A WORLD OF EXPERIENCE

JOHNSTON TESTERS

SURFACE INFORMATION

Well Flowed	Amount
NO	

Reversed Out	Amount
NO	

Recovered	Amount
MUD	65'
SALT WATER	240'
TOTAL RECOVERED IN BARRELS	(4.33)

Maximum Surface Pressure –

Description (Rate of Flow)	Time	Pressure (P.S.I.G.)	Surface Choke
Opened Tool WEAK BLOW THROUGH-OUT TEST	0202	–	1"
CLOSED FOR INITIAL SHUT-IN	0212	–	"
RE-OPENED TOOL	0242	–	"
CLOSED FOR FINAL SHUT-IN	0312	–	"
EQUALIZED MUD	0342	–	–
PULLED PACKER LOOSE	0343	–	–

Remarks: O.C.T. TYPE PI 1/4 INSERT CHOKE.

CHLORIDE CONTENT: BOTTOM SAMPLE 140,000 PPM
PIT MUD SAMPLE 90,000 PPM

TOOL, HOLE & MUD DATA

Type Test STRADDLE
Formation Tested ~~SIMPSON~~ Arb.
Elevation 1909 Ft
All Depths Measured From DERRICK FLOOR

TOOL SEQUENCE

Tool	Size/Type	Depth/Length/I.D.
DRILL PIPE	4 1/2" FH	4378' 3.8'
CIRCULATING SUB	4 1/2" FH	
DRILL PIPE	4 1/2" FH	120'
CROSS-OVER SUB	4 1/2" FH	
	4 1/2" R	
4-STAGE SHUT-IN	3 1/2" R	
HYDRAULIC TOOL	3 1/2" FH	
JARS	3 1/2" HS-1	
CROSS-OVER SUB	3 1/2" FH	
	4 1/2" R	
SAFETY JOINT	4 1/2" HOMCO	
PACKER-CONV.	6 5/8"	4404'
PERF. ANCHOR	3 1/2" FH	23'
RECORDER CARRIER	4 7/8" T	6'
RECORDER CARRIER	4 7/8" L	4'
BLANK-OFF SUB	4 7/8" FH	1'
PACKER-BOB-TAIL	6 5/8"	4438'
RECORDER CARRIER	4 7/8" L	6'
PERF. ANCHOR	3 1/2" FH	6'
DRILL PIPE	4 1/2" FH	30'
PERF. ANCHOR	3 1/2" FH	5'

Total Depth 4485 F
Main Hole Size 7 7/8" Rat Hole Size –
Casing Size – Liner Size –
Bottom Choke Size 3/4" Mud Type STARCH
Mud Wt. 10 Mud Viscosity 42
Water Loss 8.8 C.C

Cushion Type	Amount	Pressure
	NONE	

TIME DATA

Initial Flow – Hrs. 10 Mins
Initial Shut-in – Hrs. 30 Mins
Final Flow – Hrs. 30 Mins
Final Shut-in – Hrs. 30 Mins

Customer SAME AS BELOW

Company N. APPLEMAN COMPANY; 654 MADISON AVE.; NEW YORK CITY, NEW YORK Date 12-19-63
Well STEAD #1 Field PRESTON Location 27-26-12
Test Interval 4404' TO 4438' Formation Test # 3 Casing Test # –

County PRATT State KANSAS Field Report No. 12312 A
Tester SALOGA (PRATT) Test Approved By MR. PAUL D. WILLIS No. DST Reports Requested 5 x

JOHNSTON TESTERS

Pressure Breakdown Data

Date 12-19-63 Field Report No. 12312 A

Recorder No. T-864 Capacity 5000# Recorder Depth 4426'

Recorder Run INSIDE Clock Travel 0.02095 inches per min. Well Temperature 125 °F.

Point	Pressure
A Initial Hydrostatic Mud	2365
B Initial Shut-in	1508
C Initial Flow	74
D Final Flow	192
E Final Shut-in	1453
F Final Hydrostatic Mud	2359

	Time Given	Time Computed
Opened Tool	0202	
Initial Flow	10 Mins.	10 Mins.
Initial Shut-in	30 Mins.	31 Mins.
Final Flow	30 Mins.	29 Mins.
Final Shut-in	30 Mins.	30 Mins.

C-1 105
C-2 113

Remarks:

PRESSURE INCREMENTS

Breakdown: ____ increments of ____ mins. and a final increment of ____ mins.

Point Minutes	Pressure	$\frac{T+\Delta t}{\Delta t}$

Initial Shut-In

Breakdown: 10 increments of 3 mins. and a final increment of 1 mins.

Point	Minutes	Pressure	$\frac{T+\Delta t}{\Delta t}$
C-1	0	105	
	3	1062	
	6	1294	
	9	1393	
	12	1432	
	15	1459	
	18	1477	
	21	1488	
	24	1495	
	27	1502	
	30	1506	
B	31	1508	

Final Shut-In

Breakdown: 10 increments of 3 mins. and a final increment of - mins.

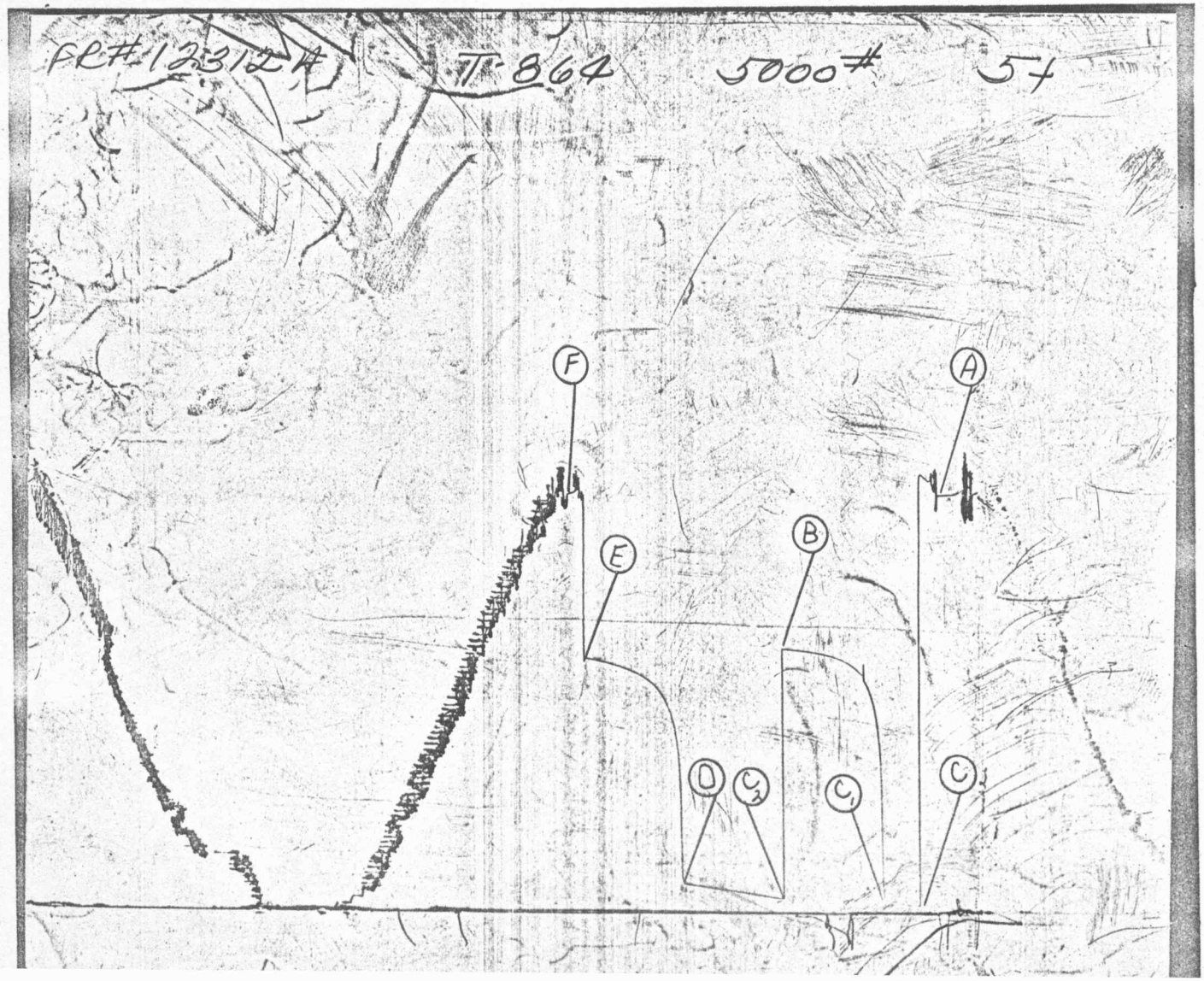
Point	Minutes	Pressure	$\frac{T+\Delta t}{\Delta t}$
D	0	192	
	3	1023	
	6	1209	
	9	1297	
	12	1344	
	15	1376	
	18	1400	
	21	1417	
	24	1432	
	27	1444	
E	30	1453	

JOHNSTON TESTERS

Pressure Data Field Report No. 12312 A

Recorder No.		T-864	INSIDE			
Capacity (P.S.I.G.)		5000				
Recorder Depth		4426'				
Pressure Gradient P.S.I./Ft.						
Well Temperature °F.		125				
A Initial Hydrostatic Mud		2365				
B Initial Shut-in		*1508				
C Initial Flow		74				
D Final Flow		192				
E Final Shut-in		*1453				
F Final Hydrostatic Mud		2359				
Remarks:	C-1	105				
	C-2	113				

*Shut in pressure did not reach static reservoir pressure.



JOHNSTON TESTERS

Pressure Data

Field Report No. 12312 A

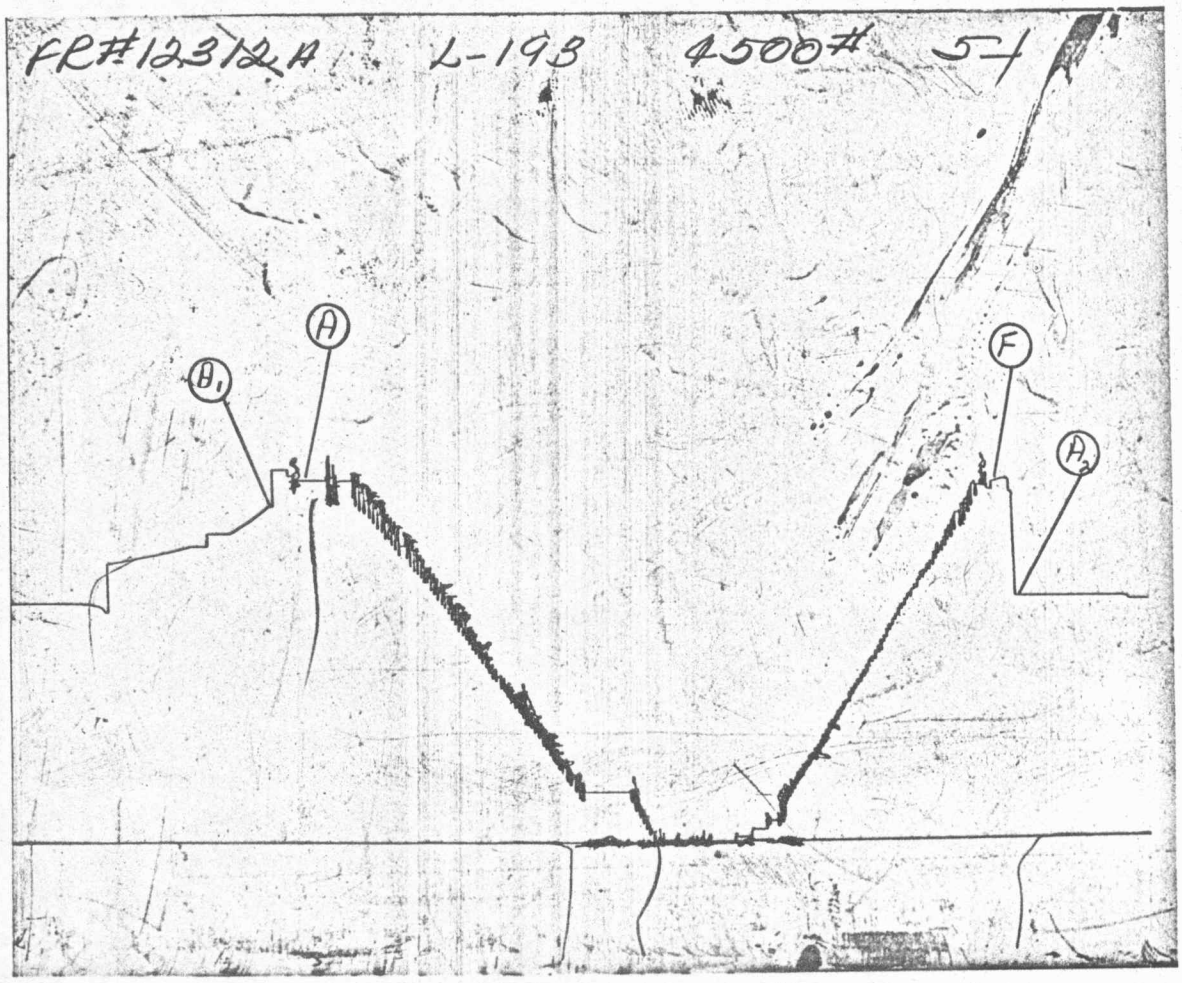
Recorder No.	L-193	OUTSIDE			
Capacity (P.S.I.G.)	4500				
Recorder Depth	4440'				
Pressure Gradient P.S.I./Ft.					
Well Temperature °F.	125				
A Initial Hydrostatic Mud	2508				
B Initial Shut-in	-				
C Initial Flow	-				
D Final Flow	-				
E Final Shut-in	-				
F Final Hydrostatic Mud	2481				

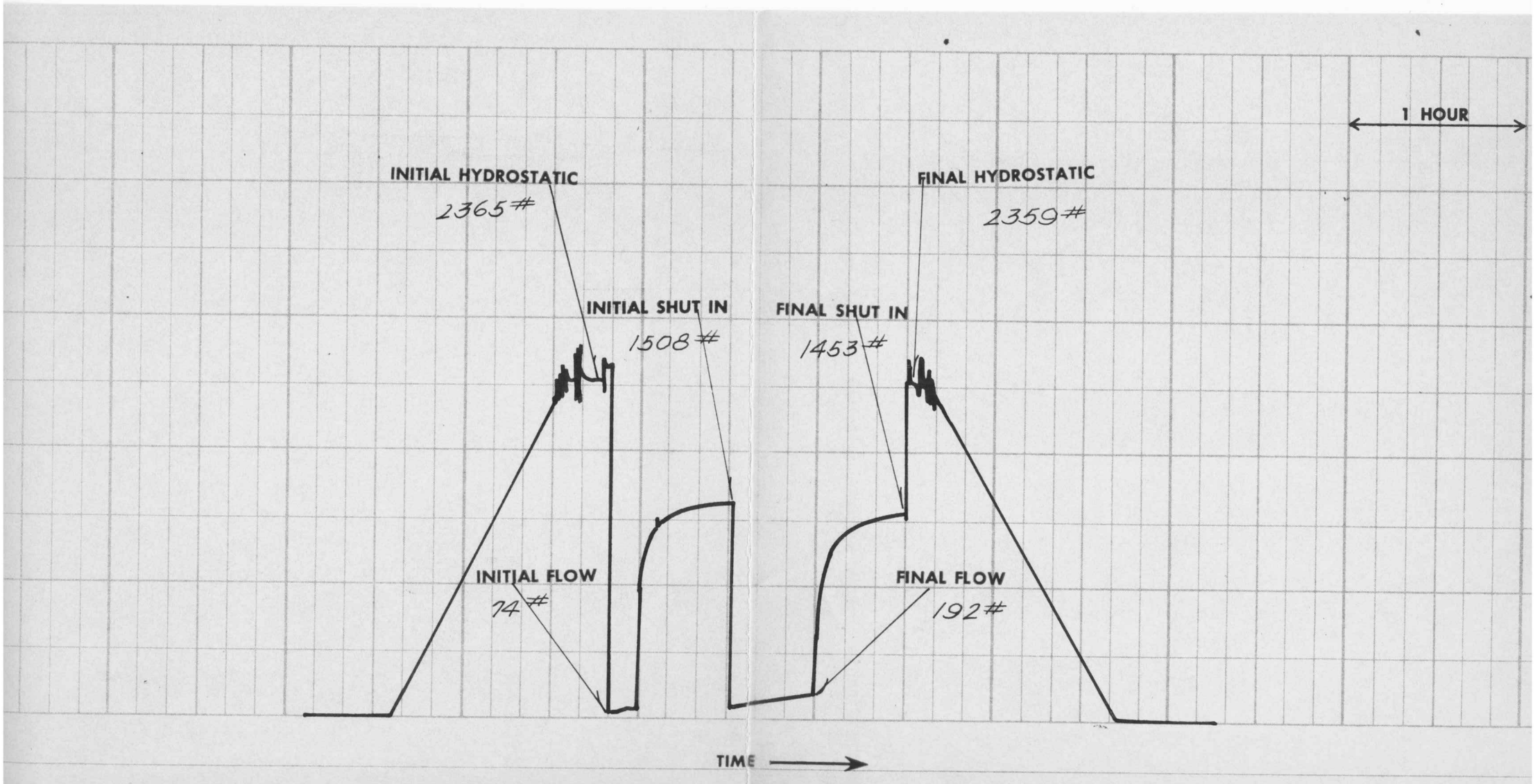
Remarks: A-1 2327

A-2 1687

BELOW STRADDLE.

*Shut in pressure did not reach static reservoir pressure.




1 HOUR
INITIAL HYDROSTATIC
2365#
INITIAL SHUT IN
1508#
INITIAL FLOW
74#
FINAL HYDROSTATIC
2359#
FINAL SHUT IN
1453#
FINAL FLOW
192#
TIME

A WORLD OF EXPERIENCE

JOHNSTON TESTERS

SURFACE INFORMATION

Well Flowed	Amount
GAS	

Reversed Out	Amount
NO	

Recovered	Amount
GAS CUT MUD	53'
OIL	1720'
HEAVY OIL & GAS CUT MUD	120'
MUDDY SALT WATER	120'
SALT WATER	540'
TOTAL RECOVERED IN BARRELS	(36.25)

Maximum Surface Pressure –

Description (Rate of Flow)	Time	Pressure (P.S.I.G.)	Surface Choke
Opened Tool	0830	–	"
CLOSED FOR INITIAL SHUT-IN	0840	–	"
RE-OPENED TOOL	0910	–	"
STRONG BLOW			
GAS TO SURFACE	0920	–	"
CLOSED FOR FINAL SHUT-IN	1010	–	"
EQUALIZED MUD	1110	–	–
PULLED PACKER LOOSE	1112	–	–

Remarks:

	CHL. CONTENT	GRAVITY
TOP SAMPLE (2500' ABOVE TOOL):		39 @ 60°
88% OIL & 12% MUD		
MIDDLE SAMPLE (700' ABOVE TOOL):		43 @ 60°
100% OIL		
BOTTOM SAMPLE (TOP OF TOOL):	50,000 PPM	
100% WATER		
PIT MUD SAMPLE:	90,000 PPM	

TOOL. HOLE & MUD DATA

Type Test STRADDLE
Formation Tested SIMPSON
Elevation 1909 Ft.
All Depths Measured From DERRICK FLOOR

TOOL SEQUENCE

Tool	Size/Type	Depth/Length/ I.D.
DRILL PIPE	4½"FH	4278' 3.8"
CIRCULATING SUB	4½"FH	
DRILL PIPE	4½"FH	120'
CROSS-OVER SUB	4½"FH	
	4½"R	
4-STAGE SHUT-IN	3½"R	
HYDRAULIC TOOL	3½"FH	
JARS	3½"HS-1	
CROSS-OVER SUB	3½"FH	
	4½"R	
SAFETY JOINT	4½"HOMCO	
PACKER-CONV.	6 5/8"	4304'
PERF. ANCHOR	3½"FH	23'
RECORDER CARRIER	4 7/8"T	6'
RECORDER CARRIER	4 7/8"L	4'
BLANK-OFF SUB	4 7/8"FH	1'
PACKER-BOB-TAIL	6 5/8"	4338'
RECORDER CARRIER	4 7/8"L	6'
PERF. ANCHOR	3½"FH	46'
DRILL PIPE	4½"FH	90'
PERF. ANCHOR	3½"FH	5'
REMARKS: (CONT'D)		
NET PRODUCTIVE INTERVAL: 7.5 FEET.		
ESTIMATED POROSITY: 18-19%.		

Total Depth 4485 Ft.
Main Hole Size 7 7/8" Rat Hole Size –
Casing Size – Liner Size –
Bottom Choke Size 3/4" Mud Type STARCH
Mud Wt. 10 Mud Viscosity 42
Water Loss 8.8 C.C.

Cushion Type	Amount	Pressure
	NONE	

TIME DATA

Initial Flow – Hrs. 10 Mins
Initial Shut-in – Hrs. 30 Mins.
Final Flow 1 Hrs. – Mins
Final Shut-in 1 Hrs. – Mins.

Customer SAME AS BELOW

Company N. APPLEMAN COMPANY; 654 MADISON AVE.; NEW YORK, NEW YORK Date 12-19-63
Well STEAD #1 Field PRESTON Location 27-26-12
Test Interval 4304' TO 4338' Formation Test # 4 Casing Test # –

County PRATT State KANSAS Field Report No. 12313 A
Tester SALOGA (PRATT) Test Approved By MR. PAUL D. WILLIS No. DST Reports Requested 5 x

JOHNSTON TESTERS

Pressure Breakdown Data

Date 12-19-63 Field Report No. 12313 A

Recorder No. T-864 Capacity 5000# Recorder Depth 4326'

Recorder Run INSIDE Clock Travel 0.02034 inches per min. Well Temperature 128 °F.

Point	Pressure
A Initial Hydrostatic Mud	2319
B Initial Shut-in	964
C Initial Flow	433
D Final Flow	945
E Final Shut-in	958
F Final Hydrostatic Mud	2307

	Time Given	Time Computed
Opened Tool	0830	
Initial Flow	10 Mins.	10 Mins.
Initial Shut-in	30 Mins.	30 Mins.
Final Flow	60 Mins.	60 Mins.
Final Shut-in	60 Mins.	60 Mins.

C-1 569
C-2 611

Remarks:

PRESSURE INCREMENTS

	Initial Shut-In	Final Shut-In
	Breakdown: 10 increments of 3 mins. and a final increment of - mins.	Breakdown: 12 increments of 5 mins. and a final increment of - mins.

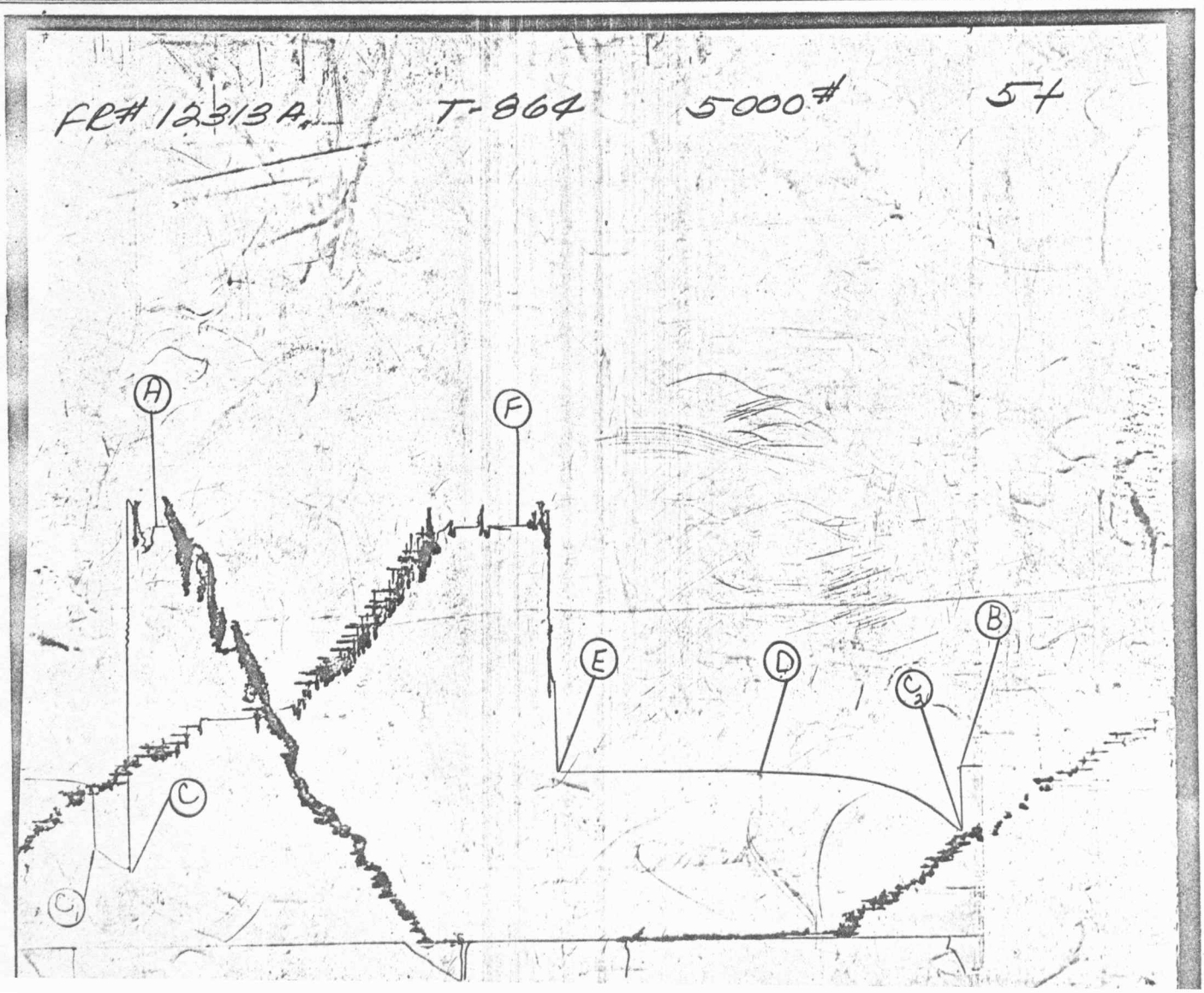
Point Minutes	Pressure	$\frac{T+\Delta t}{\Delta t}$	Point Minutes	Pressure	$\frac{T+\Delta t}{\Delta t}$	Point Minutes	Pressure	$\frac{T+\Delta t}{\Delta t}$
			C-1 0	569		D 0	945	
			3	927	4.333	5	951	15.000
			6	937	2.666	10	953	8.000
			9	944	2.111	15	954	5.667
			12	951	1.834	20	954	4.500
			15	954	1.667	25	955	3.800
			18	956	1.555	30	956	3.333
			21	958	1.476	35	956	3.000
			24	961	1.417	40	956	2.750
			27	963	1.370	45	956	2.556
			B 30	964	1.333	50	957	2.400
						55	957	2.273
						E 60	958	2.167

JOHNSTON TESTERS

Pressure Data Field Report No. 12313 A

Recorder No.	T-864	INSIDE			
Capacity (P.S.I.G.)	5000				
Recorder Depth	4326'				
Pressure Gradient P.S.I./Ft.					
Well Temperature °F.	128				
A Initial Hydrostatic Mud	2319				
B Initial Shut-in	* 964				
C Initial Flow	433				
D Final Flow	945				
E Final Shut-in	* 958				
F Final Hydrostatic Mud	2307				
Remarks: C-1	569				
C-2	611				

*Shut in pressure did not reach static reservoir pressure.



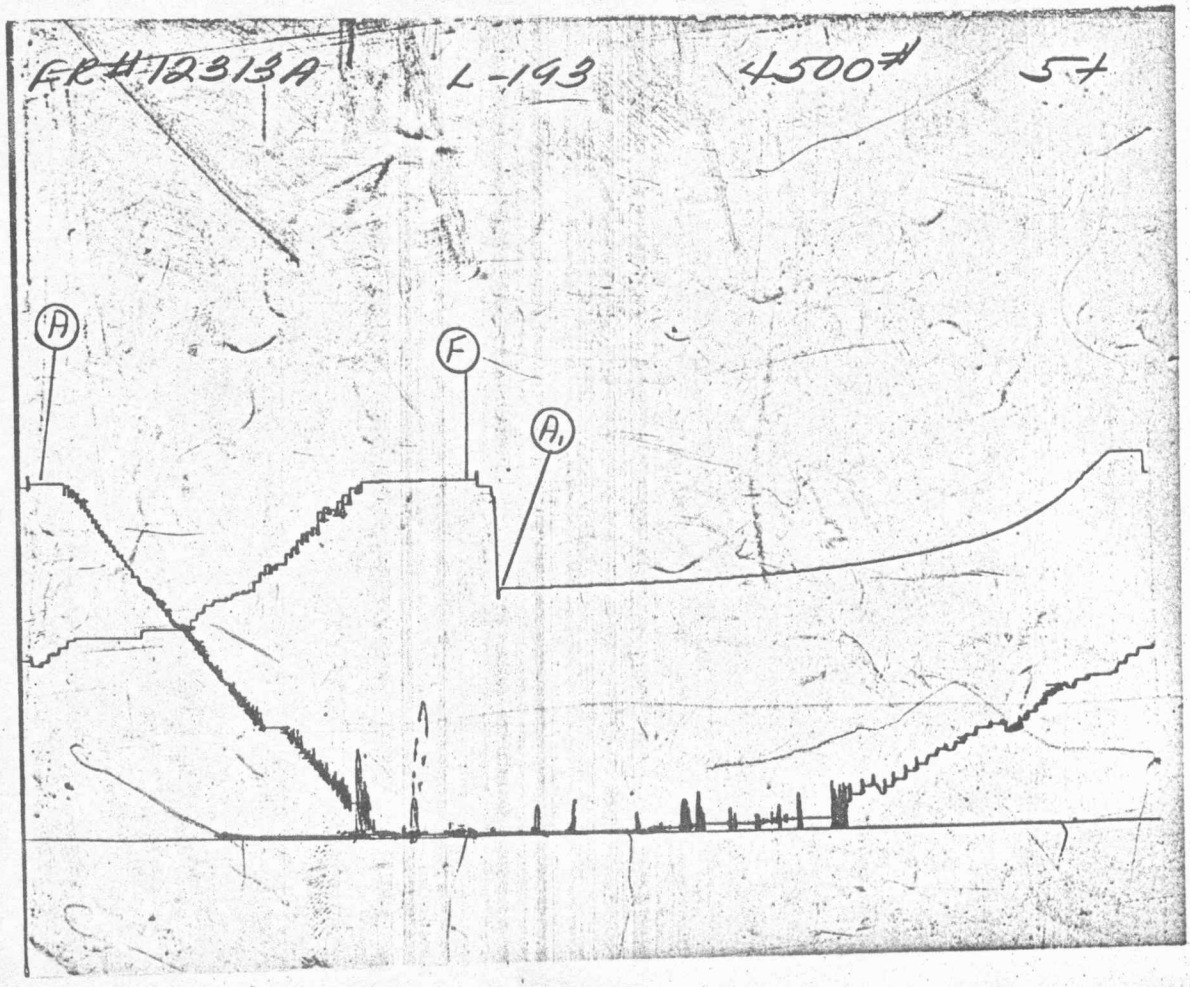
JOHNSTON TESTERS

Pressure Data Field Report No. 12313 A

Recorder No.	L-193	OUTSIDE			
Capacity (P.S.I.G.)	4500				
Recorder Depth	4342'				
Pressure Gradient P.S.I./Ft.					
Well Temperature °F.	128				
A Initial Hydrostatic Mud	2444				
B Initial Shut-in	-				
C Initial Flow	-				
D Final Flow	-				
E Final Shut-in	-				
F Final Hydrostatic Mud	2439				
Remarks: A-1	1686				

BELOW STRADDLE.

*Shut in pressure did not reach static reservoir pressure.



Assumptions made for Calculations for Liquid Recoveries

1. Q is taken as steady state flow.

2. P_f is formation flowing pressure at steady state flow.

3. Formation flow is taken as single phase flow.
   If gas is produced at surface, phase separation is assumed to have occurred in drill pipe.

4. Radial flow is assumed.

5. For the purpose of calculating EDR where specific reservoir parameters are not available it is assumed that:

Effective permeability, K, will fall between	1 to 200 md
Formation porosity, ϕ, will fall between	0.1 to 0.3
Fluid compressibility, ^{c}, will fall between	10^{-6} to 10^{-4}
Fluid viscosity, μ, will fall between	0.05 to 50 cp.
Well bore radius, r_w, will fall between	$3\frac{7}{8}$" to $4\frac{3}{8}$"
Which gives an average value for the function log $\frac{K}{\phi\mu c r_w^2}$ of	5.5

6. Other standard radial flow, steady state assumptions.

Empirical Equations:

1. $EDR = \dfrac{P_o - P_f}{M(\log T + 2.65)}$

2. Transmissibility $\dfrac{Kh}{\mu B} = \dfrac{162.6Q}{M}$

3. $P.I. = \dfrac{Q}{P_o - P_f}$

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

Symbols		Dimensions
B	Formation volume factor	vol./vol.
c	Fluid compressibility	vol./vol./psi
EDR	Estimated damage ratio	
ϕ	Formation porosity	fractional
h	Net producing interval	feet
J	Productivity index	Bbls./day/PSI
K	Permeability	Millidarcies
M	Slope of shut-in build up	PSI/log cycle
P_f	Final flowing pressure	PSIG
P_{fsi}	Final shut-in pressure at time t	PSIG
P_{isi}	Initial shut-in pressure	PSIG
P_o	Maximum reservoir pressure	PSIG
P_1	Final shut-in buildup plot intercept @ 1	PSIG
P_{10}	Final shut-in buildup plot intercept @ 10	PSIG
P.S.	Potentiometric surface	ft.

Symbols		Dimensions
Q	Rate of flow during test	Bbls./day
Q_o	Rate of oil flow during test	Bbls./day
Q_w	Rate of water flow during test	Bbls./day
Q_g	Rate of gas flow during test	MCF/day
r_w	Well bore radius	inches
t	Shut-in time period	minutes
Δt	Increment time of shut-in period	minutes
T	Open flow time period	minutes
$^\circ T_f$	Formation temperature	$^\circ$Rankin
μ	Fluid viscosity (Reservoir Conditions)	Centipoise
Z	Gas deviation factor (Compressibility factor)	
$\frac{Kh}{\mu B}$ or $\frac{Kh}{\mu}$	Transmissibility factor	$\frac{\text{Md.} - \text{ft.}}{\text{Cp.}}$

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.

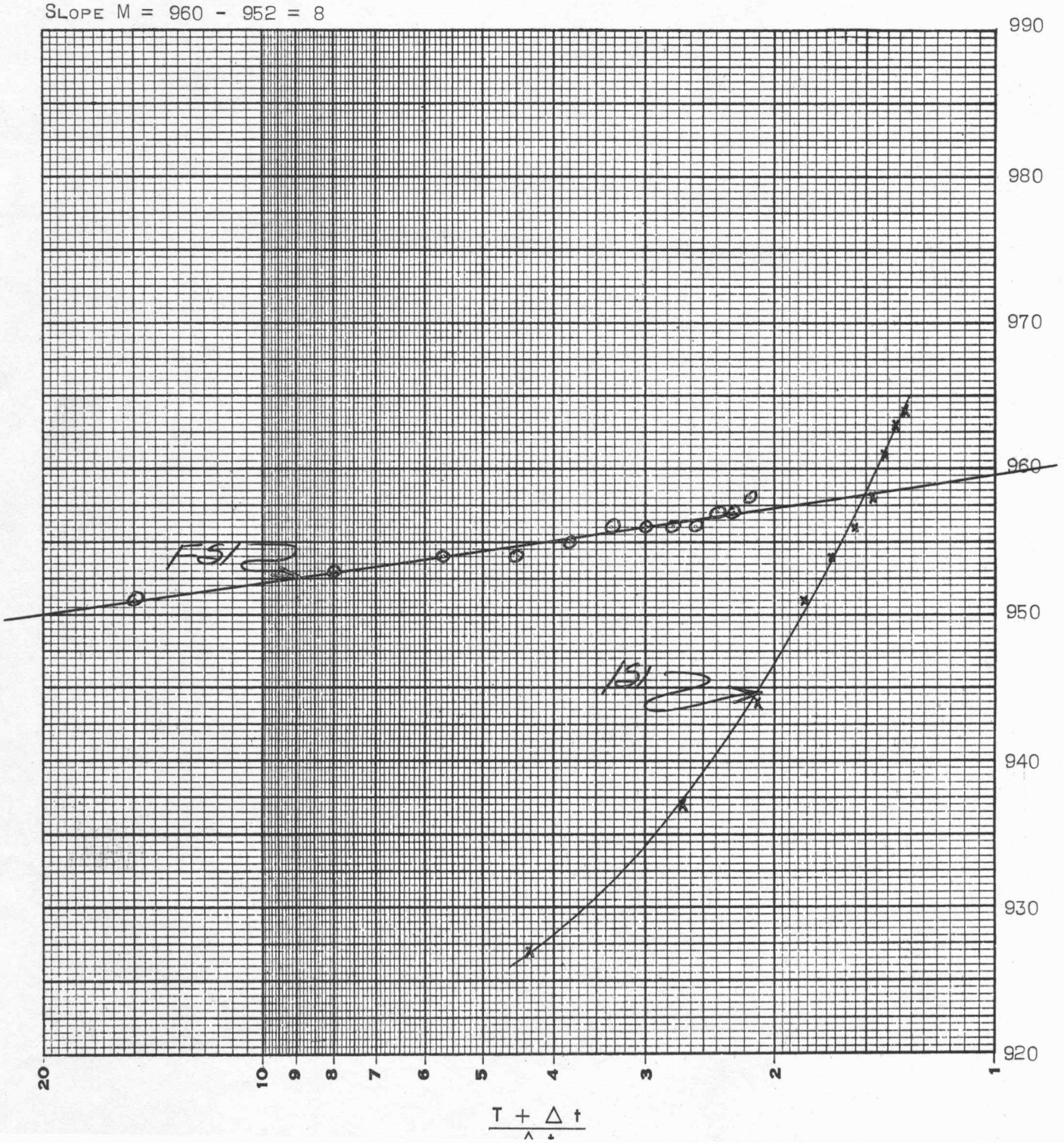
JOHNSTON TESTERS

Recorder No. T-864

Reservoir Engineering Data

Field Report No. 12313 A

Estimated Damage Ratio	EDR	0.42		Effective Transmissibility	$\frac{Kh}{\mu B}$	15154	$\frac{Md\text{-}ft.}{Cp.}$
Maximum Reservoir Pressure	P_o	960	P.S.I.G.	Effective Transmissibility	$\frac{Kh}{\mu B}$		$\frac{Md\text{-}ft.}{Cp.}$
Slope of Shut-in Curve	M	8	PSI/log cycle	Flow Rate OIL	Q	745.66	Bbl./day
Potentiometric Surface (Datum Plane, Sea Level)	PS	-200	ft.	Flow Rate	Q		Bbl./day
Productivity Index	PI	49.71	Bbl./day/PSI	Gas Oil Ratio	GOR		CF/Bbl.
Radius of Investigation		-	ft.	K (Effective to OIL)		2020	Md.



JOHNSTON TESTERS
A WORLD OF EXPERIENCE

SPECIAL DATA ANALYSIS

DECEMBER 26, 1963

THIS APPEARS TO BE A POOR MECHANICAL DRILL STEM TEST DURING WHICH THE TOOLS MAY NOT HAVE FUNCTIONED 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 SUFFICIENT. THE DATA OBTAINED SHOULD BE ADEQUATE FOR RELIABLE SPECIAL DATA ANALYSIS. BOTH THE INITIAL AND FINAL SHUT-IN BUILD-UPS MAY BE EFFECTED BY A SMALL LEAK AROUND THE BOTTOM PACKER.

1. RESERVOIR PRESSURE: EXTRAPOLATION OF THE FINAL SHUT-IN PRESSURE BUILD-UP PLOT INDICATES A MAXIMUM RESERVOIR PRESSURE OF 960 P.S.I.G. AT RECORDER DEPTH.

2. PERMEABILITY: THE CALCULATED TRANSMISSIBILITY FACTOR OF 15154 MD.-FT./CP. INDICATES AN AVERAGE EFFECTIVE PERMEABILITY TO OIL OF 2020 MD. FOR THE REPORTED 7.5 FOOT POROUS INTERVAL. THIS VALUE WAS CALCULATED ASSUMING THE PRODUCT OF THE OIL VISCOSITY AND FORMATION VOLUME FACTOR TO BE 1.0.

3. WELL BORE DAMAGE: THE CALCULATED ESTIMATED DAMAGE RATIO OF 0.42 INDICATES THAT NO WELL BORE DAMAGE IS PRESENT AT THE TIME AND CONDITIONS OF THIS TEST.

4. GENERAL COMMENTS: THIS APPEARS TO BE A TEST OF AN EXCELLENT PERMEABILITY OIL ZONE WHICH ALOS CONTAINS SOME WATER. THE WELL WILL NOT FLOW, BUT A PUMPER CAPABLE OF MAKING ITS ALLOWABLE SHOULD BE POSSIBLE IF THE WATER PRODUCTION CAN BE TOLERATED.

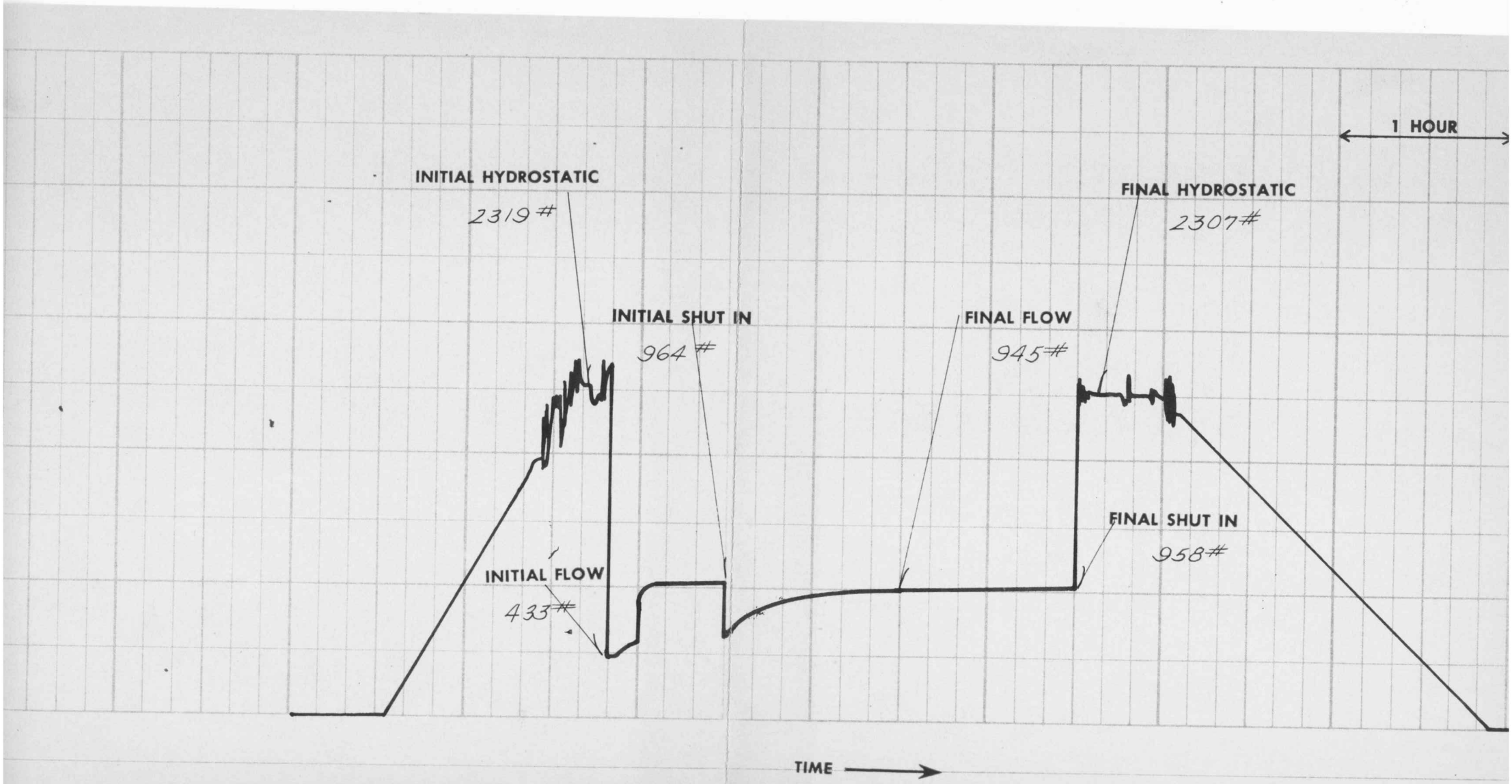
THE INITIAL PRESSURES ARE BEING EFFECTED BY A BOTTOM PACKER LEAK. THE FINAL PRESSURE MAY ALSO BE EFFECTED BY THIS LEAK.

James D. Hillhouse

JAMES D. HILLHOUSE
EVALUATION ENGINEER

N. APPLEMAN CO.
STEAD #1, PRATT CT., KANSAS
TEST NO. 4, 4304' TO 4338'

FIELD REPORT #12313 A


1 HOUR
INITIAL HYDROSTATIC
2319 #
INITIAL SHUT IN
964 #
FINAL HYDROSTATIC
2307#
FINAL FLOW
945#
FINAL SHUT IN
958#
INITIAL FLOW
433#
TIME