Draft B Date 10/28/82 ILF Doc ID 3930p Disk No 0713p Job No 27224 imm

RAFT RIVER 5MW PLANT TEST PRODUCTION WELLS REPORT

June 1982

Draft B Date 10/28/82 ILF Doc ID 3930p Disk No 0713p Job No 27224 imm

RAFT RIVER 5MW PLANT TEST, PRODUCTION WELLS REPORT

1. INTRODUCTION

The production wells RRGE-1, 2 and 3 were pumped extensively during the 5MW production experiments conducted between March 25 and June 15, 1982. Pumping schedule and discharge rates were dictated by the 5MW plant production experiments need. Thus, pumping rates varied widely and were controlled only by the schedule of the 5MW production experiments. Simultaneous pumping at maximum capacity at the three geothermal wells was required to supply geothermal fluid for the full scale power production tests. For different power plant experiments, geothermal fluid discharge was changed frequently. Additionally, several interruptions in pumping occurred due to the turbine problems. Generally, geothermal fluid supply systems worked without major problems and all transite line ruptures were the result of problems at the 5MW plant. Frequent changes and interruptions in the production pumping had a major impact on the quality of drawdown data. Additionally, the quality of drawdown measurements was relatively poor for wells RRGE-1 and 2. Drawdown data for well RRGE-3 were not collected.

In this report, the pumping activities, data collection procedure and general well response to pumping are discussed. The evaluation of the reservoir parameters is limited because of data restraints.

2. SUMMARY OF THE RESULTS

The long range production drawdown data from wells RRGE-1 and 2 indicate long term production capacities of these wells at over a 1000 gpm and about a 700 gpm range, respectively. The well RRGE-3 demonstrated declining production rates during the last long term pumping. This is not conclusive since drawdown data are not available from this well. However, the decline in production suggests limited well capacity within approximately a 500 gpm limit for the long term production. The transmissivity value for RRGE-1 is estimated at approximately 2200 gpd/ft and for RRGE-2 at 1500 gpd/ft. The interference effect between wells was not evaluated; however, it seems not to be significant.

3. WELL FIELD PUMPING ACTIVITY

The power production experiments were a main objective of testing during March-June tests. Production well pumping was directed to meet the power plant needs for geothermal heat. Thus, pumping duration and rates were adjusted to serve 5MW power plant production experiments. Three production wells RRGE-1, 2 and 3 were pumped during these tests. Pumping activities for RRGE-1, 2 and 3 wells are listed in Tables 1, 2 and 3. The total volume of geothermal fluid pumped from the wells RRGE-1, 2 and 3 was 77.90×10^6, 46.70×10^6 and 38.25×10^6 gallons, respectively. It was the most extensive production pumping ever conducted at the Raft River geothermal field. The average pumping rate for the 82 day period of testing was 1380 gpm. Long interruptions in pumping were between 04/01 and 04/11, 04/23 and 04/27, 04/30 and 05/02, 05/05 and 05/07 and at the end of May. These long-duration interruptions were the result of problems with turbines, transite pipe ruptures and power dips. The total time down for pumping at wells RRGE-1, 2 and 3 was 495, 698 and 798 hours, respectively.

4. RRGE-1 PUMPING DATA SUMMARY AND EVALUATION

4.1 RRGE-1 Pumping Activity, Data Collection and Limitations

The RRGE-1 was the most extensively pumped well during the 5MW plant experiments. The pumping rates ranged from 800 gpm to 1035 gpm. The average pumping rate for 82 days of pumping, including time down, was 672 gpm. Produced fluid temperatures as indicated by a platinum RTD thermometer were of 277.4° to 277.8°F (136.5°C); as measured with mercury thermometer, fluids were 137.5°C (279.5°F). Pumping activities including discharge rates, rates changes, time down and pumping duration are listed in Table 1. The well RRGE-1 was fully instrumented and complete pumping data were collected during testing.

Flow rate was controlled by the automatic valve, measured with inline orifice and continously recorded on a strip chart. Flow control and measurements were of good quality and produced reliable data.

Temperature was measured with a platimum RTD temperature sensor and continuously recorded on a strip chart; a mercury thermometer was an additional temperature measuring device. Temperature readings at one to two hour intervals were collected from the mercury thermometer. The platinum RTD thermometer readings demonstrated dependence on amperage used by the pump. The readings for lower pumping rates (800 gpm) were approximately 277.8°F. For higher pumping rates (900 gpm), readings were about 277.4°F. The mercury thermometer indicated temperatures of approximately 279.5°F. These readings were subject to human error during individual recording.

The drawdown data were obtained from a bubbler-type set-up equipped with a digiquartz pressure transducer, computer and printer. A secondary instrument used for the bubbler pressure readings was a Heise gauge. The

data recorded from the bubbler tube were effected by a slight leak within the tube and irregular purging procedure. Thus, the quality of bubbler data is marginal, especially for the recovery part.

4.2 RRGE-1 Evaluation of the Time Drawdown Data

The bubbler pressure data from selected pumpings were plotted on a semilogarithmic paper (plots 1 through 4). Data from the pumping test starting on March 25 are plotted on plot 1. Between 10 minutes and 26 minutes of the test, the flow rate was decreasing.

Flow rate was increased to 900 gpm and it remained relatively constant until the 975 minute of the pumping test. Short duration decreases in flow rates occurred after 200 minutes and 650 minutes. These decreases are illustrated by a sudden pressure rise on a semilogarithmic plot. Fluid temperature reached 275°F after 3 minutes of pumping and stabilized at the 277.4°F level after 40 minutes. The plot demonstrates a relatively uniform straight line trend for data between 30 and 975 minutes of the test. Calculated transmissivity-T and permeability thickness-kh values are 2105 gpd/ft and 22,055 md/ft respectively.

Pumping test data from the test started on May 7 are presented on plot 2. The flow rate at the 785 gpm level stabilized immediately after the pump started. Flow rates remained constant for the next 23 hours. The data plot follows a straight line trend for the first 12 minutes. Then, for 23 minutes, the plot gradually changes to a more gentle slope. The second straight line trend is observed between 35 minutes and 1130 minutes of pumping. The two distinctive slopes for the early time (12 minutes) and the late time indicate a recharge boundary, or an effect of skin factor and temperature change. The temperature increase was minor, only 2.8°F from 275°F to 277.8°F. The temperature stabilized after 35 minutes of pumping. The early time straight line trend indicates an apparent T of 746 gpd/ft and kh of 7,815 md-ft. The late time slope indicates an apparent T of 2228 gpd/ft and 23,340 md-ft.

Time drawdown data from the test started on May 10 are presented on Plot 3. This test started after a 16 hour recovery period. The recovery time was not sufficient to allow for full well recovery. The data plot demonstrates two distinctive straight line trends. The early time (6 to 18 minutes) straight line indicates an apparent transmissivity T of 760 gpd/ft and permeability thickness (kh) of 7,964 md-ft. The late time data indicate T at 2,183 gpd/ft and kh of 22,872 md-ft. The readings from 180 minutes to 467 minutes are scattered due to the irregular purging procedure. The irregular purging effected data, especially for the less frequent printing frequency.

Data from the test standard on June 2 are plotted on Plot 4. Only 400 minutes of the data were used. Changes in pumping rates and irregular purging procedures eliminate later time data. Again, the plot represents two straight line trends. The early time straight line (3 to 15 min) indicates lower T and kh values than at 835 gpd/ft and 8,745 md-ft, respectively. The straight line for data between 30 and 350 minutes indicates T and kh values at 2,004 gpd/ft and 20,988 md-ft, respectively. All transmissivity T and permeability thickness values for RRGE 1 are presented in Table 4.

4.3 RRGE-1 Summary of the Results Obtained From Drawdown Data Evaluation

Four separate pumpings at RRGE-1 were used to evaluate T and kh values. The early time data (up to 16 minutes) indicate T values within 750-800 gpd/ft range and kh values at 8,000 md-ft range. These T and kh values are effected by the skin factor and temperature changes. Recorded temperature changes were within the 5°F range (relatively insignificant). The late time data (from 30 minutes to over 1000 minutes) indicate T values at 2,000 to 2,100 gpd/ft and kh values of 21,000 to 23,000 md-ft. The higher apparent transmissivity values for the late time data are the result of the reacharge boundary (high conductivity fractures zone) intercepted after 12 to 18 minutes of pumping. The recovery data were not evaluated

because of the poor quality of the bubbler pressure readings. The frequent changes in pumping rates would further complicate interpretation of the recovery data.

The static bubbler pressure level is difficult to define because the well shut-in conditions are poorly documented. The shut-in wellhead temperature is not recorded. The artesian flow during the warm-up between pumpings was not recorded. During the recovery, the irregular purging of the bubbler tube is effecting pressure reading more significantly than during the pumping drawdown measurements. The nitrogen leak from the bubbler tube resulted in the pressure decline instead of the build-up during the recovery periods.

5. RREG-2 PUMPING DATA SUMMARY AND ~~ELEVATION~~ EVALUATION

5.1 RRGE-2 Pumping Activity, Data Collection and Limitation

The well RRGE-2 was extensively pumped during the 5MW plant experiments between March 25 and June 15. Pumping rates from RRGE-2 ranged between 560 and 800 gpm. The predominantly used discharge rate was 600 gpm. An average rate for 82 days of pumping, including time down, was 400 gpm. Fluid temperature measured with a resistance thermometer device (RTD) was 280°F; it was X°C with a mercury thermometer. Pumping activities at RRGE-2 including discharge rates, time down and pumping duration are listed in Table 2.

Flow control and measurements at RRGE-2 were similar to those used in RRGE-1. Temperature and drawdown measurements were collected using instrumentation as described for RRGE-1.

The bubbler readings are of more inferior quality than the data collected from RRGE-1. Two factors contributed to the poor quality of bubbler data; the irregular purging of the tube and the gas leak demonstrated by the relatively fast drop in bubbler pressure. Thus, the bubbler pressure readings are dependent on the time of the last purging. Because of this problem with the bubbler, pressure drawdown data have limited value and reliability. Additionally, most of the early time data are missing. The bubbler pressure recorder and printer were removed on June 11, 1982 before the testing ended.

5.2 RRGE 2 Evaluation of the Time Drawdown Data

The data from pumping started on May 7 are plotted on semilogarithmic graph paper Plot 5. The plot for the early time (3 to 20 minutes) forms a relatively straight line. Transmissivity calculated for this straight line is of 1680 gpd/ft and permeability thickness is of 17,600 md-ft. After 20 minutes, the plot is irregular; apparently data were effected by the

6. RRGE-3 PUMPING DATA SUMMARY AND EVALUATION

6.1 RRGE-3 Pumping Activity, Data Collection and Limitation

The well RRGE-3 was pumped less extensively than wells RRGE-1 and -2. The pumping rates ranged between 400 and 700 gpm. The average rates for 82 days of testing were 327 gpm.

The RRGE-3 is the hottest well of the Raft River well field. The temperature measured with RTD and recorded on a strip chart was of 289.5°F to 292.5°F (143°C to 144.7°C). Temperature measured with a mercury thermometer was of ___°C. Pumping activities at well RRGE-3 are presented in Table 3.

Flow control and instrumentation at RRGE-3 were similar to that used at wells RRGE-1 and -2. The bubbler tube was not functional and the drawdown data were not collected from RRGE-3. Because of that, the well and reservoir parameters may not be evaluated for this well. The only indication of the well capacity limitation was a decline in pumping rates at the end of longest duration pumping conducted between June 2 and 15. The decrease in the discharge rates from 590 gpm to 520 gpm was observed from June 6 until the end of pumping on June 15. This indicates the excessive drawdown at RRGE-3, suggesting the well maximum capacity was below 500 gpm for the long duration pumping.

7. RRGP-5 RESPONSE TO THE PUMPING

The RRGP-5 does respond to pumping conducted at the Raft River well field. The wellhead pressure data were recorded from RRGP well 5. The recorder was installed on April 16. Thus, data for the first three weeks of pumping are missing. Additionally, the well was used on an as needed basis for the warmup flow. No record of the flow and the well temperature was kept. The wellhead pressure was recorded at a one hour interval and recording time was not synchronized with a time of a day. The poor quality of collected data plus irregular pumping schedule make it impossible to evaluate reservoir parameters and closely correlate RRGP-5 response to pumping. The data from recovery after the end of pumping at RRGE-1 on June 15 are presented on Plot 7. In five hours, wellhead pressure recovered from 85.5 psia to 116 psia. For the next 45 hours, pressure was decreasing to 105 psia level. The wellhead pressure increase was observed between the 50 and 180 hours after pumping at RRGE-1 was stopped.

The response as described above may only be explained by limited artesian flow and a well shutin condition which resulted in the well heating and cooling. The well artesian flow and temperature data are not available. It is apparent that RRGE-5 does respond to the pumping at RRGE-1, but quantitative analysis is impossible.

8. MONITORING WELL RESPONSE TO THE PUMPING

No response to the production pumping was detected in the monitor wells. The monitor wells did respond to the injection pumping (see report).

9. SUMMARY AND CONCLUSIONS

The production and injection pumping conducted between March 25 and June 15, 1982 was the most extensive pumping ever conducted at the Raft River geothermal well field.

The collected data helped in evaluation of long term production rates and temperatures for the wells RRGE-1, -2 and -3. It appears that long term production rates for the pump setting at the depth of 1000 feet are 1000, 700 and 500 gpm for the RRGE well 1, 2 and 3, respectively.

The geothermal fluid temperatures produced at RRGE-1, -2 and -3 are 277.5, 280.0°F and 290.0°F, respectively. Drawdown interference at RRGP-5 is quite significant but more detailed evaluation is impossible due to the limited data. The drawdown interference between production wells was not determined because of the poor quality and complexity of the drawdown data. The well field operation to supply geothermal fluid 5MW experiments was a success. No problems with pumps and injection lines were encountered. The transite pipe ruptures were results of the turbine problems and faulty value at 5MW plant.

Draft B Date 10/28/82 ILF Doc ID 3931p Disk No 0713p Job No 27224 imm

TABLE 1. RRGE WELL 1 PUMPING ACTIVITY

Date	Time			Duration		Flow Rate		Remarks
	Pump On	Rate Change	Pump Off	Pumping (hrs)	Down (hrs)	gpm	lps	
03/25	15:45	--	--	--	--	--	--	
03/26	--	--	17:57	26.0	--	900	56.7	
03/27	01:43	--	--	--	7.75	--	--	
03/27	--	22:00	--	20.25	--	900	56.7	
03/28	--	--	17:30	19.5	--	885	55.8	
03/28	18:03	--	--	--	0.5	--	--	
03/29	--	--	08:04	14.0	--	885	55.8	
03/29	8:25	--	--	--	0.35	--	--	
03/29	--	22:00	--	13.40	--	885	55.8	
03/30	--	22:00	--	24.0	--	1005	63.4	
03/31	--	--	11:33	13.5	--	900	56.7	
03/31	15:29	--	--	--	4.0	--	--	
03/31	--	--	16:25	1.0	--	800	50.4	
03/31	18:43	--	--	--	2.3	--	--	
04/01	--	--	10:00	15.3	--	900	56.7	
04/11	06:03	--	--	--	236.0	--	--	
04/13	--	23:30	--	65.5	--	900	56.7	
04/14	--	12:00	--	12.5	--	950	59.9	
04/14	--	19:00	--	7.0	--	1030	65.0	
04/15	--	20:00	--	23.0	--	1005	63.4	
04/19	--	14:00	--	90.0	--	940	59.3	
04/20	--	06:00	--	16.0	--	955	60.2	
04/21	--	03:00	--	21.0	--	915	57.7	
04/21	--	12:00	--	9.0	--	950	59.9	
04/21	--	14:00	--	2.0	--	850	53.6	
04/21	--	23:00	--	9.0	--	1035	65.2	
04/22	--	21:00	--	22.0	--	1025	64.6	
04/23	--	--	21:39	24.6	--	875av	55.2	
04/27	05:40	--	--	--	80.0	--	--	
04/29	--	20:00	--	62.0	--	800	50.4	
04/30	--	--	12:57	17.0	--	900	56.7	
05/02	03:06	--	--	--	38.0	--	--	
05/02	--	09:00	--	6.0	--	800	50.4	
05/03	--	15:00	--	30.0	--	850	53.6	
05/05	--	--	01:35	35.0	--	800	50.4	
05/07	01:13	--	--	--	48.0	--	--	
05/07	--	23:00	--	22.0	--	785	49.5	
05/09	--	01:00	--	26.0	--	975	61.5	
05/09	--	16:00	--	15.0	--	1025	64.6	
05/10	--	--	07:32	15.5	--	1010	63.7	
05/10	23:13	--	--	--	16.0	--	--	
05/11	--	07:45	--	8.5	--	800	50.4	
05/11	--	13:00	--	5.0	--	1025	64.6	

TABLE 1. (continued)

Date	Time: Pump On	Time: Rate Change	Time: Pump Off	Duration: Pumping (hrs)	Duration: Down (hrs)	Flow Rate: gpm	Flow Rate: lps	Remarks
05/11	--	19:00	--	6.0	--	1015	64.0	
05/11	--	22:00	--	3.0	--	810	51.1	
05/12	--	11:00	--	13.0	--	955	60.2	
05/12	--	19:00	--	8.0	--	900	56.7	
05/12	--	23:00	--	4.0	--	850	53.6	
05/13	--	03:00	--	4.0	--	800	50.4	
05/13	--	13:00	--	10.0	--	1005	63.4	
05/13	--	15:00	--	2.0	--	900	56.7	
05/15	--	08:00	--	41.0	--	805	50.8	
05/17	--	20:00	--	60.0	--	810	51.1	
05/19	--	--	07:33	34.5	--	1000	63.0	
05/19	08:22	--	--	--	1.0	--	--	
05/20	--	17:20	--	33.0	--	1000	63.0	
05/22	--	05:30	--	36.0	--	800	50.4	
05/22	--	23:00	--	17.5	--	1015	64.0	
05/24	--	04:00	--	29.0	--	950	59.9	
05/24	--	09:00	--	5.0	--	800	50.4	
05/25	--	06:00	--	21.0	--	900	56.7	
05/25	--	18:00	--	12.0	--	800	50.4	
05/28	--	--	04:02	58.0	--	900	56.7	
05/29	17:12	--	--	--	37.0	--	--	
06/01	--	00:00	--	31.0	--	1000	63.0	
06/01	--	--	15:58	16.0	--	990	62.4	
06/02	15:27	--	--	--	23.5	--	--	
06/03	--	02:00	--	10.5	--	800	50.4	
06/03	--	04:00	--	2.0	--	885	--	
06/04	--	07:00	--	27.0	--	1000	63.0	
06/04	--	10:00	--	3.0	--	800	50.4	
06/15	--	--	04.57	259.0	--	890	56.1	

Draft B Date 10/28/82 ILF Doc ID 3931p Disk No 0713p Job No 27224 imm

TABLE 2. RRGE WELL 2 PUMPING ACTIVITY

Date	Time			Duration		Flow Rate		Remarks
	Pump On	Rate Change	Pump Off	Pumping (hrs)	Down (hrs)	gpm	lps	
03/25	17:54	--	--	--	--	--	--	
03/26	--	--	16:15	22.0	--	600	37.8	
03/27	2:12	--	--	--	10.0	--	--	
03/28	--	--	19:22	4.0	--	600	37.8	
03/29	15:11	--	--	--	20.0	--	--	
03/29	--	21:00	--	6.0	--	600	37.8	
03/30	--	21:00	--	24.0	--	625	39.4	
03/31	--	--	11:33	14.5	--	600	37.8	
03/31	19:00	--	--	--	7.5	--	--	
04/01	--	5:00	--	10.0	--	610	38.5	
04/01	--	10:00	--	5.0	--	600	37.8	
04/01	--	--	13:40	3.6	--	700	44.1	
04/12	23.50	--	--	--	274.0	--	--	
04/13	--	--	09:15	9.5	--	600	37.8	
04/13	13:41	--	--	--	4.5	--	--	
04/13	--	19:00	--	5.5	--	585	36.9	
04/14	--	--	11:36	16.5	--	610	38.5	
04/15	14:05	--	--	--	26.5	--	--	
04/16	--	08:00	--	18.0	--	600	37.8	
04/16	--	19:00	--	11.0	--	610	38.5	
04/17	--	05:00	--	10.0	--	605	38.1	
04/23	--	--	21:10	160.0	--	600	37.8	
04/27	07:17	--	--	--	82.0	--	--	
04/28	--	00:49	--	17.5	--	600	37.8	
04/30	--	--	12:57	60.0	--	560	35.3	
05/02	07:59	--	--	--	43.0	--	--	
05/03	--	00:26	--	16.5	--	620	39.1	
05/04	--	11:00	--	34.5	--	610	38.5	
05/05	--	--	03:05	16.0	--	595	37.5	
05/07	02:08	--	--	--	47.0	--	--	
05/08	--	03:00	--	25.0	--	600	37.8	
05/09	--	05:30	--	26.5	--	660	41.6	
05/09	--	17:49	--	12.5	--	685	43.2	
05/10	--	04:00	--	10.0	--	740	46.7	
05/10	--	--	07:32	3.5	--	800	50.5	
05/11	00:32	--	--	--	17.0	--	--	
05/13	--	03:10	--	50.5	--	600	37.8	
05/13	--	09:00	--	6.0	--	655	41.3	
05/13	--	13:00	--	4.0	--	630	39.7	
05/13	--	--	17:21	4.5	--	595	37.5	
05/17	23:15	--	--	--	102.0	--	--	
05/18	--	02:06	--	3.0	--	600	37.8	

Draft B Date 10/28/82 ILF Doc ID 3931p Disk No 0713p Job No 27224 imm

TABLE 2. (continued)

Date	Time Pump On	Time Rate Change	Time Pump Off	Duration Pumping (hrs)	Duration Down (hrs)	Flow Rate gpm	Flow Rate lps	Remarks
05/20	--	17:00	--	63.0	--	700	44.1	
05/22	--	07:00	--	38.0	--	600	37.8	
05/24	--	08:00	--	49.0	--	635	40.0	
05/24	--	11:00	--	3.0	--	600	37.8	
05/25	--	20:00	--	9.0	--	615	38.8	
05/25	--	02:00	--	6.0	--	610	38.5	
05/28	--	16:00	--	14.0	--	605	38.1	
05/30	05:28	--	04:02	60.0	--	660	41.6	
05/31	--	--	--	--	49.5	--	--	
05/31	--	05:00	--	23.5	--	610	38.5	
06/01	--	15:00	--	10.0	--	585	36.9	
06/02	16:26	--	15:58	25.0	--	770	48.6	
06/03	--	--	--	--	24.5	--	--	
06/03	--	01:50	--	9.5	--	600	37.8	
06/04	--	05:47	--	4.0	--	615	38.8	
06/04	--	08:00	--	26.0	--	700	44.1	
06/04	--	10:00	--	2.0	--	585	36.9	
06/04	--	13:00	--	3.0	--	690	43.5	
06/07	--	15:45	--	2.75	--	630	39.7	
06/14	--	01:25	--	57.5	--	620	39.1	
06/14	--	05:30	--	172.0	--	625	39.4	
06/15	--	13:00	--	7.5	--	615	38.8	
		--	04:17	15.0	--	645	40.7	

Draft B Date 10/28/82 ILF Doc ID 3931p Disk No 0713p Job No 27224 imm

TABLE 3. RRGE WELL 3 PUMPING ACTIVITY

Date	Time			Duration		Flow Rate		Remarks
	Pump On	Rate Change	Pump Off	Pumping (hrs)	Down (hrs)	gpm	lps	
03/25	18:46	--	--	--	--	--	--	
03/25	--	23:27	--	4.75	--	400	25.2	
03/26	--	05:00	--	5.5	--	550	34.6	290°F
03/26	--	--	18:15	13.25	--	600	37.8	
03/27	02:40	--	--	--	8.4	--	--	
03/27	--	06:00	--	3.33	--	600	37.8	
03/27	--	21:00	--	15.0	--	610av	38.4	
03/28	--	--	20:28	23.5	--	500	31.5	289.2°F
03/29	02:30	--	--	--	6.0	--	--	
03/29	--	03:00	--	0.5	--	500	31.5	
03/29	--	--	08:04	5.0	--	610	38.4	
03/29	10:35	--	--	--	2.5	--	--	
03/30	--	02:00	--	15.4	--	500	31.5	289.5°F
03/30	--	16:25	--	14.4	--	600	37.8	-290°F
03/30	--	17:20	--	1.0	--	670	42.3	
03/31	--	--	16:26	23.0	--	605	38.1	
03/31	17:06	--	--	--	0.66	--	--	
03/31	--	19:16	--	2.16	--	610	38.4	
04/01	--	05:00	--	9.73	--	600	37.8	
04/01	--	08:00	--	3.0	--	500	31.5	
04/02	--	--	08:53	24.9	--	600	37.8	
04/13	04:58	--	--	--	260.0	--	--	
04/13	--	07:00	--	2.0	--	600	37.8	
04/13	--	10:00	--	3.0	--	540	34.0	
04/14	--	11:00	--	25.0	--	600	37.8	
04/15	--	14:00	--	27.0	--	700	44.1	
04/16	--	15:00	--	25.0	--	600	37.8	
04/21	--	12:00	--	117.0	--	630	39.7	
04/21	--	15:00	--	3.0	--	530	33.4	
04/21	--	20:00	--	5.0	--	640	40.4	
04/22	--	21:00	--	25.0	--	630	39.7	
04/23	--	04:00	--	7.0	--	600	37.8	
04/23	--	16:00	--	12.0	--	630	39.7	
04/23	--	--	21:16	5.25	--	470	29.6	
04/27	06:03	--	--	--	81.0	--	--	
04/27	--	24:00	--	18.0	--	600	37.8	
04/28	--	21:00	--	21.0	--	445	28.0	
04/30	--	--	13:35	41.0	--	455	28.7	
05/03	08:30	--	--	--	67.0	--	--	
05/04	--	10:00	--	25.5	--	600	37.8	
05/05	--	--	00:31	14.5	--	450	28.4	
05/07	02:40	--	--	--	50.0	--	--	292.5°F

TABLE 3. (continued)

Date	Time: Pump On	Time: Rate Change	Time: Pump Off	Duration: Pumping (hrs)	Duration: Down (hrs)	Flow Rate: gpm	Flow Rate: lps	Remarks
05/11	--	14:00	--	107.0	--	600	37.8	
05/11	--	18:00	--	4.0	--	630	39.7	
05/11	--	20:00	--	2.0	--	580	36.6	
05/13	--	--	18:16	46.25	--	600	37.8	
05/21	16:44	--	--	--	190.5	--	--	
05/24	--	04:22	--	60.0	--	600	37.8	
05/24	--	06:28	--	2.0	--	535	33.7	
05/24	--	09:30	--	3.0	--	450	28.4	
05/25	--	15:30	--	30.0	--	600	37.8	
05/28	--	--	03:59	60.5	--	550	34.7	
06/02	15:44	--	--	--	132	--	--	
06/04	--	18:00	--	50.0	--	600	37.8	a
06/06	--	10:00	--	40.0	--	590	37.2	
06/15	--	--	05:20	211.5	--	550	34.7	

a. Temperature 289.5 steady. Flow was steadily decreasing from 590 to 520 gpm average for last 211.5 h at 550 gpm.

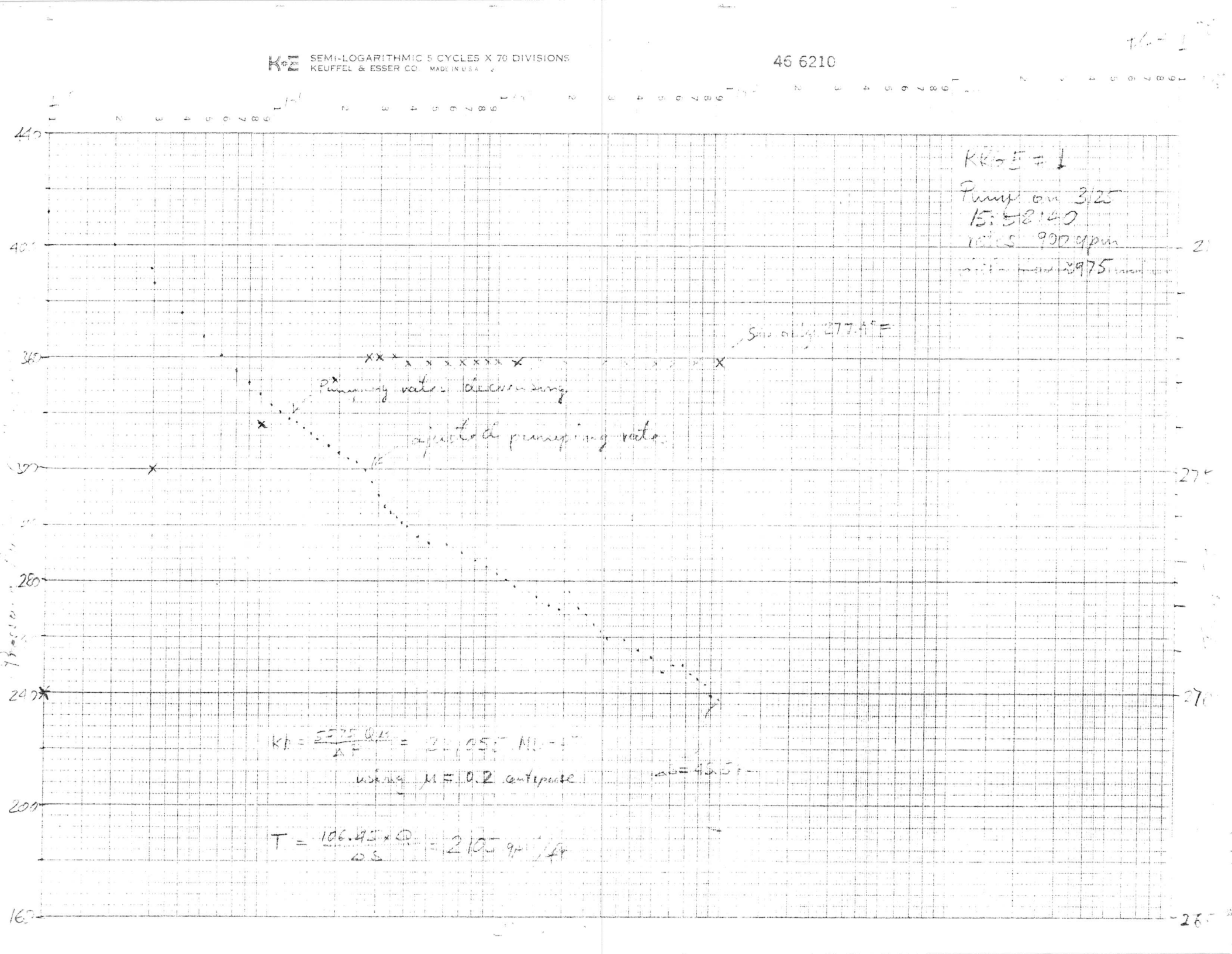
Draft B Date 10/28/82 ILF Doc ID 3931p Disk No 0713p Job No 27224 imm

TABLE 4. RRGE 1 TRANSMISSIVITY AND PERMEABILITY THICKNESS VALUES

Test Started	±S (psi)	Q/±S (gpm/psi)	T (gpd/ft)	kh (md-f)	Remarks
03-25-82	83	10.84	1,154	12,090	Early time (10 min)
	45.5	19.78	2,105	22,055	Straight line for 60-975 min
05-07-82	112	7.0	746	7,815	Early time (12 min)
	37.5	20.9	2,228	23,340	35 to 1000 min
05-10-82	112	7.14	760	7,964	Early time 6 to 16 min
	39	20.5	2,183	22,872	45 to 350 min
06-02-82	102	7.84	835	8,745	Early time 3 to 15 min
	42.5	18.82	2,004	20,988	30 to 350 min

K&E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 6210



K+E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 6210

RRST 1
5/08/82
@ 01:12:00

785 gpm
drawdown 1130 min.

Steady: 277.0'

$kh = \frac{5375 \cdot Q_M}{\Delta s} = 23,340$ MD-FT

$T = \frac{106.45 \times Q}{\Delta s} = 2228$ gpd/ft

Plot 3

K+E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 6210

RGE #1

Pump on
05/10/82
at 23:13:00
rate 809 gpm
rate changed
after 407 mins

flowing temp. 277.8°F

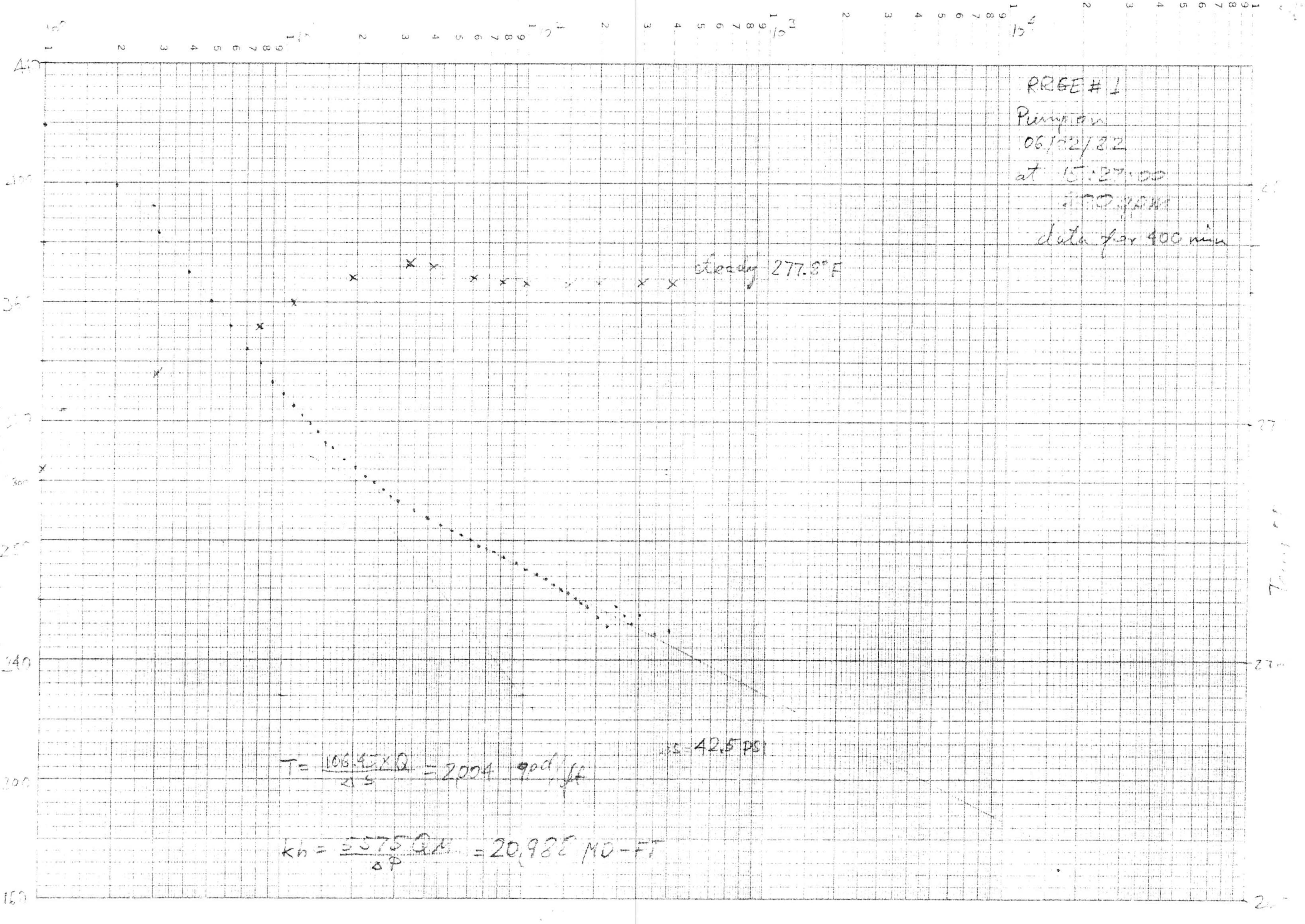
$$kh = \frac{5525 \cdot Q \cdot \mu}{\Delta p} = 22,872 \text{ MD-FT} \qquad S = 39.0 \text{ PSI}$$

$$T = \frac{10^{0.45 \cdot S}}{\Delta t} = 2183 \text{ MD-FT/CP}$$

Plot 4

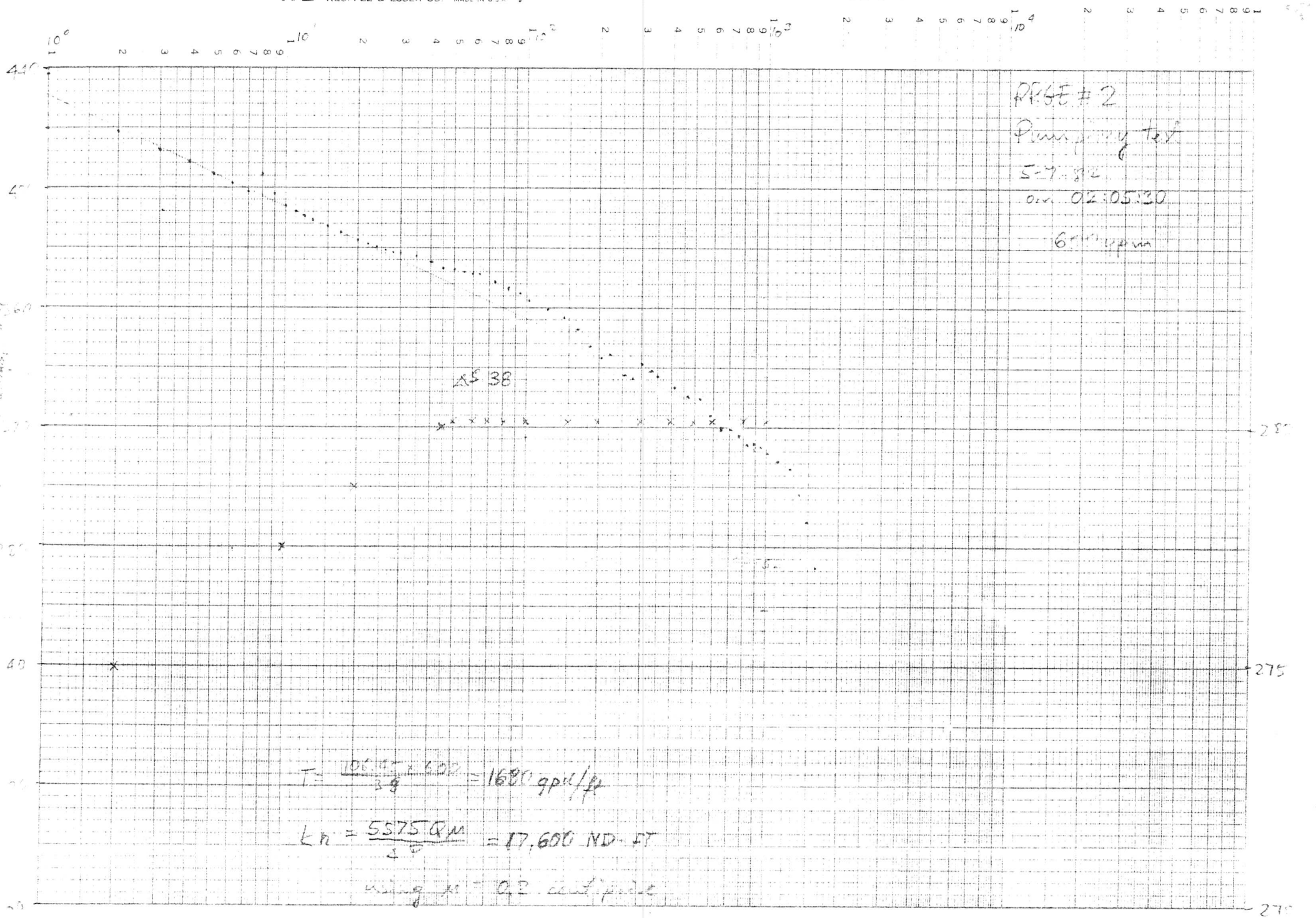
K+E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 6210



K+E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 6210



Plot #2

RRGE # 2
Pumping test
5-11-72
on 00:30:00
rate 600 gpm
data for a 1500 min.

$\Delta s = 46$ ft

$$T = \frac{106.45 \times 600}{46} = 1388 \text{ gpd/ft}$$

$$kh = \frac{5575\ Q_w}{\Delta P} = 14,543 \text{ MD-FT}$$