

Casing perms. _____ Bottom choke _____ Surf. temp _____ °F Ticket No. 778354
Gas gravity _____ Oil gravity _____ GOR _____
Spec. gravity _____ Chlorides _____ ppm Res. _____ @ _____ °F

INDICATE TYPE AND SIZE OF GAS MEASURING DEVICE USED.

[illegible]

Gauge No. 514			Depth 3210'			Clock No. 13855			12 hour	Ticket No. 778354					
First Flow Period			First Closed In Pressure			Second Flow Period		Second Closed In Pressure			Third Flow Period		Third Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t + \theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t + \theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t + \theta}{\theta}$	PSIG Temp. Corr.
0	.0000	34.9	.0000		99.4	.0000	70.9	.0000		130.7					
1	.0391	60.7*	.0474		163.9**	.0539	106.8***	.0537		186.0					
2	.0717	78.2	.0880		197.0	.1213	113.2	.1075		215.4					
3	.1043	89.3	.1286		220.9	.1888	117.8	.1612		232.9					
4	.1368	97.6	.1693		237.5	.2562	122.4	.2149		246.7					
5	.1694	101.2	.2099		248.6	.3236	127.0	.2687		256.9					
6	.2020	99.4	.2505		256.9	.3910	130.7	.3224		263.3					
7			.2911		263.3			.3761		267.0					
8			.3318		267.9			.4299		269.7					
9			.3724		270.7			.4836		270.7					
10			.4130		272.5			.5373		271.6					
11								.5911		271.6					
12								.6448		271.6					
13								.6985		272.5					
14								.7523		273.4					
15								.8060		274.3					

Gauge No. 376			Depth 3271'			Clock No. 2820			12 hour						
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t + \theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t + \theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t + \theta}{\theta}$	PSIG Temp. Corr.
0	.0000	73.9	.0000		122.2	.0000	106.7	.0000		149.6					
1	.0399	78.4*	.0466		177.0**	.0538	120.4***	.0533		195.2					
2	.0730	93.0	.0865		208.9	.1210	132.2	.1067		226.2					
3	.1063	106.7	.1265		232.6	.1883	135.9	.1600		246.3					
4	.1395	115.8	.1664		249.9	.2555	140.5	.2133		260.9					
5	.1728	122.2	.2063		261.8	.3228	145.9	.2667		271.8					
6	.2060	122.2	.2463		271.8	.3900	149.6	.3200		279.1					
7			.2862		279.1			.3733		284.6					
8			.3261		284.6			.4266		286.4					
9			.3661		288.3			.4800		289.2					
10			.4060		291.0			.5333		290.1					
11								.5866		290.1					
12								.6400		291.0					
13								.6933		291.0					
14								.7466		291.9					
15								.8000		292.8					

Reading Interval 5 6 10 8 Minutes

REMARKS: *Interval = 6 minutes **Interval = 7 minutes ***Interval = 8 minutes

	O. D.	I. D.	LENGTH	DEPTH
Drill Pipe or Tubing	5 $\frac{1}{2}$ "	2.75"	1'	3168'
Reversing Sub				
Water Cushion Valve				
Drill Pipe	4 $\frac{1}{2}$ "	3.826"	2902'	
Drill Collars	6"	2.75"	286'	
Handling Sub & Choke Assembly	5"	.87"	6'	3198'
Dual CIP Valve				
Dual CIP Sampler	5"	.75"	5'	3202'
Hydro-Spring Tester				
Multiple CIP Sampler				
Extension Joint				
AP Running Case	5"	3.06"	4'	3210'
Hydraulic Jar				
VR Safety Joint				
Pressure Equalizing Crossover				
Packer Assembly	6.75"	1.53"	5'	3216'
Distributor				
Packer Assembly	6.25"	1.53"	5'	3220'
Flush Joint Anchor				
Pressure Equalizing Tube				
Blanked-Off B.T. Running Case				
Drill Collars				
Anchor Pipe Safety Joint				
Packer Assembly				
Distributor				
Packer Assembly				
Anchor Pipe Safety Joint				
Side Wall Anchor				
Drill Collars				
Flush Joint Anchor	5"	3.84"	48'	
HT-500	5"	3.75"	1.5'	3270'
Blanked-Off B.T. Running Case	5"	2.44"	4'	3271'
Total Depth				3275'

Brown #9

DRILL STEM TEST CALCULATIONS
FOR

Topokg 3220'-3275'

Production Rate $Q = \frac{\Delta P \times DP \times 1440}{\text{grad.} \times \text{time}} = \frac{(20.2 - 93) \times .014 \times 1440}{.35 \times 20} = 84 \text{ B/D}$

Flow Capacity $Kh = \frac{162.6 \text{ QuB}}{m} = \frac{162.6 \times 84 \times 12 \times 1.1}{49} = 368 \text{ md-ft}$

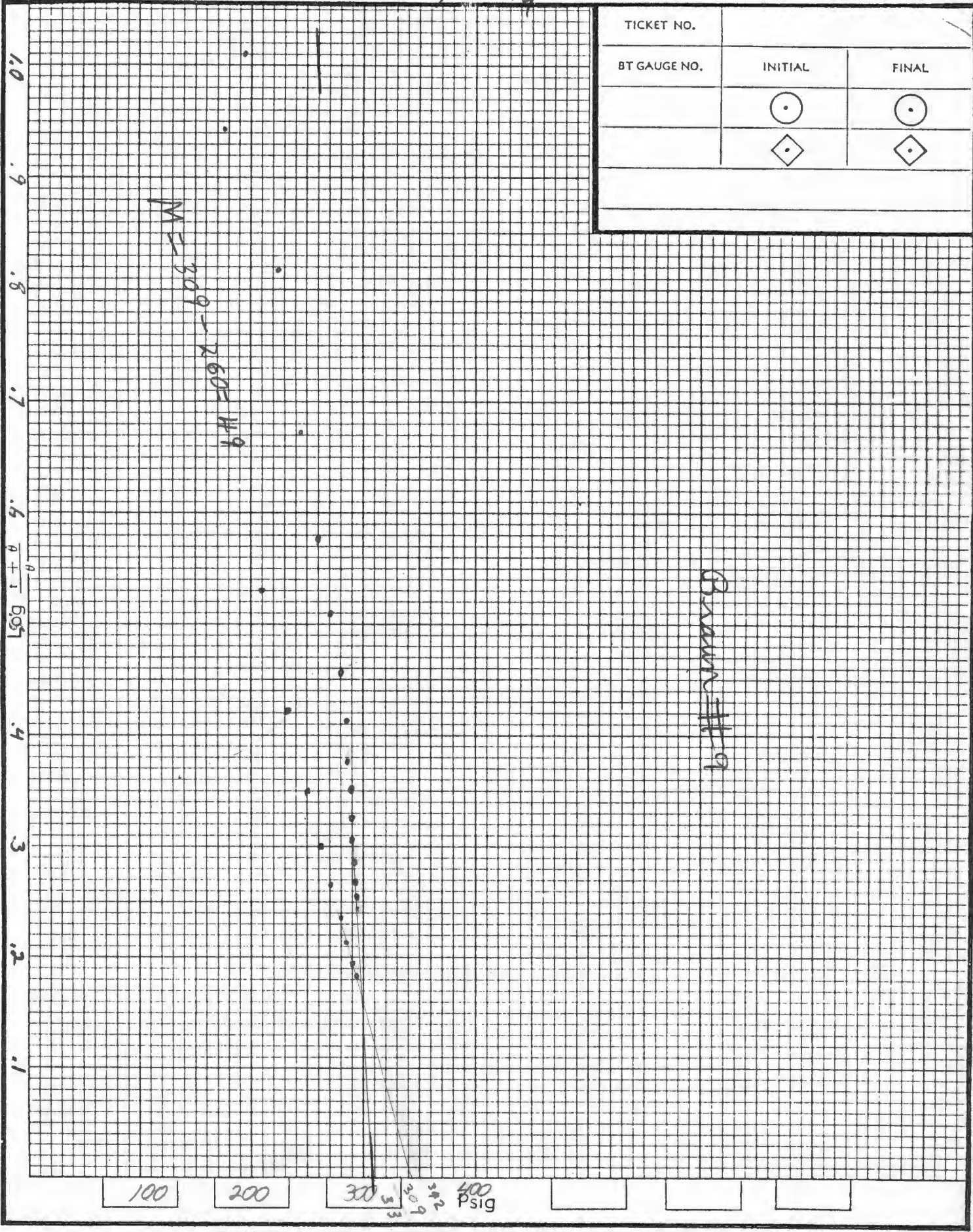
Avg. eff. Perm. $K = \frac{Kh}{h} = \frac{368}{18} = 20$

Damage Ratio $DR = 0.183 \frac{(P_e - P_f)}{m} = \frac{0.183(309 - 150)}{49} = .6$

Radius of Invest. $r_i = \sqrt{Kt} = \sqrt{20 \times 89} = 42 \text{ ft}$

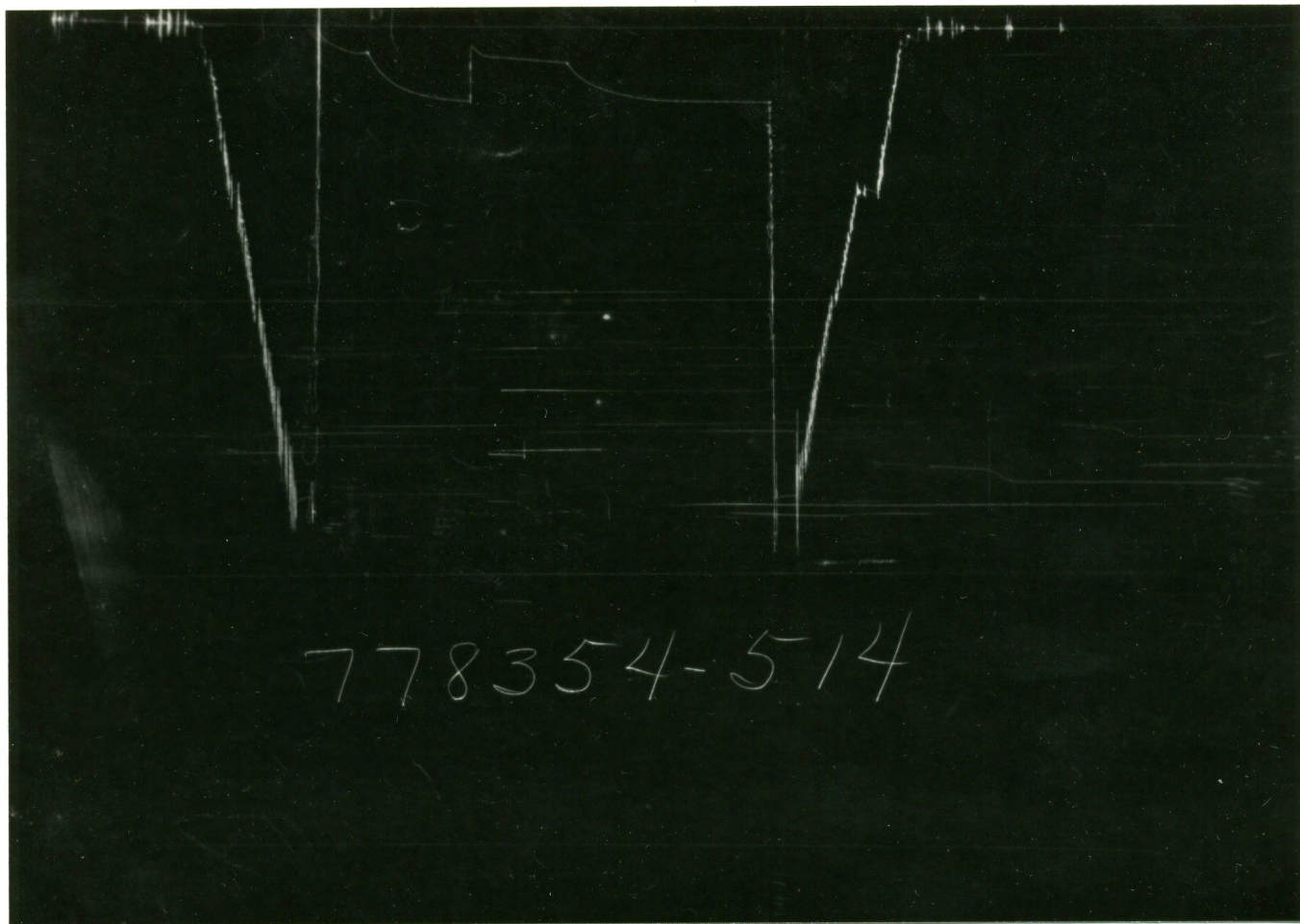
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Topoka

TICKET NO.		
BT GAUGE NO.	INITIAL	FINAL
		
		

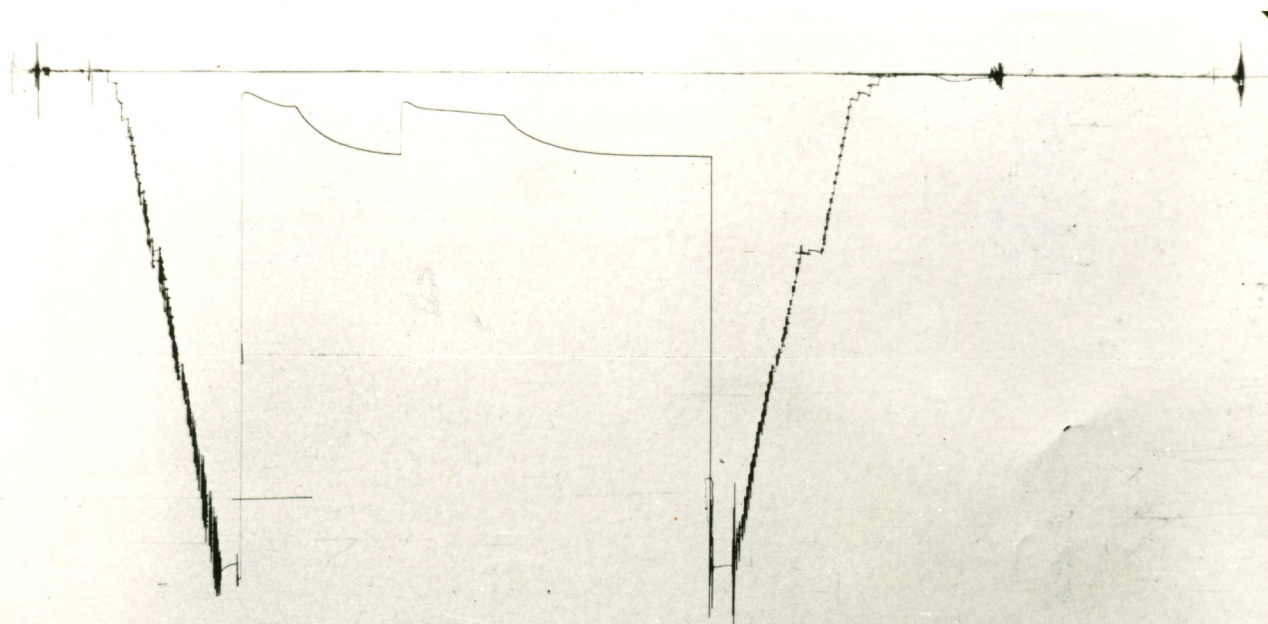


EXTRAPOLATED PRESSURE GRAPH

↓
PRESSURE
↓



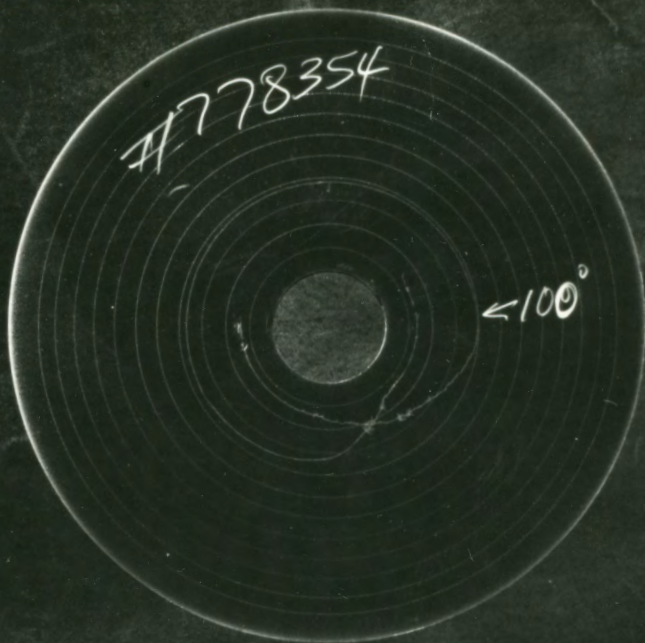
TIME →



778354-376

Each Horizontal Line Equal to 1000 p.s.i.

TEMPERATURE
RECORDER
CHART



10° each circle

ENERGY RESERVES GROUP
Lease Owner/Company Name INCORPORATED

FLUID SAMPLE DATA				Date 1-1-80		Ticket Number 778355			
Sampler Pressure _____ P.S.I.G. at Surface				Kind of Job OPEN HOLE PACKER DST		Halliburton District HAYS			
Recovery: Cu. Ft. Gas _____				Tester T. WILLIAMSON		Witness D. MOORE			
cc. Oil _____				Drilling Contractor RAINS & WILLIAMSON DRILLING COMPANY RIG					
cc. Water _____				EQUIPMENT & HOLE DATA SM					
cc. Mud _____				Formation Tested Lower Kansas City					
Tot. Liquid cc. _____				Elevation 2062' Kelly bushing Ft.					
Gravity _____ ° API @ _____ °F.				Net Productive Interval 4' Ft.					
Gas/Oil Ratio _____ cu. ft./bbl.				All Depths Measured From Kelly bushing					
RESISTIVITY _____ CHLORIDE CONTENT _____				Total Depth 3455' Ft.					
Recovery Water _____ @ _____ °F. _____ ppm				Main Hole/Casing Size 7 7/8"					
Recovery Mud _____ @ _____ °F. _____ ppm				Drill Collar Length 286' I.D. 2.25"					
Recovery Mud Filtrate _____ @ _____ °F. _____ ppm				Drill Pipe Length 3105' I.D. 3.826"					
Mud Pit Sample _____ @ _____ °F. _____ ppm				Packer Depth(s) 3407-3410' Ft.					
Mud Pit Sample Filtrate _____ @ _____ °F. _____ ppm				Depth Tester Valve 3402' Ft.					
Mud Weight 9.7 vis 37 sec _{cp}									
TYPE		AMOUNT		Depth Back Pres. Valve		Surface Choke		Bottom Choke	
Cushion				Ft.		.25"		.75"	
Recovered		287		Feet of		slightly oil cut mud			
Recovered				Feet of					
Recovered				Feet of					
Recovered				Feet of					
Recovered				Feet of					
Remarks		SEE PRODUCTION TEST DATA SHEET							
TEMPERATURE		Gauge No. 514		Gauge No. 376		Gauge No.		TIME	
Depth:		3404 Ft.		3452 Ft.		Ft.			
Est. °F.		12 Hour Clock		12 Hour Clock		Hour Clock		Tool A.M.	
Blanked Off		NO		Blanked Off YES		Blanked Off		Opened 1727 P.M.	
3450'								Opened A.M.	
Actual 100°F.		Pressures		Pressures		Pressures		Bypass 2158 P.M.	
		Field Office		Field Office		Field Office		Reported Computed	
		1792 1796.6		1832.1				Minutes Minutes	
First Period		Initial 19 11.9		57.4					
		Final 55 53.4		74.8					
		Closed in 1129 1131.1		1150.4				31 30	
								60 60	
Second Period		Initial 55 59.8		103.1					
		Final 129 132.5		153.2					
		Closed in 1120 1122.0		1143.1				60 60	
								120 120	
Third Period		Initial							
		Flow Final							
		Closed in							
Final Hydrostatic		1811 1792.9		1815.4					

Casing perms. _____ Bottom choke _____ Surf. temp. _____ °F Ticket No. 778355
Gas gravity _____ Oil gravity _____ GOR _____
Spec. gravity _____ Chlorides _____ ppm Res. _____ @ _____ °F
INDICATE TYPE AND SIZE OF GAS MEASURING DEVICE USED _____

INDICATE TYPE AND SIZE OF GAS MEASURING DEVICE USED.

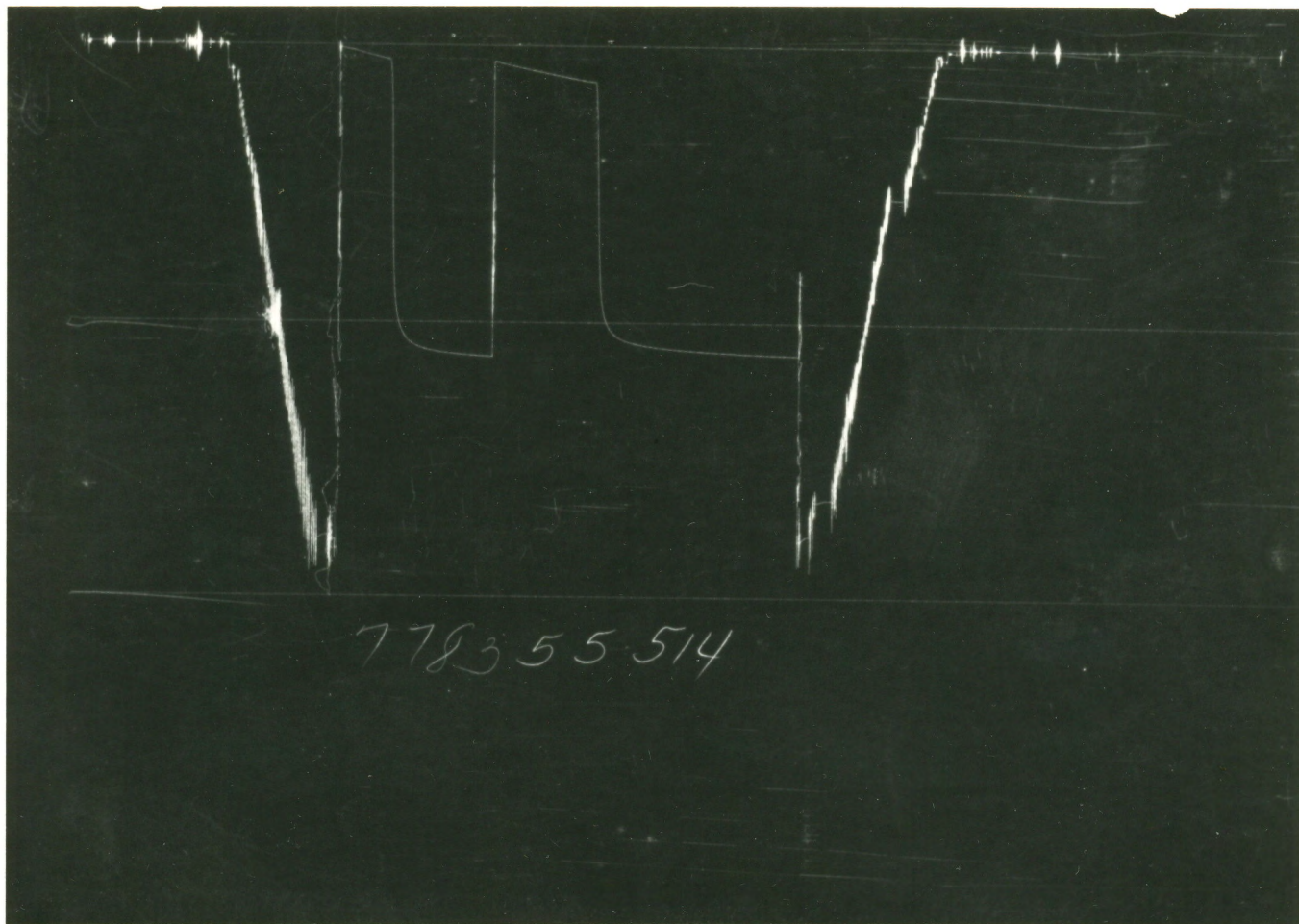
[illegible]

Gauge No. 514			Depth 3404'			Clock No. 13855			12 hour		Ticket No. 778355				
First Flow Period			First Closed In Pressure			Second Flow Period		Second Closed In Pressure			Third Flow Period		Third Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
0	.0000	11.9	.0000		53.4	.0000	59.8	.0000		132.5					
1	.0328	16.5	.0271		941.4	.0660	74.5	.0535		1020.1					
2	.0657	22.0	.0543		1044.9	.1320	87.4	.1069		1066.9					
3	.0985	31.3	.0814		1077.0	.1980	99.4	.1604		1082.5					
4	.1313	38.6	.1085		1093.5	.2640	112.3	.2139		1091.7					
5	.1642	46.9	.1357		1103.6	.3300	124.3	.2674		1098.1					
6	.1970	53.4	.1628		1109.1	.3960	132.5	.3208		1102.7					
7			.1899		1113.7			.3743		1106.4					
8			.2170		1117.4			.4278		1109.1					
9			.2442		1121.0			.4812		1111.9					
10			.2713		1122.9			.5347		1113.7					
11			.2984		1122.9			.5882		1116.5					
12			.3256		1126.6			.6416		1118.3					
13			.3527		1128.4			.6951		1120.1					
14			.3798		1129.3			.7486		1121.0					
15			.4070		1131.1			.8020		1122.0					

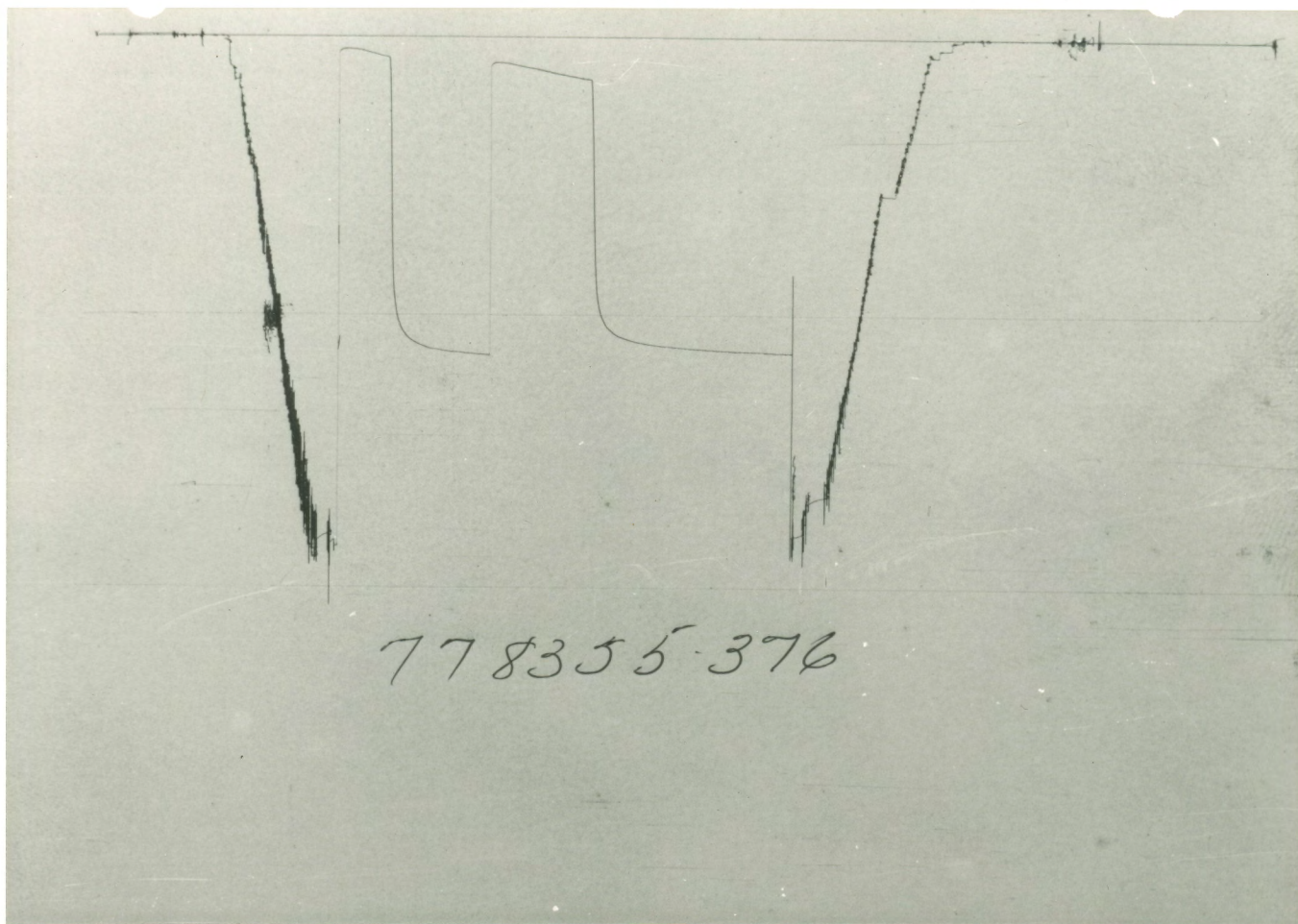
Gauge No. 376			Depth 3452'			Clock No. 2820			12 hour				
0	.0000	57.4	.0000		74.8	.0000	103.1	.0000		153.2			
1	.0333	44.7	.0266		973.5	.0660	94.8	.0532		1031.1			
2	.0666	46.5	.0532		1061.4	.1320	107.6	.1064		1080.7			
3	.0999	52.0	.0798		1092.6	.1980	119.5	.1596		1098.1			
4	.1332	60.2	.1064		1108.2	.2640	132.2	.2128		1109.1			
5	.1665	68.4	.1330		1119.2	.3300	144.1	.2660		1115.5			
6	.2000	74.8	.1596		1128.4	.3960	153.2	.3192		1119.2			
7			.1862		1132.1			.3724		1125.6			
8			.2128		1136.6			.4256		1128.4			
9			.2394		1140.3			.4788		1131.1			
10			.2660		1142.1			.5320		1133.9			
11			.2926		1144.0			.5852		1135.7			
12			.3192		1145.8			.6384		1137.6			
13			.3458		1147.7			.6916		1139.4			
14			.3724		1150.4			.7448		1142.1			
15			.3990		1150.4			.7980		1143.1			
Reading Interval 5		4		10		8						Minutes	
REMARKS:													

	O. D.	I. D.	LENGTH	DEPTH
Drill Pipe or Tubing	4.5"	3.826"	3105'	
Reversing Sub	5.75"	1'		3332'
Water Cushion Valve				
Drill Pipe				
Drill Collars	6"	2.25"	286'	
Handling Sub & Choke Assembly				
Dual CIP Valve	5"	.87"	6'	3392'
Dual CIP Sampler				
Hydro-Spring Tester	5"	.75"	5'	3402'
Multiple CIP Sampler				
Extension Joint				
AP Running Case	5"	3.06"	4'	3404'
Hydraulic Jar				
VR Safety Joint				
Pressure Equalizing Crossover				
Packer Assembly	6.75"	1.53"		3407'
Distributor				
Packer Assembly	6.75"	1.53"	5'	3410'
Flush Joint Anchor				
Pressure Equalizing Tube				
Blanked-Off B.T. Running Case				
Drill Collars				
Anchor Pipe Safety Joint				
Packer Assembly				
Distributor				
Packer Assembly				
Anchor Pipe Safety Joint				
Side Wall Anchor				
Drill Collars				
Flush Joint Anchor	5"	3.84"	38'	
HT 500	5"	3.75"	1.5'	3450'
Blanked-Off B.T. Running Case	5"	2.44"	4'	3452'
Total Depth				3455'

↓
PRESSURE
↓



→
TIME
→



Each Horizontal Line Equal to 1000 p.s.i.

TEMPERATURE
RECORDER
CHART



10° each circle

Casing perms. _____ Bottom choke _____ Surf. temp _____ °F Ticket No. 778356
Gas gravity _____ Oil gravity _____ GOR _____
Spec. gravity _____ Chlorides _____ ppm Res. _____ @ _____ °F
INDICATE TYPE AND SIZE OF GAS MEASURING DEVICE USED _____

[illegible]

Gauge No. 514			Depth 3579'			Clock No. 13855			12 hour	Ticket No. 778356					
First Flow Period			First Closed In Pressure			Second Flow Period		Second Closed In Pressure			Third Flow Period		Third Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t + \theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t + \theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t + \theta}{\theta}$	PSIG Temp. Corr.
0	.000	16.5	.000		83.7	.000	95.7	.000		135.3					
1	.0393*	28.5	.0203**		587.0	.0724***	112.3	.0663****		737.1					
2	.0720	42.3	.0475		740.8	.1383	125.2	.1194		821.4					
3	.1048	55.2	.0746		831.5	.2042	127.0	.1724		874.5					
4	.1375	64.4	.1017		897.4	.2701	128.9	.2255		907.5					
5	.1703	74.5	.1288		934.0	.3360	132.5	.2785		930.4					
6	.2030	83.7	.1559		955.1	.4020	135.3	.3316		945.9					
7			.1831		967.9			.3846		956.9					
8			.2102		978.0			.4376		965.2					
9			.2373		986.2			.4907		972.5					
10			.2644		991.7			.5437		979.8					
11			.2915		996.3			.5968		984.4					
12			.3187		1000.0			.6498		988.1					
13			.3458		1002.7			.7029		992.7					
14			.3729		1006.4			.7559		995.4					
15			.4000		1008.2			.8090		998.1					

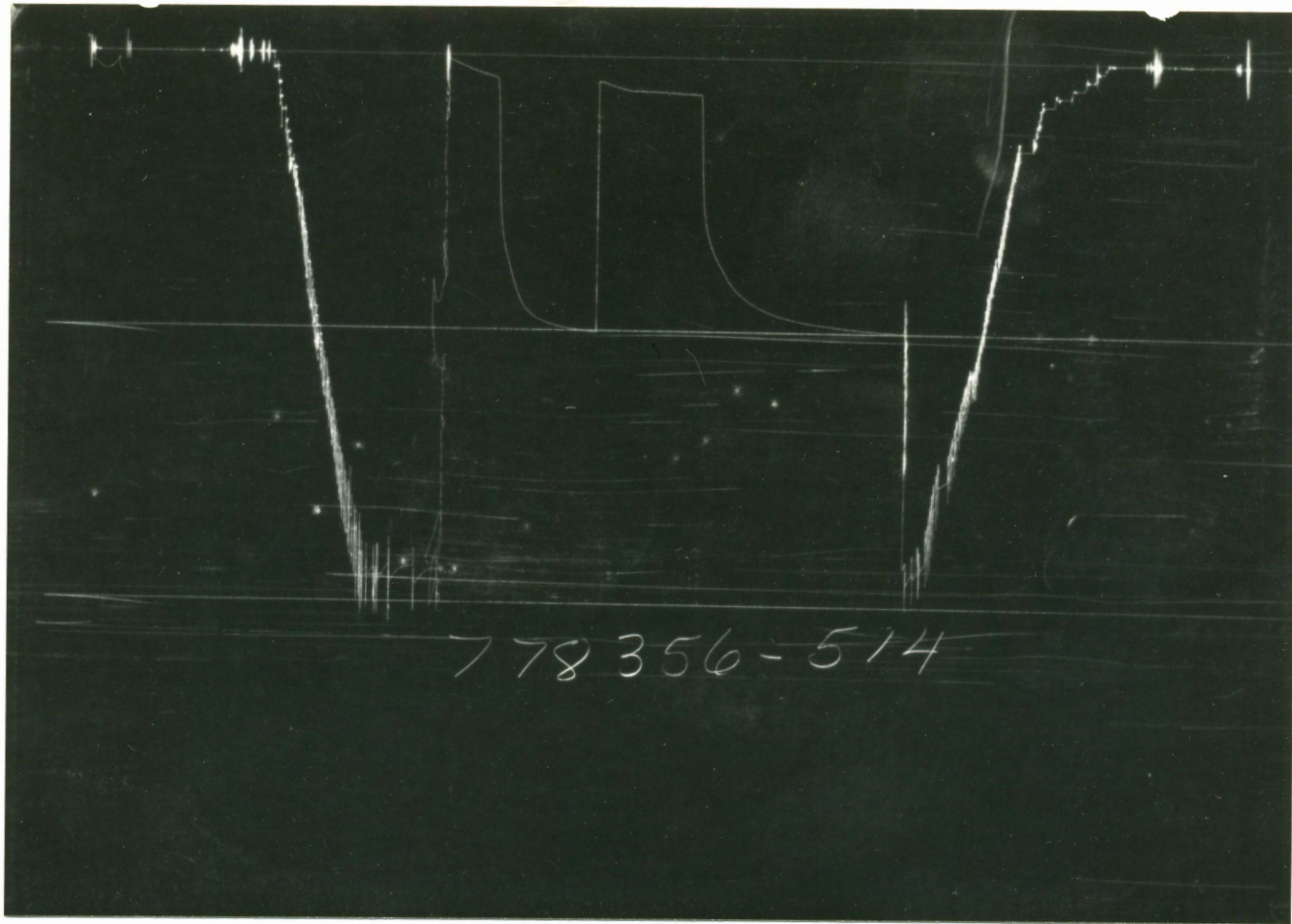
Gauge No. 376			Depth 3607'			Clock No. 2820			hour 12						
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
0	.000	45.6	.000		92.1	.000	124.9	.000		145.9					
1	.0393*	46.5	.0199**		601.0	.0727	120.4	.0663****		732.2					
2	.0720	60.2	.0465		744.0	.1387	134.1	.1194		817.8					
3	.1048	69.3	.0731		835.1	.2048	236.8	.1724		874.2					
4	.1375	73.9	.0997		898.8	.2709	138.6	.2255		908.9					
5	.1703	86.6	.1263		934.4	.3369	142.3	.2785		932.5					
6	.2030	92.1	.1528		955.3	.4030	145.9	.3316		948.9					
7			.1794		970.8			.3846		961.7					
8			.2060		979.9			.4376		971.7					
9			.2326		988.1			.4907		979.9					
10			.2592		995.4			.5437		986.3					
11			.2857		1000.8			.5968		990.8					
12			.3123		1004.5			.6498		996.3					
13			.3389		1008.2			.7029		999.0					
14			.3655		1011.0			.7559		1002.7					
15			.3920		1014.6			.8090		1005.5					

Reading Interval 5 4 10 8 Minutes

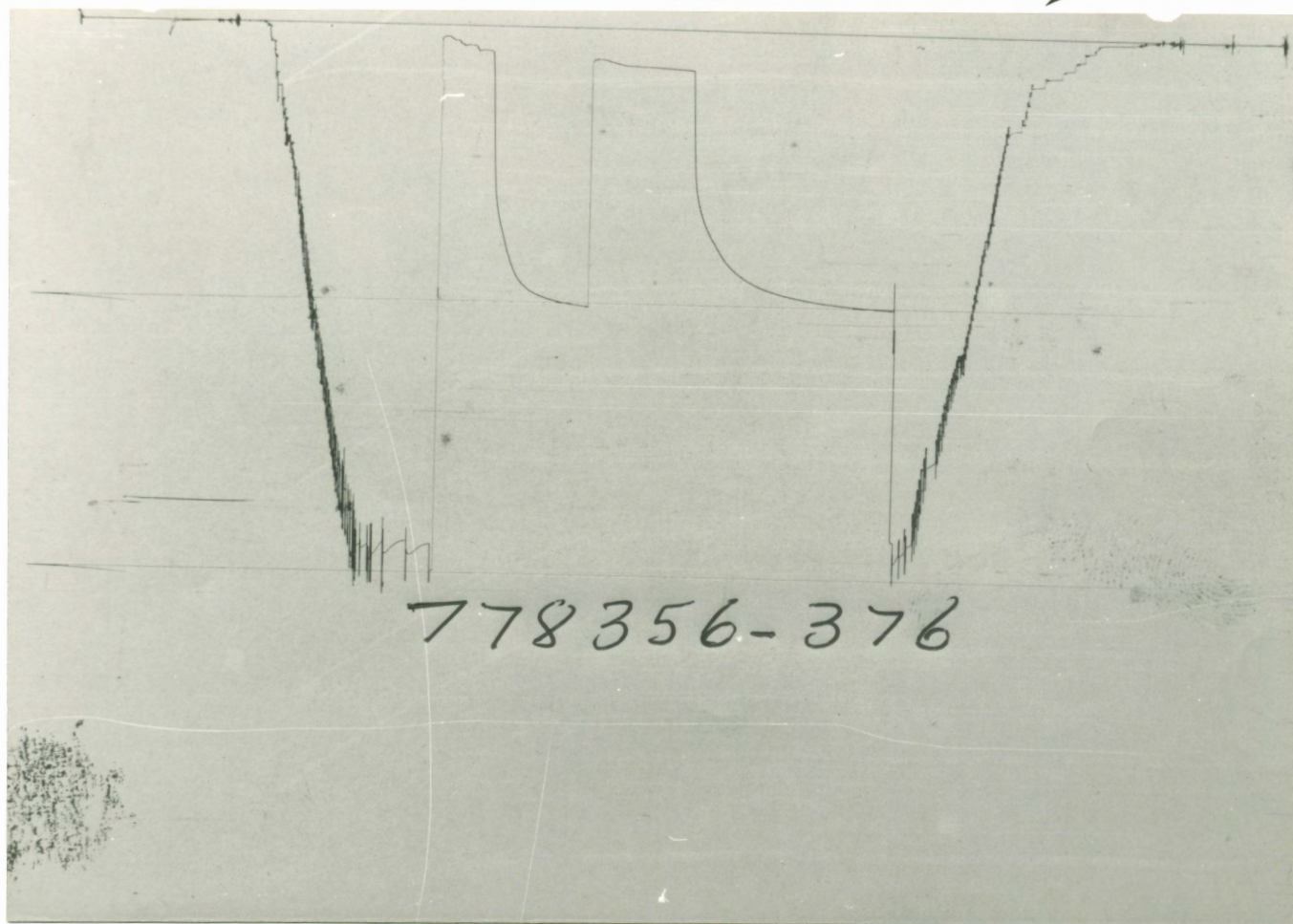
REMARKS: *-6 minutes **-3 minutes ***-11 minutes ****-10 minutes

	O. D.	I. D.	LENGTH	DEPTH
Drill Pipe or Tubing	5.75"	2.75"	1'	3507'
Reversing Sub				
Water Cushion Valve				
Drill Pipe	4 1/2"	3.826"	3275'	
Drill Collars	6"	2.75"	286'	
Handling Sub & Choke Assembly				
Dual CIP Valve	5"	.87"	6'	3567'
Dual CIP Sampler				
Hydro-Spring Tester	5'	.75"	5'	3577'
Multiple CIP Sampler				
Extension Joint				
AP Running Case	5"	3.06"	4'	3579'
Hydraulic Jar				
VR Safety Joint				
Pressure Equalizing Crossover				
Packer Assembly	6.75"	1.53"	5'	3582'
Distributor				
Packer Assembly	6.75"	1.53"	5'	3585'
Flush Joint Anchor				
Pressure Equalizing Tube				
Blanked-Off B.T. Running Case				
Drill Collars				
Anchor Pipe Safety Joint				
Packer Assembly				
Distributor				
Packer Assembly				
Anchor Pipe Safety Joint				
Side Wall Anchor				
Drill Collars				
Flush Joint Anchor	5"	3.84"	18'	
	5"	3.75"	1.5'	3605' HT-500
Blanked-Off B.T. Running Case	5"	2.44"	4'	3607'
Total Depth				3610'

↓
PRESSURE
↓

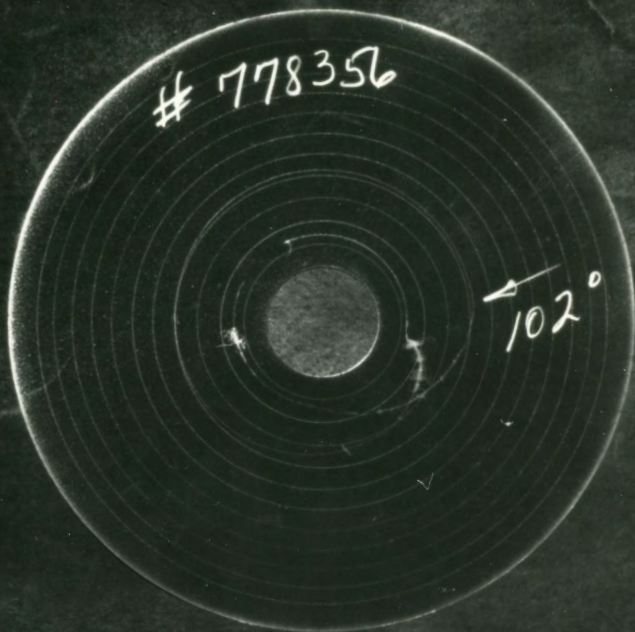


————— TIME —————→



Each Horizontal Line Equal to 1000 p.s.i.

TEMPERATURE
RECORDER
CHART



10° each circle

NOMENCLATURE

b	= Approximate Radius of Investigation	Feet
b₁	= Approximate Radius of Investigation (Net Pay Zone h ₁)	Feet
D.R.	= Damage Ratio	—
EI	= Elevation	Feet
GD	= B.T. Gauge Depth (From Surface Reference)	Feet
h	= Interval Tested	Feet
h₁	= Net Pay Thickness	Feet
K	= Permeability	md
K₁	= Permeability (From Net Pay Zone h ₁)	md
m	= Slope Extrapolated Pressure Plot (Psi ² /cycle Gas)	psi/cycle
OF₁	= Maximum Indicated Flow Rate	MCF/D
OF₂	= Minimum Indicated Flow Rate	MCF/D
OF₃	= Theoretical Open Flow Potential with/Damage Removed Max.	MCF/D
OF₄	= Theoretical Open Flow Potential with/Damage Removed Min.	MCF/D
P_s	= Extrapolated Static Pressure	Psig.
P_f	= Final Flow Pressure	Psig.
P_{or}	= Potentiometric Surface (Fresh Water *)	Feet
Q	= Average Adjusted Production Rate During Test	bbls/day
Q₁	= Theoretical Production w/Damage Removed	bbls/day
Q_g	= Measured Gas Production Rate	MCF/D
R	= Corrected Recovery	bbls
r_w	= Radius of Well Bore	Feet
t	= Flow Time	Minutes
t_o	= Total Flow Time	Minutes
T	= Temperature Rankine	°R
Z	= Compressibility Factor	—
μ	= Viscosity Gas or Liquid	CP
Log	= Common Log	

* Potentiometric Surface Reference to Rotary Table When Elevation Not Given,
Fresh Water Corrected to 100° F.