



OIL FIELD RENTAL SERVICE CO.

1984

SURVEY

1-800-231-1601
713/672-1601
Houston, Tex.

512/664-6576
Alice, Tex.

713/866-2311
Beaumont, Tex.

806/323-8961
Canadian, Tex.

214/984-5038
Kilgore, Tex.

512/723-2056
Laredo, Tex.

915/381-5140
Odessa, Tex.

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Van Vleet, Tex.

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Mobile, Ala.

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Bossier City, La.

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New Iberia, La.

601/428-1551
Laurel, Miss.

405/324-8801
Oklahoma City, Okla.

307/473-1099
Casper, Wyo.

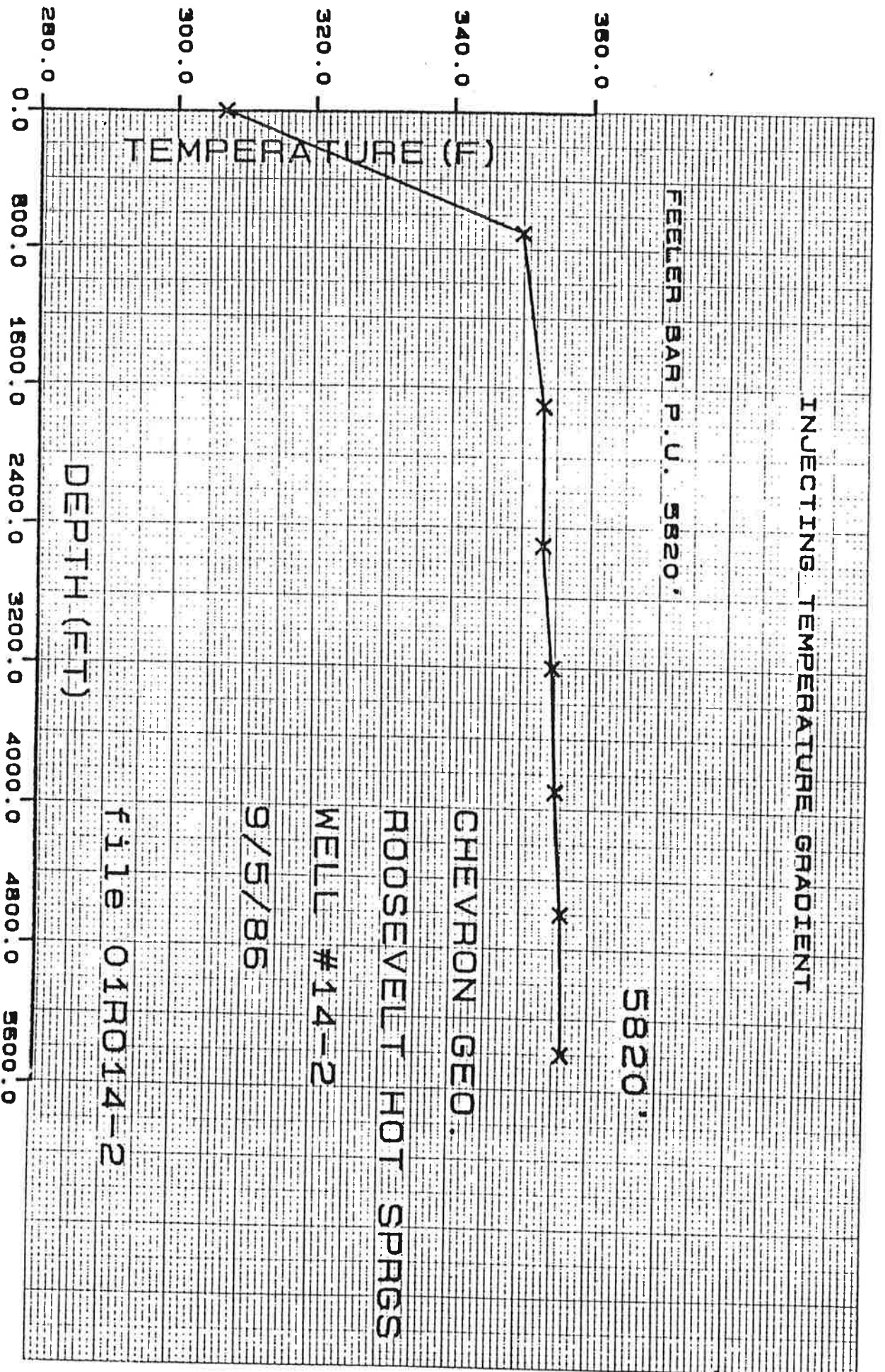
307/789-4491
Evanston, Wyo.

307/362-8655
Rock Springs, Wyo.



BAKERSFIELD, CA
(805) 589-2768

10 x 10 TO 1/2 INCH
6 1/2 INCHES



PRUETT INDUSTRIES INC
8915 ROSEDALE HWY, BAKERSFIELD, CA. 93308
(805) 589-2768

PAGE 1

SUB-SURFACE TEMPERATURE SURVEY

CO. CHEVRON GEOTHERMAL	RUN 01 FIELD ROOSEVELT HOT S WELL 14-2
OFF DEPTH 6000'	WELL STAT INJECTING
CASING 9 5/8 TO -1805'	CASING PRESS
LINER -	TUBING PRESS
DATE 090586	ELEMENT RANGE 87 - 747
ELEVATION	ZONE
MAX TEMP	PICK-UP 5820 FEELER
PERF -	CAL SER NO. 28339
TUBING -	
UNITS ENGLISH	PURPOSE INJECTING TEMP GRADIENT

SURVEY DATA

CO. CHEVRON GEOTHERMAL				RUN 01 FIELD ROOSEVELT HOT S WELL 14-2			
TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
1:00	0	306.8	0.000	1:00	3200	354.3	.002
1:00	700	349.8	.061	1:00	3900	354.9	.001
1:00	1700	352.9	.003	1:00	4600	355.7	.001
1:00	2500	352.9	0.000	1:00	5400	356.0	.000

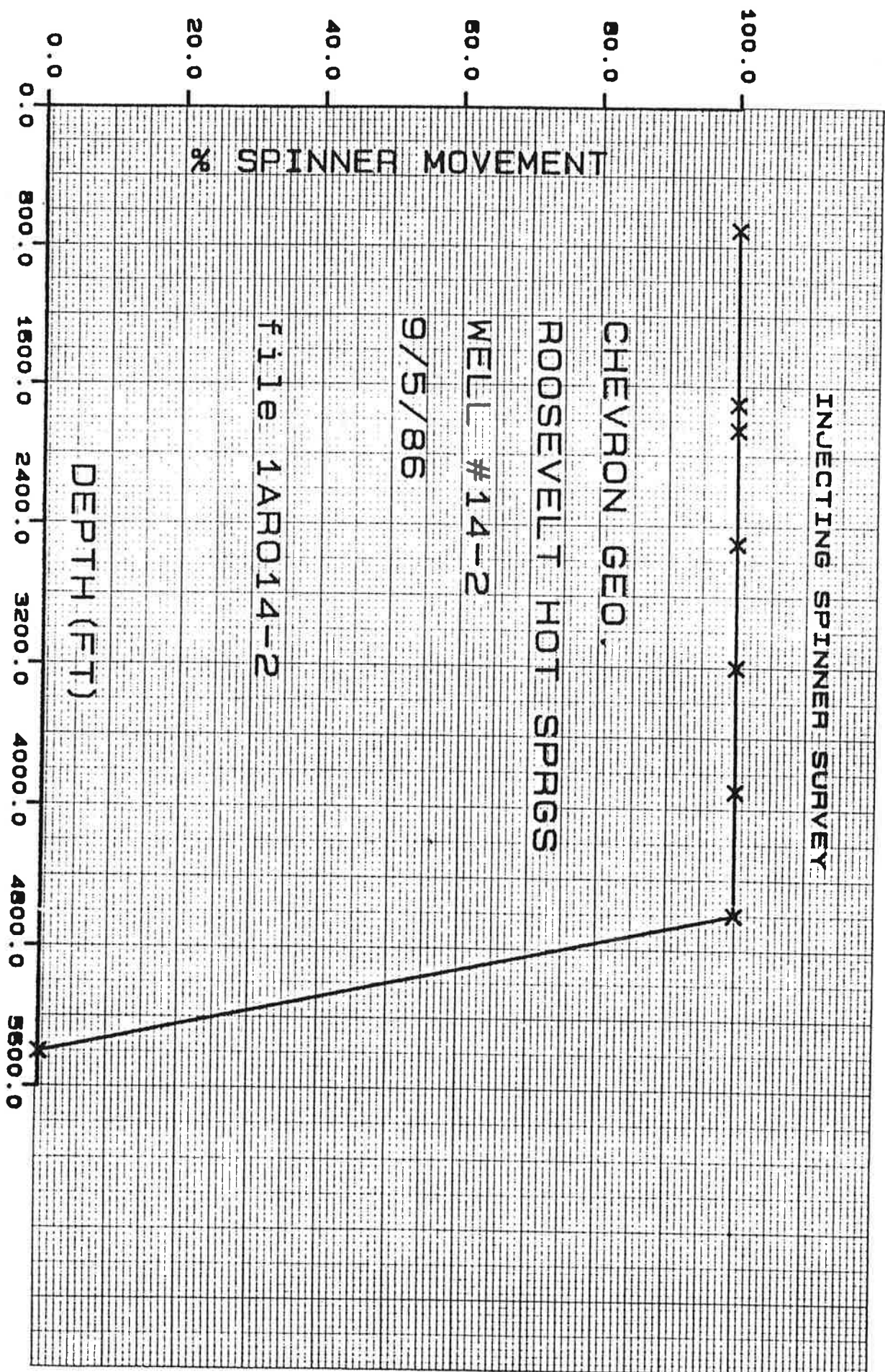
INJECTION RATE 750,000 LBS / HR

BY S WILSON / T DRIVER



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PAGE 1

SUB-SURFACE TEMPERATURE SURVEY

CO. CHEVRON GEOTHERMAL		RUN 1A FIELD ROOSEVELT HOT S WELL 14-2
EFF DEPTH 6000'		WELL STAT INJECTING
CASING 9 5/8 TO -1805'		TOOL HUNG
LINER -		ON BOTTOM 4:53
DATE 090586		OFF BOTTOM 4:58
ELEVATION		ZERO POINT 21'
MAX TEMP		SHUT-IN
PERF -		ON-PROD
TUBING -		MPP
UNITS ENGLISH		
PURPOSE		INJECTING SPINNER SURVEY

SURVEY DATA

CO. CHEVRON GEOTHERMAL		RUN 1A FIELD ROOSEVELT HOT S WELL 14-2
TIME DEPTH P/T GRAD		TIME DEPTH P/T GRAD
1:00 700 100.0 0.000		1:00 3200 100.0 0.000
1:00 1700 100.0 0.000		1:00 3900 100.0 0.000
1:00 1850 100.0 0.000		1:00 4600 100.0 0.000
1:00 2500 100.0 0.000		1:00 5400 0.0 -.125

INJECTION RATE 750,000 LBS / HR

BY S WILSON / T DRIVER



OIL FIELD RENTAL SERVICE CO.

1985
Survey

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INTRODUCTION

Spinner surveys were run in injection wells 12-35, 82-33, and 14-2 by Pruett Wireline during the week of March 5 through 8, 1985. The following is a summary of the techniques used and the results of the surveys.

Pruett's spinner tool measures the velocity of fluids, so both flow rate and hole size must be considered when designing a program. It is very important that a caliper log be available and used to interpret the results of the survey. As an example of the importance, well 14-2 caliper log shows several areas where the hole is one to five inches out of gauge. The apparent percent of flow is the parameter given by Pruett on the spinner survey. In the case of well 14-2, it was assumed that the 8 1/2" hole gives 100% flow, so lesser flow will be seen in larger or out of gauge portions of the well. Table 1 shows the apparent percent of flow and velocity in various sizes of hole, assuming a constant injection rate of 500,000 lb/hr. It is important to have a constant injection rate during the spinner survey and the pressure chart at the wellhead should be monitored during the survey to insure this. There are no working flow meters on the Roosevelt injection system, so injection rates can only be estimated.

It can be seen that in well 14-2, where the hole is five inches out of gauge, the apparent percent of flow is only 39 percent. It would be impossible to interpret the spinner survey without taking hole size from the caliper survey into account.

What caliper
are you referring
to?? 1976 or 1977?
WILL RUN BETTER
CAL IN 1989.

11
00
IS CALIPER
RIGHT? GRANITE - OTHER CM'S
DON'T SHOW 5" OUT?

TABLE 1

<u>Hole Size</u> <u>(inches)</u>	<u>Amount Out of</u> <u>Gauge (inches)</u>	<u>Flow Velocity</u> <u>(ft/sec.)</u>	<u>Apparent %</u> <u>of Flow*</u>
8 1/2	0	5.6	100
9	1/2	5.0	89
9 1/2	1	4.5	80
10	1 1/2	4.1	73
10 1/2	2	3.7	66
11	2 1/2	3.4	61
11 1/2	3	3.1	55
12	3 1/2	2.8	50
12 1/2	4	2.6	46
13	4 1/2	2.4	43
13 1/2	5	2.2	39
8.835 (9 5/8" casing)	1 1/8	5.1	91

*Based upon hole size

A second consideration is trying to adjust flow rate, hole size, and the spinner tool. The spinner tool has three settings which are one tick mark for either 100, 200, or 400 revolutions of the propeller. In the case of well 12-35, which has an open hole size of 8 1/2" and a 7" liner, we used a flow rate of approximately 500,000 lb/hr and a setting of one tick mark per 400 revolutions. We had a successful survey but a better survey would have been obtained with one tick mark per 200 revolutions. The best survey was well 14-2 where we flowed approximately one million lb/hr with a setting of one tick mark per 400 revolutions. The open hole part of the well is supposed to be 8 1/2" but much of the hole was out of gauge up to five inches or more.

A third consideration is how accurate a survey is desired. In the case of the Pruett survey, five minute stops were made at selected depths and the tick marks are counted at each five minute stop. This survey only gives apparent flow rate at each stop and does not give the precise depth where fluids are entering the formation. The apparent fluid loss intervals would have to be bracketed with more five minute stops until the loss zones are found. The

Pruett tool is not sensitive enough to be capable of giving this information while traversing. The Dresser Atlas spinner survey costs about ten times as much as the Pruett survey but results can be monitored at the surface during the survey and loss zones can be substantiated.

The Pruett spinner survey is run in conjunction with a temperature survey. The temperature survey is nearly isothermal while traversing down, until the lowest zone where fluid is being lost is encountered.

The following are interpretations of the spinner surveys. The temperature surveys and spinner surveys are attached for reference.

END. TEMPS

SPINNER SURVEY - WELL 14-2

The data obtained when running the spinner survey on well 14-2 are presented below.

TABLE 2

Well 14-2

<u>Hole Size¹</u>	<u>Depth of Five Min. Stop</u>	<u>Tick Marks in Five Min. Stop</u>	<u>% Flow Based on Tick Marks</u>	<u>Theoretical % Flow Based on Hole Size²</u>	<u>% Loss of Fluid Between Stops</u>
9 5/8" csg.	700'	14	100	100	
9 5/8" cs.	1,700	15	100	100	0
12 1/2" hole	1,850	8	53	55	0
11" hole	2,500	9	64	67	0
10" hole	3,200	8	53	80	27
9 1/2" hole	3,900	8 1/2	61	88	0
8 1/2" hole	4,600	8	53	100	20
8 1/2" hole	5,400	1	7	100	49
					4

- 1 Hole size measured on the caliper log.
- 2 Theoretical flow % based on hole size is to show the effect of oversize hole. An oversize hole would decrease velocity and give the appearance of a lesser flow rate (lower velocity) even though no fluids were lost to the formation.

The calculations assume that 100 percent flow is achieved in the 9 5/8" casing. At 1,850 feet, the hole is 3 1/2" out of gauge, which would give an apparent flow of 55 percent. The actual flow was calculated by dividing the 14 tick marks in the 9 5/8" casing into 8 marks measured at 1,850 feet. Since the figures for the two calculations are very close, i.e., 53 percent compared to a caliper of 55 percent, it was assumed that no loss was experienced between the bottom of the casing at 1,805 feet and this stop at 1,850 feet. The stop at 2,500 feet also showed no loss. However, at 3,200 feet, the hole was only out of gauge 1 1/2", which is equivalent to 80 percent flow, and the spinner survey showed 53 percent. It would appear that 24 percent of the fluids are lost between 2,500 and 3,200 feet. Another 20 percent of flow is lost between 3,900 and 4,600 feet. Forty-nine percent of the flow is lost between 4,600 and 5,400 feet. Four percent of the flow is lost below 5,400 feet. An obstruction was hit at 5,466 feet and no measurements could be made below that point. The temperature survey showed only one deflection, which was at 3,900 feet. This agrees with the spinner survey which shows 49 percent fluid loss there.

A potential error exists at the 2,500 foot stop because the wellhead pressure dropped from 135 psi to 120 psi during this stop. This is an eleven percent decrease in pressure, but it did not appear to affect the survey because there was no fluid loss indicated between 1,805 and 2,500 feet.

RHSU # 14-2

17 1/2" HOLE
20" CSG. AT 79'

17 1/2" HOLE
13 3/8" CSG. AT 645'

WELL KICKED AT 1625'

12 1/4" HOLE
9 5/8" CSG. AT 1805'

WELL FLOWED WHILE
LOGGING AT 5800'

TD 6100'

LOGS RUN-SCHLUMBERGER

9/19/76-10/15/76- SONIC,
NEUTRON, DENSITY, TEMP,
INDUCTION.

AGNEW & SWEET TEMP.

11/18/76, 10/16/76, 11/13/76

AGNEW & SWEET PRESSURE

11/18/76 2 RUNS

PRUITT PRESSURE & TEMP.

8/22/81

DIALOG CALIPER

8/29/82

KB ELEVATION 6261'

GL ELEVATION 6240'

SPUD DATE 9/11/76

FINISH DATE 10/14/76

BHT-514.3° F. AT 6087'

WHP 125 PSI

FLOW RATE-MAX. 495,000 #/HR.

HISTORY

11/16/76-11/18/76- 48 HOUR
FLOW TEST, 495,000 #/HR. AT
70 PSI - 17.8 % FLASH.

REMARKS: WELL BUILDS GAS
CAP WHEN SHUT IN. PRESSURE
WILL BUILD UP TO 700 # ±

27%	2500'
Fluid loss	
	3200'
20%	3900'
Fluid loss	
	4600'
49%	
Fluid loss	
	5400'
40%	
Fluid loss	

PRUETT INDUSTRIES, INC.
8915 ROSEDALE HWY. BAKERSFIELD, CA. 93308
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S P I N N E R S U R V E Y

COMPANY: PHILLIPS

FIELD: ROOSEVELT HOT SPRINGS

WELL: 14-2

DATE: 3/7/85

DEPTH	OUT OF GAUGE	% FLOW	SPINNER MOVMENT
700	4"	46	10
1700	3"	55	8
1850	5"	39	17
2500	1 1/2"	73	15
3200	1 1/2"	73	18
3900	1"	80	16
4600	0	100	17
5400	0	100	---

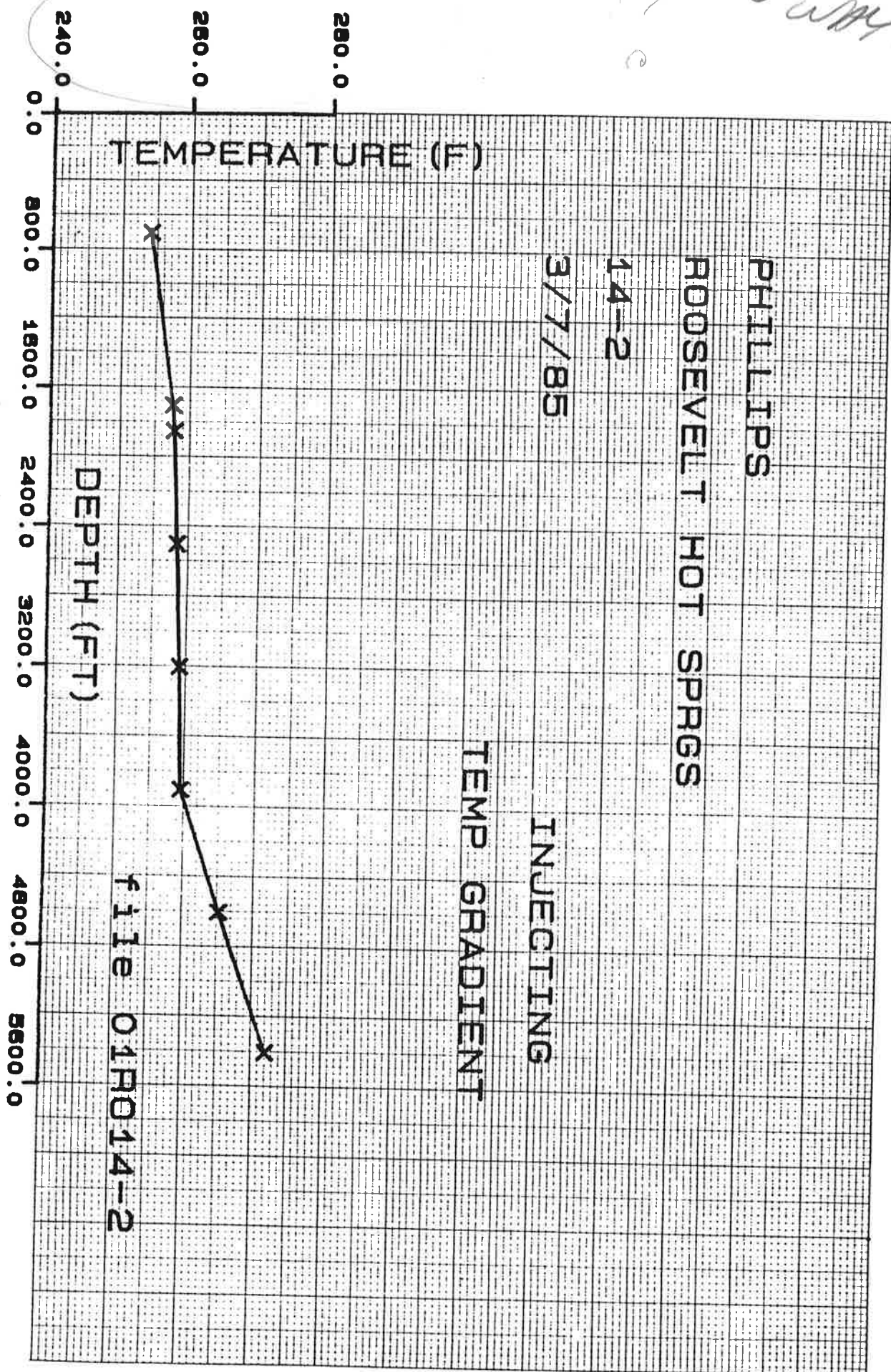
Run By S. Wilson

Injection Rate 1,000,000 lbs / hr.



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SUB-SURFACE TEMPERATURE SURVEY

CO. PHILLIPS		RUN 01 FIELD ROOSEVELT HOT S WELL 14-2
EFF DEPTH 6000'		WELL STAT INJECTING
CASING 9 5/8" TO	-1805'	TOOL HUNG
LINER	-	ON BOTTOM 10:47
DATE 030785		OFF BOTTOM 10:52
ELEVATION		ZERO POINT 21'
MAX TEMP		SHUT-IN
PERF	-	ON-PROD
TUBING	-	MPP
UNITS ENGLISH		
	PURPOSE	INJECTING TEMPERATURE GRADIENT

SURVEY DATA

CO. PHILLIPS			RUN 01 FIELD ROOSEVELT HOT S WELL 14-2				
TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
1:00	700	254.2	0.000	1:00	3200	259.1	.001
1:00	1700	257.7	.003	1:00	3900	259.5	.001
1:00	1850	257.9	.001	1:00	4600	265.3	.008
1:00	2500	258.5	.001	1:00	5400	272.0	.008

INJECTION RATE 1.000,000 LBS / HR
BY S WILSON / T DRIVER

MAYBE

354 - 372 ° F