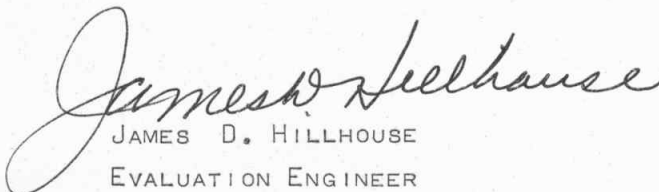


SPECIAL DATA ANALYSIS

JANUARY 27, 1964

THIS APPEARS TO BE A GOOD MECHANICAL DRILL STEM TEST DURING WHICH THE TOOLS DID FUNCTION PROPERLY. WELL CONDITIONS WERE SATISFACTORY, AND THE FORMATION WITHIN THE TEST INTERVAL DID PRODUCE ENOUGH RESERVOIR FLUID FOR PROPER IDENTIFICATION. SUFFICIENT RESERVOIR PRESSURE DRAWDOWN DID OCCUR FOR ADEQUATE SHUT-IN BUILD-UPS FOR RELIABLE SPECIAL DATA ANALYSIS. THE LENGTHS OF TIME OF THE FLOW PERIODS AND SHUT-IN PERIODS OF THIS TEST ARE NOT SUFFICIENT. THE DATA OBTAINED SHOULD NOT BE ADEQUATE FOR RELIABLE SPECIAL DATA ANALYSIS.

1. RESERVOIR PRESSURE: EXTRAPOLATION OF THE INITIAL SHUT-IN PRESSURE BUILD-UP PLOT INDICATES A MAXIMUM RESERVOIR PRESSURE OF 1705 P.S.I.G. AT RECORDER DEPTH.
2. GENERAL COMMENTS: THE FINAL SHUT-IN PERIOD SHOULD HAVE BEEN AT LEAST 30 MINUTES LONGER TO RESULT IN RELIABLE ANALYSIS.


JAMES D. HILLHOUSE
EVALUATION ENGINEER



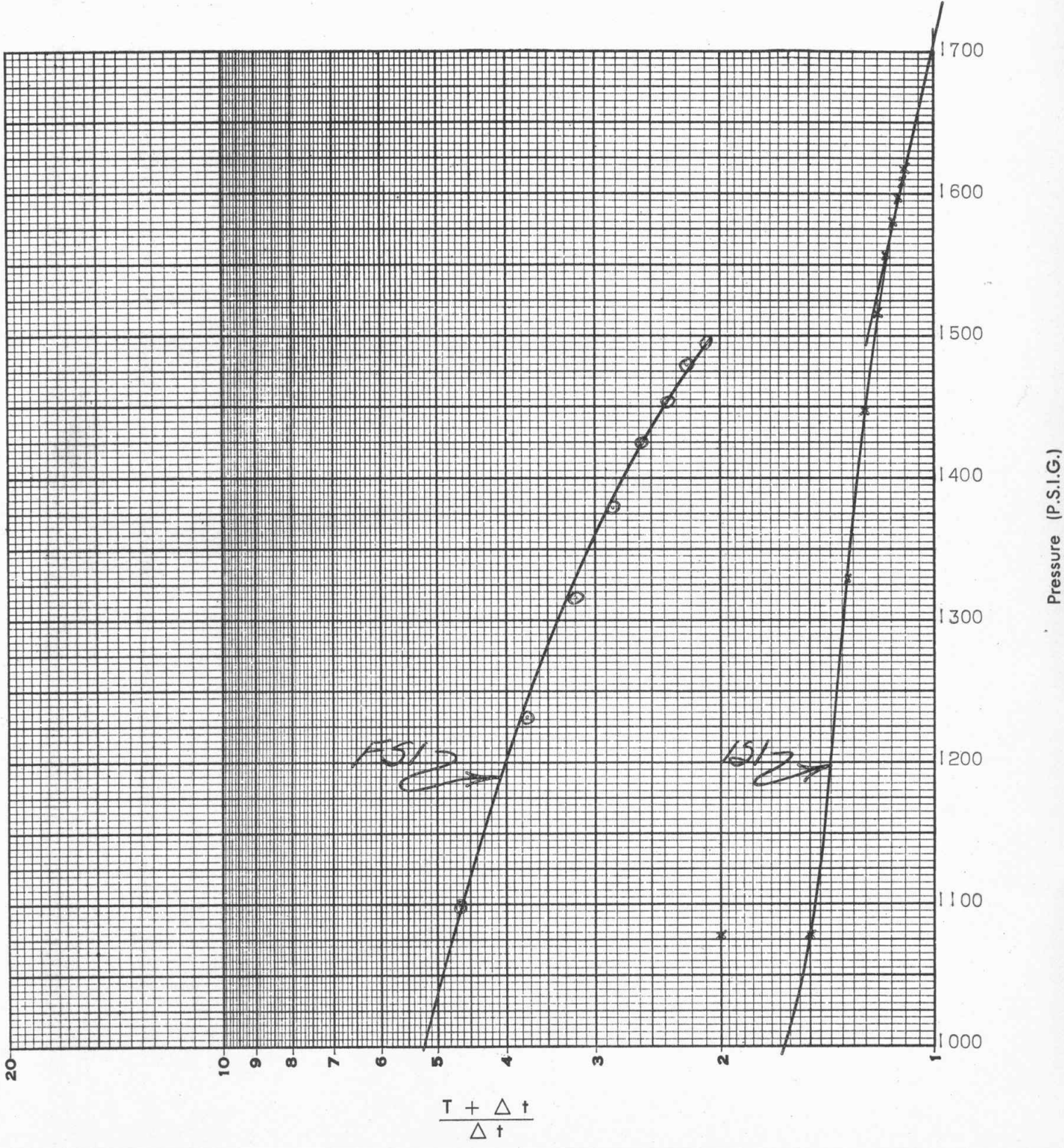
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Gas Reservoir Engineering Data

Recorder No. T-32

Field Report No. 12328 A

Estimated Damage Ratio	EDR		Effective Transmissibility	$\frac{Kh}{\mu Z}$	$\frac{Md-ft.}{C_p}$
Maximum Reservoir Pressure	P_o	1705 P.S.I.G.	Flow Rate	Q_g	MCF/Day
Slope of Shut-in Curve	M_g	PSI ² /log cycle	Flow Rate	Q	
Potentiometric Surface (Datum Plane, Sea Level)	PS	ft.	Flow Rate	Q	
Radius of Investigation		ft.	K (Effective to)		Md.



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:

$$1. \text{ EDR} = \frac{P_o^2 - P_f^2}{M_g (\log T + 2.65)} \quad \text{Where } M_g = \frac{P_1^2 - P_{10}^2}{\text{Log Cycle}}$$

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

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

Symbols	Dimensions	Symbols	Dimensions		
B	Formation volume factor	vol./vol.	Q	Rate of flow during test	Bbls./day
c	Fluid compressibility	vol./vol./psi.	Q _o	Rate of oil flow during test	Bbls./day
EDR	Estimated damage ratio		Q _w	Rate of water flow during test	Bbls./day
ϕ	Formation porosity	fractional	Q _g	Rate of gas flow during test	MCF/day
h	Net Producing interval	feet	r _w	Well bore radius	inches
J	Productivity index	Bbls./day/PSI	t	Shut-in time period	minutes
k	Permeability (effective)	Millidarcies	Δt	Increment time of	
M _g	Slope of shut-in build up	PSI ² /log cycle		shut-in period	minutes
P _f	Final flowing pressure	PSIG	T	Open flow time period	minutes
P _{fsi}	Final shut-in pressure at time t	PSIG	°T _f	Formation temperature	°Rankin
P _{isi}	Initial shut-in pressure	PSIG	μ	Fluid viscosity	
P _o	Maximum reservoir pressure	PSIG		(Reservoir conditions)	Centipoise
P ₁	Final shut-in buildup plot Intercept @ 1	PSIG	Z	Gas deviation factor (Compressibility factor)	
P ₁₀	Final shut-in buildup plot Intercept @ 10	PSIG			
P.S.	Potentiometric surface	ft.	$\frac{Kh}{\mu B}$ or $\frac{Kh}{\mu Z}$	Transmissibility factor	$\frac{\text{Md.} - \text{ft.}}{C_p}$

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.



Pressure Breakdown Data

Date 1-20-64 Field Report No. 12328 A
 Recorder No. T-32 Capacity 3,000# Recorder Depth 4,300'
 Recorder Run INSIDE Clock Travel 0.02189 inches per min. Well Temperature 128 °F.

Point	Pressure	Time Given	Time Computed
A Initial Hydrostatic Mud	2279		
B Initial Shut-in	1618		
C Initial Flow	69		
D Final Flow	91		
E Final Shut-in	1494		
F Final Hydrostatic Mud	2255		

Opened Tool	1427		
Initial Flow	3	Mins.	3 Mins.
Initial Shut-in	30	Mins.	30 Mins.
Final Flow	30	Mins.	30 Mins.
Final Shut-in	30	Mins.	30 Mins.

c-1 55
 c-2 59

Remarks: _____

PRESSURE INCREMENTS								
INITIAL SHUT-IN			FLOW PERIOD			FINAL SHUT-IN		
Breakdown: <u>10</u> increments of <u>3</u> mins. and a final increment of <u>-</u> mins.			Breakdown: <u>10</u> increments of <u>3</u> mins. and a final increment of <u>-</u> mins.			Breakdown: <u>10</u> increments of <u>3</u> mins. and a final increment of <u>-</u> mins.		
Point Minutes	Pressure	$\frac{T + \Delta t}{\Delta t}$	Point Minutes	Pressure	$\frac{T + \Delta t}{\Delta t}$	Point Minutes	Pressure	$\frac{T + \Delta t}{\Delta t}$
c-1 0	55		INITIAL FLOW			D 0	91	
3	631	2.000	C 0	69		3	516	12.00
6	1078	1.500	c-1 3	55		6	859	6.50
9	1329	1.333	FINAL FLOW			9	1098	4.67
12	1447	1.250	c-2 0	59		12	1232	3.75
15	1516	1.200	3	59		15	1316	3.20
18	1557	1.167	6	65		18	1379	2.83
21	1580	1.143	9	75		21	1424	2.58
24	1597	1.125	12	84		24	1453	2.38
27	1609	1.111	15	91		27	1479	2.23
B 30	1618	1.100	18	91		E 30	1494	2.10
			21	91				
			24	91				
			27	91				
			D 30	91				



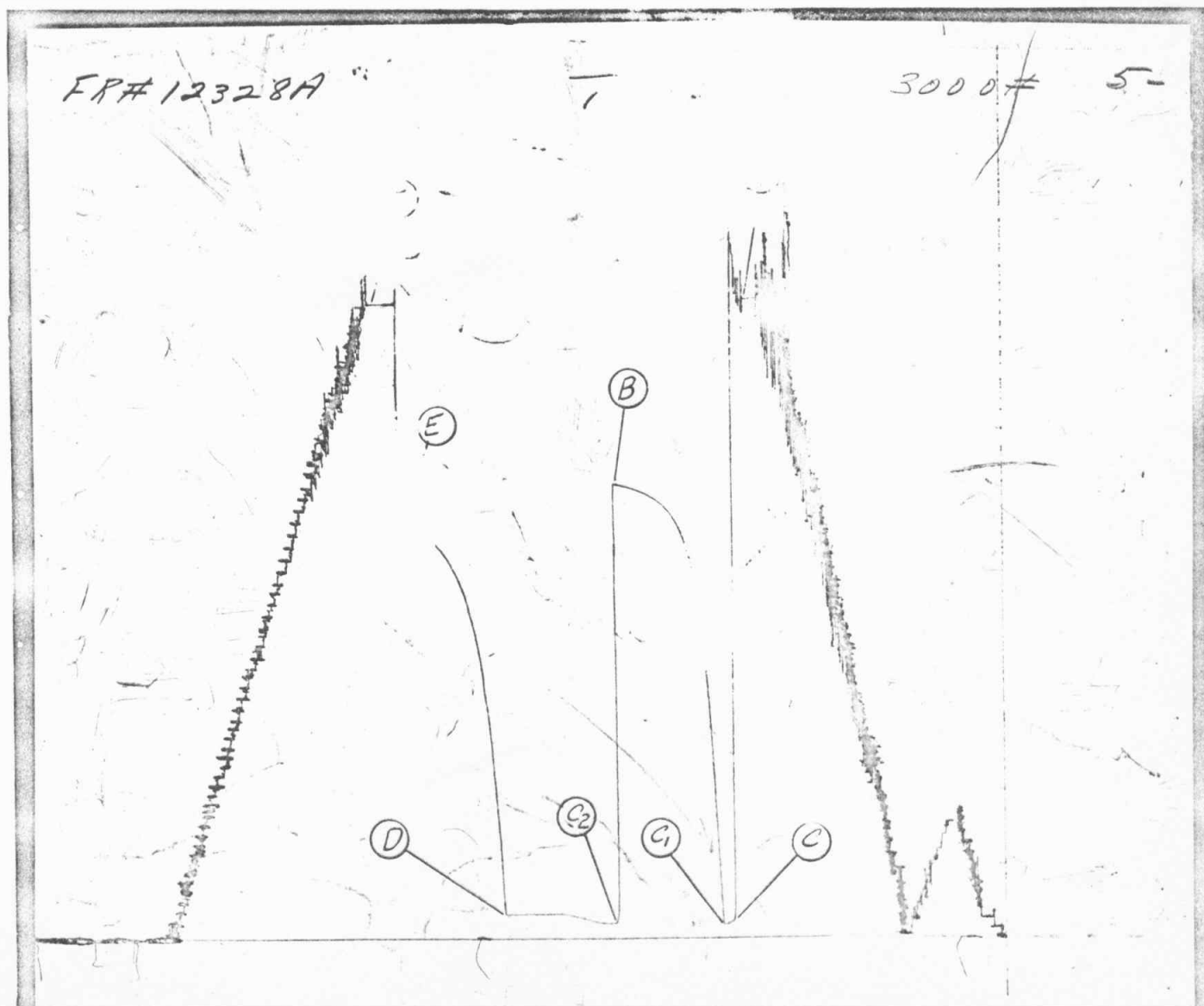
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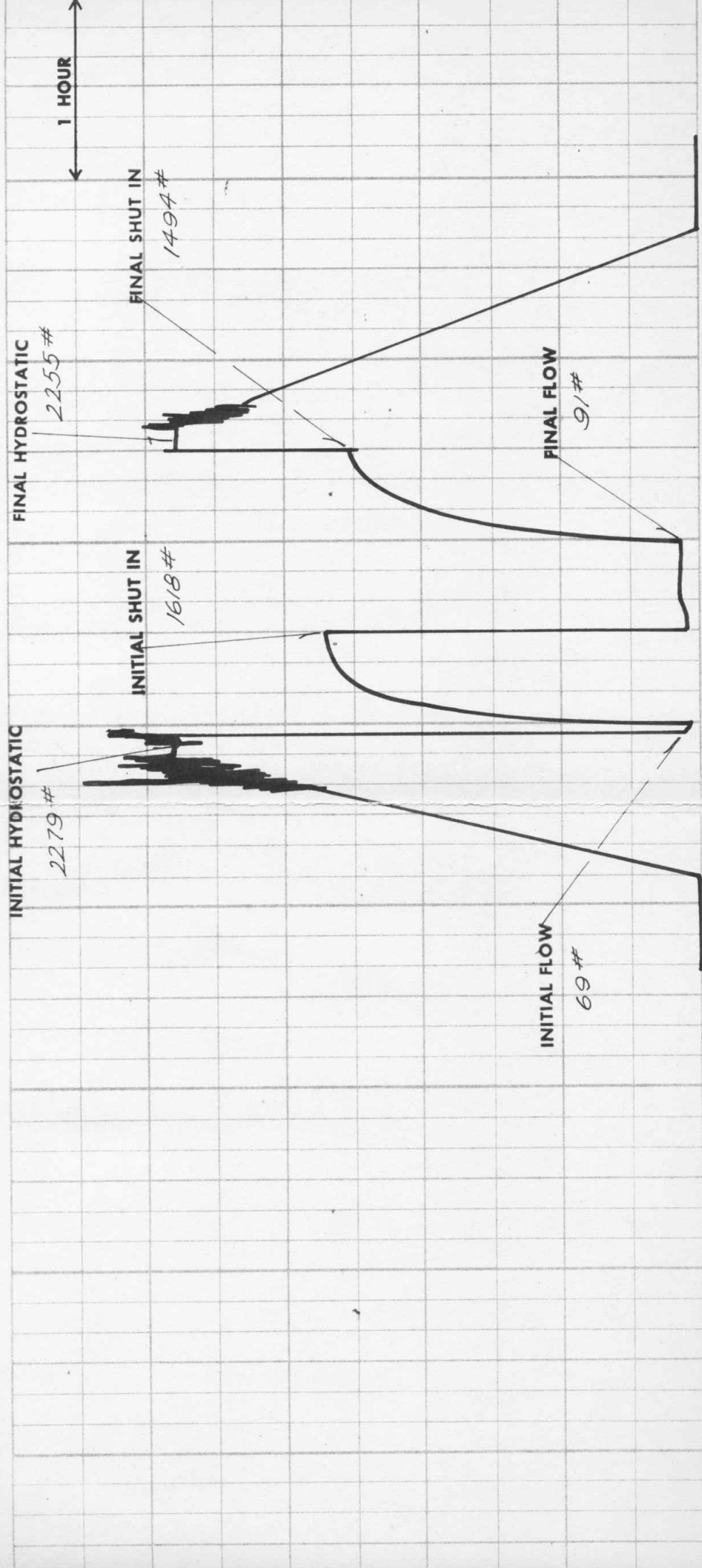
Pressure Data

Field Report No. 12328 A

Recorder No.	T-32	INSIDE		
Capacity (P.S.I.G.)	3,000			
Recorder Depth	4,300'			
Pressure Gradient P.S.I./Ft.				
Well Temperature °F.	128			
A Initial Hydrostatic Mud	2279			
B Initial Shut-in	* 1618			
C Initial Flow	69			
D Final Flow	91			
E Final Shut-in	* 1494			
F Final Hydrostatic Mud	2255			
Remarks:	c-1	55		
	c-2	59		

*Shut in pressure did not reach static reservoir pressure.





TIME →



Pressure Breakdown Data

Date 1-23-64 Field Report No. 12329 A
 Recorder No. T-32 Capacity 3,000# Recorder Depth 4,659'
 Recorder Run INSIDE Clock Travel 0.02181 inches per min. Well Temperature 147 °F.

Point	Pressure	Time Given	Time Computed
A Initial Hydrostatic Mud	2472	0846	
B Initial Shut-in	1704		
C Initial Flow	25	4 Mins.	5 Mins.
D Final Flow	123	30 Mins.	31 Mins.
E Final Shut-in	1702	60 Mins.	59 Mins.
F Final Hydrostatic Mud	2457	30 Mins.	29 Mins.

c-1 28
 c-2 49

Remarks: _____

PRESSURE INCREMENTS								
INITIAL SHUT-IN			FLOW PERIOD			FINAL SHUT-IN		
Breakdown: <u>10</u> increments of <u>3</u> mins. and a final increment of <u>1</u> mins.			Breakdown: <u>11</u> increments of <u>5</u> mins. and a final increment of <u>4</u> mins.			Breakdown: <u>9</u> increments of <u>3</u> mins. and a final increment of <u>2</u> mins.		
Point Minutes	Pressure	$\frac{T + \Delta t}{\Delta t}$	Point Minutes	Pressure	$\frac{T + \Delta t}{\Delta t}$	Point Minutes	Pressure	$\frac{T + \Delta t}{\Delta t}$
c-1 0	28		INITIAL FLOW			D 0	123	
3	1365		C 0	25		3	1299	
6	1695		c-1 5	28		6	1691	
9	1700		FINAL FLOW			9	1700	
12	1702		c-2 0	49		12	1702	
15	1704		5	51		15	1702	
18	1704		10	63		18	1702	
21	1704		15	70		21	1702	
24	1704		20	77		24	1702	
27	1704		25	83		27	1702	
30	1704		30	90		E 29	1702	
B 31	1704		35	96				
			40	103				
			45	108				
			50	114				
			55	119				
			D 59	123				



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Pressure Data

Field Report No. _____

12329 A

Recorder No.	T-32	INSIDE		
Capacity (P.S.I.G.)	3,000			
Recorder Depth	4,659'			
Pressure Gradient P.S.I./Ft.				
Well Temperature °F.	147			
A Initial Hydrostatic Mud	2472			
B Initial Shut-in	1704			
C Initial Flow	25			
D Final Flow	123			
E Final Shut-in	1702			
F Final Hydrostatic Mud	2457			
Remarks:	c-1	28		
	c-2	49		

*Shut in pressure did not reach static reservoir pressure.

