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State of New Mexico
Energy, Minerals and Natural Resources Department

Form C-122
Revised 4-1-91

OIL CONSERVATION DIVISION

P.O. Box 2088
Santa Fe, New Mexico 87504-2088

MULTIPOINT AND ONE POINT BACK PRESSURE TEST FOR GAS WELL

Operator PHILLIPS PETROLEUM COMPANY						Lease or Unit Name RANGER					
Type Test ☒ Initial ☐ Annual ☐ Special						Test Date 8/15/93		Well No. 20			
Completion Date 8/12/93		Total Depth 13250		Plug Back TD 12880'		Elevation 4151.1 GL		Unit Ltr. - Sec. - TWP - Rge. 26 12S 34E			
Csg. Size 5½	Wt. 54.5#	d 13250	Set At 13250	Perforations: From: 12851' To: 12868'				Country Lea			
Tbg. Size 2 3/8	Wt. 1.995	d 12750	Set At 12750	Perforations: From: To:				Pool West Ranger Lake (Dev.)			
Type Well - Single - Bradenhead - G.G. or G.O. Multiple SINGLE						Packer Set At 12750		Formation DEVONIAN			
Producing Thru TBG		Reservoir Temp. °F 201.5@12750		Mean Annual Temp. °F 60°		Baro. Press - P _a 13.2		Connection TO AIR			
L 12750	H 12750	Gg .669	% CO ₂ 2.24	% N ₂ 3.36	% H ₂ S	Prover		Meter Run 4.026	Taps FLG		

FLOW DATA						TUBING DATA		CASING DATA		Duration of Flow	
NO.	Prover Line Size	X	Orifice Size	Press. p.s.i.g.	Diff. h _w	Temp. °F	Press. p.s.i.g.	Temp. °F	Press. p.s.i.g.		Temp. °F
SI							2776		PKR		24 HR
1.	4	X	1.500	240	23.00	88	2580		"		48 HR
2.	4	X	1.500	250	72.00	72	2464		"		2 HR
3.	4	X	2.000	250	38.00	87	2315		"		2 HR
4.	4	X	2.000	250	58.00	86	2150		"		2 HR
5.											

RATE OF FLOW CALCULATIONS							
NO.	COEFFICIENT (24 HOUR)	$\sqrt{h_w P_m}$	Pressure P _m	Flow Temp. Factor Ft.	Gravity Factor Fg.	Super Compress. Factor, F _{pv} .	Rate of Flow Q, Mcfd
1.	10.84	76.31	253.2	.9741	1.223	1.020	1005
2.	10.84	137.70	263.2	.9887	1.223	1.024	1848
3.	19.81	100.00	263.2	.9750	1.223	1.021	2412
4.	19.81	123.55	263.2	.9759	1.223	1.021	2983
5.							

NO.	P _r	Temp. °R	T _r	Z	Gas Liquid Hydrocarbon Ratio	30.748	Mcf/bbl.
1.	.38	548	1.51	.961	A.P.I. Gravity of Liquid Hydrocarbons	49.5 @ 60°	Deg.
2.	.39	532	1.46	.954	Specific Gravity Separator Gas	.669	XXXXXXXXXX
3.	.39	547	1.50	.960	Specific Gravity Flowing Fluid	XXXXXX	
4.	.39	546	1.50	.960	Critical Pressure	*673	P.S.I.A. *670
5.					Critical Temperature	*364	R *433

NO.	P _i ²	P _w	P _w ²	P _c ² - P _w ²
1.		2602.0	6770.4	1009.2
2.		2503.9	6269.5	1510.1
3.		2373.9	5635.4	2144.2
4.		2234.0	4990.7	2788.9
5.				

1) $\frac{P_c^2}{P_c^2 - P_w^2} = 2.790$ (2) $\left[\frac{P_c^2}{P_c^2 - P_w^2} \right]^n = 2.289$

AOF = Q $\left[\frac{P_c^2}{P_c^2 - P_w^2} \right]^n = 6.828$

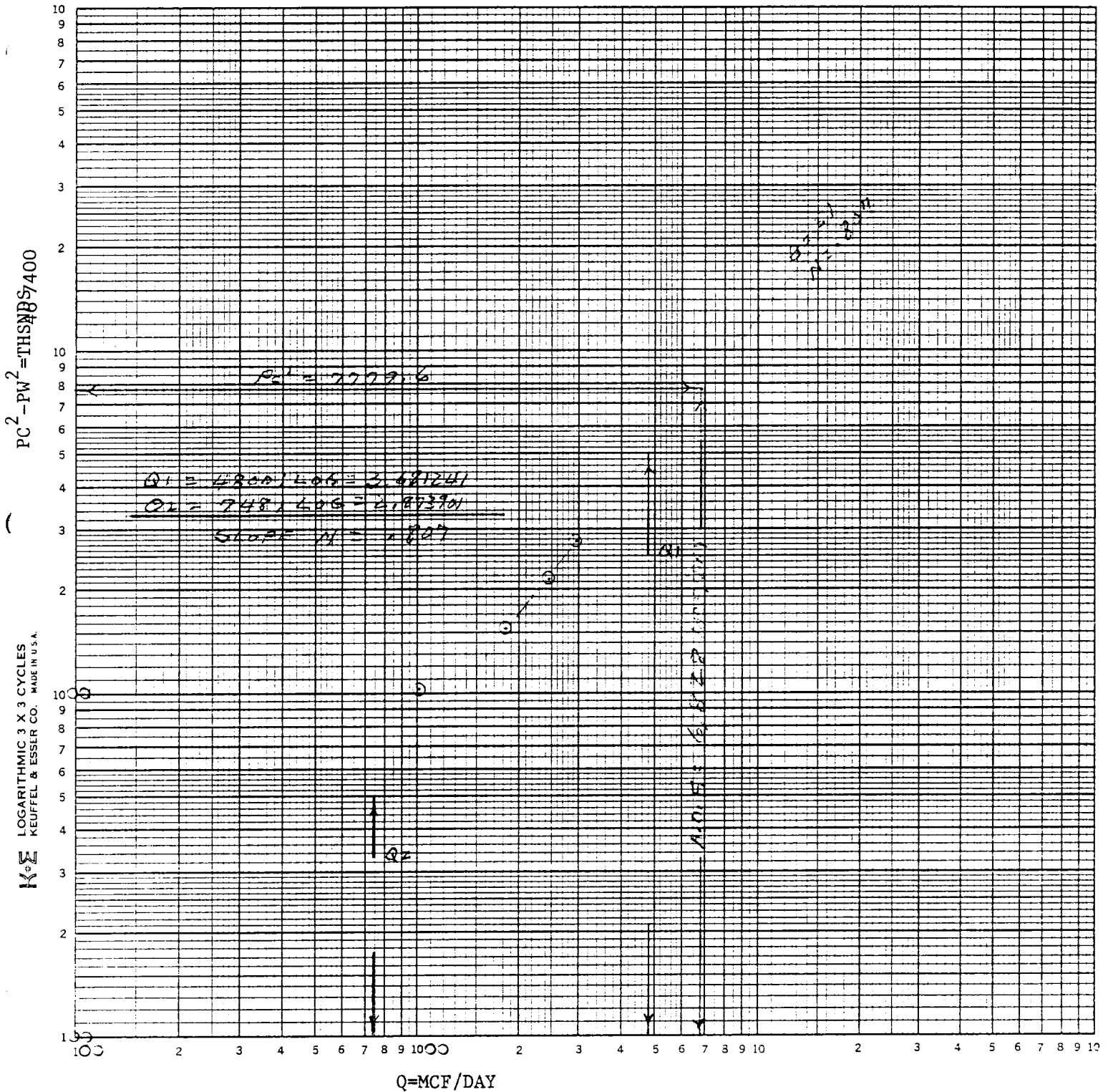
Absolute Open Flow	6,828	Mcf/d @ 15.025	Angle of Slope θ	51	Slope, n	.807
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Remarks: 85 BBLS of oil @ 49.5 API. 14 BBLS water during test

*Corrected to 2.24% CO₂ & 3.36 N₂

Approved By Division 09 JS	Conducted By: John West Engineering	Calculated By: GW	Checked By: BM
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PHILLIPS PETROLEUM COMPANY
 RANGER NO. 20
 Sec. 26-Twp. 12S- Rge. 34E
 LEA COUNTY, NEW MEXICO
 AUGUST 15, 1993



NEW MEXICO G.O.R./G. MIX

NO. OF BBLs PRODUCED = 85.0
 API GRAVITY @ 60 DEG. = 49.5

SPECIFIC GRAVITY OF GAS = 0.6690

XX
 TOTAL GAS PRODUCED = 2614

G.O.R. = 30.748

G.MIX = 0.768

VOLUME 1: 1005 PSIA 1: 2593.2
2: 1848 2: 2477.2

FORM C-122E WORKSHEET FOR STEPWISE CALCULATION (SUBSURFACE) PRESSURE (Pf & Ps)

COMPANY : PHILLIPS LEASE : RANGER WELL NO. : 20 DATE : 8/15/93

UNIT : SECTION : 26 TOWNSHIP : 12S RANGE : 34E

L : 12750 H : 12750 L/H : 1.0 G/GMIX : 0.768

CO2 : 2.24 N2 : 3.36 H2S : 0

d : 1.995 Fr : 0.018231 Qm : 1.005 (L/H) (Fr Qm) 0.000336

PCR : 670 TCR : 433

LINE	ITEM	SOURCE	1	2	3	4	5
1	H		0	6375		12750	
2	GH		0	4896.00		9792.00	DELTA P = 1359.3
3	37.56H		0	183600		367200	Ps = 3952.5
4	Pc or Pn		2593.2	3328.6	3299.8	4002.5	4002.5
5	Pr		3.87	4.97	4.93	5.97	5.97
6	T		534	597.75	597.75	661.5	661.5
7	Tr		1.23	1.38	1.38	1.53	1.53
8	Z		0.609	0.757	0.754	0.869	0.869
9	P/ZP/Z	4/8	4255.4	4399.9	4376.8	4604.1	4604.1
10	P/TZ	9/6	7.9689	7.3608	7.3221	6.9602	6.9602
11	Ln10*2/1000	(10)2/100	0.06350	0.05418	0.05361	0.04844	0.04844
12	L/H(FrQm)2		0.000336	0.000336	0.000336	0.000336	0.000336
13		11+12	0.063838	0.054517	0.053949	0.048780	0.048780
14	In	10/13	124.829	135.019	135.723	142.686	142.686
15	M=Pn-Pn-1			735	707	703	658
16	N=In+In-1			259.847	260.552	278.409	278.409
17	M x N	15x16			184098		183102
18	SUM(MxN)	SUM17			184098		367200

FORM C-122E WORKSHEET FOR STEPWISE CALCULATION (SUBSURFACE) PRESSURE (Pf & Ps)

COMPANY : PHILLIPS LEASE : RANGER WELL NO. : 20 DATE : 8/15/93

UNIT : 0 SECTION : 26 TOWNSHIP : 12S RANGE : 34E

L : 12750 H : 12750 L/H : 1.0 G/GMIX : 0.768

CO2 : 2.24 N2 : 3.36 H2S : 0

d : 1.995 Fr : 0.018231 Qm : 1.848 (L/H) (Fr Qm) 0.001135

PCR : 670 TCR : 433

LINE	ITEM	SOURCE	1	2	3	4	5
1	H		0	6375		12750	
2	GH		0	4896.00		9792.00	DELTA P = 1348.7
3	37.5GH		0	183600		367200	Ps = 3825.9
4	Pc or Pn		2477.2	3204.0	3176.9	3872.8	3872.8
5	Pr		3.70	4.78	4.74	5.78	5.78
6	T		534	597.75	597.75	661.5	661.5
7	Tr		1.23	1.38	1.38	1.53	1.53
8	Z		0.597	0.746	0.743	0.859	0.859
9	P/ZP/Z	4/8	4150.0	4297.6	4274.4	4507.9	4507.9
10	P/TZ	9/6	7.7714	7.1896	7.1508	6.8147	6.8147
11	Ln10*2/1000	(10)2/100	0.06040	0.05169	0.05113	0.04644	0.04644
12	L/H(Fr Qm)2		0.001135	0.001135	0.001135	0.001135	0.001135
13		11+12	0.061530	0.052825	0.052269	0.047575	0.047575
14	In	10/13	126.302	136.102	136.807	143.241	143.241
15	M=Pn-Pn-1			727	700	696	654
16	N=In+In-1			262.404	263.110	280.049	280.049
17	M x N	15x16			184094		183106
18	SUM(MxN)	SUM17			184094		367200

VOLUME 1: 2412 PSIA 1: 2328.2
2: 2983 2: 2163.2

FORM C-122E WORKSHEET FOR STEPWISE CALCULATION (SUBSURFACE) PRESSURE (Pf & Ps)

COMPANY : PHILLIPS LEASE : RANGER WELL NO. : 20 DATE : 8/15/93
UNIT : SECTION : 26 TOWNSHIP : 12S RANGE : 34E
L : 12750 H : 12750 L/H : 1.0 G/GMIX : 0.768
CO2 : 2.24 N2 : 3.36 H2S : 0
d : 1.995 Fr : 0.018231 Qm : 2.412 (L/H) (Fr Qm) 0.001934

PCR : 670 TCR : 433

LINE	ITEM	SOURCE	1	2	3	4	5
1	H		0	6375		12750	
2	GH		0	4896.00		9792.00	DELTA P = 1326.2
3	37.5GH		0	183600		367200	Ps = 3654.4
4	Pc or Pn		2328.2	3039.2	3014.4	3697.0	3697.0
5	Pr		3.47	4.54	4.50	5.52	5.52
6	T		534	597.75	597.75	661.5	661.5
7	Tr		1.23	1.38	1.38	1.53	1.53
8	Z		0.582	0.732	0.730	0.846	0.846
9	P/ZP/Z	4/8	3997.8	4151.7	4128.7	4370.3	4370.3
10	P/TZ	9/6	7.4865	6.9455	6.9071	6.6067	6.6067
11	Ln10*2/1000	(10)2/100	0.05605	0.04824	0.04771	0.04365	0.04365
12	L/H(Fr Qm)2		0.001934	0.001934	0.001934	0.001934	0.001934
13		11+12	0.057981	0.050174	0.049641	0.045582	0.045582
14	In	10/13	129.120	138.428	139.139	144.941	144.941
15	M=Pn-Pn-1			711	686	683	645
16	N=In+In-1			267.548	268.259	284.081	284.081
17	M x N	15x16			184088		183112
18	SUM(MxN)	SUM17			184088		367200

FORM C-122E WORKSHEET FOR STEPWISE CALCULATION (SUBSURFACE) PRESSURE (Pf & Ps)

COMPANY : PHILLIPS LEASE : RANGER WELL NO. : 20 DATE : 8/15/93

UNIT : 0 SECTION : 26 TOWNSHIP : 12S RANGE : 34E

L : 12750 H : 12750 L/H : 1.0 G/GMIX : 0.768

CO2 : 2.24 N2 : 3.36 H2S : 0

d : 1.995 Fr : 0.018231 Qm : 2.983 (L/H)(FrQm)0.002958

PCR : 670 TCR : 433

LINE	ITEM	SOURCE	1	2	3	4	5
1	H		0	6375		12750	
2	GH		0	4896.00		9792.00	DELTA P = 1302.2
3	'37.56H		0	183600		367200	
							Ps = 3465.4
4	Pc or Pn		2163.2	2855.0	2834.0	3501.5	3501.5
5	Pr		3.23	4.26	4.23	5.23	5.23
6	T		534	597.75	597.75	661.5	661.5
7	Tr		1.23	1.38	1.38	1.53	1.53
8	Z		0.569	0.719	0.717	0.832	0.832
9	P/ZP/Z	4/8	3802.4	3973.1	3951.6	4206.9	4206.9
10	P/TZ	9/6	7.1206	6.6468	6.6108	6.3596	6.3596
11	Ln10*2/1000	(10)2/100	0.05070	0.04418	0.04370	0.04045	0.04045
12	L/H(FrQm)2		0.002958	0.002958	0.002958	0.002958	0.002958
13		11+12	0.053661	0.047137	0.046660	0.043403	0.043403
14	In	10/13	132.697	141.010	141.680	146.527	146.527
15	M=Pn-Pn-1			692	671	668	635
16	N=In+In-1			273.707	274.377	288.207	288.207
17	M x N	15x16			184050		183150
18	SUM(MxN)	SUM17			184050		367200

FORM C-122E WORKSHEET FOR STEPWISE CALCULATION (SURFACE) PRESSURE (Pc & Pw)

COMPANY : PHILLIPS LEASE : RANGER WELL NO. : 20 DATE : 8/15/93
 UNIT : 0 SECTION : 26 TOWNSHIP : 12S RANGE : 34E
 L : 12750 H : 12750 L/H : 1.0 G/GMIX : 0.768
 CO2 : 2.24 N2 : 3.36 H2S : 0
 d : 1.995 Fr : 0.018231 Gm : 0.000 (L/H) (Fr Gm) 0.000000

PCR : 670 TCR : 433

LINE	ITEM	SOURCE	1	2	3	4	5	6
1	H		12750	6375		0		
2	GH		9792	4896.00		0		
3	37.5GH		367200	183600		0		
4	Pc or Pn		3952.5	3313.6	3296.6	2642.6	2594.0	2597.2
5	Pr		5.97	4.95	4.92	3.94	3.87	3.88
6	T		661.5	597.75	597.75	534	534	534
7	Tr		1.53	1.38	1.38	1.23	1.23	1.23
8	Z		0.869	0.755	0.754	0.615	0.609	0.610
9	P/ZP/Z	4/8	4604.1	4387.9	4374.2	4297.3	4256.0	4258.8
10	P/TZ	9/6	6.9602	7.3407	7.3178	8.0474	7.9701	7.9753
11	Ln10^2/1000((10)2/100)							
12	L/H(Fr Gm)2							
13		11+12						
14	In	10/13	143.675	136.227	136.654	124.264	125.469	125.387
15	M=Pn-Pn-1			639	656	654	703	699
16	N=In+In-1			279.902	280.329	260.918	262.122	262.040
17	M x N	15x16			183880			183263
18	SUM(MxN)	SUM17	367200		183320			

DELTA P = 1350.5

Pw = 2602.0

FORM C-122E WORKSHEET FOR STEPWISE CALCULATION (SURFACE) PRESSURE (Pc & Pw)

COMPANY : PHILLIPS LEASE : RANGER WELL NO. : 20 DATE : 8/15/93

UNIT : 0 SECTION : 26 TOWNSHIP : 12S RANGE : 34E

L : 12750 H : 12750 L/H : 1.0 G/GMIX : 0.768

CO2 : 2.24 N2 : 3.36 H2S : 3.36

d : 1.995 Fr : 0.018231 Qm : 0.000 (L/H)(FrQm)0.000000

PCR : 670 TCR : 433

LINE	ITEM	SOURCE	1	2	3	4	5	6
1	H		12750	6375		0		
2	GH		9792	4896.00		0		
3	'37.5GH		367200	183600		0		
4	Pc or Pn		3825.9	3200.3	3183.8	2543.8	2495.8	2502.1
5	Pr		5.78	4.78	4.75	3.80	3.73	3.73
6	T		661.5	597.75	597.75	534	534	534
7	Tr		1.53	1.38	1.38	1.23	1.23	1.23
8	Z		0.859	0.745	0.744	0.604	0.604	0.600
9	P/ZP/Z	4/8	4507.9	4294.4	4280.3	4211.7	4132.3	4173.4
10	P/TZ	9/6	6.8147	7.1843	7.1608	7.8871	7.7385	7.8154
11	Ln10*2/1000:(10)2/100							
12	L/H(FrQm)2							
13		11+12						
14	In	10/13	146.742	139.192	139.650	126.789	129.224	127.952
15	M=Pn-Pn-1			626	642	640	688	682
16	N=In+In-1			285.934	286.392	266.439	268.874	267.602
17	M x N	15x16			183894			182438
18	SUM(MxN)	SUM17	367200		183306			

DELTA P = 1322.0

Pw = 2503.9

FORM C-122E WORKSHEET FOR STEPWISE CALCULATION (SURFACE) PRESSURE (Pc & Pw)										***
COMPANY : PHILLIPS		LEASE :RANGER		WELL NO. :20		DATE : 8/15/93				***
UNIT : 0		SECTION :26		TOWNSHIP :12S		RANGE : 34E				***
L : 12750		H : 12750		L/H : 1.0		G/GNIX : 0.768				***
CO2 : 2.24		N2 : 3.36		H2S : 0						***
d : 1.995		Fr :0.018231		Qm : 0.000		(L/H)(FrQm)0.000000				***
		PCR : 670		TCR : 433						***
LINE	ITEM	SOURCE	1	2	3	4	5	6		***
1	H		12750	6375		0				***
2	GH		9792	4896.00		0			DELTA P = 1280.5	***
3	'37.56H		367200	183600		0				***
									Pw = 2373.9	***
4	Pc or Pn		3654.4	3047.9	3032.2	2412.1	2365.4	2369.2		***
5	Pr		5.52	4.55	4.53	3.60	3.53	3.54		***
6	T		661.5	597.75	597.75	534	534	534		***
7	Tr		1.53	1.38	1.38	1.23	1.23	1.23		***
8	Z		0.846	0.733	0.731	0.590	0.586	0.586		***
9	P/ZP/Z	4/8	4370.3	4159.8	4145.2	4085.9	4037.8	4041.7		***
10	P/TZ	9/6	6.6067	6.9591	6.9348	7.6516	7.5614	7.5688		***
11	Ln10*2/1000:(10)2/100:									***
12	L/H(FrQm)2									***
13		11+12								***
14	In	10/13	151.362	143.697	144.201	130.692	132.251	132.122		***
15	M=Pn-Pn-1			606	622	620	667	663		***
16	N=In+In-1			295.059	295.563	274.893	276.453	276.323		***
17	M x N	15x16			183914			183200		***
18	SUM(MxN)	SUM17	367200		183286					***

 FORM C-122E WORKSHEET FOR STEPWISE CALCULATION (SURFACE) PRESSURE (Pc & Pw) ***

COMPANY : PHILLIPS LEASE :RANGER WELL NO. :20 DATE : 8/15/93 ***

UNIT : 0 SECTION :26 TOWNSHIP :12S RANGE : 34E ***

L : 12750 H : 12750 L/H : 1.0 G/GMIX : 0.768 ***

CD2 : 2.24 N2 : 3.36 H2S : 3.36 ***

d : 1.995 Fr :0.018231 Qm : 0.000 (L/H)(FrQm)0.000000 ***

PCR : 670 TCR : 433 ***

LINE	ITEM	SOURCE	1	2	3	4	5	6	
1	H		12750	6375		0			***
2	GH		9792	4896.00		0			DELTA P = 1231.4 ***
3	37.5GH		367200	183600		0			***
									Pw = 2234.0 ***
4	Pc or Pn		3465.4	2881.6	2866.7	2270.3	2225.5	2231.5	***
5	Pr		5.23	4.30	4.28	3.39	3.32	3.33	***
6	T		661.5	597.75	597.75	534	534	534	***
7	Tr		1.53	1.38	1.38	1.23	1.23	1.23	***
8	Z		0.832	0.720	0.719	0.577	0.577	0.574	***
9	P/ZP/Z	4/8	4206.9	4000.0	3985.0	3932.7	3855.1	3887.1	***
10	P/TZ	9/6	6.3596	6.6917	6.6667	7.3646	7.2193	7.2793	***
11	Ln10^2/1000((10)2/100)								***
12	L/H(FrQm)2								***
13		11+12							***
14	In	10/13	157.241	149.438	150.000	135.785	138.517	137.376	***
15	M=Pn-Pn-1			584	599	596	641	635	***
16	N=In+In-1			306.680	307.241	285.785	288.517	287.375	***
17	M x N	15x16			183936			182539	***
18	SUM(MxN)	SUM17	367200		183264				***