada 8-24-1-26 (W1M)	Province	Manitoba
Field	Waskada	Country	Canada



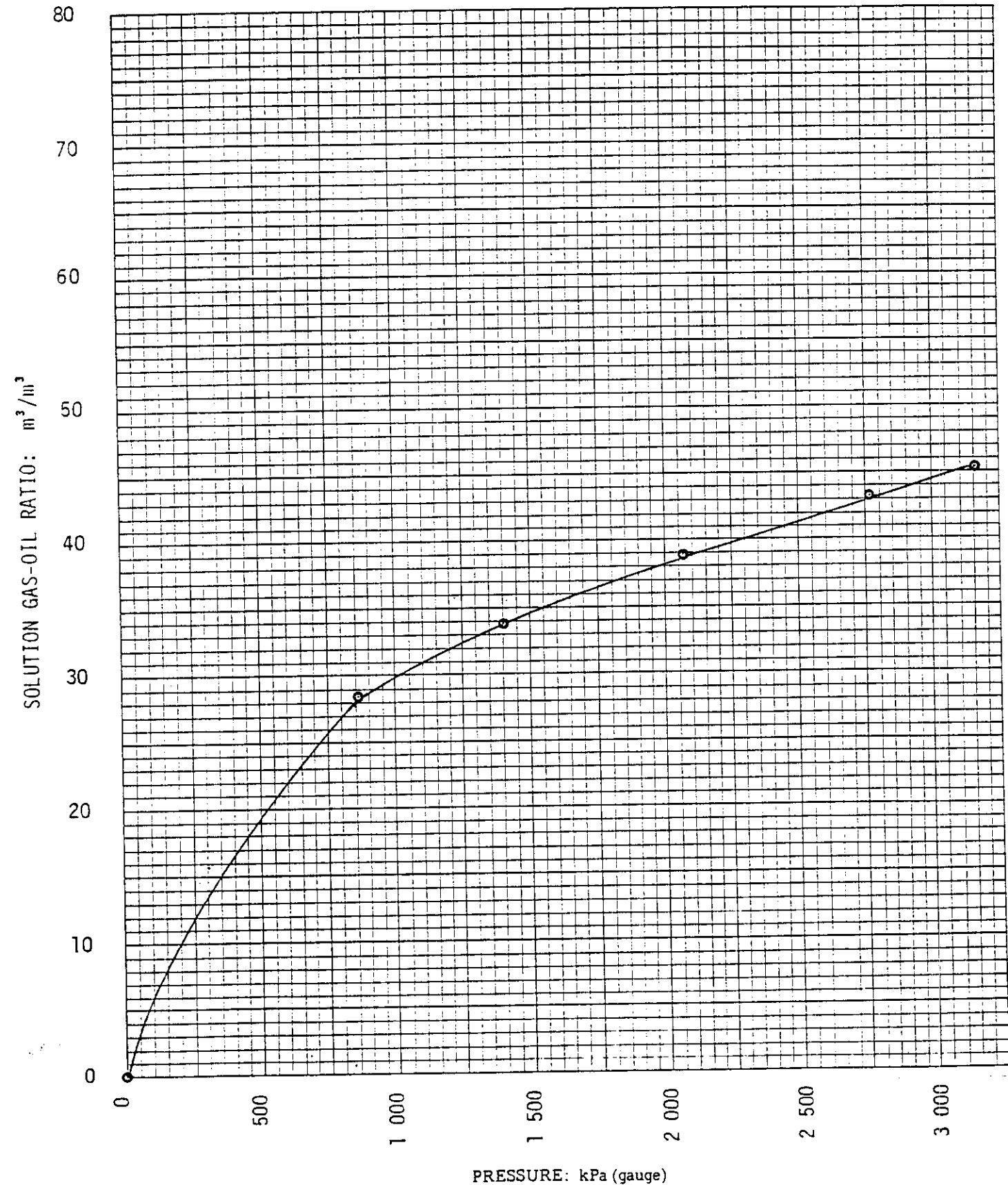
RELATIVE OIL VOLUME (V/VR)

Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
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Field	Waskada	Country	Canada



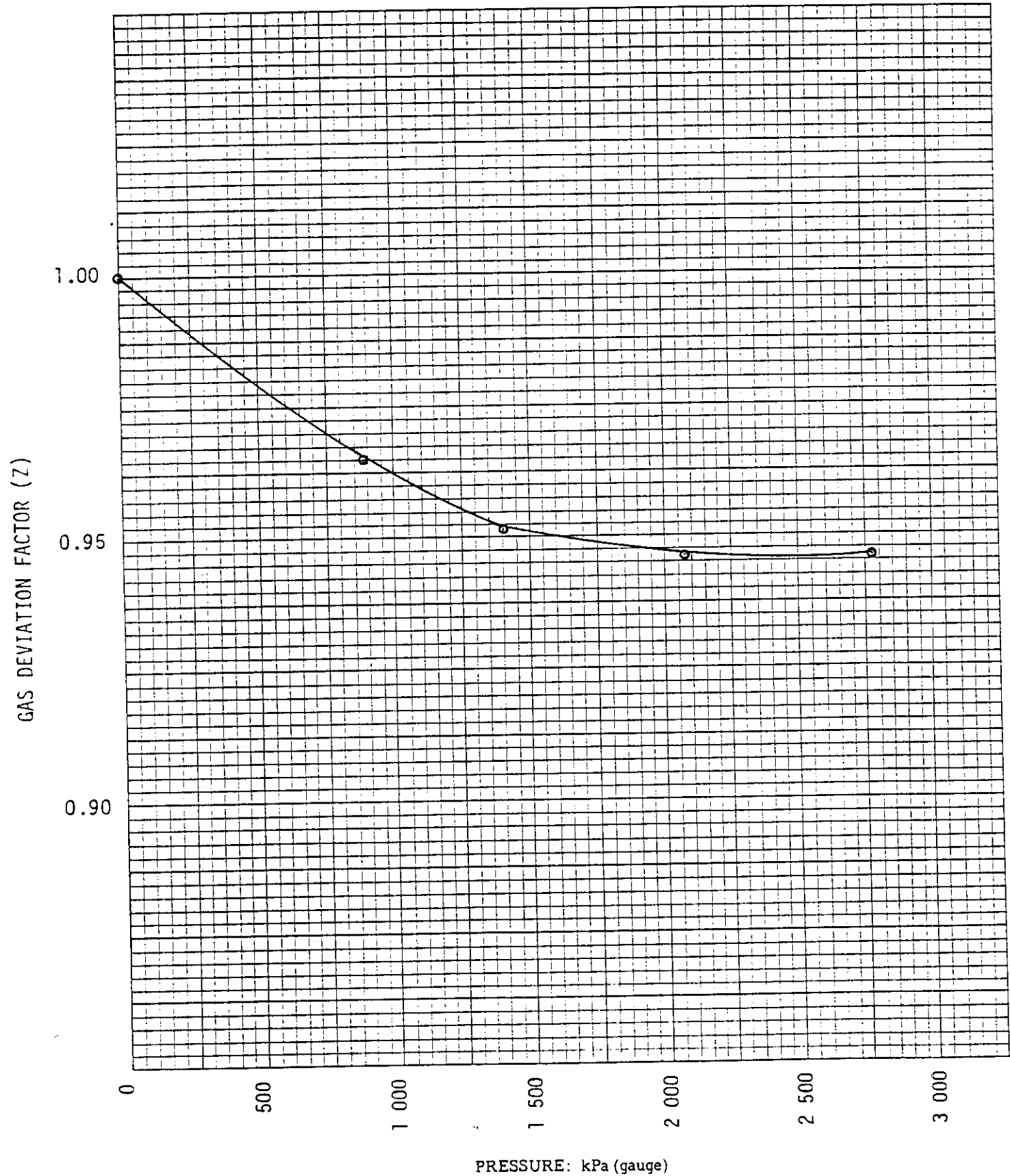
SOLUTION GAS-OIL RATIO

Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
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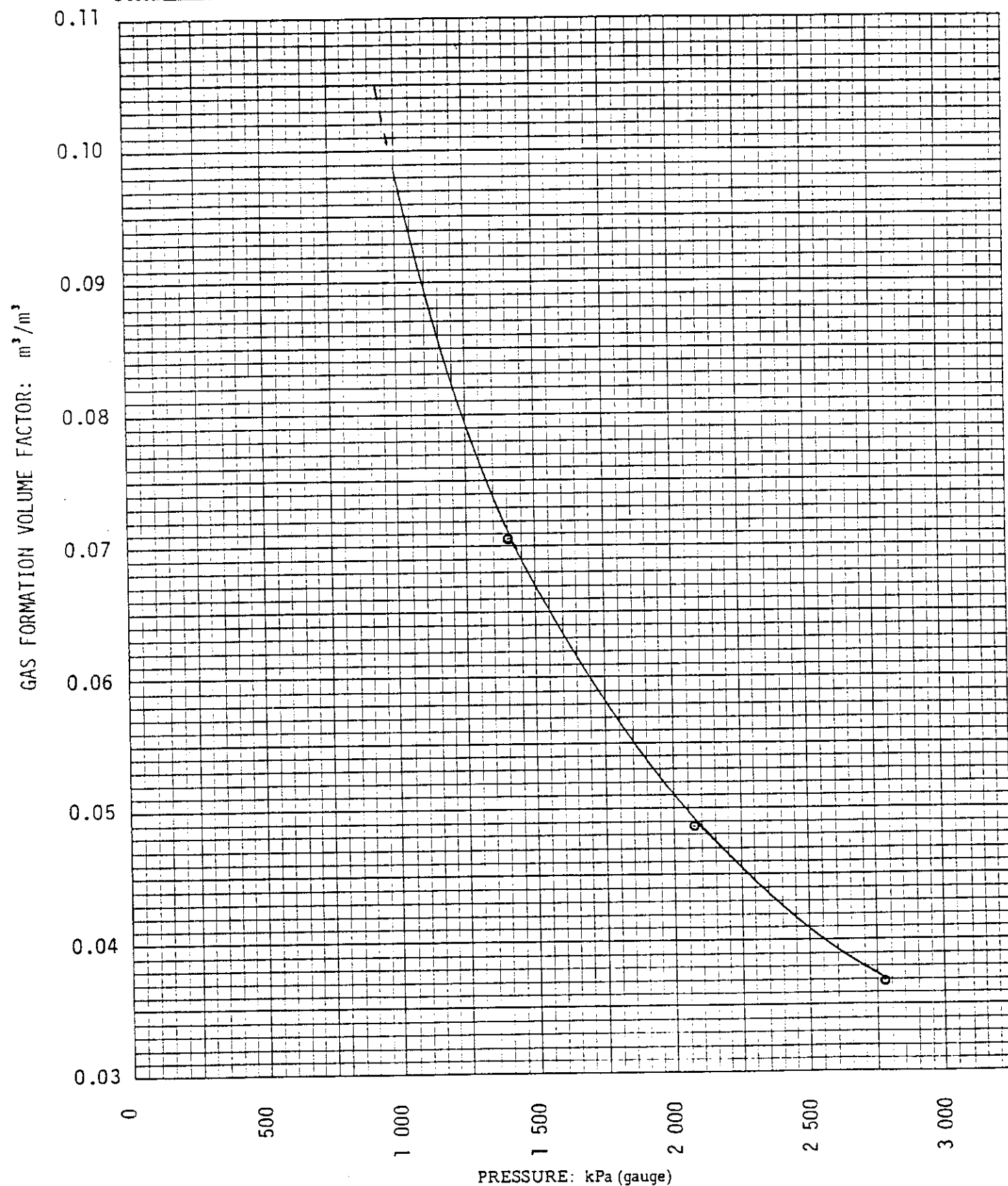
GAS DEVIATION FACTOR (Z)

Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
Well	Omega Waskada 8-24-1-26 (W1M)	Province	Manitoba
Field	Waskada	Country	Canada



GAS FORMATION VOLUME FACTOR

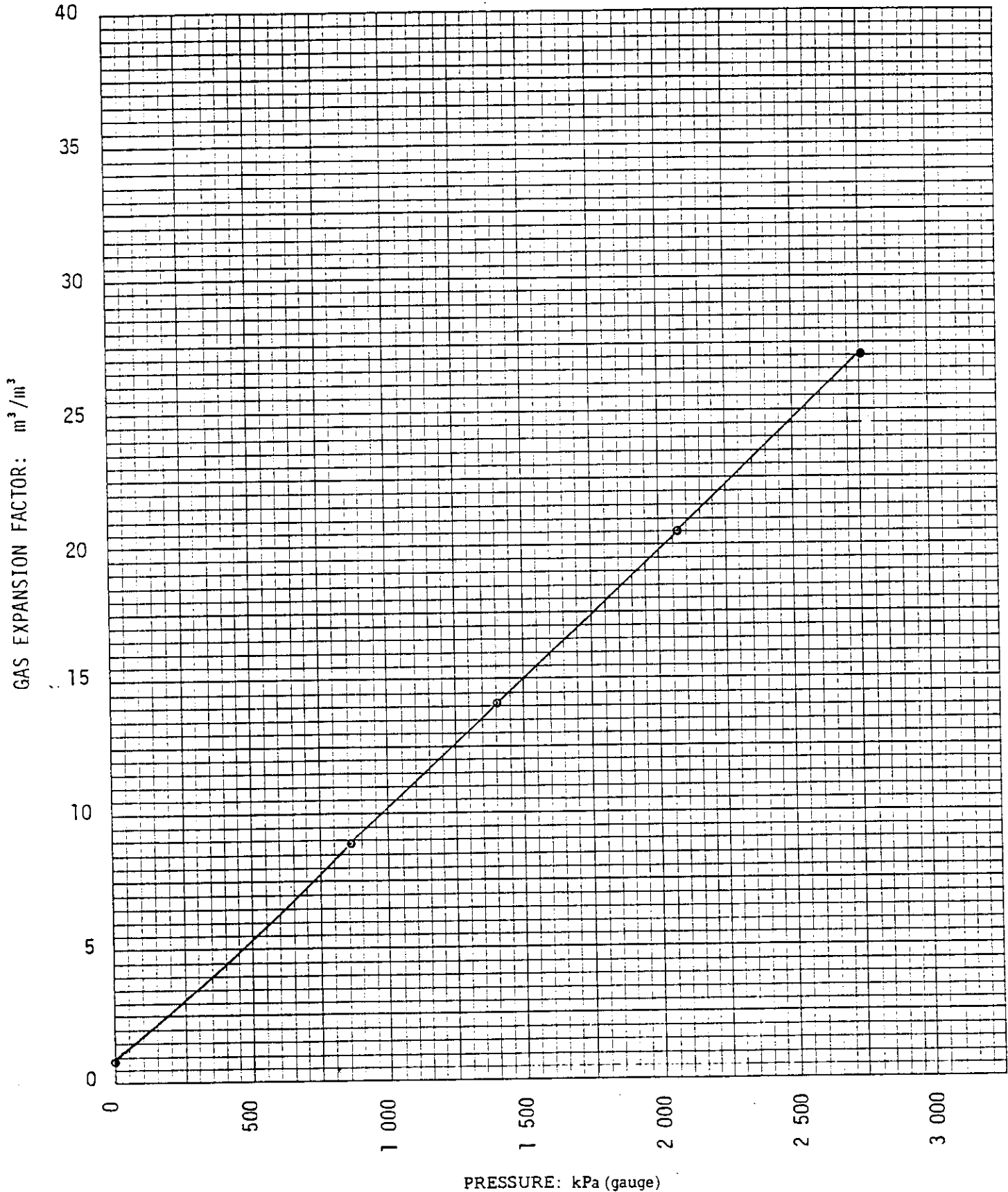
Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
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GAS EXPANSION FACTOR

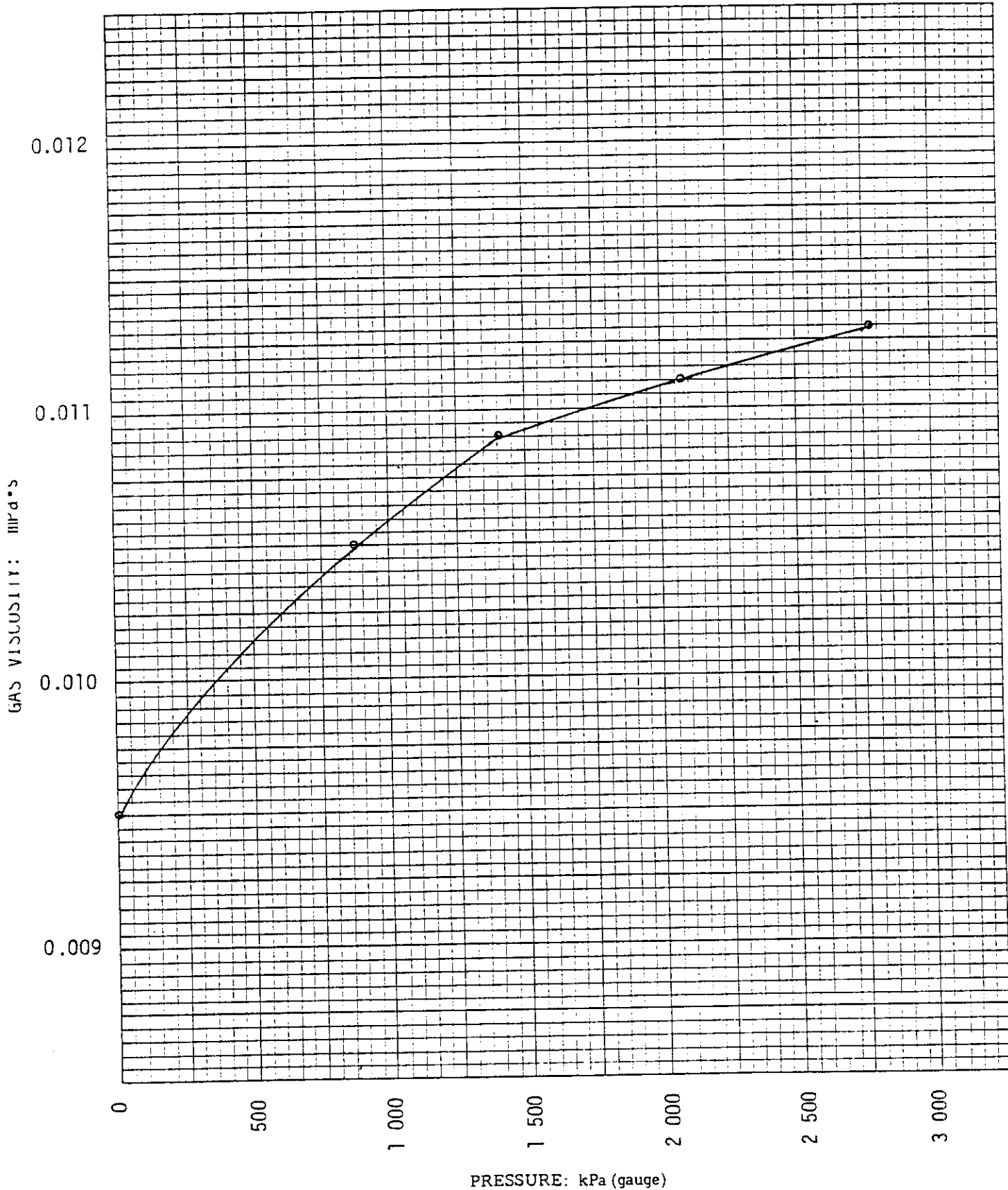
Page 13 of 15  
File 7013-82-34

Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
Well	Omega Waskada 8-24-1-26 (W1M)	Province	Manitoba
Field	Waskada	Country	Canada



GAS VISCOSITY

Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
Well	Omega Waskada 8-24-1-26 (W1M)	Province	Manitoba
Field	Waskada	Country	Canada





OIL VISCOSITY AT 45.0°C

Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
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Field	Waskada	Country	Canada

