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CLASSIFICATION

MADE BY

Bengt Hultberg

SUBTITLE

TITLE

# Well Testing Report

34/10-16

LET/BERGEN

June 1984

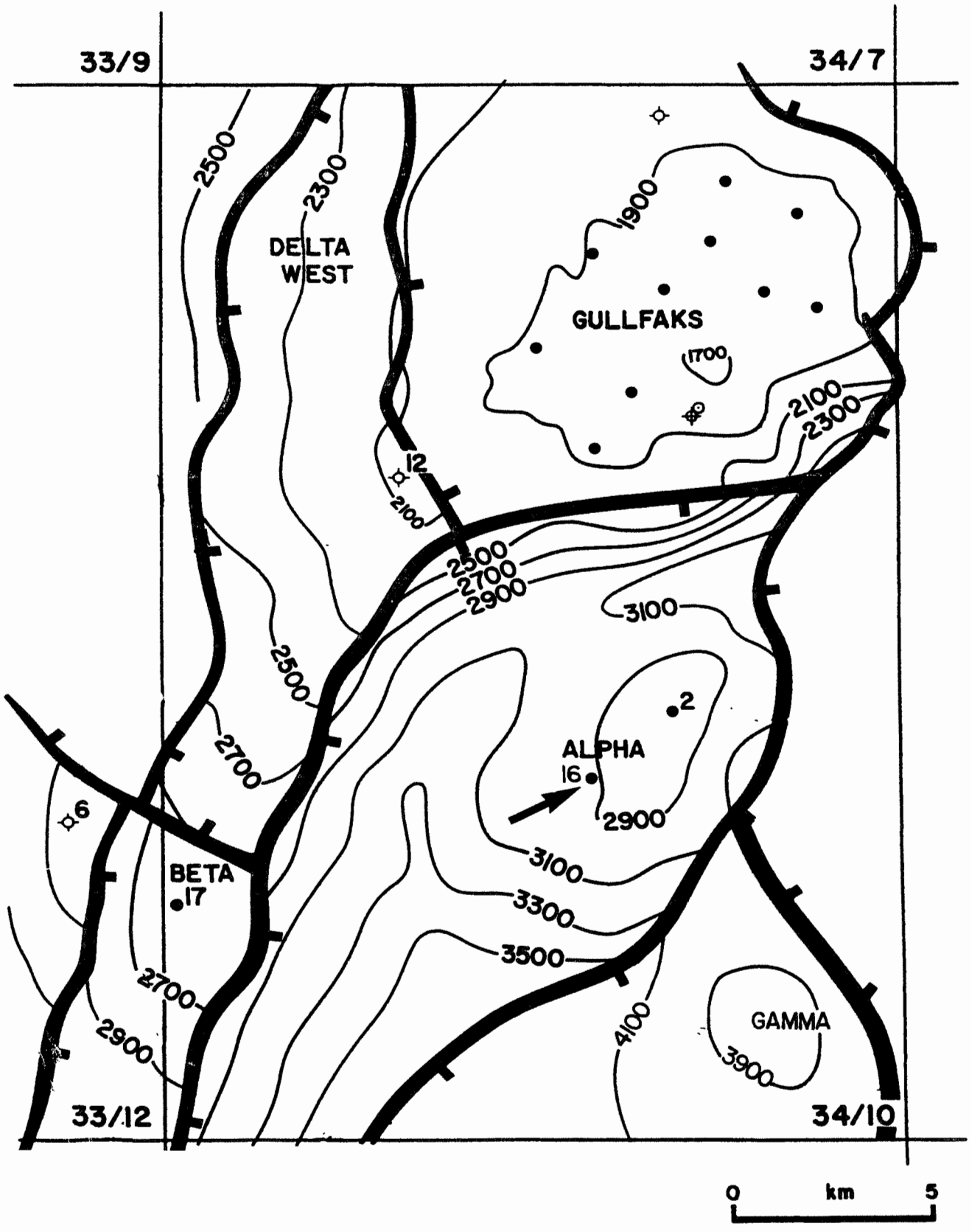
COMPLETED

APPROVED

CONTENTS

GENERAL

| | |
|---|---|
| Licence: | PL 050 |
| Well: | 34/10-16 |
| Location: | 61°05'36" N<br>02°10'47" E |
| Rig: | Neptuno Nordraug (drilling)<br>Ross Isle (testing) |
| Spudded: | 14 December 1982 |
| Rig Released: | 13 April 1983 |
| Reentered: | 30 August 1983 |
| Rig released: | 28 September 1983 |
| RKB-elevation: | 25m (N. Nordraug)<br>22m (Ross Isle) |
| Water Depth: | 138m |
| Total Depth: | 4042m |
| Objective: | Jurassic Sandstones |
| Operator: | Statoil |
| Partners: | Norsk Hydro, Saga Petroleum |
| Status: | Plugged and Abandoned |



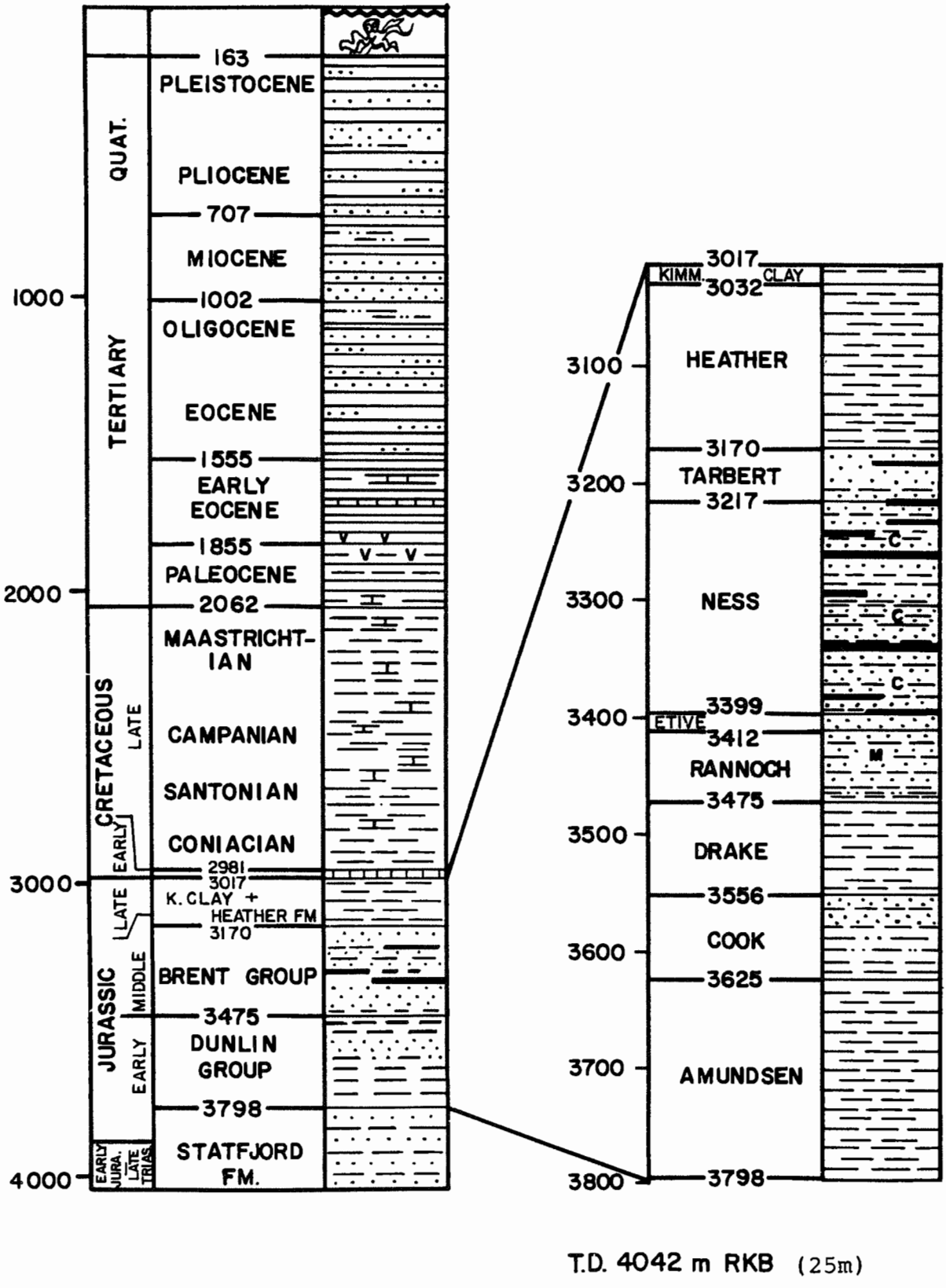

Block 34/10

TOP JURASSIC

Main structural elements

Figure 1

# 34/10-16 GENERALIZED STRATIGRAPHY




T.D. 4042 m RKB (25m)

Figure 2

## INTRODUCTION

Well 34/10-16 is the second well drilled on the Alpha structure in block 34/10.

The well was drilled into sediments of Triassic age to a total depth of 4017 m MSL.

The two primary objectives were sandstones of middle- and lower Jurassic age, the Brent Group and the Statfjord Formation.

The Brent sandstones was found to be hydrocarbonbearing while no hydrocarbons were encountered in the Statfjord formation.

This report contains test analysis of two production tests and two runs with RFT-A carried out in the Brent Group.

In the following, RKB-depths refers to Ross Isle (22 m).

OBJECTIVES

The objectives for testing well 34/10-16 were:

a) Estimate reservoir properties

b) Estimate reservoir pressure and temperature

c) Obtain fluid samples

d) Estimate productivity

CONCLUSION

DST no 1 (3397 - 3407 m RKB)

The average production rate during the main flow was:
(choke size = 48/64")

Oil: 960 $Sm^3/D$
Gas: 182 x $10^3$ $Sm^3/D$
GOR: 191 $Sm^3/Sm^3$
Oil gravity: 0.857 g/cc
Gas gravity: 0.670 (air = 1)

The drillstem test analysis gives a reservoir pressure of 458.4 bar at the midpoint of the perforated interval.

The permeability is calculated to 138 md.

The total skinfactor is estimated to 11.

The maximum recorded bottomhole temperature was 128.8°C.

Three sets of PVT samples were taken during the main flow.

One succesful run with two bottomhole samplers were carried out.

No sand was produced.

DST no 2 (3177 - 3187 m RKB)

The reservoir pressure is estimated to 449.2 bar.

The permeability is calculated to 379 mD (second build up) 360 mD (third build up).

The total skinfactor is estimated to 71.5 (second) 77.8 (third).

The average production rate was:

| | Gas $10Sm^3/D$ | Condensate $Sm^3/D$ | GOR $Sm^3/Sm^3$ | Oil grav g/cc | Gas grav (air=1) |
|---|---|---|---|---|---|
| Second flow (48/64") | 1293 | 314 | 4120 | 0.79 | 0.66 |
| Third flow (80/64") | 1647 | 400 | 4118 | 0.79 | 0.66 |

The maximum recorded bottomhole temperature was 117.9°C.

Four sets of PVT samples were taken from the separator. Two during the second and third flow resp.

The test produced a small amount of water.

No sand was produced.

RFT-A

Two segregated fluid samples were successfully recovered.

Sampling results (6 gallon chambers)

| | | |
|---|---|---|
| Depth, m RKB | 3356 | 3345 |
| Fluid type | Oil | Condensate |
| Fluid density, g/cc | 0.88 | 0.80 |

The sampling results proves that the gas/oil contact is, as expected, between these two points.

TABLE 1 TESTI

WELL 34/10-16

| | | | TEST OPERATION | | | | | | | | | | TEST ANALYSIS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DST NO. | FM | PERF. INT.MRKB | OPER. | DURATION MIN. | BHP BAR | CHOKE 1/64" | T °C | OIL RATE $SM^3/D$ | GAS RATE $10^3 SM^3/D$ | GOR $SM^3/SM^3$ | OIL GRAV g/cc | GAS GRAV (AIR=1) | KH KH (MDM) | K K (MD) | SKIN |
| 1 | Etive | 3397-3407 | Initial flow | 3 | 348 | 48 | 122 | | | | | | | | |
| | | | Initial build-up | 64 | 458.4 | | 124 | | | | | | | | |
| | | | Second flow | 667 | 307 | 48 | 129 | 955 | 182 | 191 | 0.86 | 0.67 | 1790 | 138 | 11 |
| | | | Second build-up | 656 | 460 | | 129 | | | | | | | | |
| | | | BHS | | 450 | 8 | 127 | | | | | | | | |
| 2 | Tarbert | 3177-3187 | Initial flow | 2 | 396 | 52 | 110 | | | | | | | | |
| | | | Initial build-up | 66 | 449.2 | | 112 | | | | | | | | |
| | | | Second flow | 550 | 408 | 52 | 117 | 314 | 1293 | 4120 | 0.79 | 0.66 | 7200 | 379 | 71.5 |
| | | | Second build-up | 539 | 448.9 | | 118 | | | | | | | | |
| | | | Third flow | 423 | 392 | 80 | 118 | 400 | 1647 | 4118 | 0.79 | 0.66 | 6832 | 360 | 77.8 |
| | | | Third build-up | 575 | 448.6 | | 118 | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

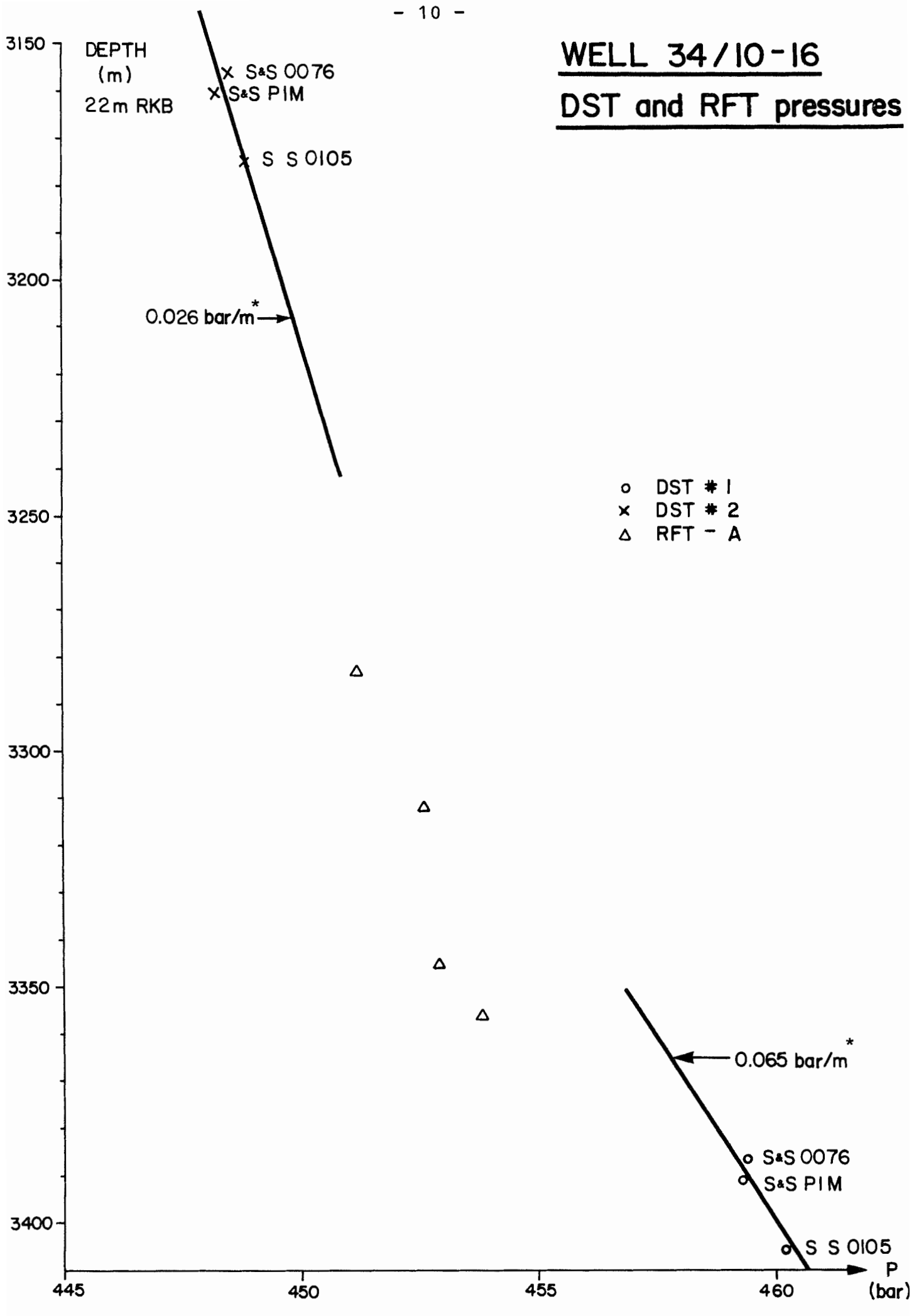



Figure 3

*/ laboratory measurements

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DISCUSSION:

Operations DST no. 1

The test was performed in the Etive sand. The test was conducted according to the test program.

The testinterval 3397-3407 m RKB was perforated with 4 shots/ft.

Seawater was used as cushion in the teststring.

A conventional Halliburton teststring with a LPR-testing valve was used during the test, see appendix A1-10 for layout of the teststring.

The choke manifold and the LPR-valve was closed simultaneously for the buildups. Observation of increasing well head pressure for the first 30 mins. of the main buildup indicated that the LPR-valve was leaking. See buildup plots in appendices A1-3 and A1-12.

The test was performed with a short initial flow, followed by an initial buildup with a duration of approximately one hour.

The main flow had a duration of approximately 11 hours.

Cleaning up the well and getting a fairly stable flow took approx. 3 hours. The oil was very viscous and it was therefore decided to go through the heater in order to get a good separation (a pour point of $+24^{o}C$ and a wax appearance point of $+35^{o}C$ are later measured in the laboratory).

The following flow rates were recorded during the main flow (48/64" choke):

Oil rate: 954-963 $Sm^3/D$
Gas rate: 181-185 x $10^3$ $Sm^3/D$

The bottomhole pressure increased during the main flow from 303 bar to 307 bar and the wellhead pressure increased from 103 bar to 107 bar.

The well was shut in for an eleven hours long buildup period.

The well was then opened up on a 12/64" choke prior to inserting the bottomhole samplers in the teststring, the well produced however only gas on this choke size. The reason for this was the high pour point (+24$^{o}$C) in combination with that the teststring had cooled off during the buildup. It was therefore decided to increase the choke size and flow the well so that the teststring would have time to warm up.

One succesfull run with two bottomhole samplers was done, and the test was ended. Both samplers were run through the bottom hole assembly and the samples were taken at 3389 resp. 3393 m RKB.

The sampling pressure was recorded with a surface read-out system.

Sampling conditions were (8/64" choke):

Oil rate: 68 $Sm^3$/day
Gas rate: 15 x $10^3$ $Sm^3$/day

Sampling pressure was 449 bar.

Sampling at surface:

1. Three sets of PVT samples
2. Dead oil
3. Water

All samples were taken from the separator. Sampling details are given in appendix A1-8.

The cement bond above/below the testinterval was considered good and hence no cement squeeze was needed. A copy of the cement bond log is included in appendix A1-11.

Operations DST no. 2

The test was performed in the Tarbert sand. The test was conducted according to the test program.

The testinterval 3177-3187 m RKB was perforated with 4 shots/ft.

Seawater was used as cushion in the teststring.

A conventional Halliburton teststring with a LPR-testing valve was used during the test, see appendix A2-10, for layout of teststring.

Both the choke manifold and the LPR-valve were closed during the buildups.

The LPR-valve was however opened 30 minutes before the second buildup ended. This was to see whether the valve was leaking or not. The wellhead pressure did not change when the LPR-valve was opened, and this indicates that the valve leaked.

The test was performed with a short initial flow, followed by an initial buildup that lasted for approximately one hour.

The second flow period had a duration of approximately 9 hours.

The flow was considered clean enough to divert through the separator after only 45 minutes, getting a stable flow took however almost 2 hours.

The following flow rates were recorded during the second flow (52/64" choke):

Condensate: 310-322 $Sm^3$/day
Gas: 1281-1296 x $10^3$ $Sm^3$/day

The bottomhole pressure increased during the second flow from 403 bar to 408 bar and the wellhead pressure increased from 229 bar to 233 bar.

The well was shut in for a 9 hours buildup period and then opened up on a 80/64" choke for a third flow which lasted for 6 hours. The flow stabilized quickly and readings on the separator could start after one hour flow.

The following rates were recorded during the third flow (80/64" choke):

Condensate: 371-402 $Sm^3$/day
Gas: 1638-1649 x $10^3$ $Sm^3$/day

The bottom hole pressure in the third flow increased during the stable flow period from 390 bar to 392 bar and the wellhead pressure increased from 144 bar to 145 bar.

The gas rate was fairly stable during this period, but the oil rate fell almost constantly. The meter factor is most likely incorrect during this flow. A rate of 400 $Sm^3$/day have been used in the calculations, as this gives a GOR similar to that measured in the second flow.

The well was shut in for a buildup period of 9.6 hours.

Sampling at surface:

1. 2 sets of PVT samples (second flow)
   2 sets of PVT samples (third flow)
2. Dead condensate
3. Water

All samples were taken from the separator, for details see appendix A2-8.

The cement bond above/below the testinterval was considered good and hence no cement squeeze was considered needed. A copy of the cement bond log is included in appendix A2-11.

RFT-A

No pressure points or samples were taken during the reservoir logging due to bad hole conditions.

Two successful runs with the RFT-A tool (through casing) were performed between DST 1 and DST 2.

Two segregated samples were taken, (each consisting of one 1-gallon chamber and one 6-gallon chamber). The 1-gallon chambers were sealed off and sent to Statoil Lab for analysis. The 6-gallon chambers were bled off on the rig and the results are listed below.

Sampling results (6 gallon chambers) :

| | Run 1 | Run 2 |
|---|---|---|
| Depth m RKB, Ross Isle | 3356 | 3345 |
| Fluid type | Oil | Condensate |
| Fluid recovery, $cm^3$ | 17000 | 1800 |
| Fluid density, $g/cm^3$ | 0.88 | 0.80 |
| Gas recovery, $m^3$ | 25.06 | 54.57 |
| $CO_2$ (draeger) % | 0.8 | 1.75 |
| $H_2S$ (draeger) % | 0 | 0 |

Pressure results

| Depth m RKB | Hydr.bef. bar | Form.pr. bar | Hydr.after bar |
|---|---|---|---|
| 3283 | 511.7 | 451.2 | 511.9 |
| 3312 | 516.0 | 452.6 | 516.8 |
| 3345 | 522.9 | 452.9 | 524.7 |
| 3356 | 528.8 | 453.8 | 524.2 |

ANALYSIS

DST no. 1

The reservoir pressure is 458.4 bar at the midpoint of the perforated zone, calculated from the initial buildup.

The Horner method was chosen for the calculations as the semilog straight line is well defined from the main buildup. The reservoir reached a semilog straight line behavior after approximately 45 minutes, see appendix A1-3.

The afterflow, due to leaking LPR-valve had a duration of 30 min.

A kh value of 1790 mdm is calculated using a slope, m, of 0.574 bar/cycle, see appendix A1-3. The formation thickness contributing to the test response has been estimated using the available core and log analysis data. A low permeability zonr is seen from 3409-3411 m RKB. The coal layer on top of the Etive formation is belived to be impermeable. This gives a producing interval of 13 m, which is used in the calculations. The calculations gives a permeability of 138 md, whic is less than the aritmetic mean of the laboratory measured core permeability (208 md). The skin was estimated to 11.

DST no. 2

The initial build up indicates a reservoir pressure of 449.2 bar at the midpoint of the perforated interval.

The Horner method was used in both the second and the third build up, as the semilog straight lines were well defined. See appendix A2-3.

The reservoir reached in both buildups, a semilog straight line behavior after approximately 30 minutes.

A coal layer at 3175-3177 m RKB and a shale layer at 3196 m RKB defines the vertical extent of the contributing formation in this test. A producing interval of 19 m in the calculations gives the following results:

| | m (bar/cycle) | kh (mdm) | k (md) | s |
|---|---|---|---|---|
| second build up | 0.754 | 7200 | 379 | 71.5 |
| third build up | 0.750 | 6832 | 360 | 77.8 |

Laboratory measurements give a core permeability of 536 md (aritmetric mean over the perforated interval).

Productivity DST no. 2

One of the objectives of this test was to evaluate the productivity of the Tarbert formation.

A plot of pressure versus rate for the two flow rates on back pressure curves gives a n-exponent of 0.73, indicating pressure drop due to turbulent flow.

The turbulent and laminar parts of the total drawdown has been calculated, assuming radial semisteady state gas flow in the reservoir.

| Rate no. | $q_g$ ($10^6 Sm^3/D$) | $\Delta P_{turb.}$ (bar) | $\Delta P_{laminar}$ (bar) | $\Delta P_{tot}$ (bar) |
|---|---|---|---|---|
| 1 | 1.293 | 13.5 | 26.5 | 40.0 |
| 2 | 1.647 | 22.0 | 34.0 | 56.0 |

One can see that the turbulent part of the total drawdown increases with the rate.

Pressure drawdown at higher rates can be calculated by the following formula (assuming negligible change in viscosity and z-factor with pressure, and no change in saturation):

$$pwf = (p^{*2} - Cq_g - Dq_g^2)^{0.5}$$

The constants C (for laminar flow) and D (for turbulent flow) have, by using the test results, been calculated to:

$$C = 0.018$$
$$D = 7.0 \times 10^{-9}$$

Bottom hole pressure for higher rates have been estimated as shown in figure 4.

Figure 4 also shows that the well was flowing almost at the maximum rate, for this specific teststring (2700 m 5" and 450 m 3 1/2"), during the third flow period.

# Bottom Hole Pressure and Tubing Pressure Loss versus Rate 34/10-16, DST 2

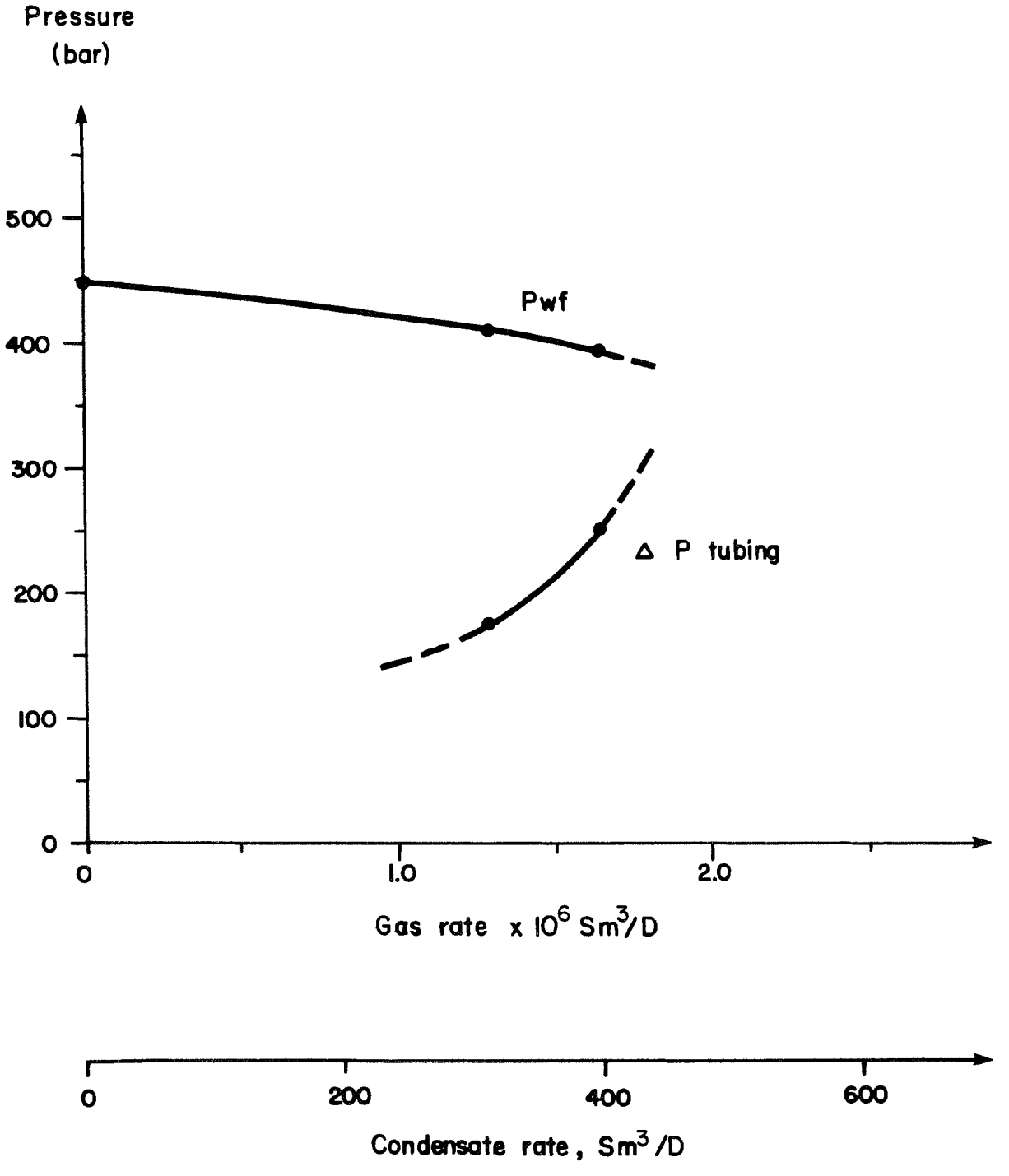


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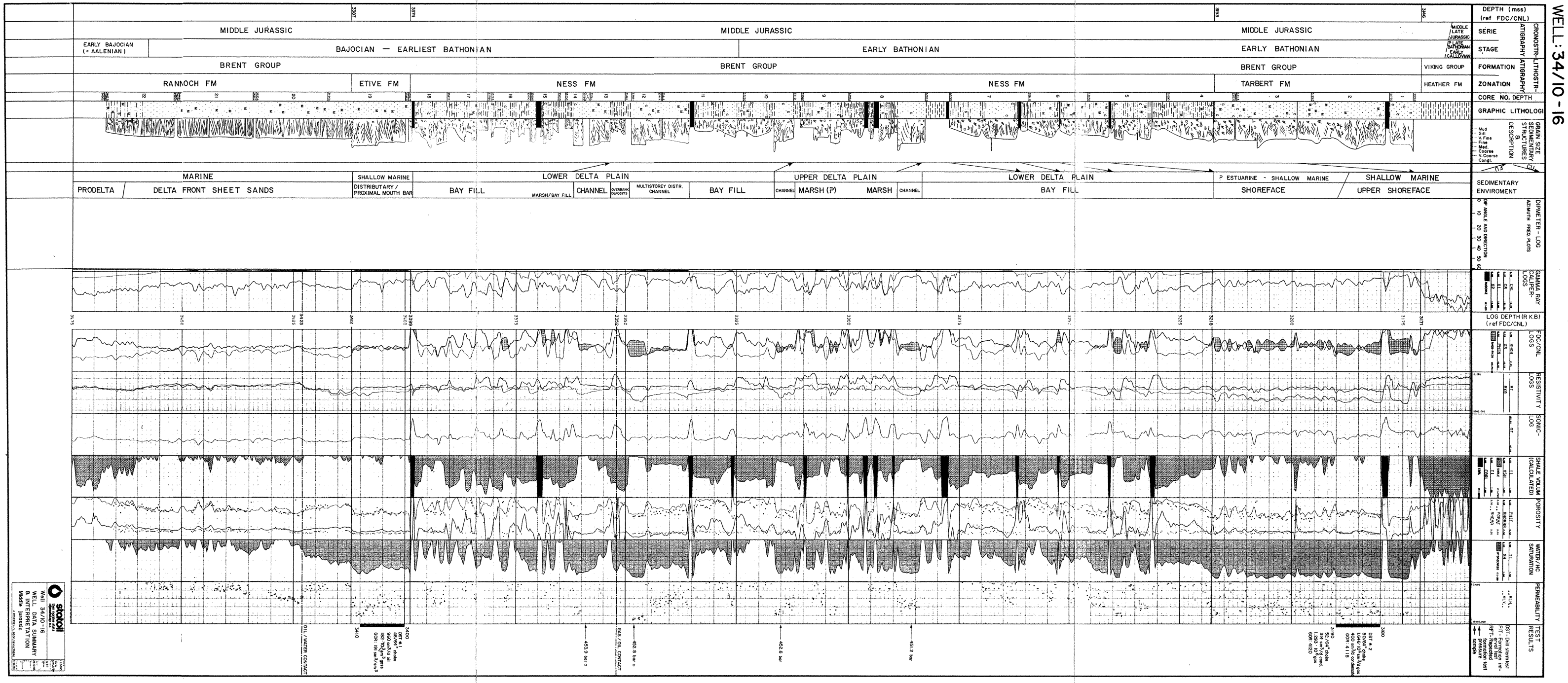
Figure 4

WELL: 34/10 - 16

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Well 34/10-16

WELL DATA SUMMARY & INTERPRETATION

Middle jurassic

REFERENCES

1. Petrophysical Evaluation,
Well 34/10-16, Statoil, Oct. 1983

2. PVT-Analysis, well 34/10-16
DST no. 1, Statoil, lab.84.202

3. TBP distillation of oil from
34/10-16, DST no. 1
Statoil, lab.84.206

4. Sperry Sun
Pressure Survey Report : DST no. 1, gauge no. 0076, 0105, PIM

" " DST no.2, gauge no. 0076, 0105, PIM

" " DST no.1, Mr six surface pressures

" " DST no. 2, Mr six surface pressures

5. Flopetrol

Well testing report, DST no. 1, no.83/2301/36
Well testing report, DST no. 2, no.83/2301/37

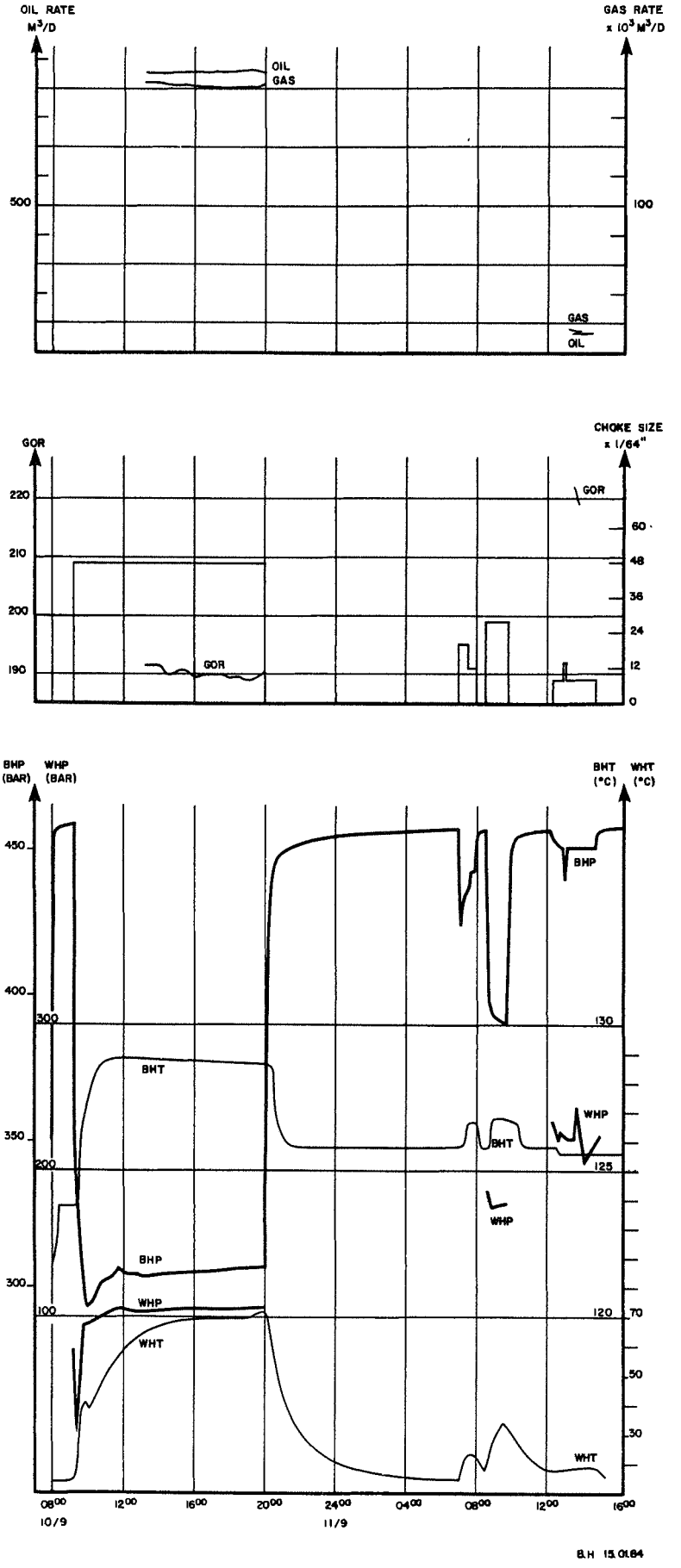
6. Core Lab. : Reservoir Fluid Study
34/10-16, DST no.2

7. Geco : Routine Core Analysis,
well 34/10-16

APPENDIX 1

34/10-16 DST #1

PRESSURE, TEMPERATURE, RATE, GOR AND CHOKE SIZE



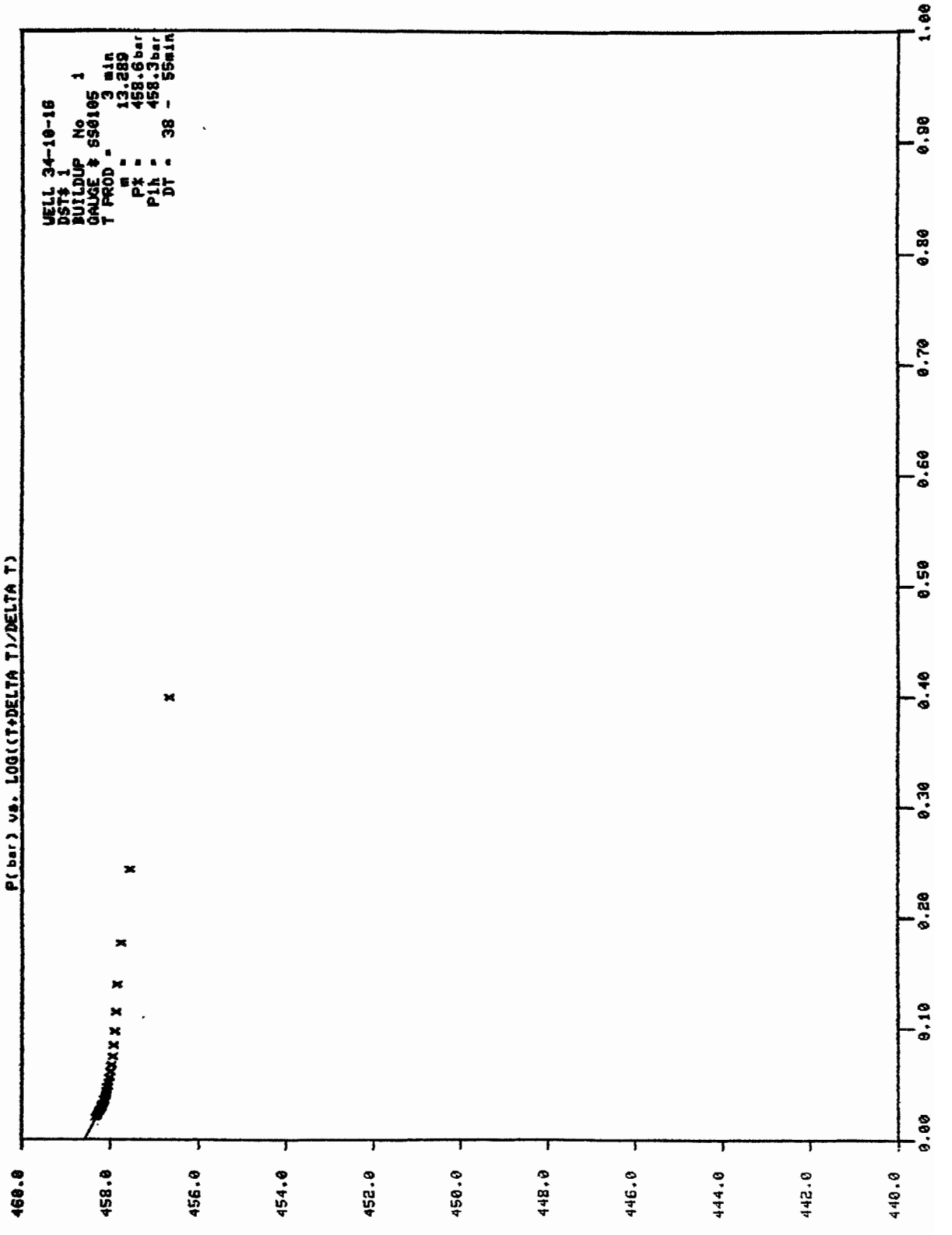
| Well | 34/10-16 |
|---|---|
| DST no. | 1 |

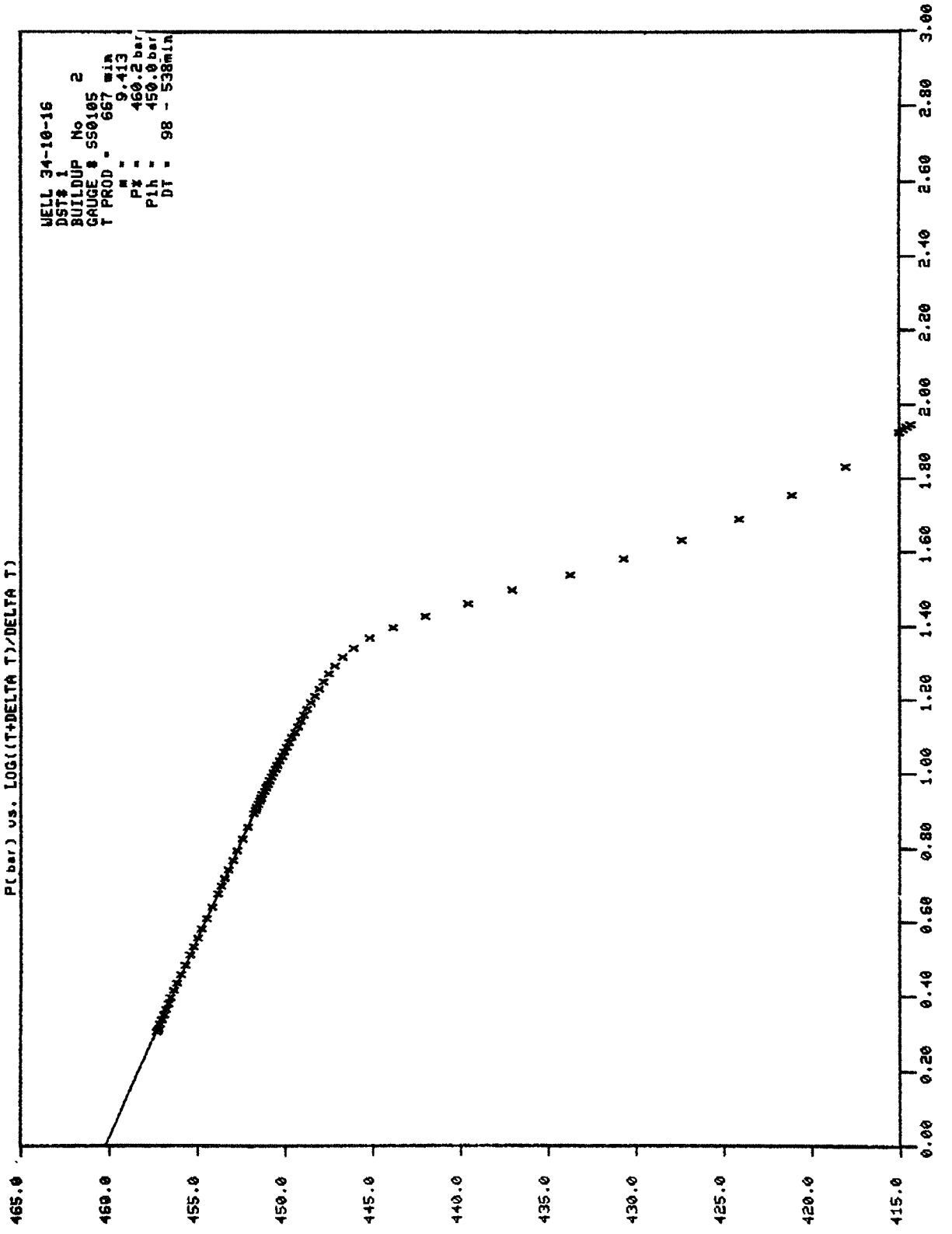
# FLOW DATA

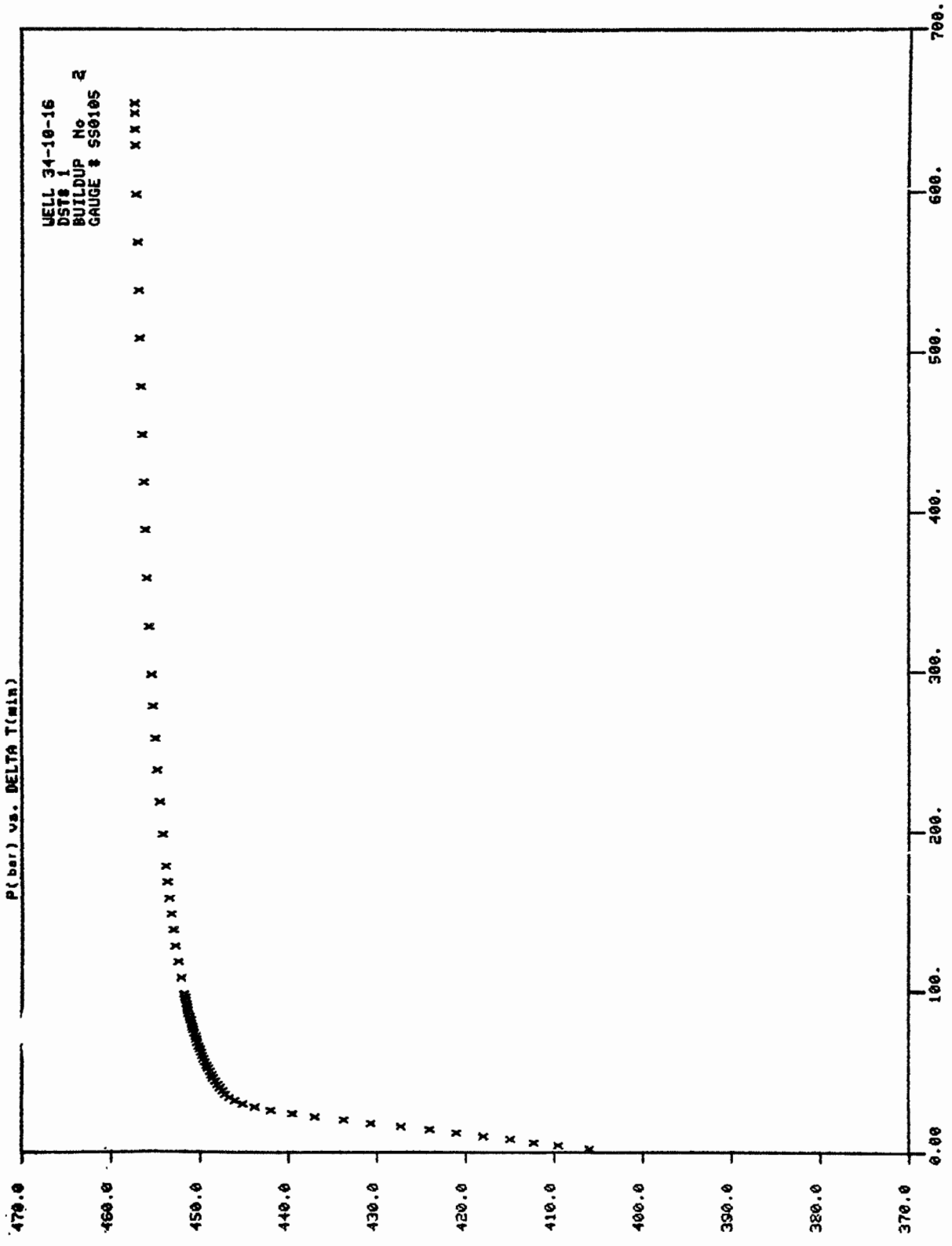
| CHP/PG | |
|---|---|
| Perfs. : | 3397-3407 m RKB |
| Zone tested | Etive |

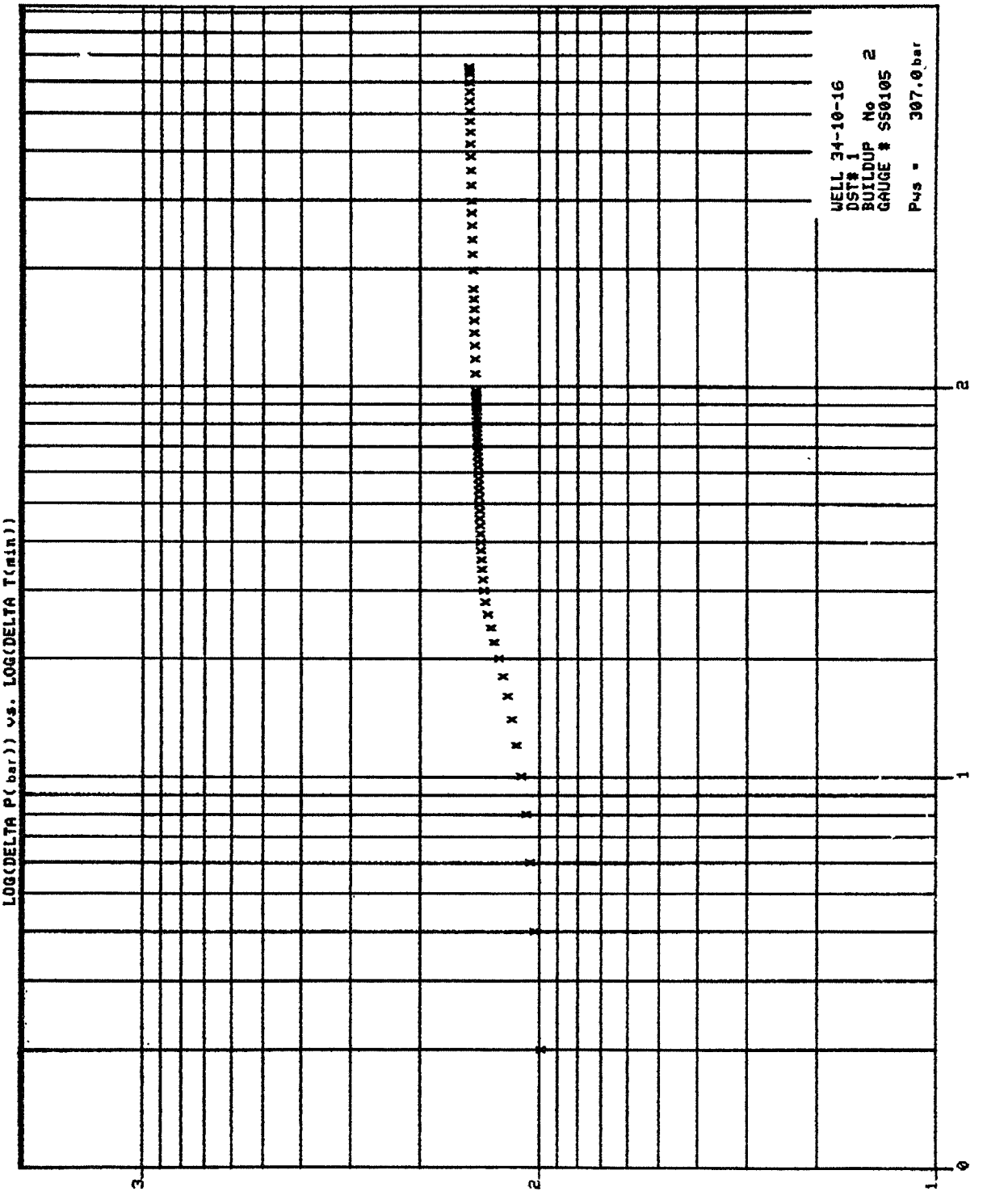
| Date/ time | Bottom hole | | Well head | | Chokes 1/64" | | Separator data | | | | | | | Liq. and gas analysis | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | press. bar | temp °C | press bar | temp. °C | mani-fold | heat. | press. bar | temp. °C | gas rate $10^3 Sm^3/D$ | oil rate $Sm^3/D$ | GOR $Sm^3/Sm^3$ | sp.gr.oil | sp.gr.gas (Air=1) | Water % | Sedim. % | $CO_2$ % | $H_2S$ ppm | | |
| 10/9-83 | | | | | | | | | | | | | | | | | | | |
| 13:30 | 303.7 | 128.8 | 103.2 | 71 | 48 | | 23.1 | 55.6 | 184.5 | 955.4 | 193 | 0.856 | 0.660 | – | – | 1.0 | – | | |
| 14:00 | 304.1 | 128.8 | 103.7 | 72 | 48 | | 22.7 | 57.8 | 184.0 | 954.0 | 193 | 0.856 | 0.660 | – | – | | – | | |
| 14:30 | 304.5 | 128.8 | 104.0 | 73 | 48 | | 22.7 | 58.9 | 182.4 | 957.5 | 190 | 0.856 | 0.669 | – | – | 1.5 | – | | |
| 15:00 | 304.8 | 128.8 | 104.4 | 73 | 48 | | 22.7 | 59.4 | 182.7 | 958.2 | 191 | 0.856 | 0.669 | – | – | | | | |
| 15:30 | 304.9 | 128.6 | 104.5 | 73 | 48 | | 22.7 | 59.4 | 182.7 | 958.2 | 191 | 0.856 | 0.669 | – | – | | | | |
| 16:00 | 305.0 | 128.6 | 104.7 | 73 | 48 | | 22.7 | 59.4 | 181.5 | 959.7 | 189 | 0.856 | 0.669 | – | – | 1.0 | – | | |
| 16:30 | 305.1 | 128.6 | 104.8 | 74 | 48 | | 22.7 | 59.4 | 181.5 | 957.5 | 190 | 0.856 | 0.669 | – | – | | | | |
| 17:00 | 305.3 | 128.6 | 105.0 | 75 | 48 | | 22.7 | 59.4 | 181.7 | 958.2 | 190 | 0.857 | 0.668 | – | – | | | | |
| 17:30 | 305.4 | 128.6 | 105.1 | 75 | 48 | | 22.7 | 59.4 | 181.7 | 958.2 | 190 | 0.857 | 0.668 | – | – | | | | |
| 18:00 | 306.0 | 128.6 | 105.4 | 76 | 48 | | 22.7 | 59.4 | 181.7 | 959.0 | 189 | 0.857 | 0.668 | – | – | 1.5 | – | | |
| 18:30 | 306.2 | 128.6 | 105.7 | 76 | 48 | | 22.7 | 59.4 | 181.6 | 961.8 | 189 | 0.857 | 0.668 | – | – | 1.5 | – | | |
| 19:00 | 306.1 | 128.6 | 105.7 | 77 | 48 | | 22.7 | 60.0 | 180.8 | 963.2 | 188 | 0.857 | 0.670 | – | – | | | | |
| 19:30 | 306.5 | 128.6 | 106.1 | 77 | 48 | | 22.7 | 60.0 | 181.6 | 962.5 | 189 | 0.857 | 0.670 | – | – | 2.0 | 0+ | | |
| 20:00 | 306.7 | 128.6 | 106.4 | 77 | 48 | | 22.4 | 62.2 | 182.8 | 955.4 | 191 | 0.857 | 0.670 | – | – | | | | |
| 11/9-83 | | | | | | | | | | | | | | | | | | | |
| 13:30 | 450.5 | 125.6 | 222.3 | 21 | 8 | | 14.4 | 32.2 | 15.2 | 68.4 | 223 | 0.857 | 0.672 | – | – | – | – | | |
| 13:45 | 450.7 | 125.6 | 223.4 | 20 | 8 | | 14.4 | 35.6 | 14.9 | 68.3 | 218 | 0.857 | 0.672 | – | – | | | | |

**Remarks**


WELL 34-10-18
DST# 1
BUILDUP No 1
GAUGE # 650105
T PROD - 3 min
m = 13.289
Pi = 458.6bar
P1h = 458.3bar
DT = 38 - 55min
P(bar) vs. LOG((T+DELTA T)/DELTA T)
460.0
458.0
456.0
454.0
452.0
450.0
448.0
446.0
444.0
442.0
440.0
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00


WELL 34-10-16
DST# 1
BUILDUP No 2
GAUGE # SS0105
T PROD = 667 min
m = 9.413
P* = 460.2 bar
P1h = 450.0 bar
DT = 98 - 538min
P(bar) vs. LOG((T+DELTA T)/DELTA T)
465.0
460.0
455.0
450.0
445.0
440.0
435.0
430.0
425.0
420.0
415.0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
2.20
2.40
2.60
2.80
3.00


WELL 34-10-16
DST# 1
BUILDUP No 2
GAUGE # SS010S
P( bar) vs. DELTA T(min)
470.0
460.0
450.0
440.0
430.0
420.0
410.0
400.0
390.0
380.0
370.0
0.00
100.
200.
300.
400.
500.
600.
700.


LOG(DELTA P(bar)) vs. LOG(DELTA T(min))
WELL 34-10-16
DST# 1
BUILDUP No 2
GAUGE # SS0105
Pws = 307.0 bar
3
2
1
0
1
2

BRØNN 34-10-16 DST# 1
BUILDUP NUMMER 2
GAUGE SS0105

| NR. | Time | Pressure (bar) |
|---|---|---|
| 1 | 20.05 | 406.083 |
| 2 | 20.07 | 409.588 |
| 3 | 20.09 | 412.324 |
| 4 | 20.11 | 415.001 |
| 5 | 20.13 | 418.048 |
| 6 | 20.15 | 421.114 |
| 7 | 20.17 | 424.113 |
| 8 | 20.19 | 427.367 |
| 9 | 20.21 | 430.701 |
| 10 | 20.23 | 433.776 |
| 11 | 20.25 | 437.065 |
| 12 | 20.27 | 439.596 |
| 13 | 20.29 | 442.036 |
| 14 | 20.31 | 443.872 |
| 15 | 20.33 | 445.214 |
| 16 | 20.35 | 446.132 |
| 17 | 20.37 | 446.767 |
| 18 | 20.39 | 447.212 |
| 19 | 20.41 | 447.552 |
| 20 | 20.43 | 447.850 |
| 21 | 20.45 | 448.102 |
| 22 | 20.47 | 448.354 |
| 23 | 20.49 | 448.591 |
| 24 | 20.51 | 448.798 |
| 25 | 20.53 | 448.989 |
| 26 | 20.55 | 449.167 |
| 27 | 20.57 | 449.330 |
| 28 | 20.59 | 449.507 |
| 29 | 21.01 | 449.670 |
| 30 | 21.03 | 449.819 |
| 31 | 21.05 | 449.952 |
| 32 | 21.07 | 450.085 |
| 33 | 21.09 | 450.218 |
| 34 | 21.11 | 450.381 |
| 35 | 21.13 | 450.485 |
| 36 | 21.15 | 450.589 |
| 37 | 21.17 | 450.719 |
| 38 | 21.19 | 450.822 |
| 39 | 21.21 | 450.926 |
| 40 | 21.23 | 451.015 |
| 41 | 21.25 | 451.119 |
| 42 | 21.27 | 451.222 |
| 43 | 21.29 | 451.341 |
| 44 | 21.31 | 451.415 |
| 45 | 21.33 | 451.474 |
| 46 | 21.35 | 451.578 |
| 47 | 21.37 | 451.652 |
| 48 | 21.39 | 451.726 |
| 49 | 21.41 | 451.830 |
| 50 | 21.51 | 452.156 |
| 51 | 22.01 | 452.467 |
| 52 | 22.11 | 452.778 |
| 53 | 22.21 | 453.000 |
| 54 | 22.31 | 453.267 |
| 55 | 22.41 | 453.475 |
| 56 | 22.51 | 453.667 |
| 57 | 23.01 | 453.860 |
| 58 | 23.21 | 454.201 |
| 59 | 23.41 | 454.497 |
| 60 | 0.01 | 454.779 |
| 61 | 0.21 | 455.001 |
| 62 | 0.41 | 455.238 |
| 63 | 1.01 | 455.431 |
| 64 | 1.31 | 455.697 |
| 65 | 2.01 | 455.949 |
| 66 | 2.31 | 456.157 |
| 67 | 3.01 | 456.333 |
| 68 | 3.31 | 456.512 |
| 69 | 4.01 | 456.646 |
| 70 | 4.31 | 456.779 |
| 71 | 5.01 | 456.898 |
| 72 | 5.31 | 457.016 |
| 73 | 6.01 | 457.135 |
| 74 | 6.31 | 457.209 |
| 75 | 6.41 | 457.238 |
| 76 | 6.51 | 457.268 |
| 77 | 6.57 | 457.298 |

Pressure data DST#1, build-up no. 2.

# INPUT TO TEST ANALYSIS

Well no. 34/10-16
DST no. 1 Test Date 10-11.09.83

Reservoir Parameters

Perforations 3397-3407 m RKB Zone (s) Etive

Wellbore radius 0.11 m

RKB Elev. 22 m

Depth Mid. Perfs: 3402 m RKB 3380 mSS

Pressure Gauge no. S S 0105 Depth 3405.24 m RKB 3383.24 mSS

Pressure Gradient: 0.06 bar/m

Pressure Correction, Gauge to Mid. Perfs.: - 0.2 bar

Formation Volume Factor 1.64 Res.$m^3/Sm^3$ Viscosity 0.50 cp

Thickness 13 m Porosity 17.9 %

Oil Saturation 69.1 % Oil Compressibility 207 $10^{-6}$ $bar^{-1}$

Water Saturation 30.9 % Water Compressibility 51.5 $10^{-6}$ $bar^{-1}$

Gas Saturation ____ % Gas Compressibility ____ $10^{-6}$ $bar^{-1}$

Formation Compressibility 55.4 $10^{-6}$ $bar^{-1}$

System Compressibility $C_t = S_o C_o + S_w C_w + S_g C_g + C_f$

$C_t$ = 0.691 x 207 $10^{-6}$ + 0.309 x 51.5 $10^{-6}$ + ____ x ____ $10^{-6}$ + 55.4 $10^{-6}$

$C_t$ = 214.3 $10^{-6}$ $bar^{-1}$

Flow Data: Flow Period no. 2

Choke 48 / 64 inches Oil Rate 956.0 $Sm^3/D$ Gas Rate 182000 $Sm^3/D$

$P_{tf}$ 235 bar Water Rate - $Sm^3/D$ GOR 190.4 $Sm^3/Sm^3$

Oil Spec. Grav. 0.857 g/cc Gas Spec. Grav. 0.670 (air=1)

Cumulative Production Oil 442.8 $Sm^3$ Gas 79200 $Sm^3$

Water - $Sm^3$

## Horner Analysis

Well no. 34/10-16
DST no. 1
Build Up no. 2
Gauge no. Sperry Sun 0105 Test Date 10-11.09.83

Effective Production Time tp = Cumulative Production / Last Rate

tp = 442.8 / 956.0 = 11.1 hrs

Straight Line Starts at 0.75 hrs Slope: m = 9.413 bar/cycle

$P_{wf}$ = 307 bar $P_{1hr}$ 449.8 bar P* 460.2 bar

Estimated Reservoir Pressure (P*) at Mid. Perfs. ( 3380 mSS): 460.0 bar

**Permeability:**

$$Kh = \frac{21.49\ q\ B\mu}{m} = \frac{21.49 \times 956.0 \times 1.64 \times 0.50}{9.413} = 1790 \text{ md.m}$$

K = Kh / h = 1790 / 13 = 138 md.

**Skin:**

$$S = 1.1513 \left[\left[\frac{P1hr - Pwf}{m}\right] + \text{Log}\left[\frac{tp+1}{tp}\right] - \text{Log}\left[\frac{K}{\phi \mu\ Ct\ rw^2}\right] + 3.098\right]$$

$$S = 1.1513 \left[\left[\frac{449.8-307.0}{9.413}\right] + \text{Log}\left[\frac{11.1+1}{11.1}\right] - \text{Log}\left[\frac{138}{0.179 \times 0.5 \times 214.3 \times 10^{-6} \times 0.11^2}\right] + 3.098\right]$$

S = 11

**For the Previous Flow Period:**

$$\Delta Ps = \frac{18.665 \cdot q\ B\mu}{kh} \quad S = \frac{18.665 \times 956 \times 1.64 \times 0.5 \times 11}{1790} = 90 \text{ bar}$$

$\Delta Pdd = P^* - Pwf$ = 153 bar

Skin as Fraction of Total Drawdown: $\frac{\Delta Ps}{\Delta Pdd}$ = 59%

| Well 34/10-16<br>DST no. 1 | DIARY OF EVENTS | CHP/PG<br>Perfs.: 3397 - 3407<br>Zone tested ETIVE |
|---|---|---|

| Date | Time | OPERATIONS |
|---|---|---|
| 9.9.83 | 05.45 | Perforated 3397 - 3407 mRKB. |
| | 07.00 | Started running the teststring. Installed the pressure gauges in the F-nipple and the bundle carriers. Pressure tested the teststring and all the equipment involved. |
| 10.9.83 | 06.14 | Set packer. |
| | 07.55 | Opened LPR-valve. |
| | 08.05 | Opened choke manifold on 48/64" fixed choke for initial flow. |
| | 08.08 | Closed choke on manifold and LPR-valve for initial build up. Flowed 1.12 $m^3$ to tank. |
| | 09.11 | Opened LPR-valve. |
| | 09.12 | Opened choke manifold on 48/64" fixed choke for main flow. |
| | 09.34 | Gas to surface. |
| | 11.30 | Switched flow through heater. |
| | 12.10 | Switched flow to starboard burner due to plugging of port burner. |
| | 12.50 | Switched flow back to port burner. |
| | 12.52 | Directed flow through separator. |
| | 13.30 | Directed flow to tank for meter factor. |
| | 15.17 | Started taking 1st set of PVT samples. |
| | 16.51 | Started taking 2nd set of PVT samples. |
| | 18.53 | Started taking 3rd set of PVT samples. |
| | 20.00 | Bypassed the separator. |
| | 20.04 | Closed LPR-valve and choke on the manifold for main build up. |
| 11.9.83 | 07.00 | Opened choke manifold on 20/64" adjustable choke. |
| | 07.02 | Opened LPR-valve. |
| | 07.30 | Changed to 12/64" fixed choke. |
| | 07.56 | Closed in well at choke manifold. |
| | 08.37 | Opened well at choke manifold on 28/64" fixed choke to obtain higher temperature in fluid. |
| | 09.46 | Closed in well at choke manifold. |
| | 11.44 | Started to RIH with bottom hole samplers. |
| | 12.20 | Opened well on 8/64" fixed choke. Only gas to surface. |
| | 12.55 | Opened adjustable choke on 12/64" to get oil flowing to the surface. (total: 8/64"+12/64" = 14/64"). |
| | 13.04 | Closed adjustable choke. |
| | 13.05 | Directed flow through separator. |
| | 13.08 | Chambers reached sampling depth. |

**Remarks:**

| Well 34/10-16<br>DST no. 1 | DIARY OF EVENTS | CHP/PG<br>Perfs.: 3397 - 3407<br>Zone tested ETIVE |
|---|---|---|

| Date | Time | OPERATIONS |
|---|---|---|
| 11.9.83 | 13.17 | First chamber started sampling |
| | 13.25 | Second chamber started sampling |
| | 13.50 | Started to POOH with samplers. |
| | 14.43 | Closed in well at choke manifold and LPR-valve. |
| | 15.02 | bottom hole samplers at surface. |
| | 16.45 | Started bullheading. |
| | | END OF DST NO. 1 |

Remarks :

| Well 34/10-16 | SAMPLING | CHP/PG |
|---|---|---|
| DST no 1 | | Perfs.: 3397-3407 |
| | | Zone tested ETIVE |

## SEPARATOR SAMPLES

| Time/date | Sample no. | Type of sample | Transfer time | Bottle no |
|---|---|---|---|---|
| 10.09.83 | | | | |
| 15.17 | 1:set | Oil | 50 min | 83021001 |
| 15.27 | | Gas | 40 min | A 14799 |
| 16.51 | 2:set | Oil | 47 min | 83021302 |
| 16.55 | | Gas | 38 min | A 14754 |
| 18.53 | 3:set | Oil | 41 min | 83021412 |
| 18.56 | | Gas | 33 min | A 14693 |

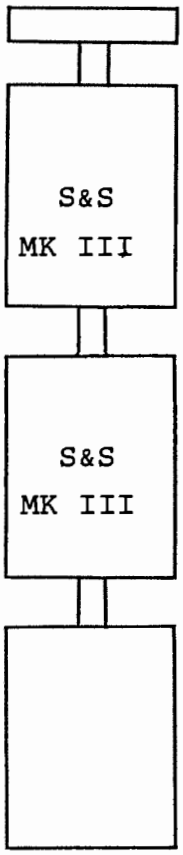
## BOTTOM HOLE SAMPLES

| Time/date | Sample depth mRKB | Estimated PB bar/°C | Transfering pressure(bar) | Bottle no |
|---|---|---|---|---|
| 11.09.83 | 3389.03 | 381.6/12 | 415 | 9214/315 |
| " | 3392.65 | 382.3/10 | 415 | 16251/33 |

## SAMPLES

| Time/date | Sampling point | Sampling equipment | | Remarks |
|---|---|---|---|---|
| 10.09.83 | separator | 6 x 1 l | glass jar | oil samples |
| | | 1 x 2 l | plastic bottle | water |
| | | 2 x 20 l | jerry cans | oil samples |
| | | 1 x 140 l | barrel | oil sample |
| | mud pit | 1 x 2 l | plastic bottle | mud sample |

| Well 34/10-16 | GAUGE ARRANGEMENT | CHP/PG |
|---|---|---|
| DST no. 1 . | | Perfs.: 3397 - 3407 |
| | | Zone tested ETIVE |




Bundle Carrier at: 3383.34 mRKB

Gauge type and number : Sperry Sun, MK III 0076

Depth, pressure elemement : 3386.63 mRKB Range : 690 bar

Mode : 2 mins. Delay : 17 hrs.

Actuated : time 07.49 date : 09.09.83

Will run out : time 09.34 date : 12.09.83

Gauge type and number : Sperry Sun, MK III P1M

Depth, pressure elemement : 3390.93 mRKB Range : 690 bar

Mode : 4 mins Delay : 17 hrs.

Actuated : time 07.47 date : 09.09.83

Will run out : time date :

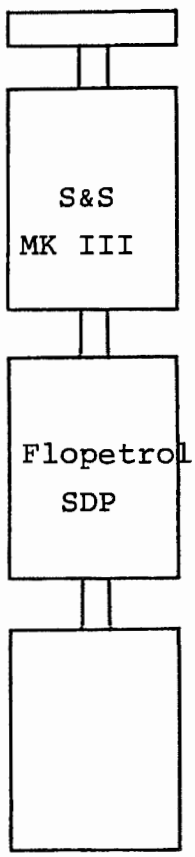
Gauge type and number :

Depth, pressure elemement : Range :

Mode : Delay :

Actuated : time date :

Will run out : time date :




F-nipple at: 3402.14 mRKB

Gauge type and number : Sperry Sun MK III 0105

Depth, pressure elemement : 3405.24 mRKB Range : 690 bar

Mode : 2 mins. Delay : 17 hrs.

Actuated : time 07.22 date : 09.09.83

Will run out : time 09.34 date : 12.09.83

Gauge type and number : Flopetrol SDP no. 82818

Depth, pressure elemement : 3409.24 mRKB Range :

Mode : 10 sec. Delay : 18 hrs.

Actuated : time 07.22 date : 09.09.83

Will run out : time 17.52 date : 14.09.83

Gauge type and number :

Depth, pressure elemement : Range :

Mode : Delay :

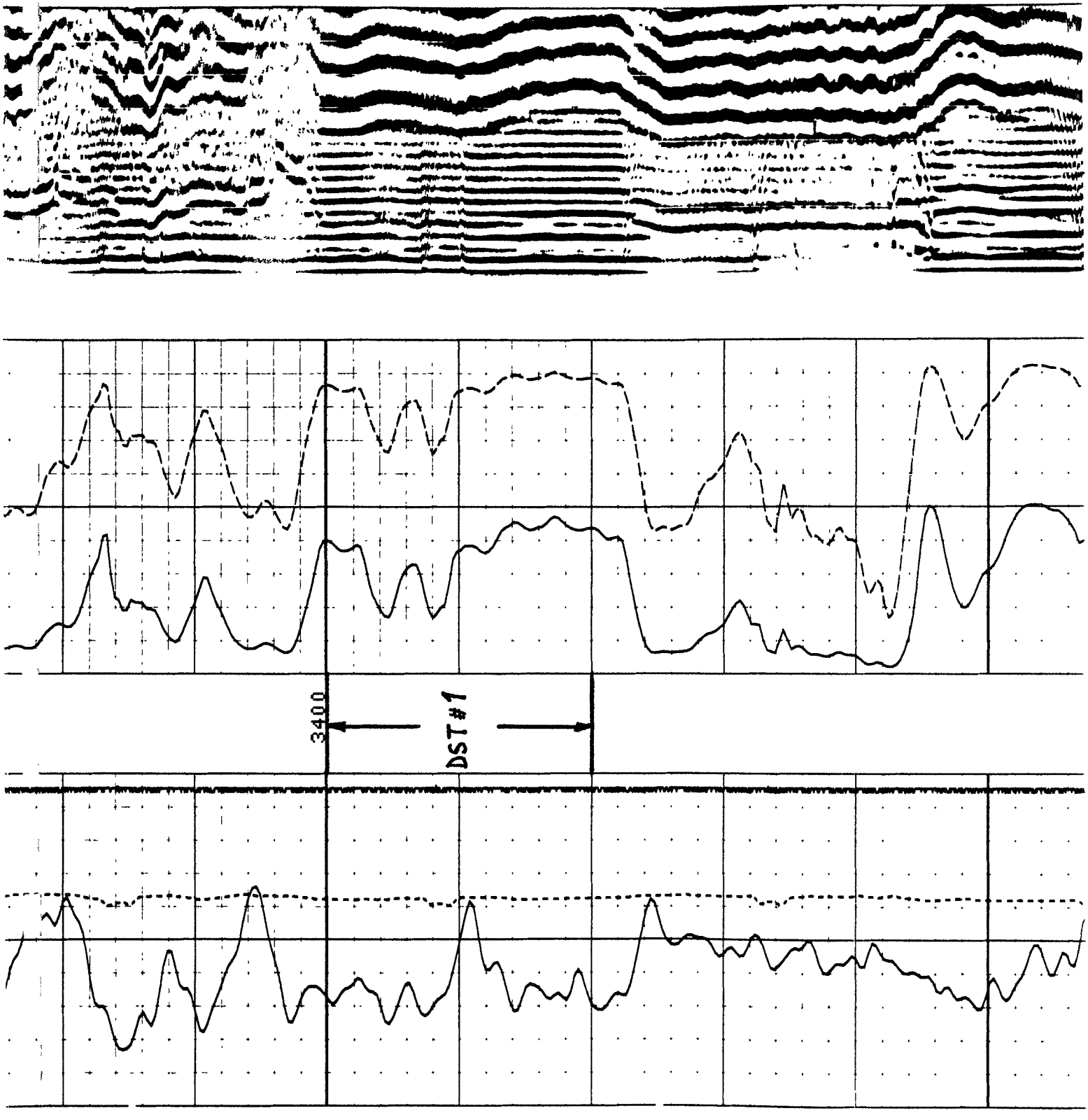
Actuated : time date :

Will run out : time date :

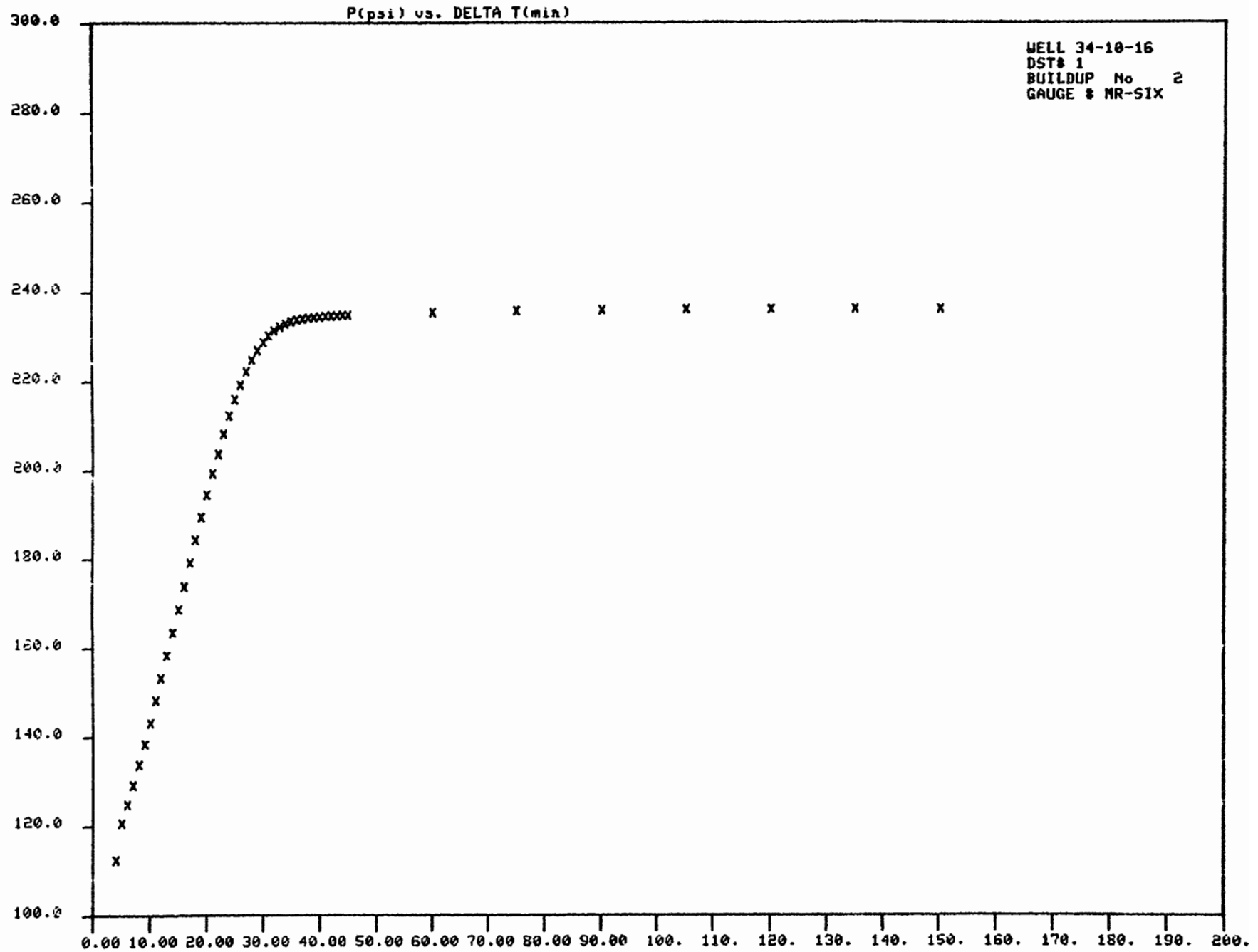
| Well 34/10-16 | LAYOUT OF TEST-STRING | CHP/PG |
|---|---|---|
| DST no 1 | | Perfs 3397 - 3407 |
| | | Zone tested ETIVE |

| TEST-STRING | ID inch | OD inch | LENGTH m | DEPTH mRKB |
|---|---|---|---|---|
| SURFACE TEST TREE | | | | -5.41 |
| 2 SGLS + 1 PUP 5" VAM | | | 20.76 | 15.35 |
| LUBRICATOR VALVE ANG X-OVER | 3.00 | 13.1 | 2.10 | 17.45 |
| 3 PUP JOINTS 5 " VAM | 4.27 | 5.00 | 6.47 | 23.92 |
| 13 JOINTS 5" VAM | 4.27 | 5.00 | 125.66 | 149.58 |
| 1 PUP JOINT | 4.27 | 5.00 | 1.99 | 151.57 |
| X-OVER | | | 0.31 | 151.88 |
| CENTRALIZER | | | 1.05 | 152.93 |
| SAVER SUB | | | 0.26 | 153.19 |
| EZ-TREE | 3.00 | 10.87 | 2.44 | 155.63 |
| SLICK JOINT | | | 2.94 | 158.57 |
| FLUTED HANGER | 3.00 | 9.75 | 0.29 | 158.86 |
| X-OVER | | | 0.29 | 159.15 |
| 1 SINGLE 5" VAM | 4.27 | 5.00 | 10.19 | 169.34 |
| 88 STDS 5" VAM | 4.27 | 5.00 | 2537.25 | 2706.59 |
| X-OVER 5" VAM BOX x 3½" TDS PIN | | | 0.23 | 2706.82 |
| 15 STDS 3½" TDS | 2.75 | 3½ | 414.89 | 3121.71 |
| X-OVER 3½" TDS BOX x 3½" IF PIN | | | 0.30 | 3122.01 |
| SLIP JOINT | 2 1/4 | 5.00 | 5.54 | 3127.55 |
| SLIP JOINT | 2 1/4 | 5.00 | 4.02 | 3131.57 |
| 6 STDS DRILL COLLAR | 2 1/4 | 4 3/4 | 170.91 | 3302.48 |
| RTTS CIRC. VALVE | 2.44 | 4.87 | 1.10 | 3303.58 |
| 1 STD DRILL COLLAR | 2 1/4 | 4 3/4 | 28.49 | 3332.07 |
| SLIP JOINT | 2 1/4 | 5.00 | 4.02 | 3336.09 |
| SLIP JOINT | 2 1/4 | 5.00 | 4.02 | 3340.11 |
| 1 STD DRILL COLLAR | 2 1/4 | 4 3/4 | 28.49 | 3368.60 |
| APR-M VALVE | 2 1/4 | 5.00 | 2.29 | 3370.89 |
| DRILL PIPE TESTER VALVE | 2 1/4 | 5.00 | 1.35 | 3372.24 |
| LPR-N TESTER VALVE | 2 1/4 | 5.00 | 4.99 | 3377.23 |
| FUL FLO HYDRAULIC BYPASS | 2 1/4 | 4.62 | 2.02 | 3379.25 |
| BIG JOHN JAR | 2.37 | 4.62 | 1.58 | 3380.83 |
| SAFETY JOINT | 2.44 | 5.00 | 0.88 | 3381.71 |
| RTTS PACKER | 2.40 | 5 3/4 | 1.38 | 3383.09 |
| X-OVER 2 7/8" EUE BOX x 3½" IF PIN | 2.5 | 4 3/4 | 0.25 | 3383.34 |
| BUNDLE CARRIER | 2.00 | 5 5/8 | 4.33 | 3387.67 |
| BUNDLE CARRIER | 2.00 | 5 5/8 | 4.30 | 3391.97 |
| X-OVER 3½" IF BOX x 2 7/8" EUE PIN | 2.25 | 4 3/4 | 0.23 | 3392.20 |
| PERFORATED 2 7/8" EUE TUBING JOINT | 2.44 | 2.88 | 9.36 | 3401.56 |
| X-OVER 2 7/8" EUE BOX x 2 3/8" EUE PIN | 2.00 | 3.25 | 0.31 | 3401.87 |
| F-NIPPLE 2 3/8" EUE | 1.75 | 3.00 | 0.27 | 3402.14 |
| X-OVER 2 3/8" EUE BOX x 2 7/8" EUE PIN | 2.00 | 3.25 | 0.24 | 3402.38 |
| 1 JOINT 2 7/8" EUE TUBING | 2.44 | 2.88 | 9.12 | 3411.50 |
| BULLPLUG W/CROSS, 2 7/8" EUE BOX | 2.88 | 4.00 | 0.15 | 3411.65 |

Remarks.




A1-11 Cement Bond Log




A1-12-1 Well head pressure

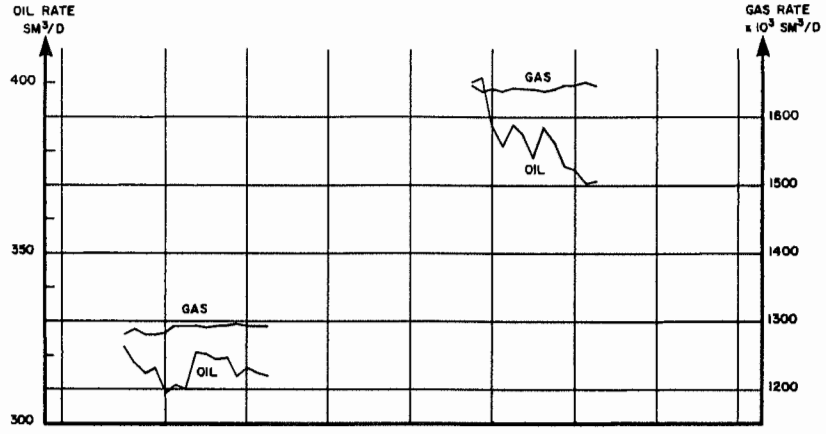
BRØNN 34-10-16 DST# 1
BUILDUP NUMMER 2
GAUGE MR-SIX

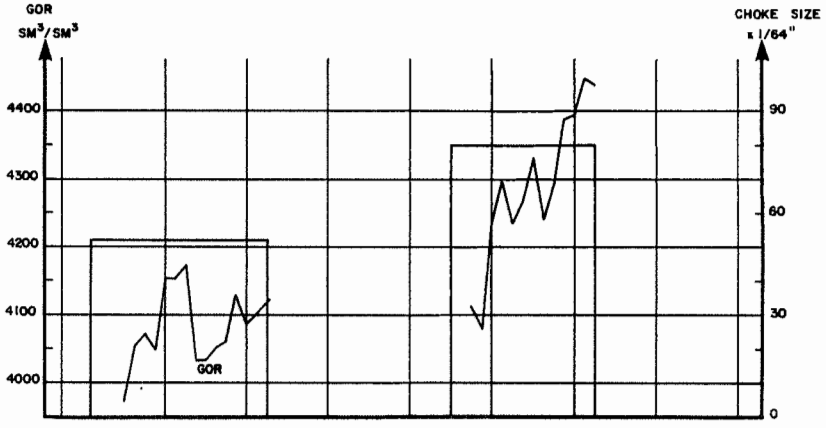
| NR. | TID | TRYKK |
|---|---|---|
| 1 | 20.04 | 112.419 |
| 2 | 20.05 | 120.693 |
| 3 | 20.06 | 124.830 |
| 4 | 20.07 | 129.242 |
| 5 | 20.08 | 133.793 |
| 6 | 20.09 | 138.412 |
| 7 | 20.10 | 143.239 |
| 8 | 20.11 | 148.203 |
| 9 | 20.12 | 153.236 |
| 10 | 20.13 | 158.338 |
| 11 | 20.14 | 163.509 |
| 12 | 20.15 | 168.749 |
| 13 | 20.16 | 173.920 |
| 14 | 20.17 | 179.229 |
| 15 | 20.18 | 184.332 |
| 16 | 20.19 | 189.503 |
| 17 | 20.20 | 194.467 |
| 18 | 20.21 | 199.293 |
| 19 | 20.22 | 203.637 |
| 20 | 20.23 | 208.118 |
| 21 | 20.24 | 212.186 |
| 22 | 20.25 | 215.910 |
| 23 | 20.26 | 219.282 |
| 24 | 20.27 | 222.253 |
| 25 | 20.28 | 224.873 |
| 26 | 20.29 | 227.010 |
| 27 | 20.30 | 228.872 |
| 28 | 20.31 | 230.251 |
| 29 | 20.32 | 231.423 |
| 30 | 20.33 | 232.319 |
| 31 | 20.34 | 232.940 |
| 32 | 20.35 | 233.491 |
| 33 | 20.36 | 233.836 |
| 34 | 20.37 | 234.043 |
| 35 | 20.38 | 234.319 |
| 36 | 20.39 | 234.388 |
| 37 | 20.40 | 234.525 |
| 38 | 20.41 | 234.663 |
| 39 | 20.42 | 234.732 |
| 40 | 20.43 | 234.801 |
| 41 | 20.44 | 234.870 |
| 42 | 20.45 | 234.870 |
| 43 | 21.00 | 235.422 |
| 44 | 21.15 | 235.766 |
| 45 | 21.30 | 235.894 |
| 46 | 21.45 | 236.042 |
| 47 | 22.00 | 236.042 |
| 48 | 22.15 | 236.042 |
| 49 | 22.30 | 236.042 |

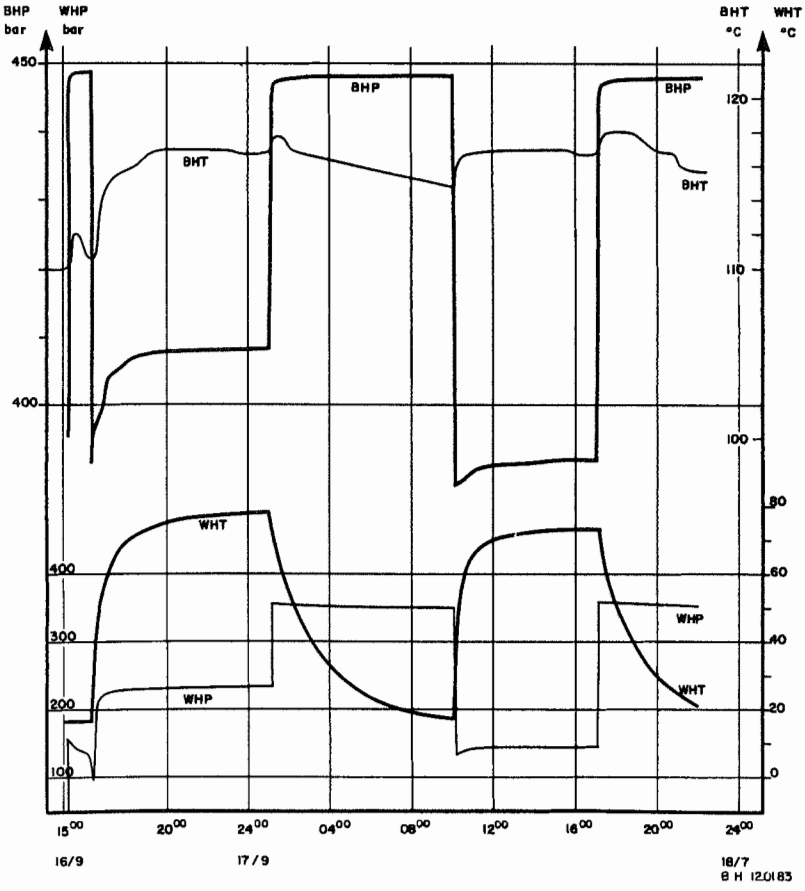
APPENDIX 2

34/10-16 DST # 2

PRESSURE, TEMPERATURE, RATE, GOR AND CHOKE SIZE



| Well 34/10-16 | FLOW DATA | CHP/PG |
|---|---|---|
| DST no. 2 | | Perfs.: 3177-3187 mRKB |
| | | Zone tested Tarbert |

| Date/ time | Bottom hole | | Well head | | Chokes 1/64" | | Separator data | | | | | | | Liq. and gas analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | press. bar | temp. °C | press bar | temp. °C | manifold | heater | press. bar | temp. °C | gas rate x10³Sm³ | oil rate Sm³ | GOR Sm³/Sm³ | sp.gr.oil | sp.gr.gas air=1 | Water % | Sedim. % BSW% | $CO_2$ % | $H_2S$ ppm | | | |
| 16/9-83 | | | | | | | | | | | | | | | | | | | | |
| 18:30 | 407.4 | 115.9 | 230.8 | 74 | 52 | | 62.7 | 43.9 | 1289 | 318.2 | 4051 | 0.788 | 0.655 | | | 1.0 | - | | | |
| 19:00 | 407.5 | 116.7 | 231.2 | 75 | " | | 62.4 | 45.0 | 1282 | 314.9 | 4071 | " | 0.664 | | 2.5 | | | | | |
| 19:30 | 407.7 | " | 231.3 | 77 | " | | 61.0 | " | 1281 | 316.4 | 4049 | " | " | | | 2.0 | - | | | |
| 20:00 | 407.8 | 116.9 | 231.3 | 78 | " | | " | 45.6 | 1283 | 309.1 | 4151 | 0.789 | " | | trace | | | | | |
| 20:30 | 407.9 | " | 232.0 | " | " | | 61.3 | " | 1293 | 311.2 | 4155 | " | 0.660 | | | 2.0 | - | | | |
| 21:00 | 408.0 | " | 232.0 | 79 | " | | " | 47.2 | " | 310.0 | 4171 | " | " | | trace | | | | | |
| 21:30 | 408.0 | " | 232.0 | " | " | | " | 47.8 | 1294 | 321.0 | 4031 | 0.791 | " | | | 2.0 | - | | | |
| 22:00 | 408.0 | " | 232.3 | " | " | | " | 48.9 | 1292 | 320.3 | 4034 | " | " | | 3.0 | | | | | |
| 22:30 | 408.1 | " | 232.2 | " | " | | " | " | " | 318.7 | 4054 | " | " | | " | | | | | |
| 23:00 | 408.1 | 116.7 | 232.3 | 80 | " | | " | " | " | 322.5 | 4064 | " | " | | " | | | | | |
| 23:30 | 408.2 | " | 232.2 | 81 | " | | " | 49.4 | 1296 | 301.2 | 4129 | 0.792 | " | | | | | | | |
| 24:00 | 408.3 | " | 232.4 | " | " | | " | 50.6 | 1293 | 297.4 | 4088 | 0.789 | " | | 3.0 | 2.0 | - | | | |
| 17/9-83 | | | | | | | | | | | | | | | | | | | | |
| 00:30 | 408.5 | 116.7 | 233.0 | 81 | 52 | | 61.3 | 50.6 | 1293 | 298.6 | 4105 | 0.789 | 0.660 | | 3.0 | | | | | |
| 01:00 | 408.5 | " | 233.2 | " | " | | " | " | " | 313.8 | 4120 | " | " | | " | | | | | |

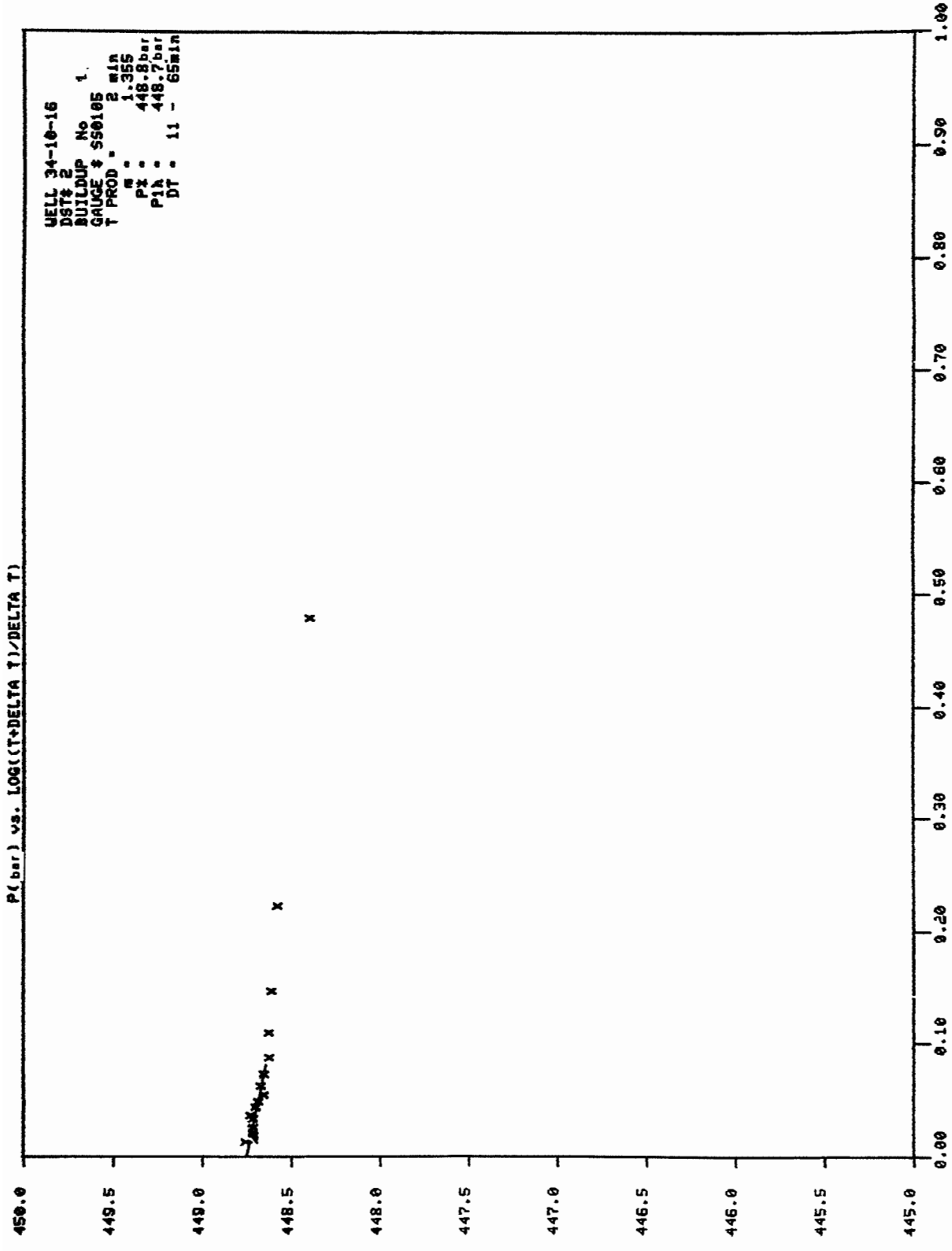
**Remarks**

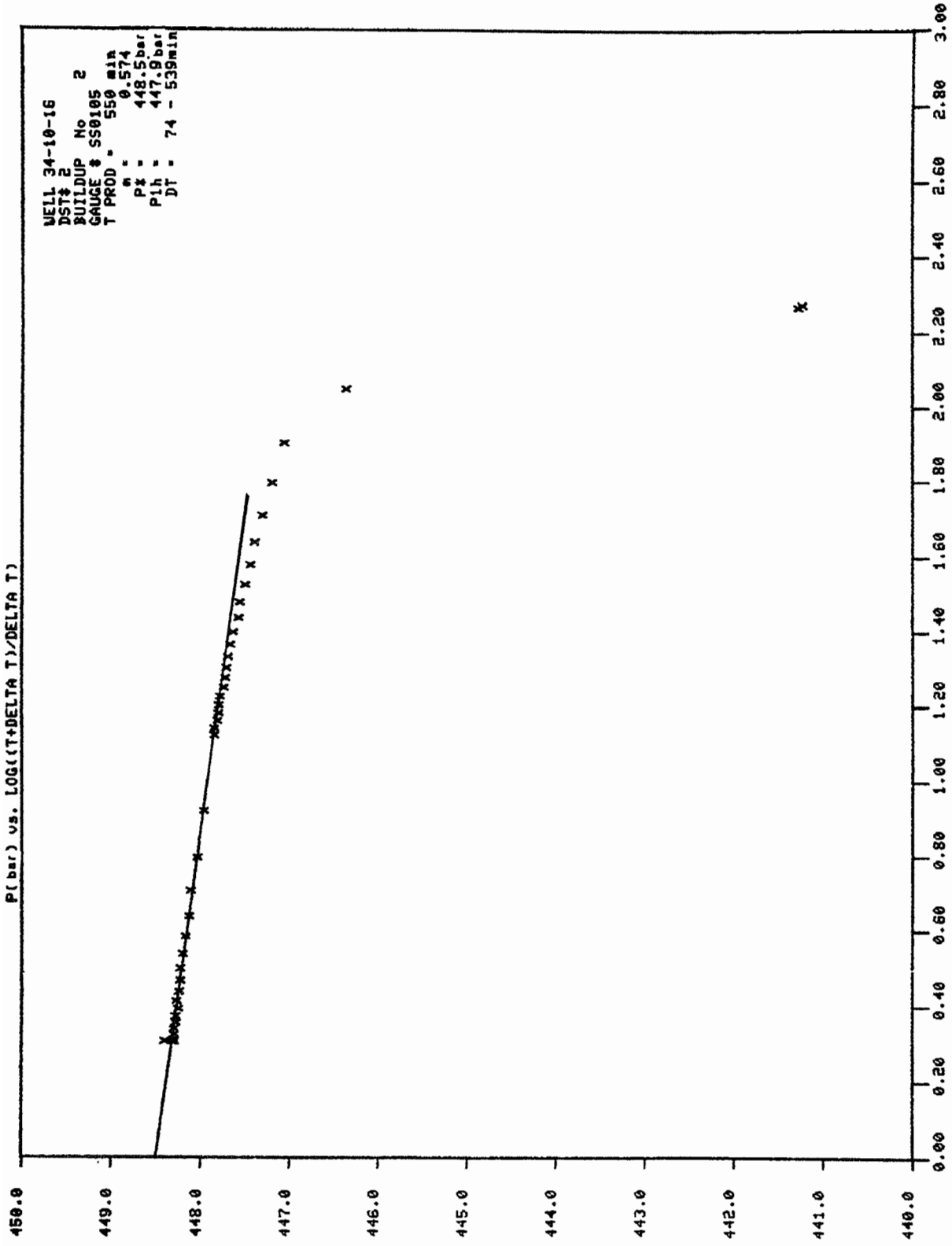
Average waterproduction during the second flow was 2.9%.

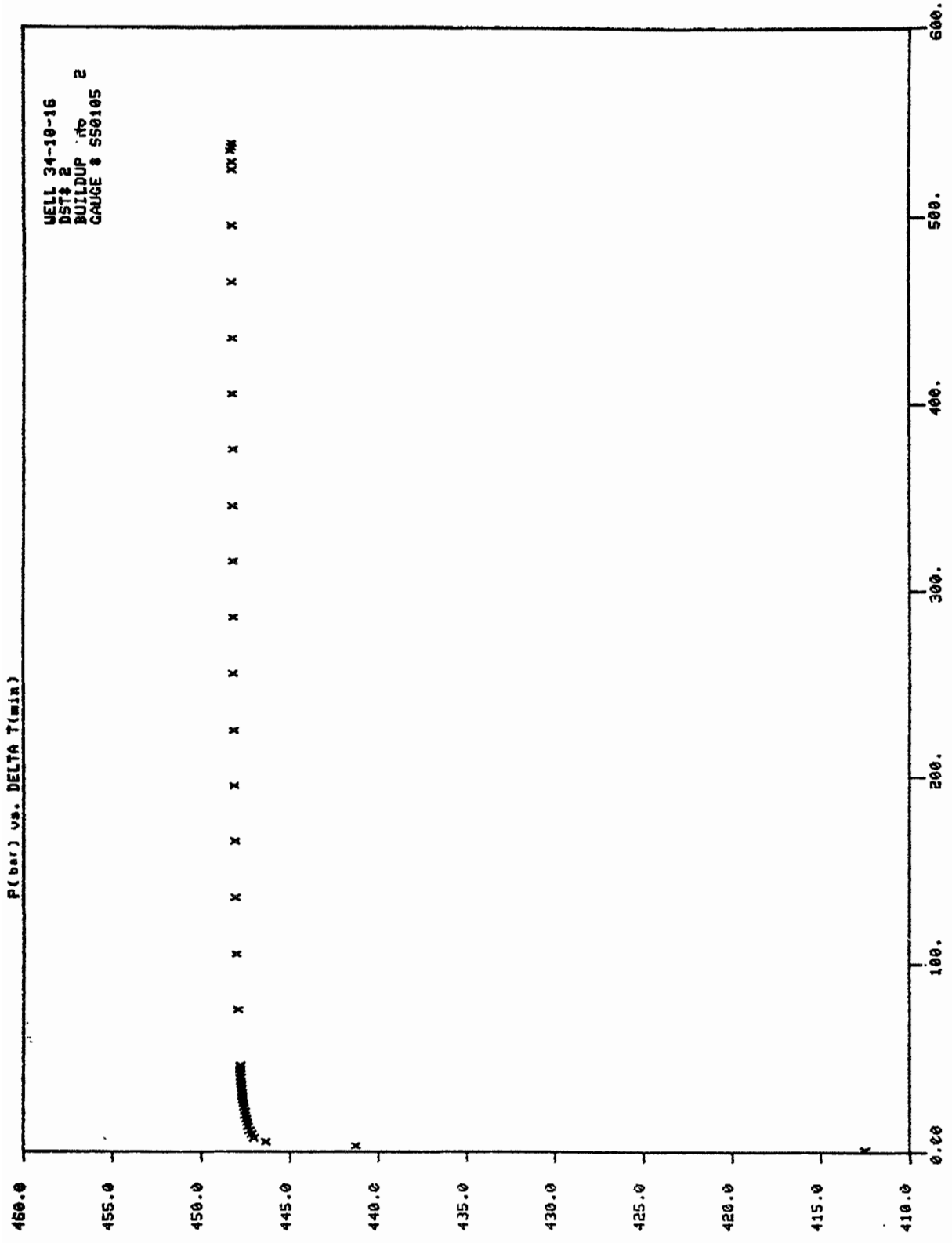
| Well 34/10-16 | FLOW DATA | CHP/PG |
|---|---|---|
| DST no. 2 | | Perfs.: 3177-3187 mRKB |
| | | Zone tested Tarbert |

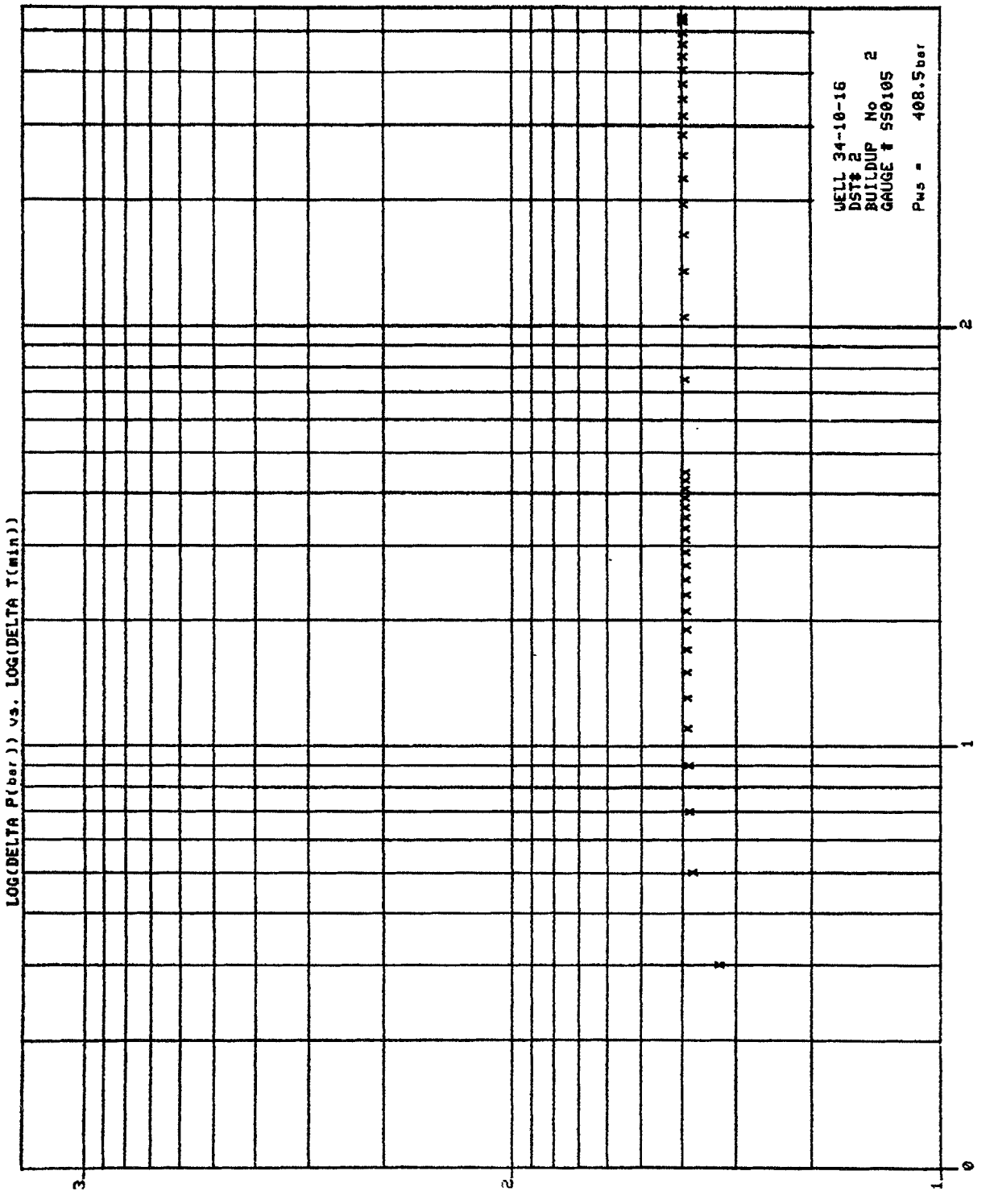
| Date/ time | Bottom hole | | Well head | | Chokes 1/64" | | Separator data | | | | | | | Liq. and gas analysis | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | press. bar | temp. °C | press bar | temp. °C | manifold | heater | press. bar | temp. °C | gas rate x10$^3$Sm$^3$ | oil rate Sm$^3$ | GOR Sm$^3$/Sm$^3$ | sp.gr.oil | sp.gr.gas air=1 | Water % | Sedim. % BSW% | $CO_2$ % | $H_2S$ ppm | | |
| 17/9-83 | | | | | | | | | | | | | | | | | | | |
| 11:00 | 390.2 | 116.7 | 143.5 | 71 | 80 | | 64.8 | 47.2 | 1647 | 400.3 | 4114 | 0.793 | 0.663 | | 2.0 | 1.0 | - | | |
| 11:30 | 390.8 | " | 143.9 | 72 | " | | 64.4 | 50.6 | 1639 | 401.6 | 4081 | " | 0.665 | | | | | | |
| 12:00 | 391.3 | " | 144.4 | 73 | " | | 64.1 | 51.7 | 1640 | 387.2 | 4236 | " | " | | 1.0 | 2.0 | - | | |
| 12:30 | 391.2 | 116.9 | 144.5 | 74 | " | | 63.7 | 52.2 | 1638 | 381.3 | 4296 | " | " | | | | | | |
| 13:00 | 391.3 | " | 144.8 | " | " | | " | 53.3 | 1643 | 387.9 | 4236 | " | 0.663 | | 1.5 | | | | |
| 13:30 | 391.3 | " | 144.8 | " | " | | 63.4 | 53.3 | 1642 | 384.6 | 4269 | " | " | | | | | | |
| 14:00 | 391.5 | " | 144.9 | 75 | " | | " | 53.9 | 1640 | 378.7 | 4331 | " | " | | 2.0 | | | | |
| 14:30 | 391.7 | " | 144.8 | " | " | | " | " | 1639 | 386.5 | 4241 | " | 0.664 | | | 2.0 | - | | |
| 15:00 | 391.8 | " | 145.0 | " | " | | 63.7 | 54.4 | 1642 | 382.3 | 4295 | " | " | | 2.0 | | | | |
| 15:30 | 391.8 | " | 145.2 | 76 | " | | " | " | 1647 | 375.5 | 4386 | " | " | | | | | | |
| 16:00 | 391.7 | " | 145.4 | " | " | | " | 55.0 | 1646 | 374.5 | 4395 | " | 0.663 | | 2.0 | | | | |
| 16:30 | 391.8 | 116.7 | 145.2 | " | " | | " | " | 1649 | 370.8 | 4447 | " | " | | | | | | |
| 17:00 | 391.6 | " | 145.2 | 77 | " | | " | 55.6 | 1647 | 371.1 | 4438 | 0.794 | " | | | 2.0 | - | | |

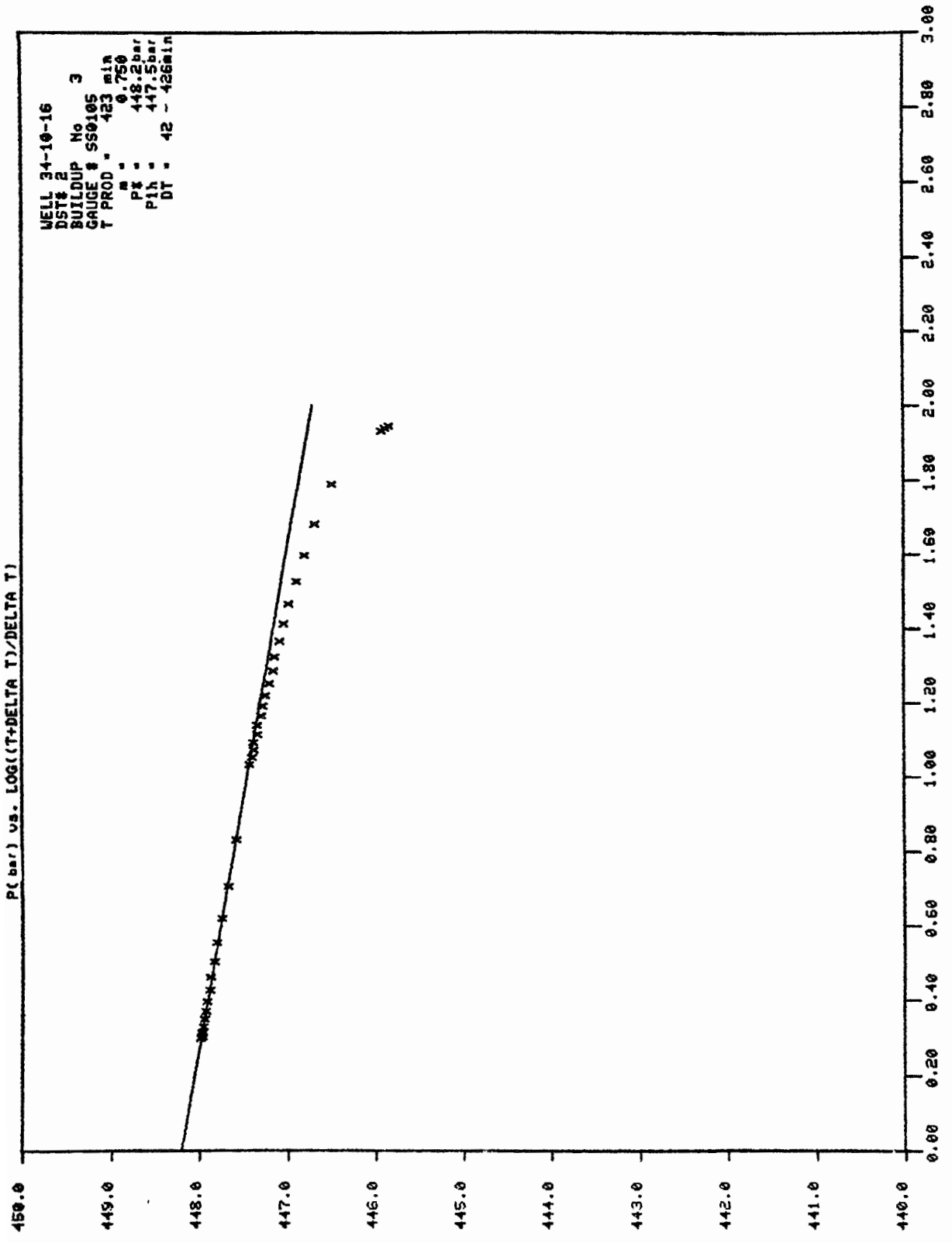
**Remarks** Average waterproduction during the third flow was 2.0%.

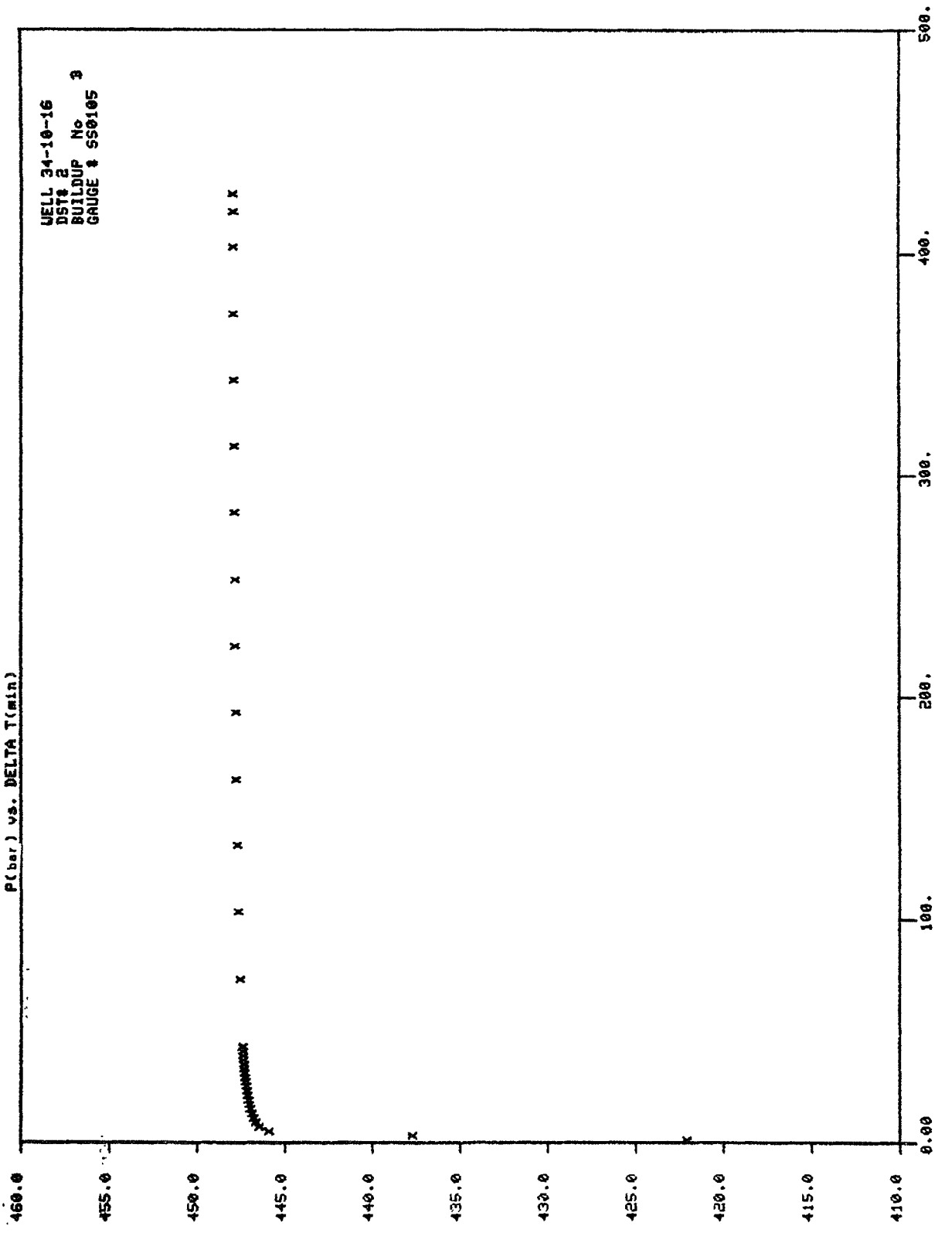

WELL 34-10-16
DST# 2
BUILDUP No 1
GAUGE # SS0105
T PROD = 2 min
m = 1.355
P* = 448.8bar
P1h = 448.7bar
DT = 11 - 65min
P(bar) vs. LOG((T+DELTA T)/DELTA T)
450.0
449.5
449.0
448.5
448.0
447.5
447.0
446.5
446.0
445.5
445.0
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00

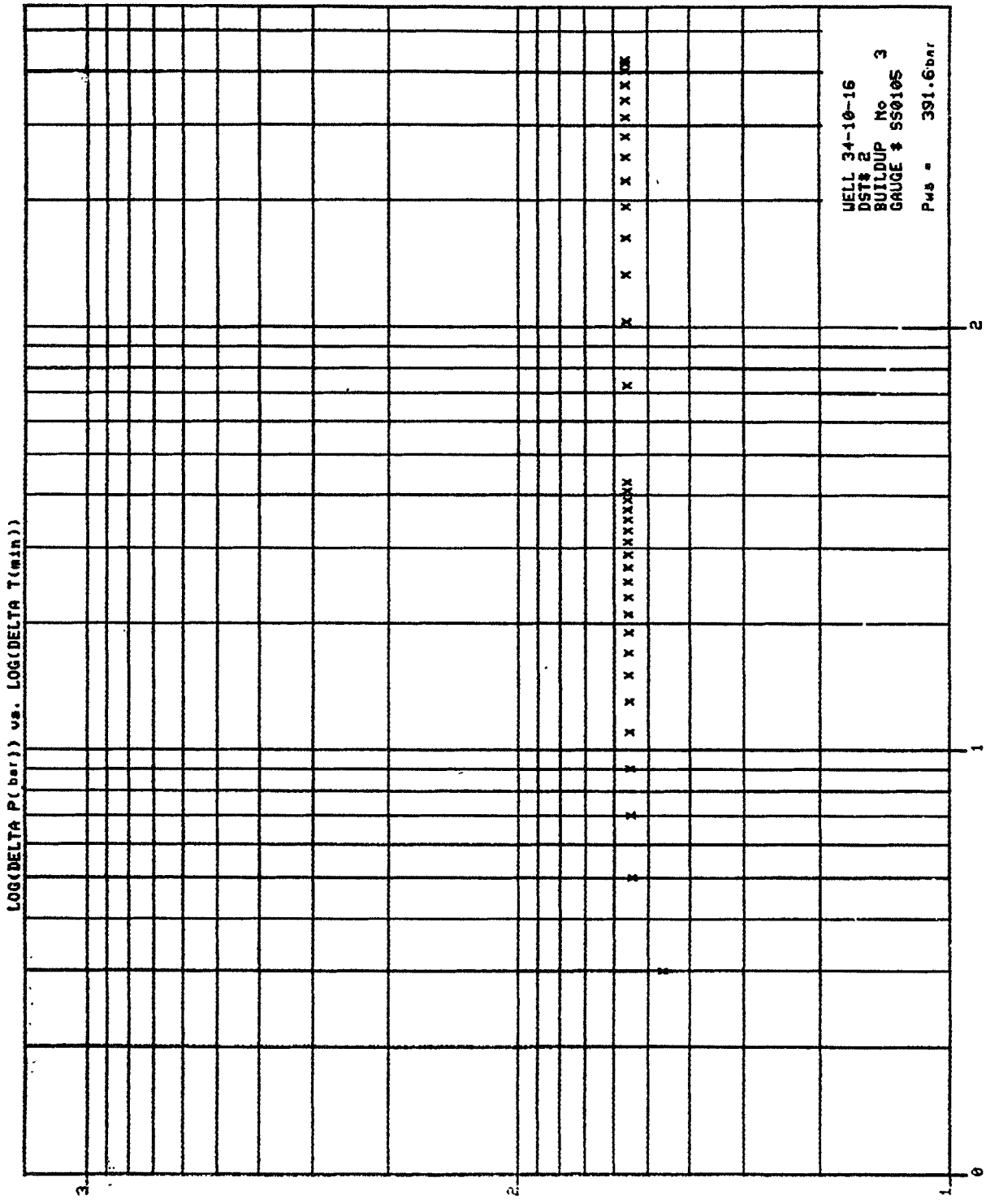

WELL 34-10-16
DST# 2
BUILDUP No 2
GAUGE # SS0105
T PROD = 550 min
m = 0.574
P* = 448.5bar
P1h = 447.9bar
DT = 74 - 539min
P( bar) vs. LOG((T+DELTA T)/DELTA T)
450.0
449.0
448.0
447.0
446.0
445.0
444.0
443.0
442.0
441.0
440.0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
2.20
2.40
2.60
2.80
3.00


WELL 34-10-16
DST# 2
BUILDUP
GAUGE # SS0105
P(bar) vs. DELTA T(min)
460.0
455.0
450.0
445.0
440.0
435.0
430.0
425.0
420.0
415.0
410.0
0.00
100.
200.
300.
400.
500.
600.


LOG(DELTA P(bar)) vs. LOG(DELTA T(min))
WELL 34-10-16
DST# 2
BUILDUP No 2
GAUGE # SS0105
Pws = 408.5bar
3
2
1
0
1
2


WELL 34-10-16
DST# 2
BUILDUP No 3
GAUGE # SS0105
T PROD = 423 min
m = 0.750
P* = 448.2bar
P1h = 447.5bar
DT = 42 - 426min
P( bar ) vs. LOG((T+DELTA T)/DELTA T)
450.0
449.0
448.0
447.0
446.0
445.0
444.0
443.0
442.0
441.0
440.0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
2.20
2.40
2.60
2.80
3.00


WELL 34-10-16
DST# 2
BUILDUP No 3
GAUGE # SS0105
P( bar ) vs. DELTA T(min)
460.0
455.0
450.0
445.0
440.0
435.0
430.0
425.0
420.0
415.0
410.0
0.00
100.
200.
300.
400.
500.


LOG(DELTA P(bar)) vs. LOG(DELTA T(min))
WELL 34-10-16
DST# 2
BUILDUP No 3
GAUGE # SS0105
Pws = 391.6bar
3
2
1
0
1
2

BRONN 34-10-16 DST# 2
BUILDUP NUMMER 2
GAUGE SS0105

| NR. | Time | Pressure (bar) |
|---|---|---|
| 1 | 1.01 | 412.516 |
| 2 | 1.03 | 441.283 |
| 3 | 1.05 | 446.371 |
| 4 | 1.07 | 447.069 |
| 5 | 1.09 | 447.203 |
| 6 | 1.11 | 447.311 |
| 7 | 1.13 | 447.400 |
| 8 | 1.15 | 447.445 |
| 9 | 1.17 | 447.504 |
| 10 | 1.19 | 447.564 |
| 11 | 1.21 | 447.580 |
| 12 | 1.23 | 447.638 |
| 13 | 1.25 | 447.668 |
| 14 | 1.27 | 447.697 |
| 15 | 1.29 | 447.712 |
| 16 | 1.31 | 447.727 |
| 17 | 1.33 | 447.742 |
| 18 | 1.35 | 447.787 |
| 19 | 1.37 | 447.801 |
| 20 | 1.39 | 447.801 |
| 21 | 1.41 | 447.816 |
| 22 | 1.43 | 447.846 |
| 23 | 1.45 | 447.846 |
| 24 | 2.15 | 447.962 |
| 25 | 2.45 | 448.035 |
| 26 | 3.15 | 448.109 |
| 27 | 3.45 | 448.125 |
| 28 | 4.15 | 448.169 |
| 29 | 4.45 | 448.196 |
| 30 | 5.15 | 448.224 |
| 31 | 5.45 | 448.225 |
| 32 | 6.15 | 448.239 |
| 33 | 6.45 | 448.269 |
| 34 | 7.15 | 448.251 |
| 35 | 7.45 | 448.280 |
| 36 | 8.15 | 448.280 |
| 37 | 8.45 | 448.295 |
| 38 | 9.15 | 448.295 |
| 39 | 9.45 | 448.310 |
| 40 | 9.49 | 448.310 |
| 41 | 9.55 | 448.399 |
| 42 | 9.57 | 448.325 |
| 43 | 9.59 | 448.295 |

Pressure data DST# 2, build-up no. 2.

BRONN 34-10-16 DST# 2
BUILDUP NUMMER 3
GAUGE SS0105

| NR. | Time | Pressure (bar) |
|---|---|---|
| 1 | 17.03 | 422.074 |
| 2 | 17.05 | 437.729 |
| 3 | 17.07 | 445.984 |
| 4 | 17.09 | 446.490 |
| 5 | 17.11 | 446.686 |
| 6 | 17.13 | 446.805 |
| 7 | 17.15 | 446.896 |
| 8 | 17.17 | 446.985 |
| 9 | 17.19 | 447.044 |
| 10 | 17.21 | 447.089 |
| 11 | 17.23 | 447.149 |
| 12 | 17.25 | 447.163 |
| 13 | 17.27 | 447.207 |
| 14 | 17.29 | 447.251 |
| 15 | 17.31 | 447.282 |
| 16 | 17.33 | 447.297 |
| 17 | 17.35 | 447.342 |
| 18 | 17.37 | 447.342 |
| 19 | 17.39 | 447.386 |
| 20 | 17.41 | 447.386 |
| 21 | 17.43 | 447.401 |
| 22 | 17.45 | 447.431 |
| 23 | 18.15 | 447.580 |
| 24 | 18.45 | 447.668 |
| 25 | 19.15 | 447.742 |
| 26 | 19.45 | 447.801 |
| 27 | 20.15 | 447.828 |
| 28 | 20.45 | 447.871 |
| 29 | 21.15 | 447.883 |
| 30 | 21.45 | 447.913 |
| 31 | 22.15 | 447.927 |
| 32 | 22.45 | 447.942 |
| 33 | 23.15 | 447.957 |
| 34 | 23.45 | 447.972 |
| 35 | 0.01 | 447.972 |
| 36 | 0.09 | 447.987 |

Pressure data DST#2, build-up no. 3.

# INPUT TO TEST ANALYSIS
## (GAS / COND. SYSTEM)

Well no. 34/10-16
DST no. 2 Test Date 16.09.83

Reservoir Parameters

Perforations 3177-3187 m RKB Zone (s) Tarbert
Wellbore radius 0.11 m
RKB Elev. 22 m

Depth Mid. Perfs: 3182 m RKB 3160 mSS
Pressure Gauge no. S S 0105 Depth 3174.5 m RKB 3152.5 mSS
Pressure Gradient: 0.045 bar/m
Pressure Correction, Gauge to Mid. Perfs.: + 0.4 bar

Formation Volume Factor $3.55 \times 10^{-3}$ Res.$m^3/Sm^3$ Viscosity 0.032 cp

Thickness 19 m Porosity 17.6 %
Oil Saturation ____ % Oil Compressibility ____ $10^{-6}$ $bar^{-1}$
Water Saturation 13.7 % Water Compressibility 50.0 $10^{-6}$ $bar^{-1}$
Gas Saturation 86.3 % Gas Compressibility 1276 $10^{-6}$ $bar^{-1}$
Formation Compressibility 55.8 $10^{-6}$ $bar^{-1}$

System Compressibility $C_t = S_o C_o + S_w C_w + S_g C_g + C_f$

$C_t$ = ____ x ____ $10^{-6}$ + 0.137 x 50 $10^{-6}$ + 0.863 x 1276 $10^{-6}$ + 55.8 $10^{-6}$

$C_t$ = 1164 $10^{-6}$ $bar^{-1}$

Flow Data: Flow Period no. 2

Choke 52 / 64 inches Cond. Rate 313.8 $Sm^3/D$ Gas Rate $1293 \times 10^3$ $Sm^3/D$
$P_{tf}$ ____ bar Water Rate 9.16 $Sm^3/D$ GOR 4120 $Sm^3/Sm^3$
Cond. Spec. Grav. 0.789 Gas Spec. Grav. 0.660 (air=1)

Cumulative Production Condensate 119.9 $Sm^3$ Gas $493.9 \times 10^3$ $Sm^3$
Water 3.50 $Sm^3$

Equivalent Gas Rate = qg + qc Vsc + qw · 7390 = $1.693 \times 10^6$ $Sm^3/D$

## Horner Analysis

Well no. 34/10-16
DST no. 2
Build Up no. 2
Gauge no. Sperry Sun 0105 Test Date 16.09.83

Effective Production Time tp = Cumulative Production / Last Rate

$tp = 0.647 \times 10^6 / 1.693 \times 10^6 = 9.17$ hrs

Straight Line Starts at 0.5 hrs Slope: m = 0.574 bar/cycle

$P_{wf}$ = 408.5 bar $P_{1hr}$ 447.9 bar P* 448.5 bar

Estimated Reservoir Pressure (P*) at Mid. Perfs. ( 3160 mSS): 449.2 bar
(Initial build-up)

**Permeability:**

$$Kh = \frac{21.49\, q\, Bu}{m} = \frac{21.49 \times 1.693 \times 10^6 \times 3.55 \times 10^{-3} \times 0.032}{0.574} = 7200 \text{ md.m}$$

K = Kh / h = 7200 / 19 = 379 md.

**Skin:**

$$S = 1.1513 \left[\left[\frac{P1hr - Pwf}{m}\right] + \text{Log}\left[\frac{tp+1}{tp}\right] - \text{Log}\left[\frac{K}{\emptyset \mu Ct\, rw^2}\right] + 3.098\right]$$

$$S = 1.1513 \left[\left[\frac{447.9-408.5}{0.574}\right] + \text{Log}\left[\frac{10.17}{9.17}\right] - \text{Log}\left[\frac{379}{0.176 \times 0.032 \times 1.164 \times 10^{-3} \times 0.11^2}\right] + 3.098\right]$$

S = 71.5

**For the Previous Flow Period:**

$$\Delta Ps = \frac{18.665 \cdot q\, B\, \mu}{kh} \quad S = \frac{18.665 \times 1.693 \times 10^6 \times 3.55 \times 10^{-3} \times 0.032 \times 71.5}{7200} = 35.6 \text{ bar}$$

$\Delta Pdd = P^* - Pwf$ = 40.0 bar

Skin as Fraction of Total Drawdown: $\frac{\Delta Ps}{\Delta Pdd}$ = 89%

# INPUT TO TEST ANALYSIS
## (GAS / COND. SYSTEM)

Well no. 34/10-16

DST no. 2 Test Date 17.09.83

Reservoir Parameters

Perforations 3177-3187 m RKB Zone (s) Tarbert

Wellbore radius 0.11 m

RKB Elev. 22 m

Depth Mid. Perfs: 3182 m RKB 3160 mSS

Pressure Gauge no. S S 0105 Depth 3174.5 m RKB 3152.5 mSS

Pressure Gradient: 0.045 bar/m

Pressure Correction, Gauge to Mid. Perfs.: + 0.4 bar

Formation Volume Factor $3.55 \times 10^{-3}$ Res.$m^3/Sm^3$ Viscosity 0.032 cp

Thickness 19 m Porosity 17.6 %

Oil Saturation ____ % Oil Compressibility ____ $10^{-6}$ $bar^{-1}$

Water Saturation 13.7 % Water Compressibility 50 $10^{-6}$ $bar^{-1}$

Gas Saturation 86.3 % Gas Compressibility 1276 $10^{-6}$ $bar^{-1}$

Formation Compressibility 55.8 $10^{-6}$ $bar^{-1}$

System Compressibility $C_t = S_o C_o + S_w C_w + S_g C_g + C_f$

$C_t =$ ____ x ____ $10^{-6}$ + 0.137 x 50 $10^{-6}$ + 0.863 x 1276 $10^{-6}$ + 55.8 $10^{-6}$

$C_t =$ 1164 $10^{-6}$ $bar^{-1}$

Flow Data: Flow Period no. 3

Choke 80 / 64 inches Cond. Rate 400 $Sm^3/D$ Gas Rate $1647 \times 10^3$ $Sm^3/D$

$P_{tf}$ ____ bar Water Rate 8.0 $Sm^3/D$ GOR 4118 $Sm^3/Sm^3$

Cond. Spec. Grav. 0.79 Gas Spec. Grav. 0.66 (air=1)

Cumulative Production Condensate 117.5 $Sm^3$ Gas $484 \times 10^3$ $Sm^3$

Water 2.35 $Sm^3$

Equivalent Gas Rate = qg + qc Vsc + qw · 7390 = $2096 \times 10^3$ $Sm^3/D$

## Horner Analysis

Well no. 34/10-16
DST no. 2
Build Up no. 3
Gauge no. Sperry Sun 0105

Test Date 17.09.83

**Effective Production Time tp = Cumulative Production / Last Rate**

$tp = 0.616 \times 10^6 / 2.096 \times 10^6 = 7.05$ hrs

Straight Line Starts at 0.75 hrs Slope: m = 0.749 bar/cycle

$P_{wf}$ = 392 bar $P_{1hr}$ 447.5 bar $P^*$ 448.2 bar

Estimated Reservoir Pressure ($P^*$) at Mid. Perfs. ( 3160 mSS): 449.2 bar
(Initial build-up)

**Permeability:**

$$Kh = \frac{21.49\, q\, Bu}{m} = \frac{21.49 \times 2.096\times10^{6} \times 3.55\times10^{-3} \times 0.032}{0.749} = 6832 \text{ md.m}$$

$K = Kh/h = 6832 / 19 = 360$ md.

**Skin:**

$$S = 1.1513 \left[\left[\frac{P1hr - Pwf}{m}\right] + \text{Log}\left[\frac{tp+1}{tp}\right] - \text{Log}\left[\frac{K}{\emptyset\mu\, Ct\, rw^2}\right] + 3.098\right]$$

$$S = 1.1513 \left[\left[\frac{447.5-392.0}{0.749}\right] + \text{Log}\left[\frac{8.05}{7.05}\right] - \text{Log}\left[\frac{360}{0.176\times0.032\times1.164\times10^{-3}\times0.11^2}\right] + 3.098\right]$$

$S$ = 77.8

**For the Previous Flow Period:**

$$\Delta Ps = \frac{18.665 \cdot q\, B\, \mu}{kh} \quad S = \frac{18.665 \times 2.096\times10^{6} \times 3.55\times10^{-3} \times 0.032 \times 77.8}{6832} = 50.6 \text{ bar}$$

$\Delta Pdd = P^* - Pwf$ = 56.2 bar

Skin as Fraction of Total Drawdown: $\frac{\Delta Ps}{\Delta Pdd}$ = 90%

| Well 34/10-16<br>DST no. 2 | DIARY OF EVENTS | CHP/PG<br>Perfs.: 3177-3187<br>Zone tested Tarbert |
|---|---|---|

| Date | Time | OPERATIONS |
|---|---|---|
| 15.9 | 17.55 | Perforated 3177-3187 m RKB |
| | 19.30 | Started running the test string |
| 16.9 | 15.00 | Set packer |
| | 15.05 | Opened LPR-valve |
| | 15.13 | Opened well on 52/64" fixed choke |
| | 15.15 | Closed in at chokemanifold and LPR-valve |
| | 16.19 | Opened LPR-valve |
| | 16.21 | Opened well on 52/64" fixed choke |
| | 16.25 | Gas to surface |
| | 17.03 | Diverted flow through separator |
| | 17.30 | Diverted flow to surge tank for 1. meterfactor |
| | 19.15 | Diverted flow to surge tank for 2. meterfactor |
| | 23.03 | Started to collect first set of PVT-samples |
| 17.9 | 00.05 | Started to collect second set of PVT-samples |
| | 01.00 | Bypassed separator |
| | 01.01 | Closed in at choke manifold and LPR-valve |
| | 05.57 | Opened LPR-valve |
| | 10.00 | Opened well on 80/64" fixed choke |
| | 10.25 | Diverted flow through separator |
| | 10.45 | Diverted flow to surge tank for 3. meterfactor |
| | 15.03 | Started to collect third set of PVT-samples |
| | 16.06 | Started to collect fourth set of PVT-samples |
| | 17.01 | Bypassed separator |
| | 17.03 | Closed in at choke manifold and LPR-valve |
| 18.9 | 00.37 | Opened LPR-valve |
| | 00.42 | Started bullheading |
| | | |
| | | END OF DST NO. 2 |

Remarks :

| Well 34/10-16 | SAMPLING | CHP/PG |
|---|---|---|
| DST no 2 | | Perfs.: 3177-3187 |
| | | Zone tested Tarbert |

## SEPARATOR SAMPLES.

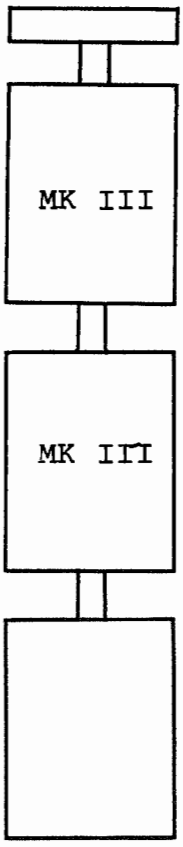
| Time/date | Sample no. | Type of sample | Transfer time | Bottle no |
|---|---|---|---|---|
| 16.09.83 23:03 | 1:set | Cond.<br>Gas<br>Gas | 29 min | 8308922<br>A14786<br>A14681 |
| 17.09.83 00:05 | 2:set | Cond.<br>Gas<br>Gas | 30 min | 83021217<br>A14695<br>A14761 |
| 15:03 | 3:set | Cond.<br>Gas<br>Gas | 37 min | 8308308<br>A14668<br>A14751 |
| 16:06 | 4:set | Cond.<br>Gas<br>Gas | 39 min | 83021209<br>A14789<br>A14688 |

| Time/date | Sample depth mRKB | Estimated PB bar/°C | Transfering pressure(bar) | Bottle no |
|---|---|---|---|---|
| | | | | |

## SAMPLES

| Time/date | Sampling point | Sampling equipment | | Remarks |
|---|---|---|---|---|
| 17.09.83 | Separator | 1 x 200 l<br>6 x 1 l<br>2 x 20 l<br>4 x 1 l | drum<br>glass jars<br>jerry cans<br>plastic bottles | condensate<br>condensate<br>condensate<br>water |

| Well 34/10-16 | GAUGE ARRANGEMENT | CHP/PG |
|---|---|---|
| DST no. 2 | | Perfs.: 3177 - 3187 mRKB |
| | | Zone tested TARBERT |




Top Bundle Carrier a 3152.64 mRKB

Gauge type and number : Sperry Sun, Mark III no. 0076

Depth, pressure elemement : 3155.97 mRKB Range : 690 bar

Mode : 2 Delay : 17 hrs.

Actuated : time 19.28 date : 15.09.83

Will run out : time 21.13 date : 18.09.83

Top Bundle Carrier a 3156.97 mRKB

Gauge type and number : Sperry Sun, Mark III no. P1M

Depth, pressure elemement : 3160.23 mRKB Range : 690 bar

Mode : 4 min Delay : 17 hrs.

Actuated : time 19.24 hrs. date : 15.09.83

Will run out : time 05.48 hrs. date : 21.09.83

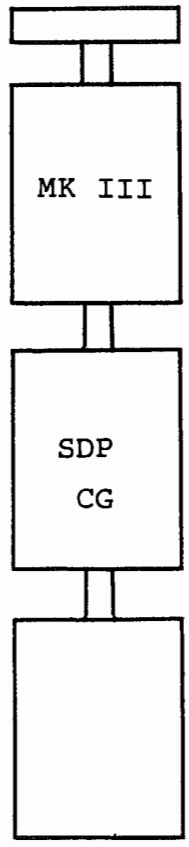
Gauge type and number :

Depth, pressure elemement : Range :

Mode : Delay :

Actuated : time date :

Will run out : time date :




"F"-nipple a 3171.44 mRKB

Gauge type and number : Sperry Sun, Mark III no. 0105

Depth, pressure elemement : 3174.54 mRKB Range : 690 bar

Mode : 2 mins. Delay : 17 hrs.

Actuated : time 19.10 hrs date : 15.09.83

Will run out : time 20.55 date : 08.09.83

Gauge type and number : Flopetrol, SDP CG no. 82818

Depth, pressure elemement : 3176.14 mRKB Range : 690 bar

Mode : 30 sec. Delay : 15 hrs.

Actuated : time 19.11 hrs. date : 15.09.83

Will run out : time " date : "

Gauge type and number :

Depth, pressure elemement : Range :

Mode : Delay :

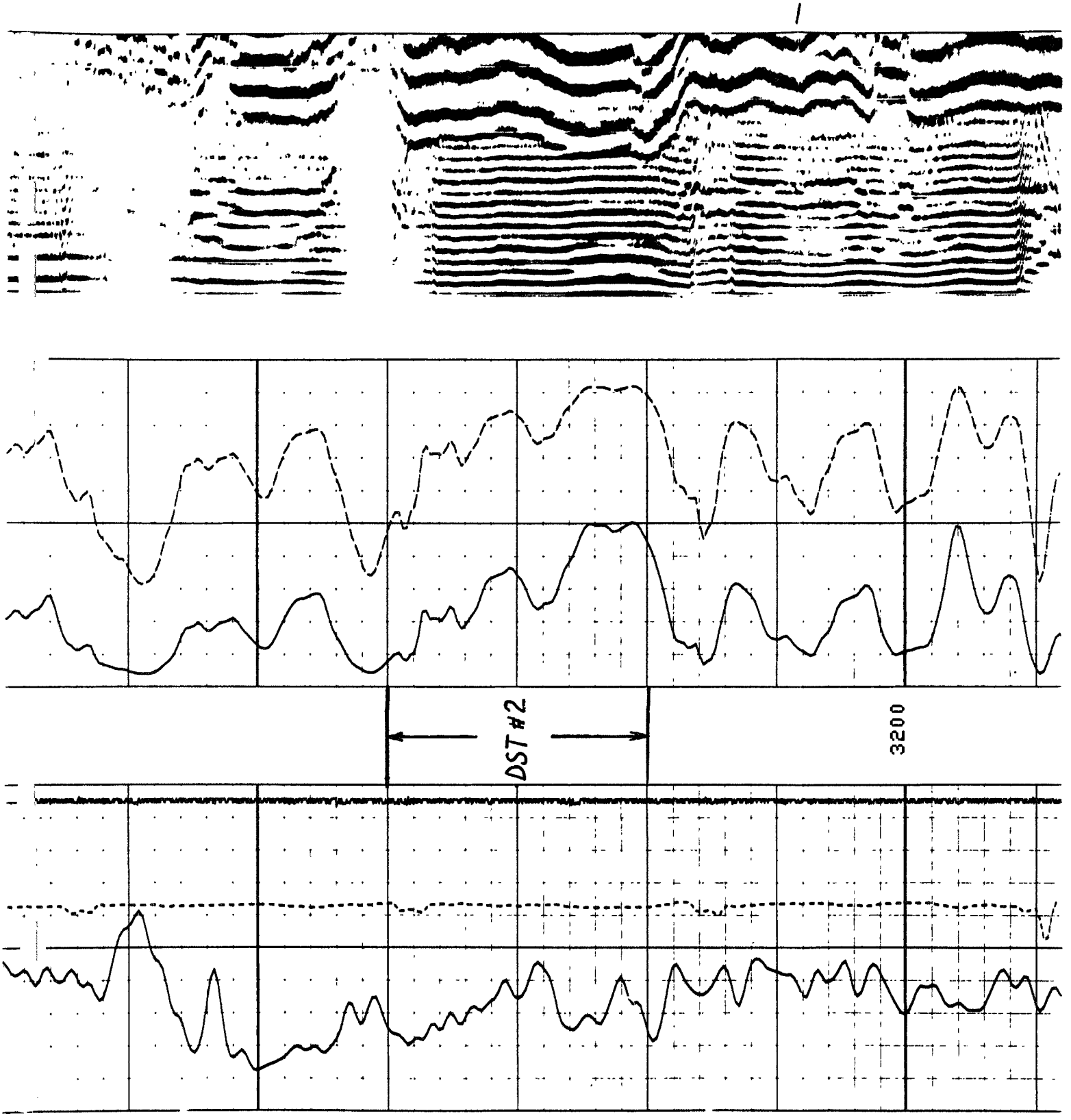
Actuated : time date :

Will run out : time date :

| Well 34/10-16 | LAYOUT OF TEST-STRING | CHP/PG |
|---|---|---|
| DST no 2 | | Perfs 3177-3187 |
| | | Zone tested TARBERT |

| TEST-STRING | ID inch | OD inch | LENGTH m | DEPTH mRKB |
|---|---|---|---|---|
| SURFACE TEST TREE | | | | -5.41 |
| 2 SINGLE + 1 PUP 5" VAM | 4.27 | 5 | 20.76 | 15.35 |
| LUBRICATOR VALVE AND X/O | 3.00 | 9/13 | 2.10 | 17.45 |
| 3 PUP JOINTS 5" VAM | 4.27 | 5 | 6.47 | 23.92 |
| 13 JOINTS 5"-18LBS/FT-L80 VAM | 4.27 | 5 | 125.66 | 149.58 |
| 1 PUP JOINT | 4.27 | 5 | 1.99 | 151.57 |
| X-OVER | 3.00 | | 0.31 | 151.88 |
| CENTRALIZER | 3.00 | 17.5 | 1.05 | 152.93 |
| SAVERSUB | 3.00 | | 0.26 | 153.19 |
| EZ-TREE | 3.00 | 10.87 | 2.44 | 155.63 |
| SLICKJOINT | 3.00 | 5.00 | 2.94 | 158.57 |
| FLUTED HANGER | 3.00 | 15.00 | 0.29 | 158.86 |
| X-OVER | 3.00 | | 0.29 | 159.15 |
| 88 STDS 5"-18LBS/FT L80 VAM | 4.27 | 5.00 | 2537.96 | 2697.11 |
| X-OVER 5" VAM BOX x 3½"TDS PIN | 2.75 | 6.25 | 0.25 | 2697.34 |
| 7 STDS 3½" - 12.7 LBS/FT L-80 TDS | 2.75 | 3.5 | 193.67 | 2891.01 |
| X-OVER 3½" TDS BOX x 3½" IF PIN | 2.75 | 5.5 | 0.30 | 2891.31 |
| SLIP JOINT | 2.25 | 5.0 | 5.54 | 2896.85 |
| SLIP JOINT | 2.25 | 5.0 | 4.02 | 2900.87 |
| 6 STDS DRILL COLLARS | 2.25 | 4.75 | 170.91 | 3071.78 |
| RTTS CIRC VALVE (BACKUP) | 2.44 | 4.87 | 1.10 | 3072.88 |
| 1 STD DRILL COLLAR | 2.25 | 4.75 | 28.49 | 3101.37 |
| SLIP JOINT | 2.25 | 5.00 | 4.02 | 3105.39 |
| SLIP JOINT | 2.25 | 5.00 | 4.02 | 3109.41 |
| 1 STD DRILL COLLAR | 2.25 | 4.75 | 28.49 | 3137.90 |
| APR-M VALVE (BACKUP) | 2.25 | 5.00 | 2.29 | 3140.19 |
| DRILLPIPE TESTER VALVE (BACKUP) | 2.25 | 5.00 | 1.35 | 3141.54 |
| LPR-N TESTER VALVE (BACKUP) | 2.25 | 5.00 | 4.99 | 3146.53 |
| FUL FLOW HYDRAULIC BYPASS | 2.25 | 4.62 | 2.02 | 3148.55 |
| BIG JOHN JAR | 2.37 | 4.62 | 1.58 | 3150.13 |
| SAFETY JOINT | 2.44 | 5.00 | 0.88 | 3151.01 |
| RTTS PACKER (NEW RUBBERS) | 2.4 | 5.75 | 1.38 | 3152.39 |
| X-OVER 2 7/8" EUE BOX x 3½" IF PIN | 2.50 | 4.75 | 0.25 | 3152.64 |
| BUNDLE CARRIER 180° OUT OF PHASE | 2.00 | 5.63 | 4.33 | 3156.97 |
| BUNDLE CARRIER | 2.00 | 5.63 | 4.30 | 3161.27 |
| X-OVER 3½" IF BOX x 2 7/8" EUE PIN | 2.50 | 4.75 | 0.23 | 3161.50 |
| PERFORATED 2 7/8" EUE PIN | 2.44 | 2.88 | 9.36 | 3170.86 |
| X-OVER 2 7/8" EUE BOX x 2 3/8" EUE PIN | 2.00 | 3.25 | 0.31 | 3171.17 |
| F-NIPPLE 2 3/8" EUE BOX x PIN | 1.81 | 3.25 | 0.27 | 3171.44 |
| X-OVER 2 3/8 " EUE BOX x 2 7/8" EUE PIN | 2.00 | 3.25 | 0.24 | 3171.68 |
| 1 JOINT 2 7/8" EUE JOINT | 2.44 | 2.88 | 9.12 | 3180.80 |
| BULLPLUG W/CROSS 2 7/8" EUE BOX | 2.88 | 4.00 | 0.15 | 3180.95 |

**Remarks.**




A2-13 Cement Bond Log