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RECORDS SECTION

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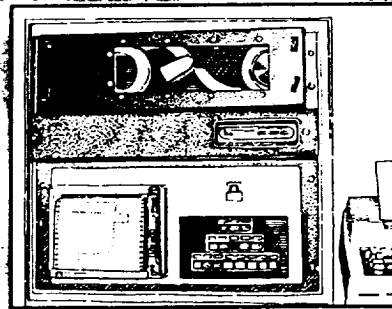
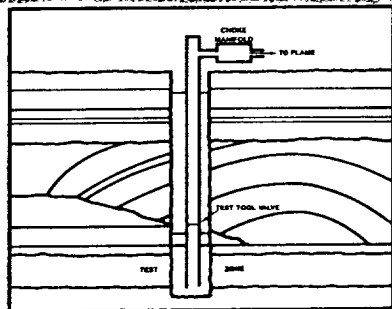
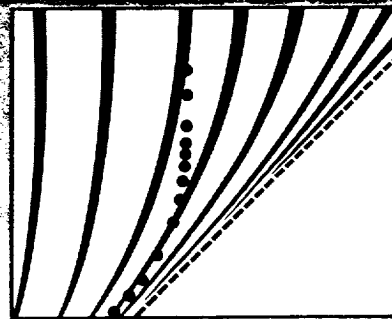
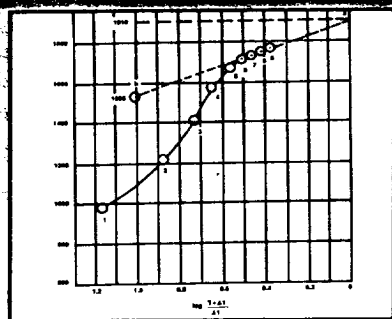
JUL 27 1979

DRILLING

JOHNSTON

Schlumberger

Teleflow Test Systems Reservoir Analysis



COMPUTERIZED DATA ANALYSIS

RECEIVED

JUL 21 1979

JULY 11, 1979

DRILLING & PRODUCTION

GENTLEMEN:

THE ENCLOSED TEST APPEARS TO BE A GOOD MECHANICAL DRILL STEM TEST DURING WHICH THE TOOLS DID FUNCTION PROPERLY. THE FORMATION PRODUCED ENOUGH RESERVOIR FLUID FOR PROPER IDENTIFICATION. RESERVOIR PRESSURE DRAWDOWN WAS SUFFICIENT AND AD-EQUATE SHUT-IN BUILD-UPS DID OCCUR FOR RELIABLE QUANTITATIVE ANALYSIS. AFTER-FLOW WAS STILL IN EFFECT ON THE SECOND SHUT-IN BUILD-UP TO THE EXTENT THAT THE PLOT IS CONSIDERED UNRELIABLE FOR ANALYSIS. RESERVOIR PARAMETERS WERE CALCULATED BY THE HORNER METHOD.

1. FLOW RATE: AN AVERAGE FLOW RATE OF 60 MCF/DAY OF GAS WAS NOTED DURING THIS TEST.
2. RESERVOIR PRESSURE: EXTRAPOLATION OF THE SHUT-IN PRESSURE BUILD-UP INDICATES A MAXIMUM RESERVOIR PRESSURE OF 4058 P.S.I.G. AT RECORDER DEPTH.
3. PERMEABILITY: THE CALCULATED TRANSMISSIBILITY FACTOR OF 16.3 MD.-FT./CP. INDICATES AN AVERAGE EFFECTIVE PERMEABILITY TO GAS OF .008 MD. FOR THE REPORTED 32 FOOT TEST INTERVAL. THE CALCULATIONS WERE BASED ON A SLOPE OF 774 P.S.I./LOG CYCLE OBTAINED FROM THE FINAL SHUT-IN BUILD-UP PLOT. IT WAS ASSUMED FOR THESE CALCULATIONS: (A) GAS GRAVITY 0.70 (B) VISCOSITY .0165 CP. (C) AND GAS DEVIATION FACTOR .842. THESE FIGURES WERE OBTAINED FROM THE AVAILABLE TECHNICAL LITERATURE.
4. WELL BORE DAMAGE: THE CALCULATED DAMAGE RATIO OF 3.23 INDICATES THAT WELL BORE DAMAGE IS PRESENT AT THE TIME AND CONDITIONS OF THIS TEST.
5. RADIUS OF INVESTIGATION: THE CALCULATED RADIUS OF INVESTIGATION OF THIS TEST IS 3 FEET BASED ON AN ASSUMED POROSITY OF 10%, COMPRESSIBILITY OF 4.94 X 10⁻⁴, AND OTHER ASSUMPTIONS MADE IN NUMBER 3 ABOVE.
6. GENERAL COMMENTS: THE FORMATION EXHIBITS THE CHARACTERISTICS OF RELATIVELY LOW PERMEABILITY EFFECTIVE TO THE RESERVOIR FLUID AND INDICATES THE PRESENCE OF WELL BORE DAMAGE.

Stephen Gardner
STEPHEN GARDNER
RESERVOIR EVALUATION
DEPARTMENT

DOW CHEMICAL COMPANY
STATE 16 #1; LEA COUNTY, NEW MEXICO
TEST #1; 11,387' TO 11,419'
LOCATION: SEC. 16 - T10S - R36E

F.R. #13986 D

In making any interpretation, our employees will give Customer the benefit of their best judgment as to the correct interpretation. Nevertheless, since all interpretations are opinions based on inferences from electrical, mechanical or other measurements, we cannot, and do not guarantee the accuracy or correctness of any interpretations, and we shall not be liable or responsible, except in the case of gross or wilful negligence on our part, for any loss, costs, damages or expenses incurred or sustained by Customer resulting from any interpretation made by any of our agents or employees.

Gas Reservoir Engineering Data



Instrument No. J-072

Field Report No. 13986 D

Damage Ratio	DR	3.23		Effective Transmissibility	$\frac{Kh}{\mu}$	16.3	Md-ft. Cp.
				GAS			
Maximum Reservoir Pressure	P _o	4058	P.S.I.G.	Flow Rate	Q _g	60	MCF./day
				AVERAGE GAS			
Slope of Shut-in Curve	M _g	774	PSI /log cycle	Flow Rate	Q	—	
FINAL SHUT-IN							
Potentiometric Surface	PS	—	ft.	Pressure Gradient		.356	PSI/ft.
(Datum Plane, Sea Level)							
Radius of Investigation		3	ft.	K (Effective to GAS)		.008	Md.

$$\text{SLOPE } M_g = 4058 - 3284 = 774$$

Assumptions made for Calculations for Gas Recoveries

1. Q_g is taken as steady state flow and unless stated otherwise at standard conditions 14.7 P.S.I. and 60°F.
2. P_f is final formation flowing pressure at steady state flow.
3. Formation flow is taken as single phase flow. If liquid (condensate) is produced at surface, condensation is assumed to have occurred in drill pipe.
4. Radial flow is assumed.
5. Unless given, gas specific gravity is assumed to be 0.7 (air 1.0) and having pseudo critical temperature at 385° Rankin and pseudo critical pressure of 666 P.S.I.A.
6. Other standard radial flow, steady state assumptions.

Empirical Equations:

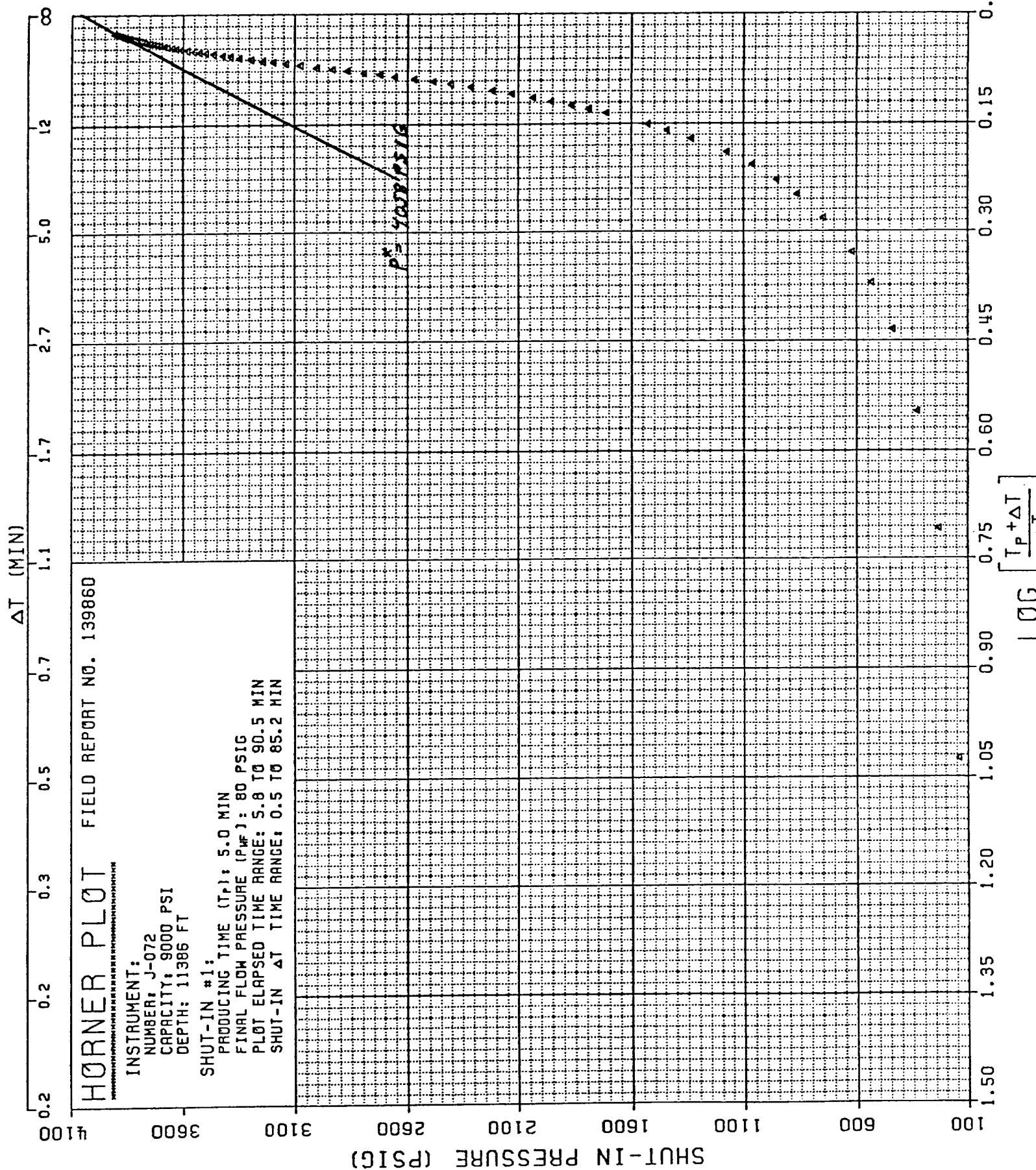
$$1. \text{ EDR} = \frac{P_o^2 - P_f^2}{M_g (\log T + 2.65)} \text{ where } M_g = \frac{P_i^2 - P_{i0}^2}{\text{Log Cycle}}$$

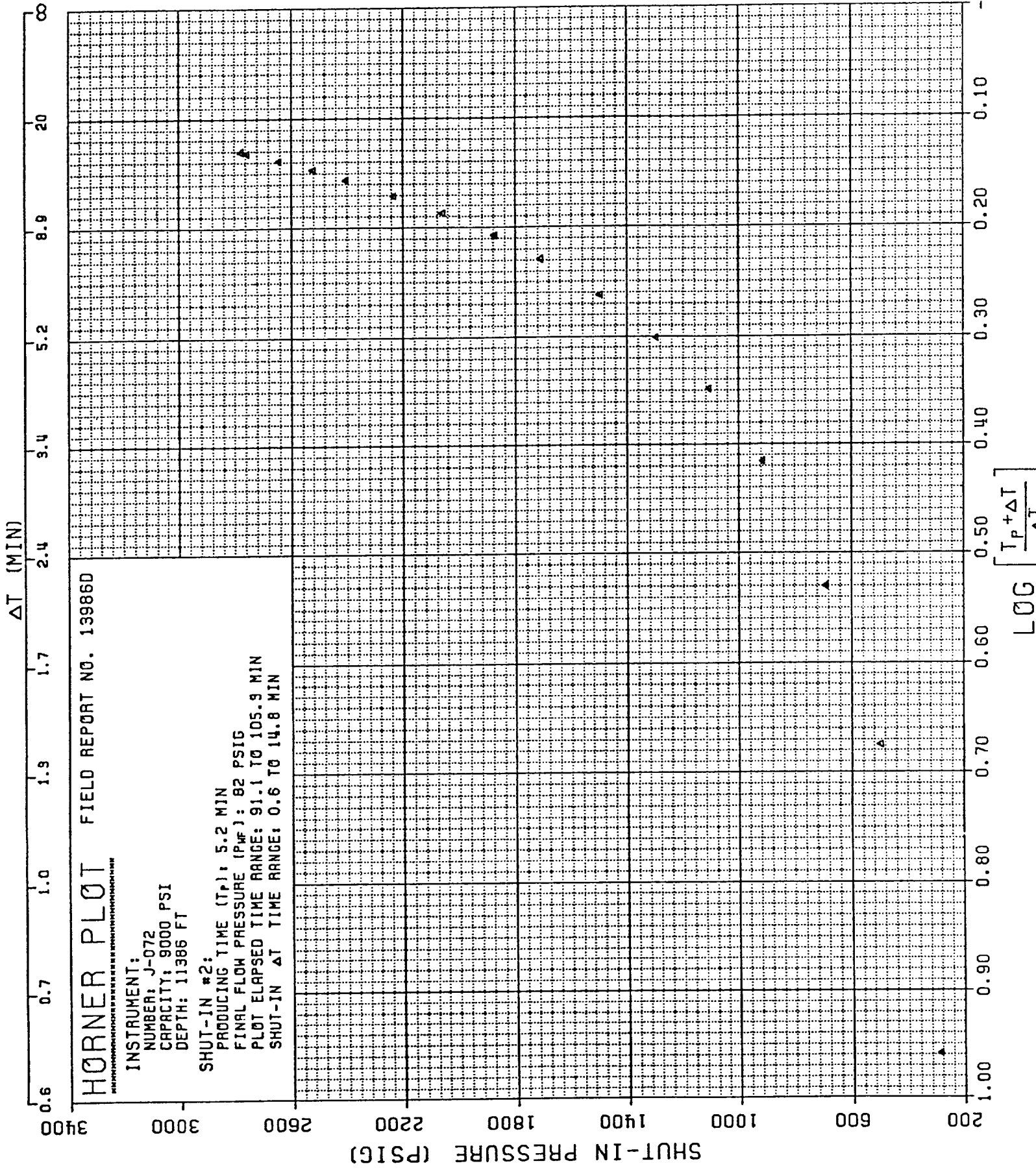
$$2. \text{ Transmissibility } \frac{Kh}{\mu Z} = \frac{1637^\circ T_f Q_g}{M_g}$$

$$3. \text{ P.S.} = \left[P_o \times 2.309 \text{ ft./PSI} \right] - \left[\text{Recorder depth to sea level.} \right]$$

$$4. \text{ Radius of Investigation, } r_i = \sqrt{\frac{Kt}{40\phi (1 - S_w)\mu c}} \text{ where } t = \text{time in days}$$

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ΔT (MIN)

0.4 0.7 1.0 1.7 2.7 4.5 7.7 14 27 70 80

HORNER PLOT FIELD REPORT NO. 139860

INSTRUMENT:

NUMBER: J-072

CAPACITY: 9000 PSI

DEPTH: 11386 FT

SHUT-IN #3:

PRODUCING TIME (T_p): 40.7 MIN

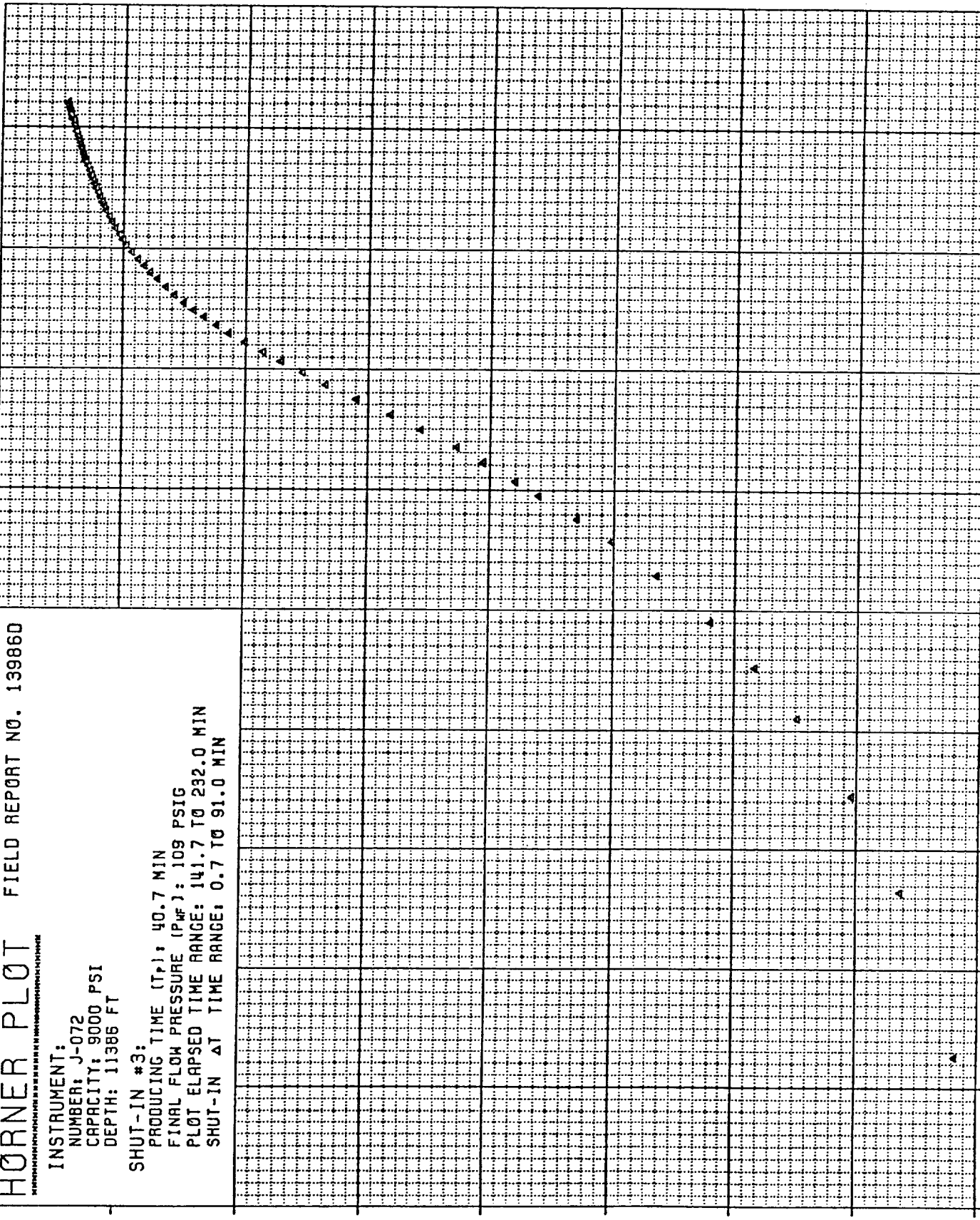
FINAL FLOW PRESSURE (P_{wf}): 109 PSIG

PLOT ELAPSED TIME RANGE: 141.7 TO 232.0 MIN

SHUT-IN ΔT TIME RANGE: 0.7 TO 91.0 MIN

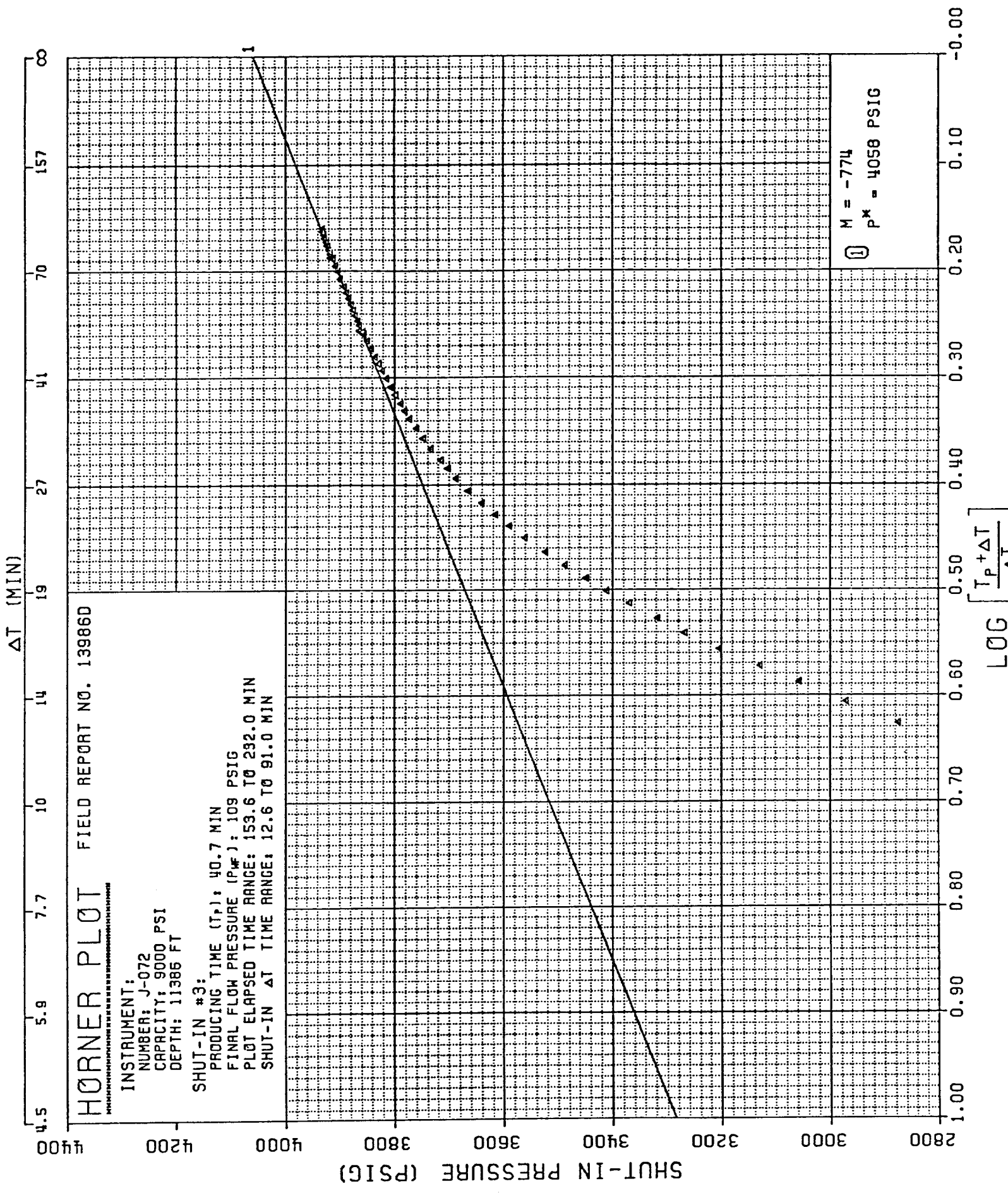
SHUT-IN PRESSURE (PSIG)

4200 3700 3200 2700 2200 1700 1200 700 200



$\log \left[\frac{T_p + \Delta T}{T_p} \right]$

0.00 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00



FIELD REPORT NO. 13986D

INSTRUMENT:

NUMBER: J-072

CAPACITY: 9000 PSI

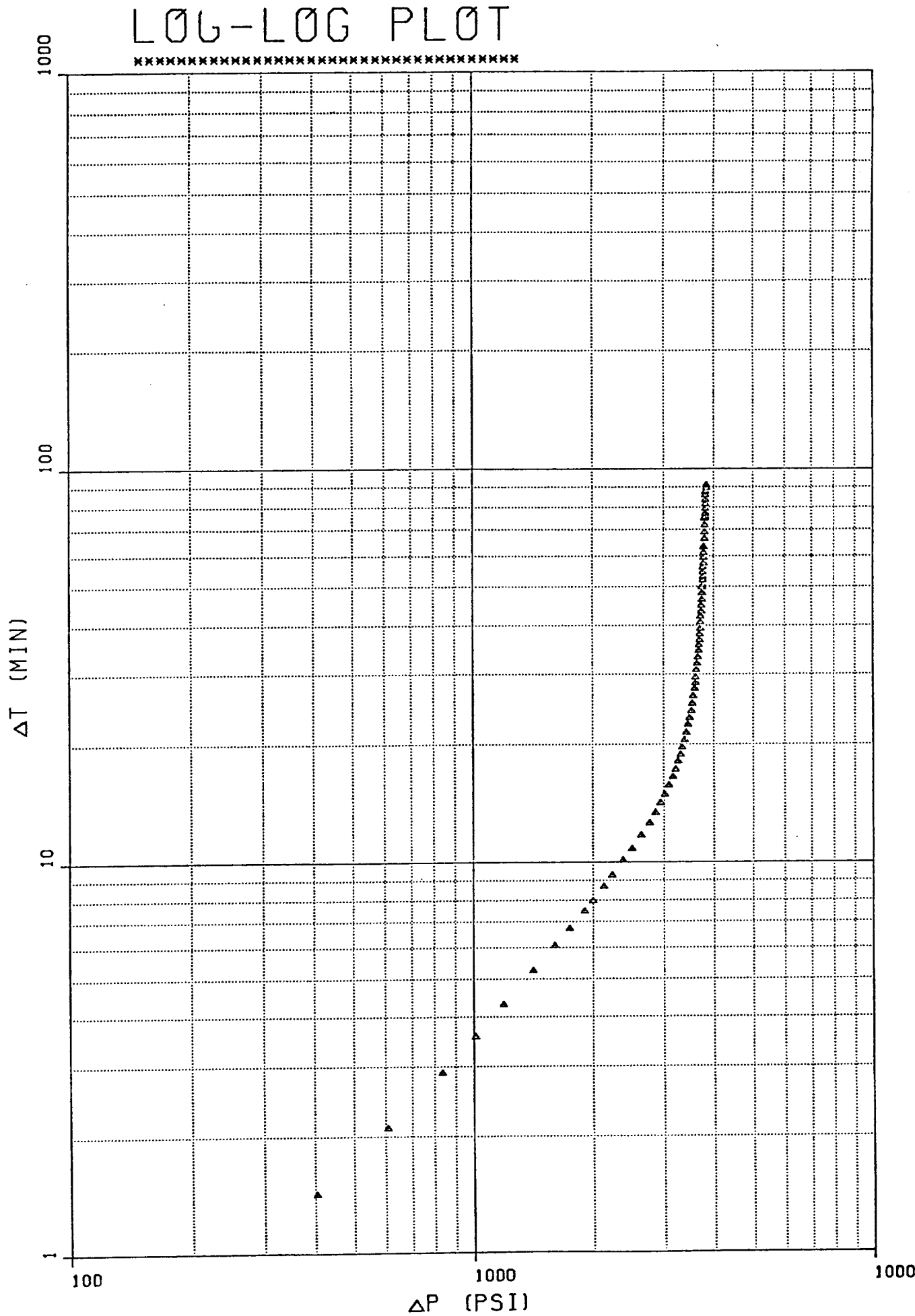
DEPTH: 11386 FT

SHUT-IN #3:

FINAL FLOW PRESSURE (P_{WF}): 109 PSIG

PLOT ELAPSED TIME RANGE: 142.4 TO 232.0 MIN

SHUT-IN ΔT TIME RANGE: 1.4 TO 91.0 MIN



WELL IDENTIFICATION

COMPANY: DOW CHEMICAL COMPANY
 1123 WILCO BUILDING
 MIDLAND, TEXAS 79701
 STATE 16 #1
 WELL: INTERVAL: 11387' TO 11419'
 TEST NO: 1
 COUNTY: LEA
 TECHNICIAN: TREECE/MARION (HOBBS)

CUSTOMER: SAME

LOCATION: * SEE REMARKS
 FIELD: -
 TEST DATE: 6-28-79
 STATE: NEW MEXICO
 TEST APPROVED BY: MR. D.K. SAGE

EQUIPMENT AND HOLE DATA

TEST TYPE: M.F.E. OPEN HOLE
 ELEVATION: -
 TOTAL DEPTH: 11419
 MAIN HOLE/CASING SIZE: 7 7/8
 RAT HOLE/LINER SIZE: -
 FORMATION TESTED: -
 NET PROD. INTERVAL: 32
 POROSITY: 10%

DRILL PIPE LENGTH: 10732
 DRILL PIPE I.D.: 3.826
 DRILL COLLAR LENGTH: 619
 DRILL COLLAR I.D.: 2.25
 PACKER DEPTHS: 11381 & 11387
 FT. IN. FT. IN. FT. IN. FT. IN.
 FT. DEPTHS REF. TO: ROTARY KELLY BUSHING

TEST TOOL CHAMBER DATA

SAMPLER PRESSURE: 2700
 RECOVERED OIL GRAVITY: - API @
 RECOVERY GOR: 25262

SAMPLE CHAMBER CONTENTS

FLUID VOLUME
 GAS: 15.89 FT.3
 OIL: 100 CC
 WATER: 400 CC
 MUD: - CC
 FILTRATE:
 TOTAL LIQUID: 500 CC

RESIST. (OHM-M) (DEG F.)
 .24 85 250000
 - - -
 - - -

MEAS. TEMP. (DEG F.)
 CHLOR. (PPM)

MUD DATA

TYPE: SALT GEL & STARCH
 WEIGHT: 9.7 LB/GAL.
 VISCOSITY: 47 SEC.
 WATER LOSS: 24 CC
 FLUID RESIST (OHM-M) (DEG F) (PPM)
 MUD: -
 FILTRATE: -

REMARKS

* LOCATION: SEC. 16 - T10S - R36E OF LEA COUNTY NEW MEXICO
 "TELEFLOW TEST SYSTEM"

NO. OF REPORTS REQUESTED: 5

FIELD REPORT NO. 13986D

SURFACE INFORMATION

DESCRIPTION(RATE OF FLOW)

TIME

PRESSURE
PSIG

SURFACE
CHOKE

SEE TELEFLOW INFORMATION SHEET

CUSHION TYPE: -

- FT

- PSIG

.625 IN. BOTTOM CHOKE

RECOVERY INFORMATION

RECOVERY

FEET

BARRELS

%OIL

%WATER

%OTHERS

API
GRAV.

DEG.

RESIST

DEG.

CHL
PPM

FORMATION WATER
DRILLING FLUID

60
60

0.29
0.29

-

-

-

-

-

.16
.18

85
85

22000
23000

FIELD REPORT NO. 13986D

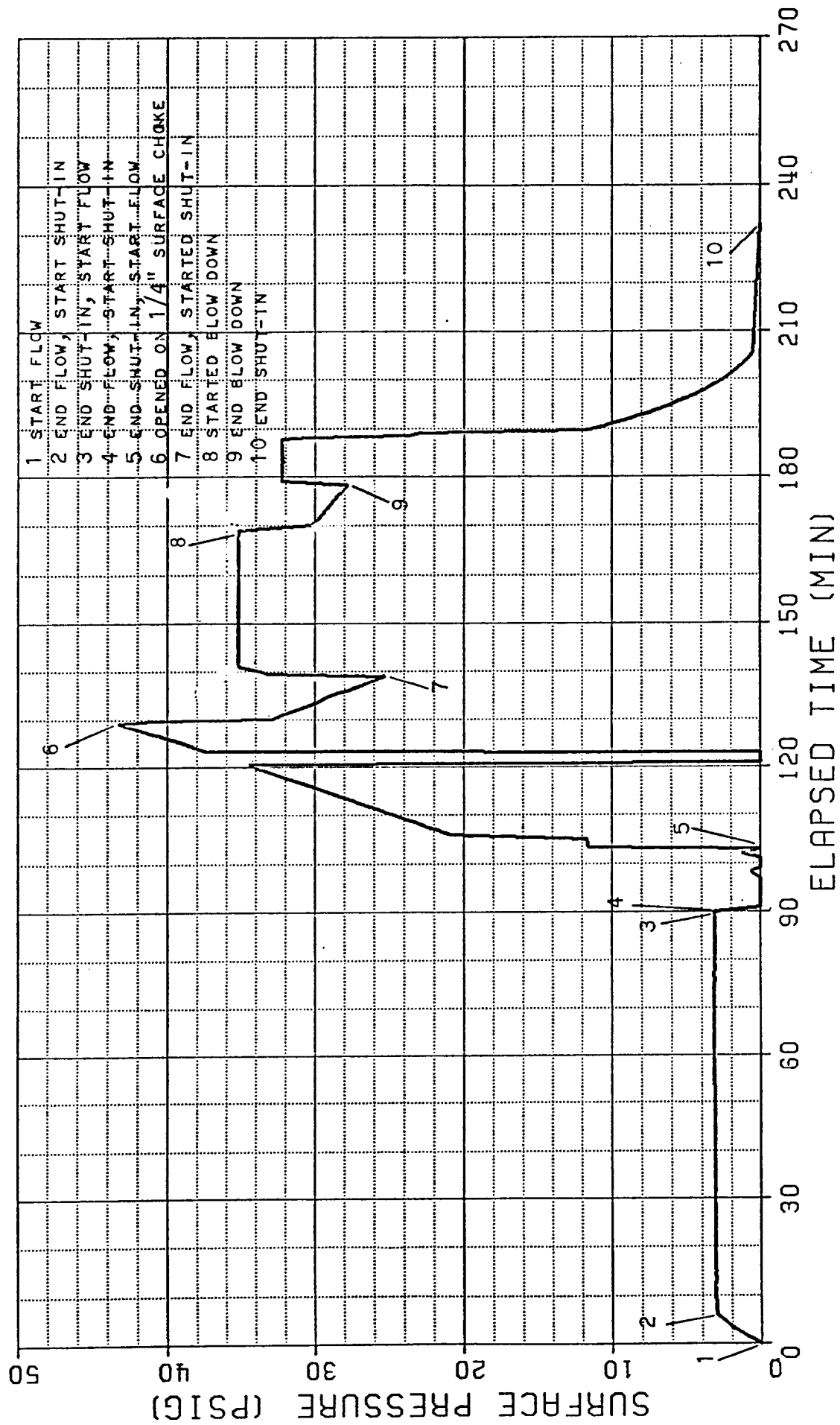
RATES BASED ON EITHER PURE LIQUID OR PURE GAS PRODUCTION

13986 D

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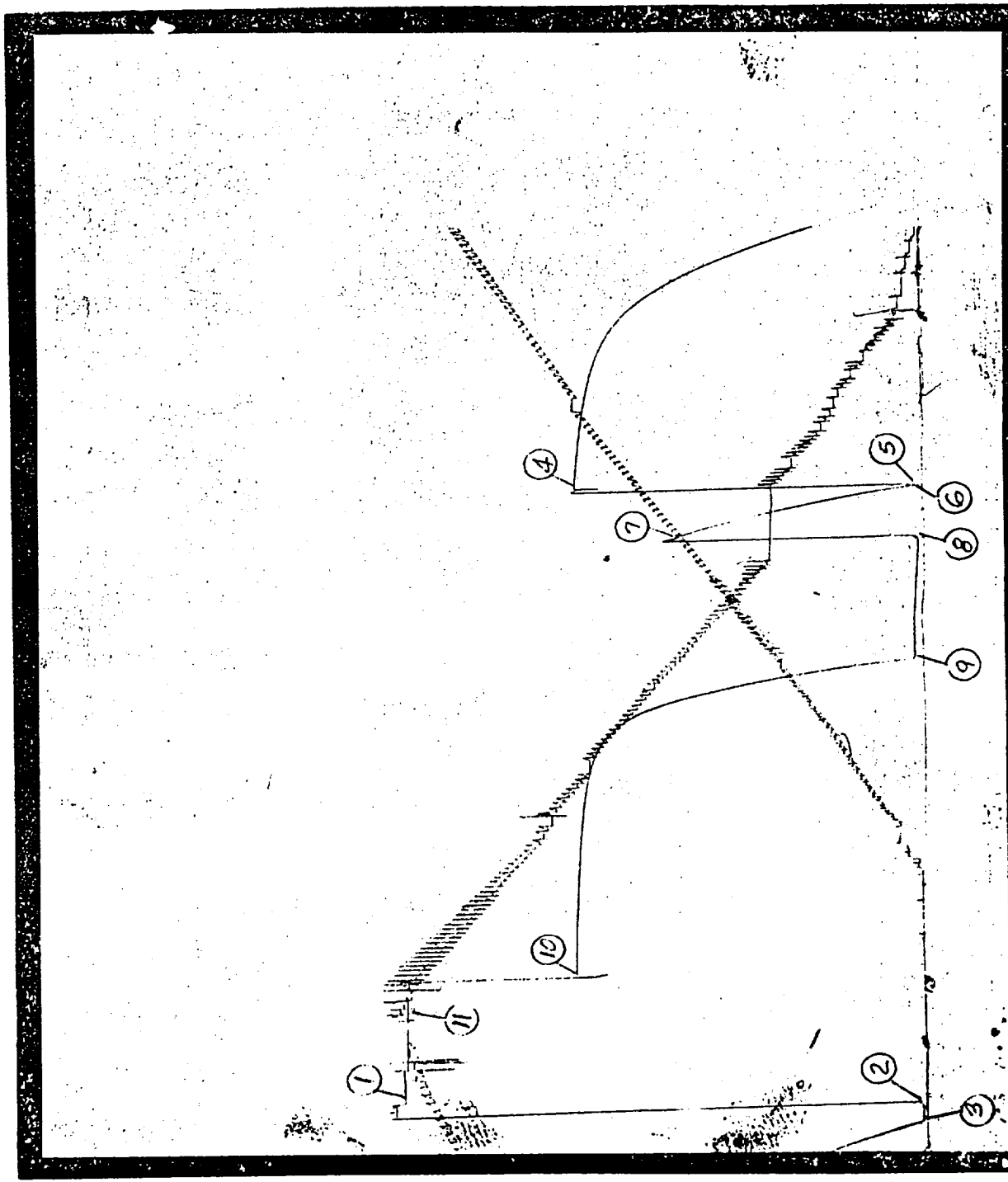
TELEFLOW SURFACE PRESSURE LOG

FIELD REPORT NO. 13986D



FIELD REPORT NO.: 13986 D CAPACITY: 9000 #

INSTRUMENT NO.: J-072 NUMBER OF REPORTS: 5-



PRESSURE LOG

FIELD REPORT NO. 13986D

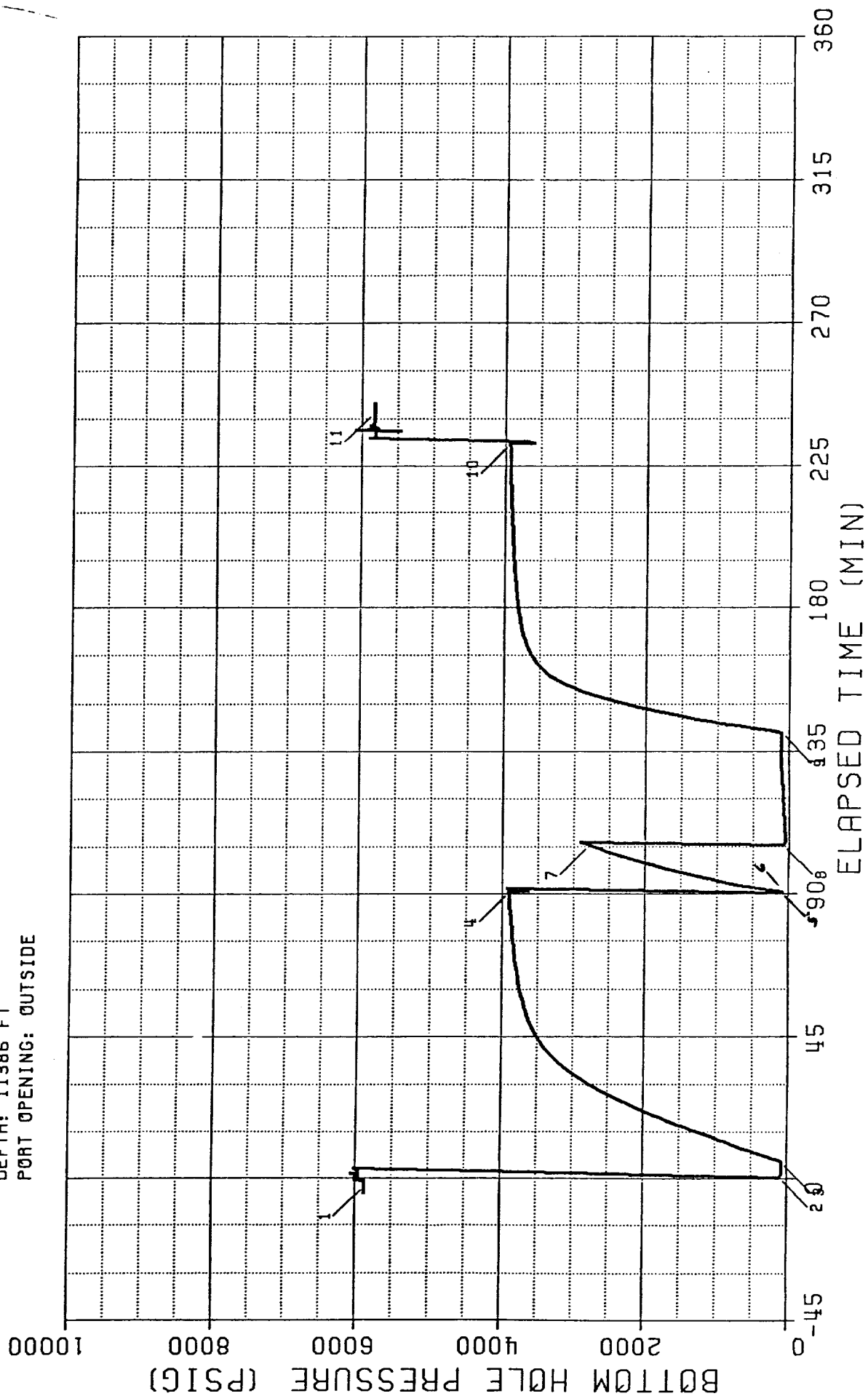
INSTRUMENT:

NUMBER: J-072

CAPACITY: 9000 PSI

DEPTH: 11386 FT

PORT OPENING: OUTSIDE



BOTTOM HOLE PRESSURE AND TIME DATA

INSTRUMENT NO.: J-Ø72
PORT OPENING: OUTSIDE

CAPACITY (PSI): 9000
BOTTOM HOLE TEMP (F): 175

DEPTH (FT): 11386
PAGE 1

***** EXPLANATION *****

*****	*****	*****	*****	*****	*****	*****
*****	*****	*****	*****	*****	*****	*****
HYDROSTATIC MUD						
START FLOW	1	5872				-2.8
END FLOW & START SHUT-IN	2	110				0.3
END SHUT-IN	3	80				5.3
START FLOW	4	3907				90.5
END FLOW & START SHUT-IN	5	104				90.3
END SHUT-IN	6	82				90.5
START FLOW	7	2777				105.3
END FLOW & START SHUT-IN	8	77				105.4
END SHUT-IN	9	109				140.9
HYDROSTATIC MUD	10	3932				232.0
	11	5831				241.7

***** SUMMARY OF FLOW PERIODS *****

*****	*****	*****	*****	*****	*****	*****
*****	*****	*****	*****	*****	*****	*****
FLOW PERIOD	ELAPSED TIME	ELAPSED TIME	DURATION OF	PRESSURE AT	PRESSURE AT	
	AT START (MIN)	AT END (MIN)	FLOW (MIN)	START (PSIG)	END (PSIG)	
*****	*****	*****	*****	*****	*****	*****
1	0.3	5.3	5.0	110	80	
2	90.3	90.5	0.2	104	82	
3	105.4	140.9	35.5	77	109	

***** SUMMARY OF SHUT-IN PERIODS *****

*****	*****	*****	*****	*****	*****	*****
*****	*****	*****	*****	*****	*****	*****
SHUT-IN	ELAPSED	DURATION OF	PRESSURE	FINAL FLOW	PRODUCING	
PERIOD	TIME AT	SHUT-IN	AT END	PRESSURE	TIME (MIN)	
	START (MIN)	(MIN)	(PSIG)	(PSIG)		
*****	*****	*****	*****	*****	*****	*****
1	5.3	85.2	3907	80	5.0	
2	90.5	14.8	2777	82	5.2	
3	140.9	91.0	3932	109	40.7	

FIELD REPORT NO. 13986D
INSTRUMENT NO. J-072

TEST PHASE : FLOW PERIOD # 1

ELAPSED TIME (MIN)	DELTA TIME (MIN)	FLOWING PRESSURE (PSIG)
0.3	0.0	110
3.3	3.0	80
5.3	5.0	80

TEST PHASE : SHUT-IN PERIOD # 1

- 1. FINAL FLOW PRESSURE ["P"] = 80 PSIG
- 2. PRODUCING TIME ["T"] = 5.0 MIN

ELAPSED TIME (MIN)	DELTA TIME ["DT"] (MIN)	SHUT-IN PRESSURE ["P"] (PSIG)	LOG [(T +DT)/DT] P	DELTA PRESSURE [P - P] WS
5.3	0.0	80	0.300	0
10.3	5.0	692	0.175	612
15.3	10.0	1289	0.124	1209
20.3	15.0	1860	0.096	1780
25.3	20.0	2360	0.079	2279
30.3	25.0	2786	0.067	2705
35.3	30.0	3117	0.058	3037
40.3	35.0	3353	0.051	3272
45.3	40.0	3514	0.045	3433
50.3	45.0	3623	0.041	3542
55.3	50.0	3698	0.038	3618
60.3	55.0	3753	0.035	3672
65.3	60.0	3793	0.032	3712
70.3	65.0	3826	0.030	3745
75.3	70.0	3851	0.028	3771
80.3	75.0	3873	0.026	3792
85.3	80.0	3891	0.025	3811
90.3	85.0	3906	0.025	3826
95.3	90.0	3907	0.025	3826

TEST PHASE : FLOW PERIOD # 2

ELAPSED TIME (MIN)	DELTA TIME (MIN)	FLOWING PRESSURE (PSIG)
90.3	0.0	104
95.3	0.2	82

FIELD REPORT NO. 13986D
INSTRUMENT NO. J-Ø72

TEST PHASE : SHUT-IN PERIOD # 2

- 1. FINAL FLOW PRESSURE ["P"] = 82 PSIG
- 2. PRODUCING TIME ["T"] = 5.2 MIN

ELAPSED TIME (MIN)	DELTA TIME ["DT"]	SHUT-IN PRESSURE ["P"] (PSIG)	LOG [(T +DT)/DT] P	DELTA PRESSURE [P - P] WS WF
*****	*****	*****	*****	*****
9Ø.5	Ø.Ø	82	Ø.555	Ø
92.5	2.Ø	646	Ø.361	564
94.5	4.Ø	1Ø67	Ø.27Ø	984
96.5	6.Ø	1448	Ø.217	1366
98.5	8.Ø	1799	Ø.181	1717
1ØØ.5	1Ø.Ø	2116	Ø.156	2Ø34
1Ø2.5	12.Ø	2414	Ø.137	2332
1Ø4.5	14.Ø	2678	Ø.137	2595
1Ø5.3	14.8	2777	Ø.13Ø	2695

TEST PHASE : FLOW PERIOD # 3

ELAPSED TIME (MIN)	DELTA TIME (MIN)	FLOWING PRESSURE (PSIG)
*****	*****	*****
1Ø5.4	Ø.Ø	77
1Ø8.4	3.Ø	56
111.4	6.Ø	62
114.4	9.Ø	7Ø
117.4	12.Ø	77
12Ø.4	15.Ø	85
123.4	18.Ø	92
126.4	21.Ø	99
129.4	24.Ø	1Ø7
132.4	27.Ø	1Ø8
135.4	3Ø.Ø	1Ø8
138.4	33.Ø	1Ø8
14Ø.9	35.5	1Ø9

FIELD REPORT NO. 13986D
INSTRUMENT NO. J-872

TEST PHASE : SHUT-IN PERIOD # 3

1. FINAL FLOW PRESSURE ["P"] = 109 PSIG
WF
2. PRODUCING TIME ["T"] = 40.7 MIN
P

ELAPSED TIME (MIN)	DELTA TIME ["DT"]	SHUT-IN PRESSURE ["P"] WS (PSIG)	LOG [(T +DT)/DT] P	DELTA PRESSURE [P - P] WS
140.9	0.0	109	1.620	0
141.9	1.0	376	1.329	267
142.9	2.0	690	1.163	581
143.9	3.0	974	1.048	865
144.9	4.0	1225	0.961	1116
145.9	5.0	1461	0.891	1352
146.9	6.0	1689	0.833	1580
147.9	7.0	1910	0.784	1801
148.9	8.0	2108	0.742	1999
149.9	9.0	2288	0.705	2180
150.9	10.0	2468	0.643	2359
152.9	12.0	2791	0.592	2682
154.9	14.0	3037	0.549	2928
156.9	16.0	3230	0.513	3122
158.9	18.0	3367	0.482	3258
160.9	20.0	3469	0.455	3360
162.9	22.0	3548	0.431	3439
164.9	24.0	3611	0.409	3502
166.9	26.0	3658	0.390	3549
168.9	28.0	3695	0.372	3586
170.9	30.0	3724	0.335	3615
175.9	35.0	3776	0.305	3667
180.9	40.0	3811	0.280	3702
185.9	45.0	3836	0.259	3727
190.9	50.0	3856	0.241	3747
195.9	55.0	3872	0.225	3763
200.9	60.0	3884	0.211	3775
205.9	65.0	3895	0.199	3786
210.9	70.0	3904	0.188	3795
215.9	75.0	3912	0.179	3803
220.9	80.0	3921	0.170	3812
225.9	85.0	3926	0.162	3817
230.9	90.0	3931	0.160	3822
232.0	91.0	3932	0.160	3823