

TO M. E. McAlpine / F. R. Faist, JECO Site Operations

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CUST.
JECOFILE NO. OR REF.
NSS - 14 / T-3.5SUBJ.
Analysis of Natural Circulation Transient DataDATE
21 Dec 1977

This memo is in response to JECO's request for a B&W analysis of their loss of site power on 11/24/77. After extensive analysis of the available data, several observations can be made; but before getting into the specifics of the transient, I would like to point out that the acceptance criteria for the natural circulation test is that total core flow must exceed the minimum ^{flow} as delineated in the FSAR.

The data which NPGD analyzed is attached for your reference and ^{any} future discussions with the customer. The two primary concerns in the data analysis were that the data was incomplete and that the NSS may not have been in an equilibrium condition. Perhaps the best way to point out the problems with the data is to list the observed anomalies and a short discussion of each item.

1. No loop 2 hot leg temperature measurement is available. Initially it was thought that the simple assumption that both hot leg temperatures were the same would be adequate. However, it is clear that the OTSG levels, OTSG pressures, and cold leg temperatures were considerably different. At low flow rates, there is inadequate mixing to insure that core outlet temperatures are uniform. In addition note that when the first pump was started ($t \approx 900$ sec), a temperature spike of about 12 to 15 °F occurred on the loop 2 hot leg instrument. Although there is no direct evidence to prove just where this hot slug of water (the spike lasted about 32 seconds) came from, it is interesting to note that following the 0 count natural circulation test which lasted considerably longer than 15 minutes, no such spike was observed when their first RCO was started. Their loops were at the same conditions prior to the pump startup. The evidence strongly suggests that the loop 2 hot leg was somewhat hotter than the loop 2 hot leg.

2. The loop 2 steam generator rate appears incorrect to the loop 1

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A

80 inches

steam generator. Clearly, the operator's manual level control to 80 in the loop 1 generator would cause significant differences in generator conditions (loop 2 level was at 120 inches). However, there are some unexplained peculiarities I refer you to the attached reactimeter plots. Notice the sharp drop in pressure in OTSG 1 at the 300 sec mark. Pressure dropped to about 610 psig. It's true that the generator had just reached the 80 inch setpoint controlled by the operator, but OTSG 2 was filled to 120 inches just before this and maintained its pressure much better. However, of more concern is that after the initial AFW filling of the generator the OTSG pressures varied in opposite ways. From the 5 minute mark (300 seconds) OTSG 1 smoothly increases pressure until a safety lift at about $t = 805$ seconds. OTSG 2 steadily decreases pressure during this same period in time, not bottoming out until the first RCP was started. Since both MSIVs were shut within the first minute after the reactor trip, this behavior is difficult to explain. Two possibilities can be offered:

- When OTSG 1 pressure dropped to 610 psig, perhaps the AFW system aligned to pump to OTSG 2 using steam from OTSG 2. No mention of this configuration is made on the plant computer printout and M. E. McAlpin's site investigation substantiated that this probably did not occur.
 - At 22:55:56 on the plant computer printout the entry states that "NN STM LINE 2 WU ISO VALVE" closed. Refs to M-003, Main Steam System PEID, shows that were this valve to be open a path for steam flow to the main condenser existed. I rather suspect that the JECO operators were unaware that this valve was open, but it provides a logical explanation for the steady decrease in OTSG 2 level and pressure.
- the note

Item b. would appear to be a likely explanation for the OTSG anomalies.

- During the period from $t = 600$ to 900 seconds the available data shows that the loop 2 cold leg was considerably above the saturation temperature of the steam generator. Tabulated data is attached which shows that $T_c - T_{sat}$ in loop 1 was essentially zero at all times that T_c data is available whereas in loop 2 this difference was approximately 20 °F and roughly steady. This in conjunction with the fact that the level in OTSG 2 was decreasing faster than would indicate some steam flow from OTSG 2 in excess of that required by the AFW pump.

Table 1 summarizes the loop conditions which existed during the 0:00 to

900 second time period. It seems to me that a major flaw in the presentation of this data (and the results derived therefrom) is that equilibrium in the NSS may not have been reached. Note that step 7.2.15 in TP 800.04.0 (Natural Circulation test procedure) calls for a waiting period to insure that T_c , T_o , and RCS pressure are stable. Stable ΔT 's are to be observed in each loop. It points out that this may take up to 1/2 hour.

Bearing these things in mind, it is still possible to make an attempt to conservatively calculate what the core flow was during the 600 to 900 second period. As per the test procedure, method I requires a knowledge of loop temperatures and core power. The decay heat rate can be calculated from the power history of the core. This was accomplished using DEHEZ, a digital code used to calculate decay power and energy released following shutdown. Figure 1 is a plot of the decay heat at DB-I following the reactor trip on 11/29/77. The natural circulation flow calculation requires the assumption of some loop 1 hot leg temperature. These calculations are also attached but in summary, natural circulation flow at the 14 minute mark with an assumed loop 1 hot leg temperature of 503°F is 1.14% of the design flow rate. The decay heat rate at this time was 0.78% of full power and the flow requirement as shown in attachment 7 of the TP was only 0.32%. Based on this calculation, more than enough flow was present to satisfy the TP acceptance criteria.

In view of the non-equilibrium status of the NSS during the 15 minute period in question and the lack of loop 1 hot leg temperature data, B&W cannot approve the transient in question as a satisfactory test of natural circulation. Although NPSD feels that more than adequate natural circulation flow probably did exist during this transient, the dynamic condition of the plant precludes full approval of the results. It is NPSD's opinion that the transient data does not satisfy the NRC requirement to perform a satisfactory natural circulation test.

Q.A. Statement

The information contained in this memo has been checked for accuracy and completeness.

Signature Robert W. Wolfe

Date Dec 21, 1977

TABLE 2

TIME PERIOD: 600 to 900 SECONDS

<u>Parameter</u>	<u>Loop 1</u>	<u>Loop 2</u>
T_c	$529 \pm 5 \text{ } ^\circ\text{F}$	$< 520 \text{ } ^\circ\text{F}$ for all but ~ 30 SECS
T_e	No data	$553 \pm 3 \text{ } ^\circ\text{F}$
$P_{s/w}$	$870 \pm 20 \text{ psia}$	$675 \pm 40 \text{ psia}$ (decreasing)
OTSG level	$75 \pm 5 \text{ inches}$	$105 \pm 5 \text{ inches}$
$ T_c - T_{sat,w} $	$\sim 0 \text{ } ^\circ\text{F}$	$18-24 \text{ } ^\circ\text{F}$

Support of assumption that T_c (i.e. reactor inlet temperature) = T_{set} of S/G

Consider loop 1 - same method as loop 2, $t = 0$ to 285 seconds

TIME (SEC)	T_{cool} , LP1 (°F)	$P_{S/G}$, LP1 (psia)	T_{set} , LP1 S/G (°F)	$T_{cool} - T_{set}$ (°F)
0	567.5	903.1	532.4	35.1
30	564.8	983.2	542.5	22.3
60	562.2	1002.2	544.8	17.4
90	562.1	965.8	540.4	21.7
120	560.2	919.6	534.5	25.7
150	560.5	875.8	528.7	31.8
180	557.2	835.7	523.3	33.9
210	540.3	802.4	518.6	21.7
240	532.3	775.7	514.7	17.6
255	527.2	765.2	513.1	14.1
270	523.9	779.9	515.3	8.6
285	520.7	803.9	518.8	1.9

Reactimeter Data

Parameter	Channel No.
Time, sec	27
RC inlet TP, IA1-NR	8
OTSG "B" STU. PRESS.	19

PROJECT: JECO
Natural Circulation Analysis
DWT NO: 6200014
A/C BY: Curtally
DATE: 14 Dec 77

PROP. NO. FILE NO.
DWG. NO. COMP. NO.
GROUP NO. SHEET NO.

BABCOCK & WILCOX
GENERAL CALCULATIONS

Loop 1 $T_{cold} - T_{sat}$ $\frac{1}{2}$ from $t = 600$ to 900 seconds

TIME (sec)	T_{cold} , Lp 1 (°F)	P_{sib} Lp 1 (psia)	T_{sat} , Lp 1 $\frac{1}{2}$ (°F)	$T_{cold} - T_{sat}$ (°F)
600	526.26	858.5	526.4	< 1° F
630	524.87	854.6	525.9	1.0
660	526.13	861.3	526.8	< 1.0
690	526.55	865.1	527.3	< 1.0
720	529.95	884.8	529.9	< 1.0
750	528.10	878.6	529.1	1.0
780	527.98	887.5	530.3	2.3
* 810	532.42	880.0	529.3	3.1
840	533.22	798.7	518.0	15.2
870	533.63	817.0	520.6	13.0
900	527.68	865.2	527.3	< 1.0

* Safety Valve in loop 1 lifts and reseats in about 25 seconds

CUSTOMER

PROP NO

FILE NO

PROJECT

DWG NO

DATE

DNT NO 62000

GROUP NO

ALC BY

DATE

FILE NO

MKD BY

DATE

BABCOCK & WILCOX
GENERAL CALCULATIONS

Support of assumption that T_c (i.e. reactor inlet temperature) = $T_{sat} \frac{1}{5/6}$.

Consider only loop 2 - no loop 1 hot leg data is available for further Cels.

Method: tabulate and plot loop 2 cold leg temperature and $T_{sat} \frac{1}{5/6}$ where reactimeter data is available. Calculate the difference and verify that it approaches zero.

TIME (SEC)	$T_{COLD, LP2}$ (°F)	$P_{5/6, LP2}$ (psia)	$T_{sat, LP2} \frac{1}{5/6}$ (°F)	$T_{COLD} - T_{sat}$ (°F)
0	567.5	907.7	533.0	34.5
30	567.1	980.5	542.2	24.9
60	563.5	1018.3	546.8	16.6
90	562.1	965.2	540.3	21.8
120	551.1	989.2	543.2	7.9
150	544.0	945.2	537.8	6.2
180	537.4	874.0	528.5	8.9
210	530.8	819.2	520.9	9.9
240	526.4	776.2	514.7	11.7
255	523.6	758.8	512.2	11.4
270	521.4	743.0	509.8	11.6
279	520.2	651.0	495.1	25.1 *

Reactimeter Data

Parameter	Channel no.
Time, sec	27
RC inlet TP, 1A2-NR (°F)	7
OTSG "A" STM. Press.	2.0

* Note that $T_{cold} - T_{sat}$ does not approach zero as in loop 1

USER JECO
SUBJECT Natural Circulation Analysis
CONT NO. 4400014
REC BY Curtally
DATE

PROP NO.
DWG. NO.
GROUP NO.
FILE NO.
COMP. NO.
SHEET NO.

BABCOCK & WILCOX
GENERAL CALCULATIONS

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DOC. I.D.

SERIAL NUMBER: REV

Loop 2

T_{old} - T_{sat}

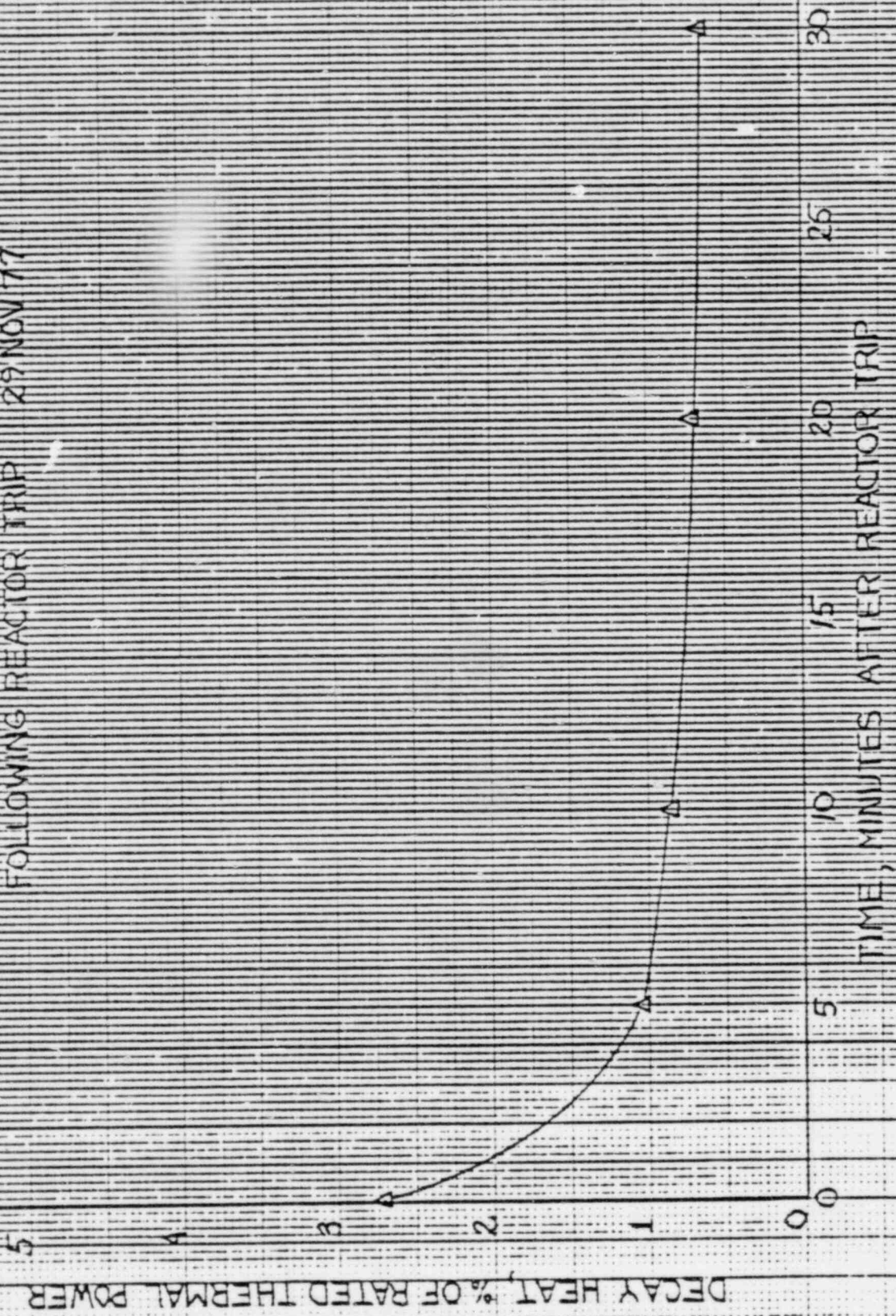
t = 819 to 855 sec (only time T_c data available)

TIME (sec)	T _{old} , Lp 2 (°F)	P _{1/2} , Lp 2 (psia)	T _{sat} , Lp 2 5/8 (°F)	T _{old} - T _{sat} (°F)
819	520.0	697.4	502.7	17.3
825	521.1	687.0	501.0	20.1
831	521.7	676.7	499.3	22.4
837	522.2	671.2	498.4	23.8
843	522.6	682.3	500.2	22.4
849	522.0	689.4	501.2	20.8
855	520.6	696.4	502.5	18.1

CUSTOMER
SUBJECT
CONT. NO. 62000
CALC. BY
CHKD BY

PROP. NO.
DRAWING NO.
FILE NO.
COMP. NO.
SHEET NO.

FIGURE 1
DECAY HEAT AT DAVIS-BESSE I
FOLLOWING REACTOR TRIP 29 NOV 77



Out

Calculations of Core Flow During Natural Circulation

For a 1st cut, check $t = 840$ seconds since at this time both cold legs are on scale and one assumption may be eliminated.

At $t = 840$ sec, the following values were recorded:

	$T_c, ^\circ F$	$T_h, ^\circ F$
Loop 1	533.2	No data
Loop 2	522.6	551.9

Obviously a value for T_h must be assumed for loop 1. At the worst, this value would equal saturation temperature for the RCS. A much more reasonable estimate would be that the loop 1 hot leg temperature was at least equal to the peak temperature recorded on the loop 2 hot leg temperature instrument, this value being 563°F. Were this to be the case, the following would be true:

$$Q_{core} = \dot{m} C_p (\Delta T)_{avg}$$

$$\Delta T_{avg} = \frac{563 + 551.9}{2} - \frac{533.2 + 522.6}{2} = 29.6 \text{ } ^\circ F$$

At $t = 840$ sec, DHR = 1.55% of rated power

$$\dot{m}_{core} = \frac{0.0078 (2772 \text{ Mw}) (3.412 \times 10^6 \text{ BTU/hr/Mwt})}{(29.6 \text{ } ^\circ F) (1.24 \text{ BTU/lbm-}^\circ F)}$$

$$= \frac{1}{2} (3.994 \times 10^6) \text{ lbm/hr} = 1.997 \times 10^6 \text{ lbm/hr}$$

$$= \frac{1.997 \times 10^6}{131.3 \times 10^6} \times 100 = 1.52\% \text{ of design flow}$$

If 20°F of conservatism were added to this, excessive flow would still have existed and can be shown as follows:

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SCALE NUMBER

$$\Delta T_{avg} = \frac{583 + 551.9}{2} - \frac{533.2 + 522.6}{2} = 39.6 \text{ } ^\circ\text{F}$$

$$(\dot{m}_{core} C_p \Delta T)_1 = (\dot{m}_2 C_p \Delta T)_2 = Q_{DN}$$

$$\therefore \dot{m}_2 = \frac{(\dot{m}_1 \Delta T)_1}{\Delta T_2} = \frac{1.52\% (29.6)}{39.6} = 1.14\%$$

Attachment 7 of the TP shows that for a core power of 0.73% FP, the required flow about 0.32% of design flow. Therefore, it would be clear that more than enough core flow existed during natural circulation had loop 1 hot leg temperatures have remained anywhere near loop 2 hot leg temperatures.

BY: [unclear]
DATE: [unclear]
CONT. NO. [unclear]
CALC. NO. [unclear]

PROJECT NO. [unclear]
FILE NO. [unclear]
GROUP NO. [unclear]

No.	Time t_0	Time t_1	Shut-down	Shut-down	Shut-down	Shut-down	Shut-down	Shut-down
	(hours)	(Sec)	+ 5 min (sec)	+ 10 min (sec)	+ 20 min (sec)	+ 30 min (sec)	+ 45 min (sec)	+ 60 min (sec)
1	0	0	300	600	1200	1800	2700	3600
2	138	4.97×10^5	4.97×10^5	4.97×10^5	4.97×10^5	4.99×10^5	5.00×10^5	5.31×10^5
3	150	5.40×10^5	5.40×10^5	5.41×10^5	5.41×10^5	5.42×10^5	5.43×10^5	5.44×10^5
5	222	7.97×10^5	9.00×10^5	9.00×10^5	9.00×10^5	9.09×10^5	9.02×10^5	9.03×10^5
DECAY HEAT (BTU / HR)								
			(1.99×10^5)	(1.52×10^5)	(1.25×10^5)	(1.12×10^5)		
1		5.04×10^5	1.8×10^5	1.5×10^5	1.2×10^5	1.1×10^5	1.0×10^5	9.0×10^4
2		4.2×10^5	4.2×10^5	4.2×10^5	4.2×10^5	4.1×10^5	4.0×10^5	4.0×10^5
3		4.2×10^6	1.2×10^6	1.2×10^6	1.1×10^6	1.1×10^6	1.1×10^6	1.1×10^6
5		6.1×10^6	6.1×10^6	6.1×10^6	6.1×10^6	6.1×10^6	6.1×10^6	6.1×10^6
			(1.967×5)	(1.50×5)	(1.33×5)	(1.20×5)		
Total	*	5.12×10^5	1.99×10^5	1.52×10^5	1.25×10^5	1.12×10^5	1.08×10^5	9.7×10^4
% FP		5.41	(4.06) 1.98	(3.07) 1.59	(2.40) 1.35	(1.27) 1.25	1.14	1.03

* If these results contain a 100% conservative safety factor (operator error), then the results should be divided by two yielding the following:

% FP	2.71	1.04	0.86	0.70	0.64
------	------	------	------	------	------

803 1/10

DAVIS-BESSE I
POWER HISTORY PRIOR TO TRIP ON 27 NOV 77

40
0.8
0.8

3.4

40%
5.7%

1.1
1.1

1.1
2.2

14.5%
10%

25%
5.4/1.1

19 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

1.1

17 P. 11

4
3
2
1

87.000
70.000
60.000
50.000
40.000
30.000
20.000
10.000
0.000

POWER RANGE LVL (PCT)

0.000

3.000

6.000

9.000

12.000

15.000

18.000

21.000

24.000

27.000

30.000

33.000

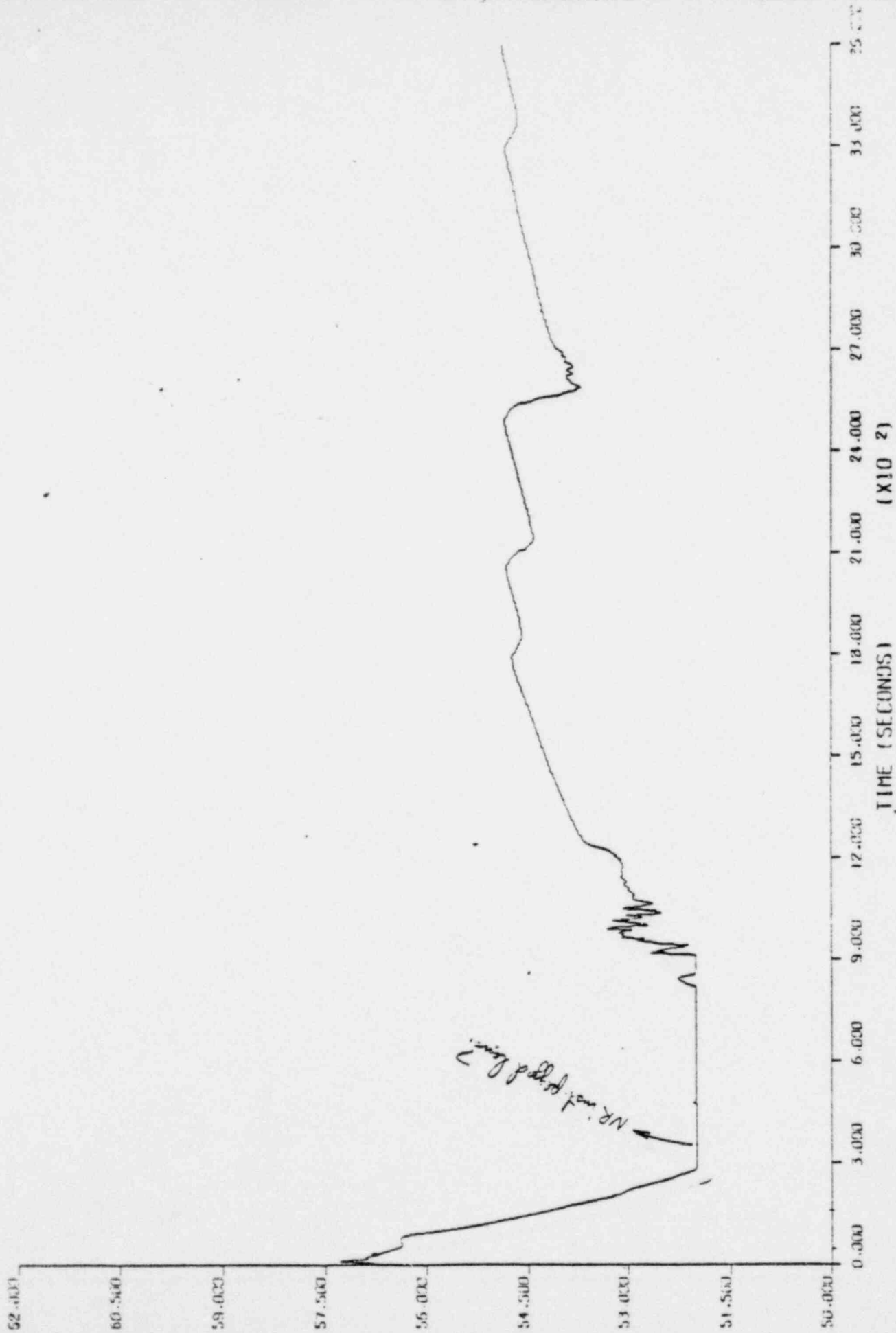
35.000

TIME (SECONDS)

(X10⁴)

REACTIMETER PLOT

TSN=67

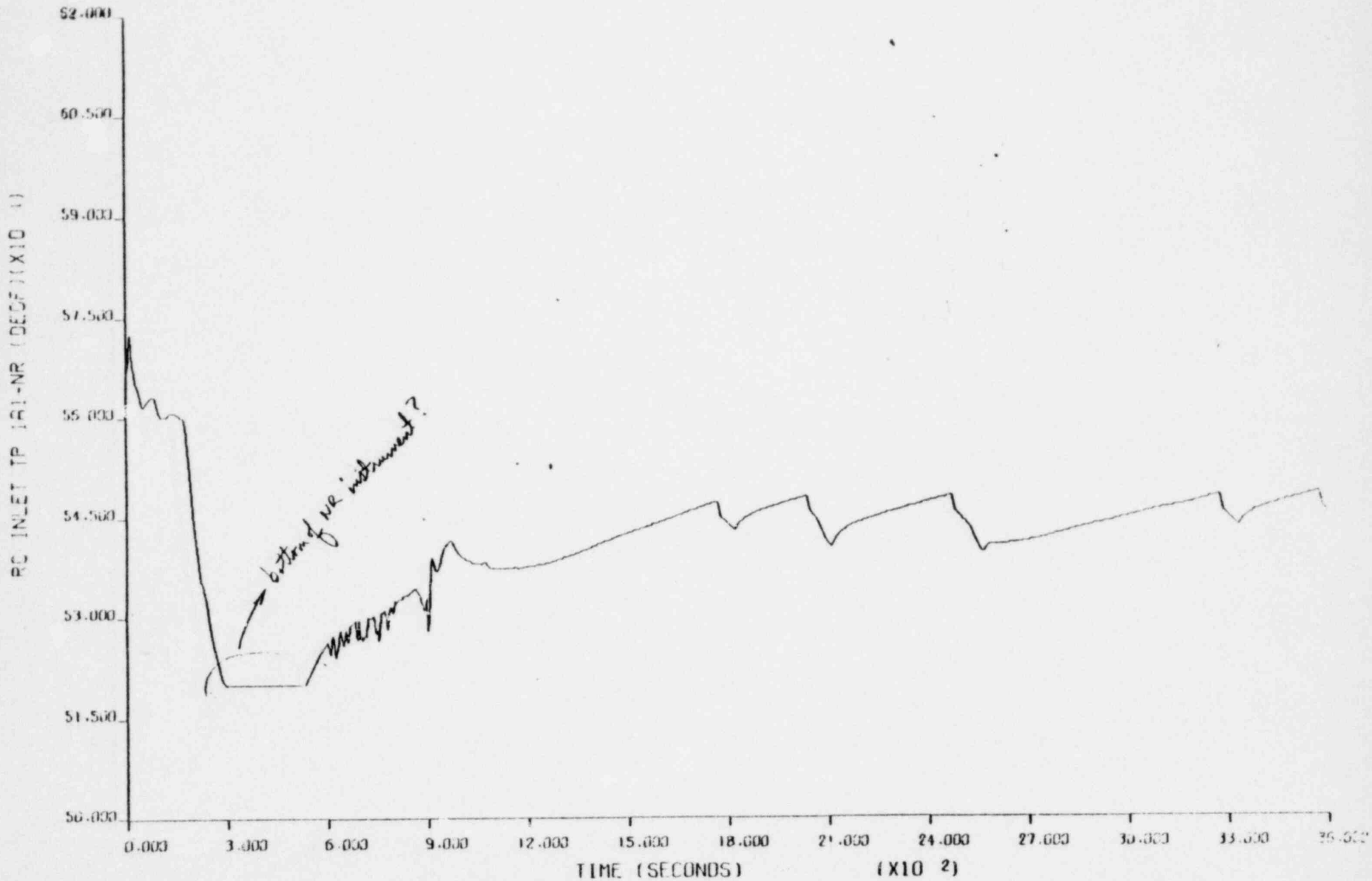


RC INLET TP 122-NR (DECF)(X10 1)
Loop 2

TIME (SECONDS) (X10 2)

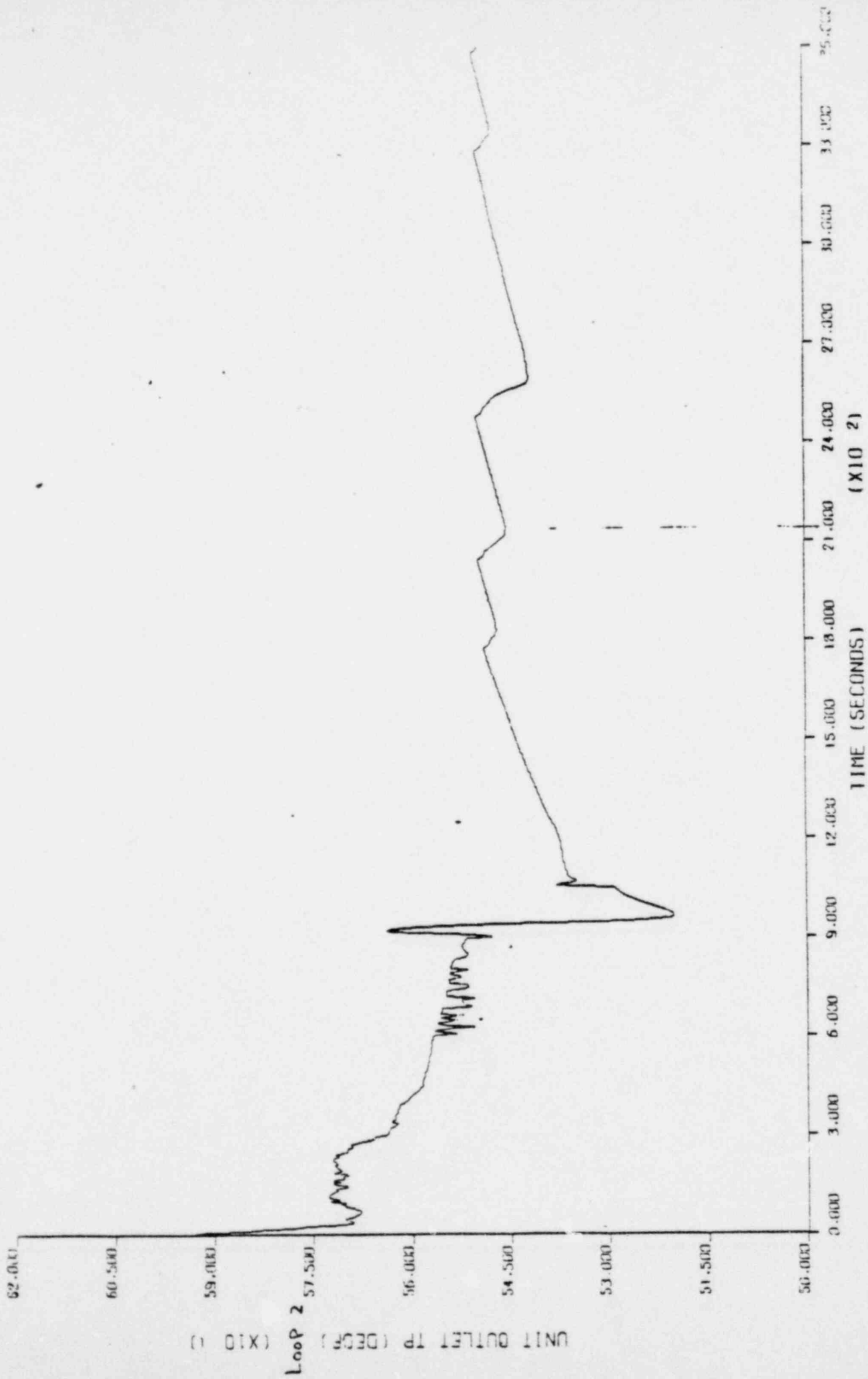
REACTIMETER PLOT TSN=67

NR not signed down?

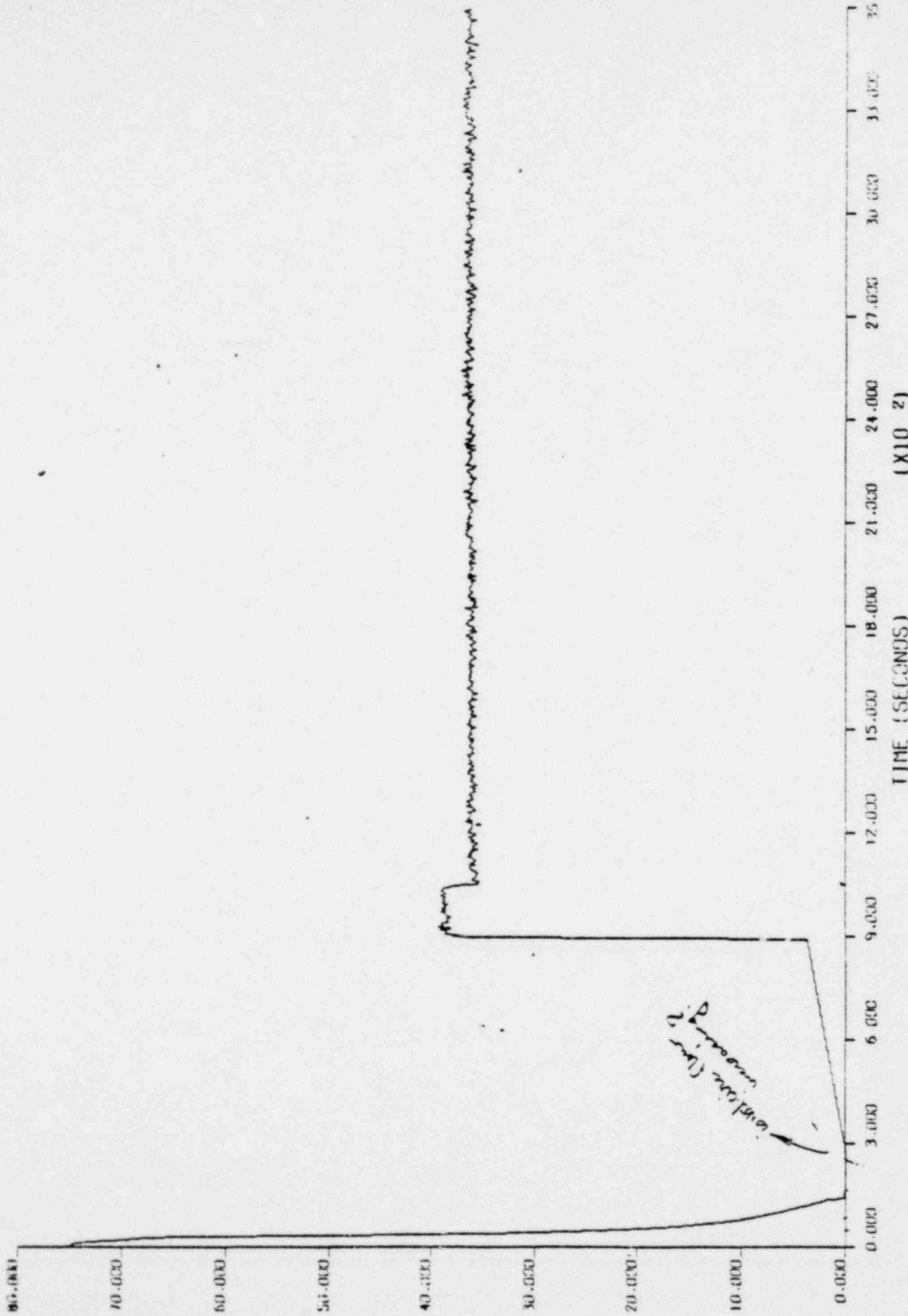


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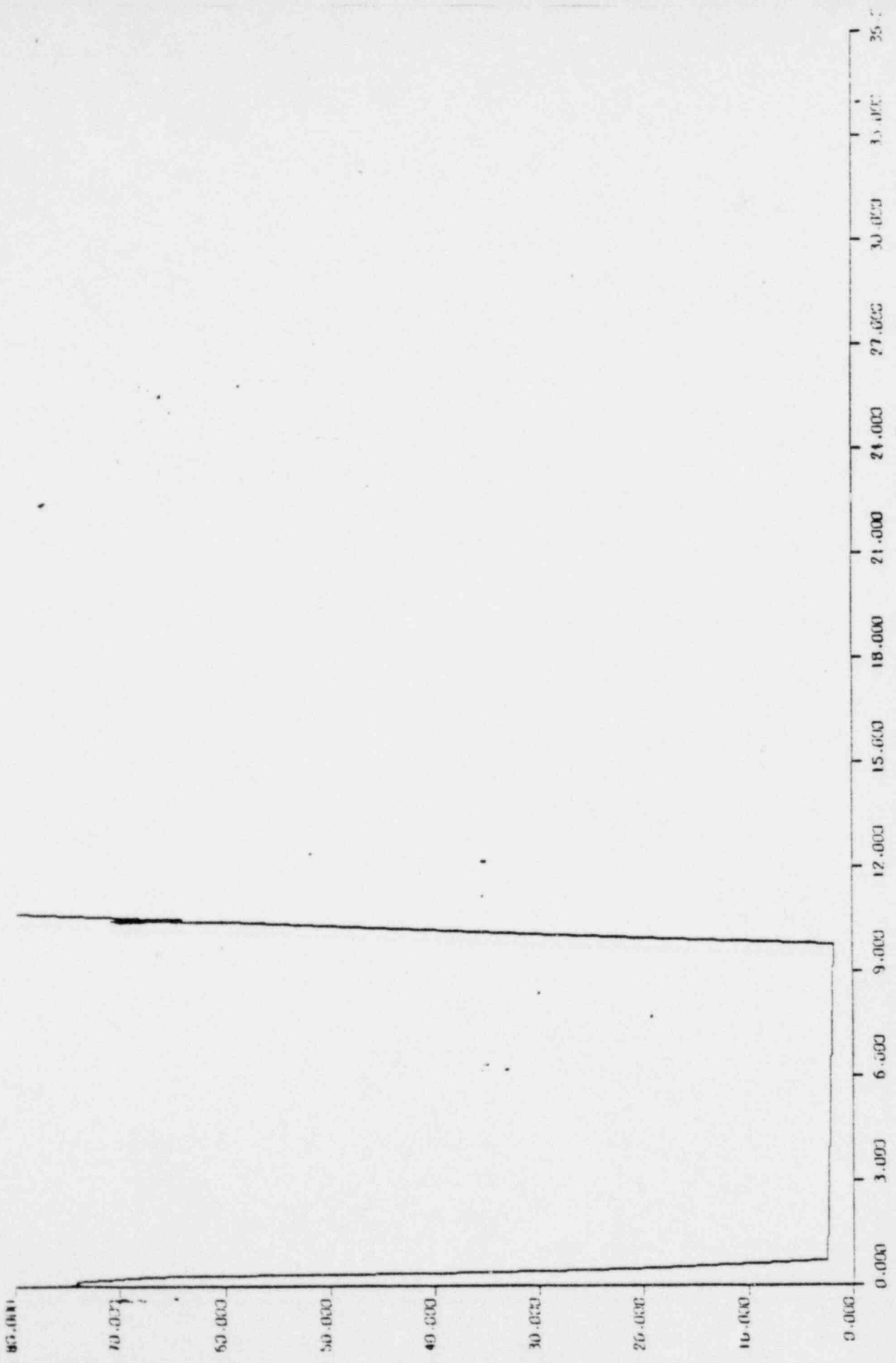


REACTIMETER PLOT TSN=67



RC Flow Loop 1 (4)

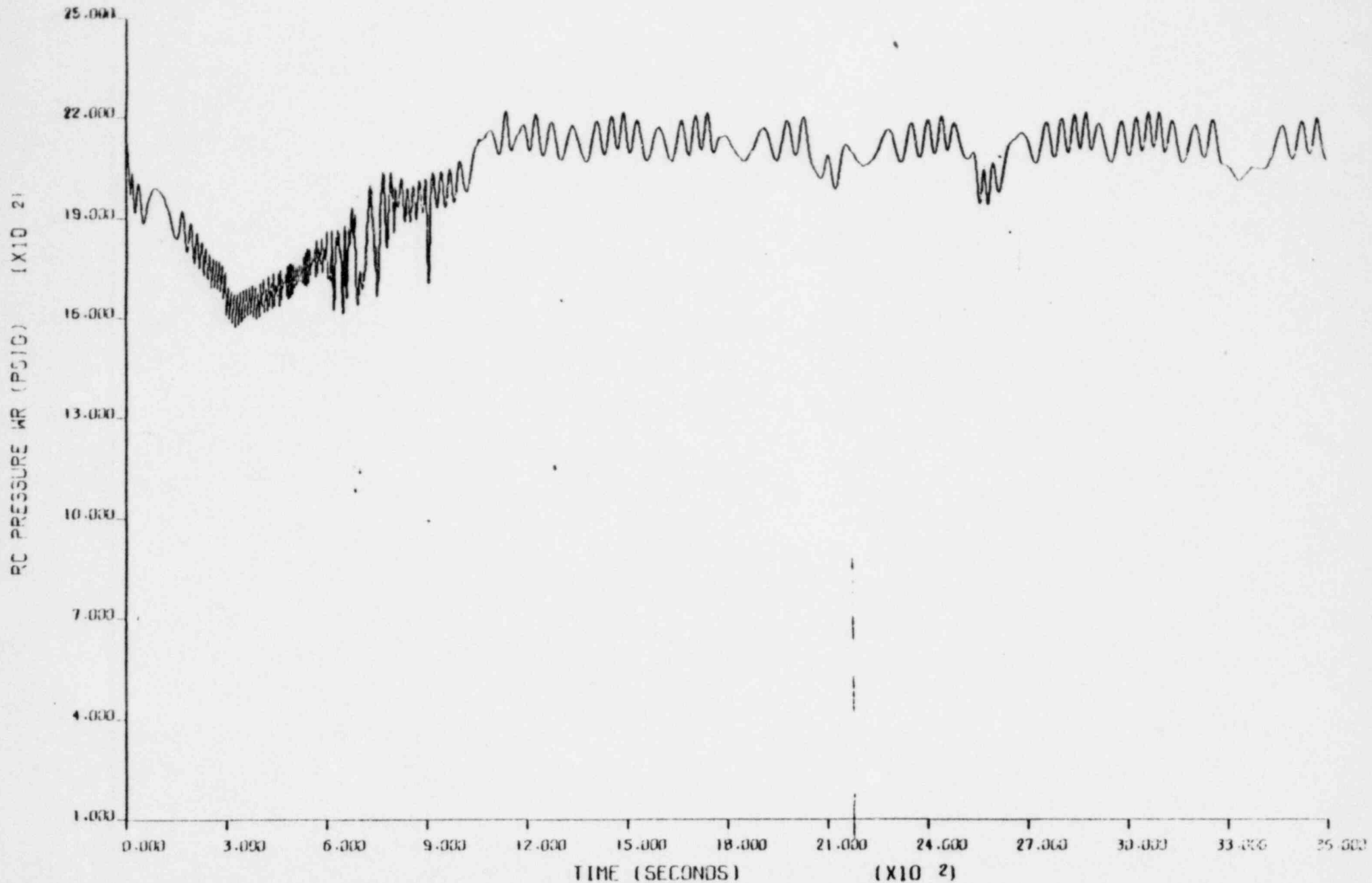
REACTIMETER PLOT 1SN=67



RC Flow Loop 2 (1)

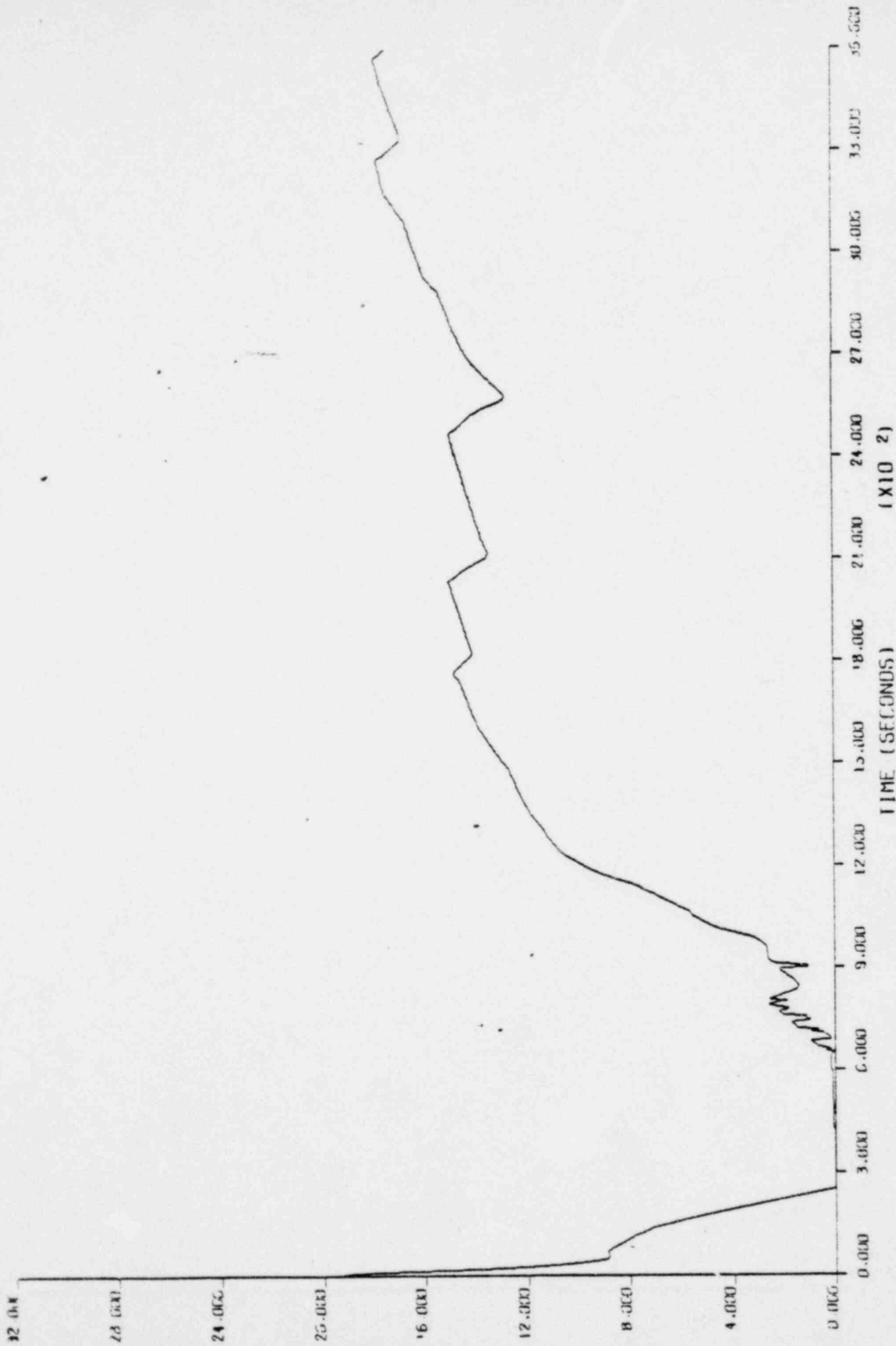
TIME (SECONDS) (X10 2)

REACTIMETER PLOT TSN=67

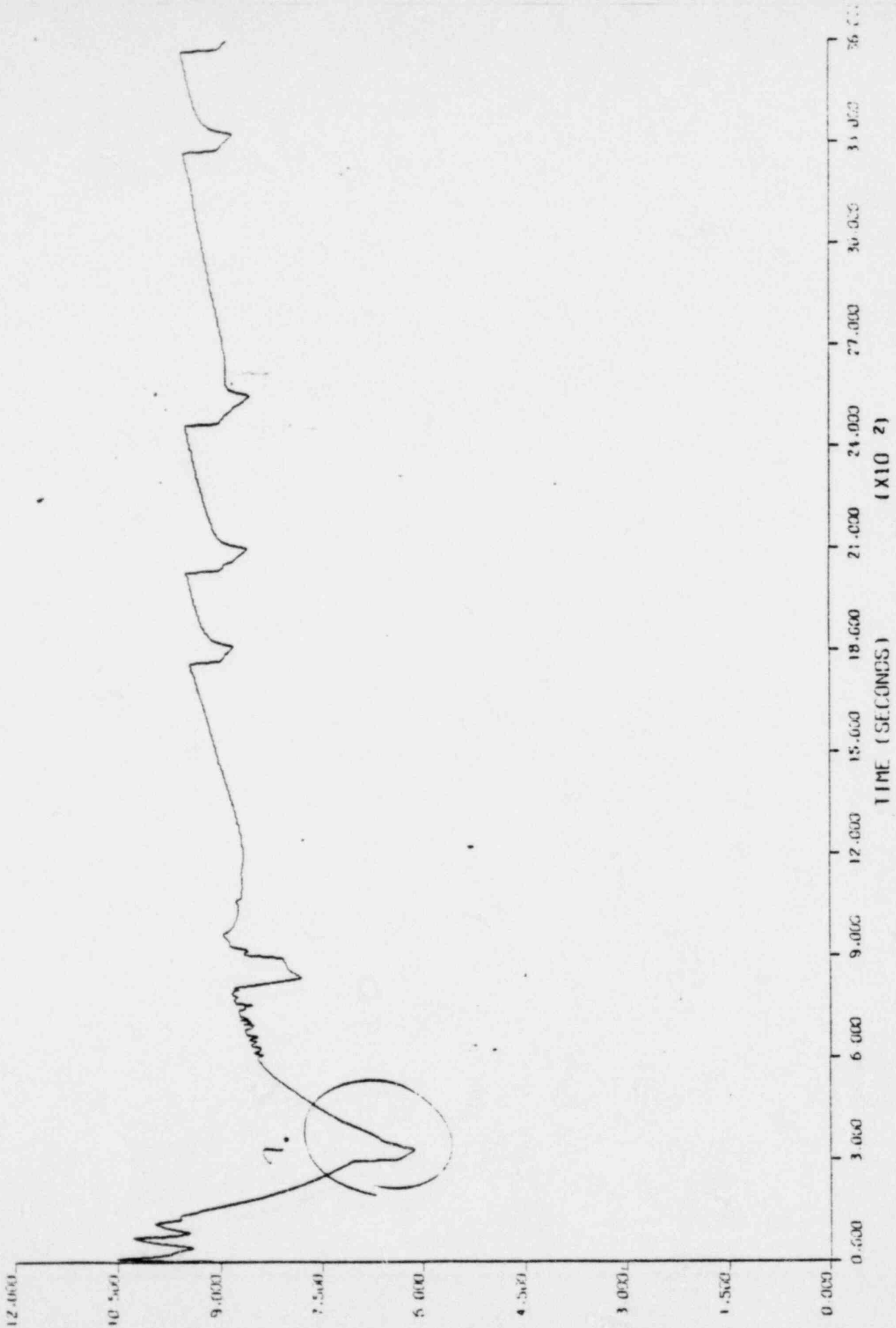


REACTIMETER PLOT

TSN-67



REACTIMETER PLOT TSN=67



DTSG A OUTLT GP (PSIG) (X10 2)
 LOOP 1

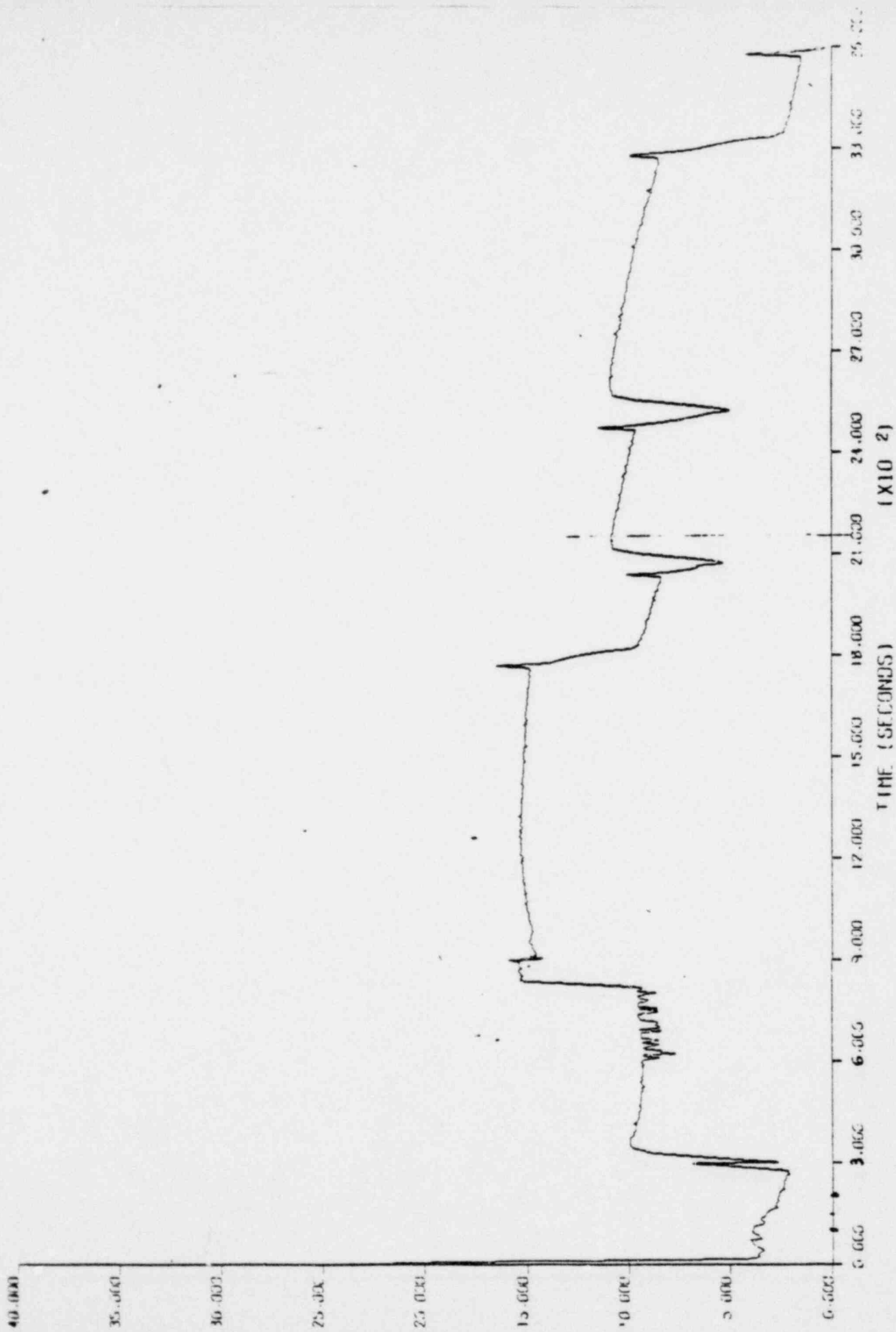
TIME (SECONDS) (X10 2)

REACTIMETER PLOT TSN=67



TIME (SECONDS) (X10 2)

REACTIMETER PLOT TSN=67

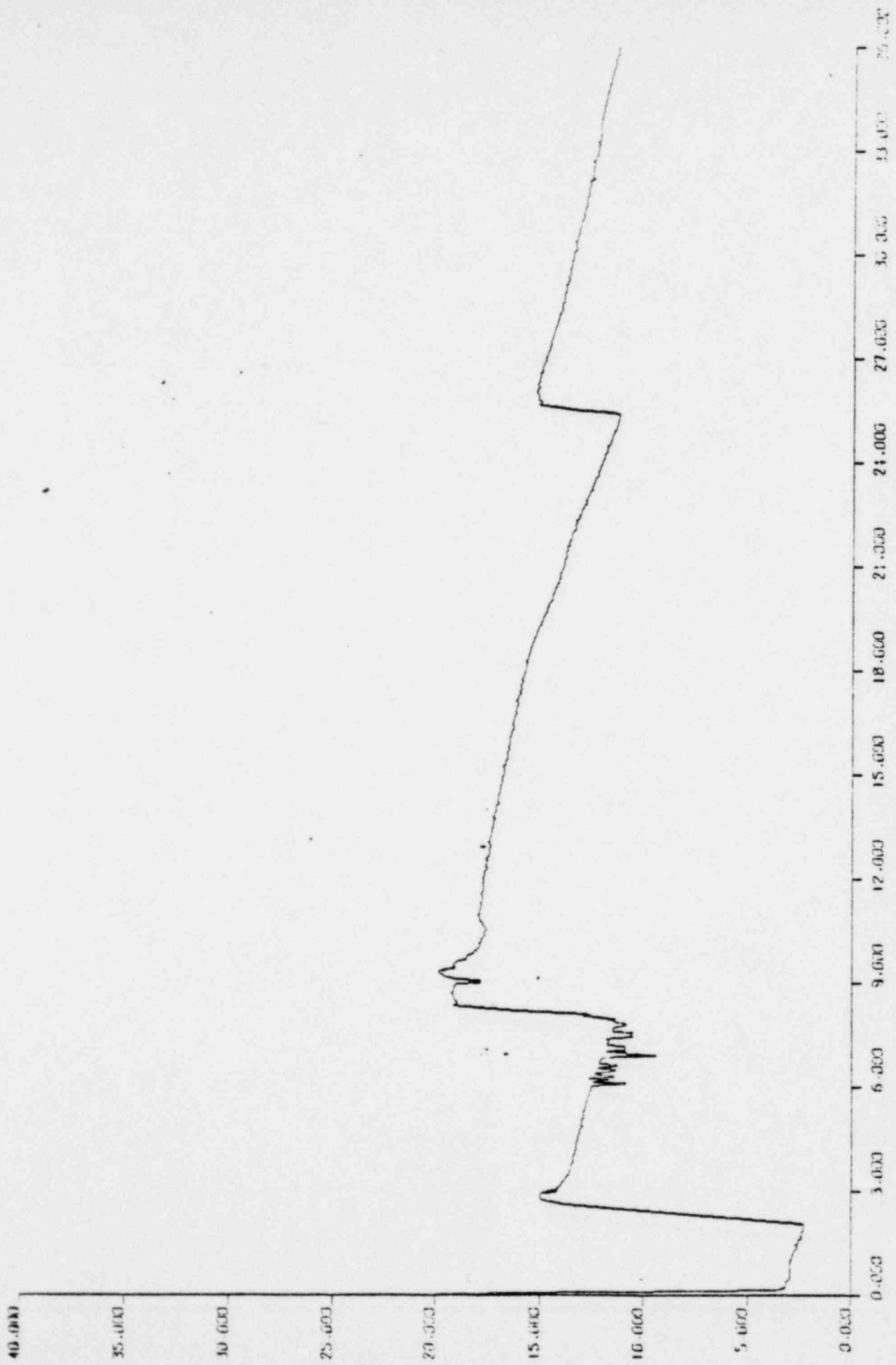


DT30 X OPER LVL (PCT)

Loop 1

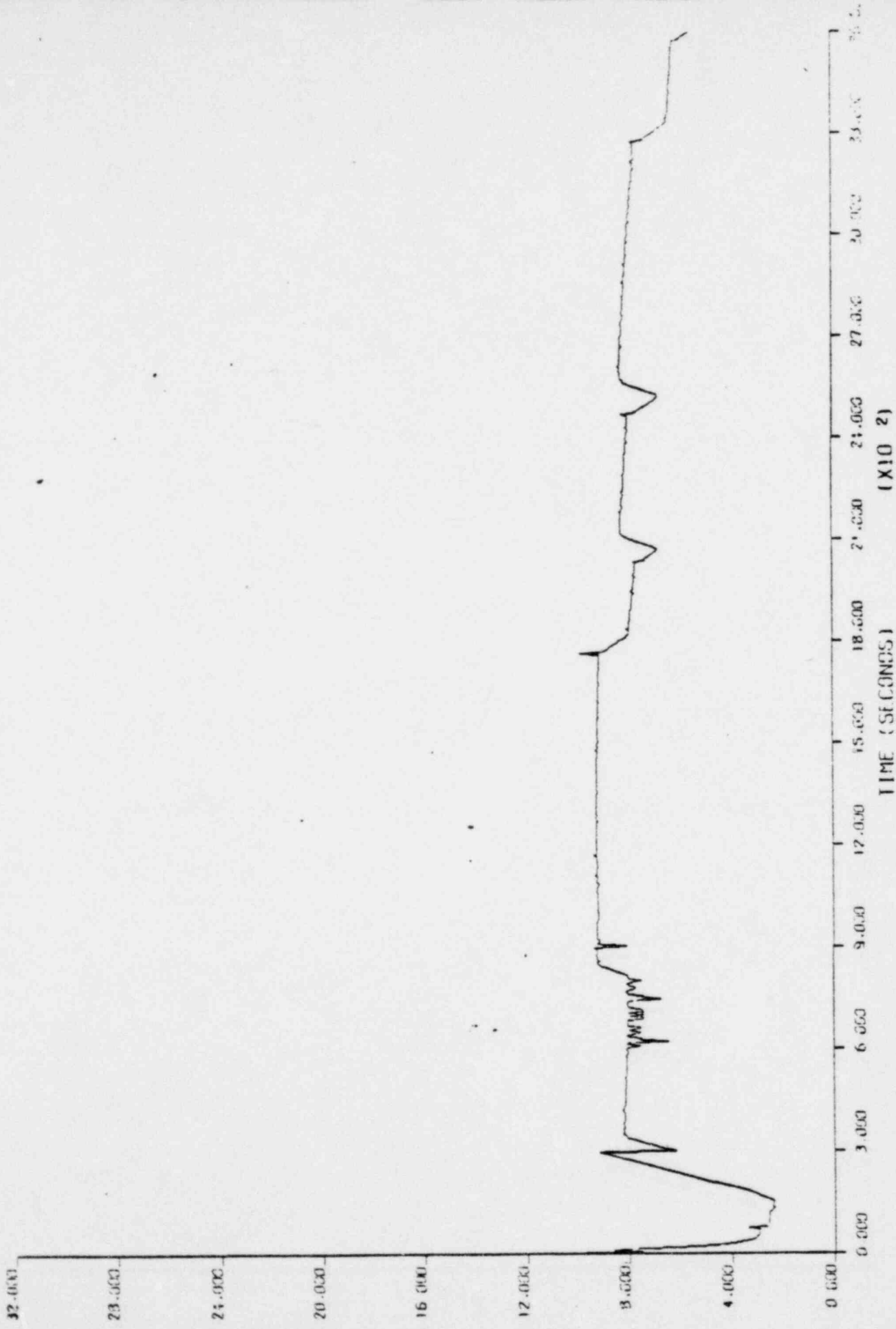
TIME (SECONDS) (X10 2)

REACTIMETER PLOT TSN C7



TIME (SECONDS) (X10 2)

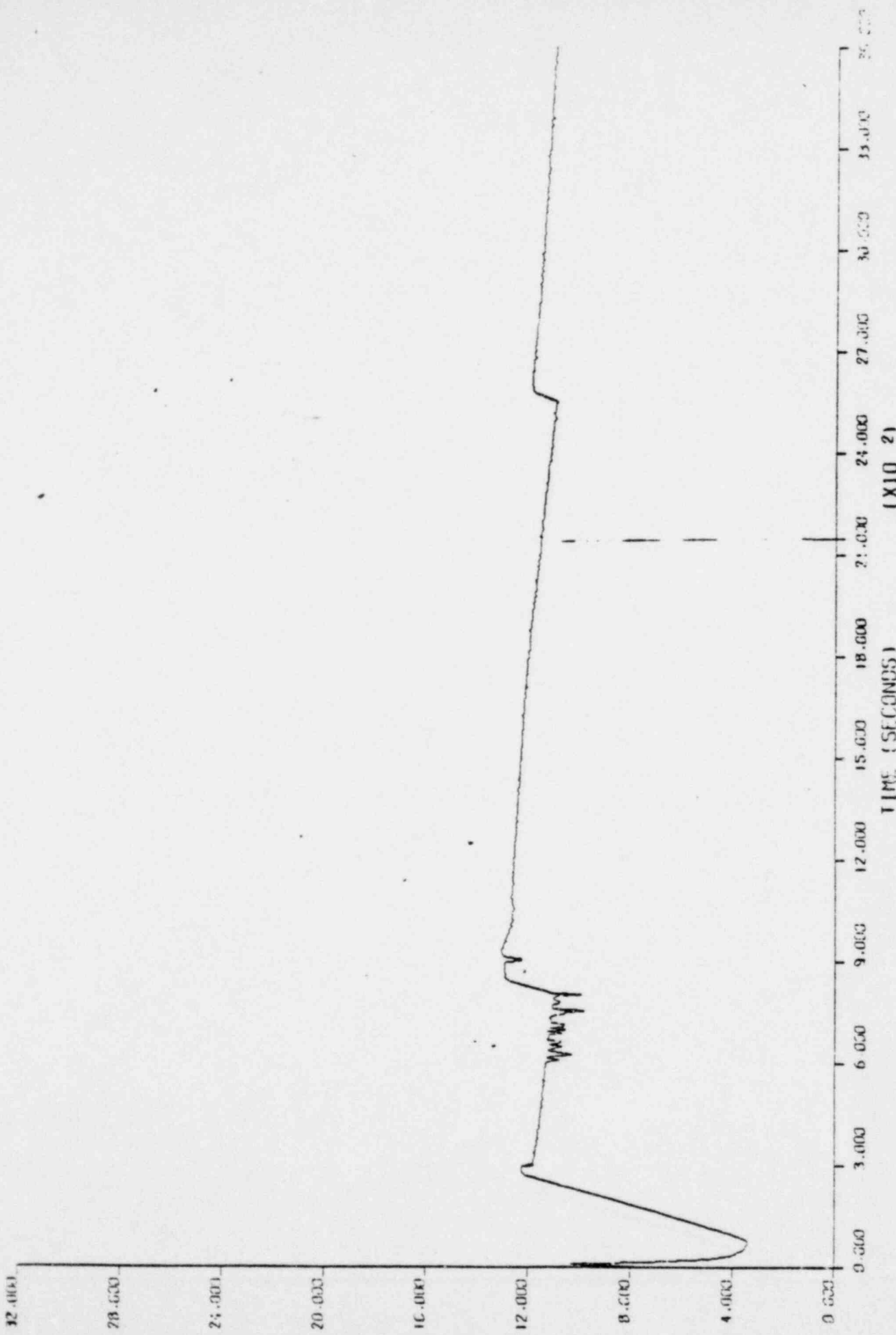
REACTIMETER PLOT TSN=67



REACTIMETER PLOT TSN=67

STG/KWR LEVEL (2) (X10 1)

TIME (SECONDS) (X10 2)



REACTIMETER PLOT TSN=67

RTSG W/L Level (3) (X10 1)

Loop 2

NOT CERTIFIED

NOT CERTIFIED

NOT CERTIFIED

NOT CERTIFIED

RPRINT MONITORED VARIABLES

CHANNEL	BASE NUMBER	UNITS	-----TITLE-----
27	2	C	TIME (SECONDS)
6	600	DEGF	UNIT OUTLET TP (DEGF)
7	620	DEGF	RC INLET TP 1A2-NR (DEGF)
8	630	DEGF	RC INLET TP 1A1-NR (DEGF)
9	8991		----- (4) RCS FLOW LP4
10	8991		----- (4) RCS FLOW LP2
11	8996		----- (5) SU FW FLOW LP2
14	8996		----- (5) SU FW FLOW LP1
15	1000	PCT	OTSG B OPER LVL (PCT) LP2
17	9A0	PCT	OTSG A OPER LVL (PCT) LP1
19	937	PSIG	OTSG B OUTLT SP (PSIG) LP1
20	920	PSIG	OTSG A OUTLT SP (PSIG) LP1

RPRINT MONITORED VARIABLES

CHANNEL 27	T _h Lp2 CHANNEL 6	T _c Lp2 CHANNEL 7	T _c Lp1 CHANNEL 8	CHANNEL 9	CHANNEL 10	CHANNEL 13	CHANNEL 14	OTSG of level #2 CHANNEL 15	#1 CHANNEL 17
.000	592.871	567.546	567.464	75.784	75.019	1.264	1.096	21.626	22.633
3.000	592.890	567.351	567.262	74.929	74.591	1.104	1.017	18.336	20.515
6.000	590.110	569.139	569.258	74.547	73.830	.607	.745	16.517	18.992
9.000	585.251	572.255	572.207	74.874	74.250	.104	.188	11.811	14.051
12.000	544.005	572.957	572.640	74.154	74.017	.083	.068	7.181	8.381
15.000	581.851	569.939	570.116	73.066	73.198	.072	.058	3.699	4.331
18.000	577.801	568.173	567.983	71.366	71.223	.070	.054	3.308	3.818
21.000	576.870	568.556	567.375	69.410	69.951	.068	.053	3.244	3.650
24.000	576.021	568.498	566.667	68.990	68.875	.067	.053	3.134	3.574
27.000	572.809	567.491	565.413	67.422	67.051	.066	.051	3.079	3.699
30.000	570.519	567.067	564.818	64.137	63.870	.066	.051	3.125	3.638
33.000	569.081	566.939	564.772	49.911	50.134	.065	.050	3.089	3.586
36.000	568.748	566.490	564.265	41.454	41.264	.065	.050	3.095	3.540
39.000	568.837	566.025	563.551	35.353	34.612	.065	.050	3.086	3.430
42.000	569.432	565.434	562.840	30.038	29.588	.065	.051	3.049	3.369
45.000	570.177	564.909	562.199	26.654	25.122	.064	.050	3.082	3.501
48.000	570.055	564.461	561.693	24.026	21.705	.064	.049	3.033	3.620
51.000	569.200	564.082	561.519	21.625	18.442	.064	.049	3.089	3.678
54.000	568.825	563.753	561.696	19.628	16.055	.064	.049	3.039	3.797
57.000	568.483	563.515	561.964	17.821	13.921	.063	.049	3.036	3.830
60.000	568.209	563.502	562.224	16.231	11.860	.063	.049	3.039	3.906
63.000	567.891	563.603	562.498	14.926	9.333	.063	.049	3.030	3.949
66.000	567.717	563.719	562.709	13.978	6.430	.063	.049	3.035	3.937
69.000	567.607	563.695	562.883	13.058	5.576	.063	.049	3.030	3.980
72.000	567.757	563.808	562.959	11.946	2.480	.063	.049	3.039	4.032
75.000	568.245	563.780	563.042	11.333	-0.003	.062	.049	3.039	3.443
78.000	568.923	563.725	563.103	10.320	-0.003	.062	.048	3.039	3.617
81.000	568.871	563.561	563.130	9.859	-0.003	.062	.048	3.039	3.656
84.000	570.156	563.399	563.103	9.023	-0.003	.062	.049	3.039	3.641
87.000	570.231	562.889	562.767	8.762	-0.003	.061	.048	3.039	3.607
90.000	570.055	562.068	562.092	8.227	-0.003	.061	.048	3.039	3.922
93.000	570.909	560.875	561.491	7.669	-0.003	.061	.048	3.039	3.900
96.000	569.896	559.633	560.982	7.164	-0.003	.061	.047	3.039	4.022
99.000	571.795	558.223	560.454	6.664	-0.003	.061	.047	3.039	3.894
102.000	572.411	557.130	560.252	6.219	-0.003	.061	.047	3.039	3.885
105.000	570.815	555.897	560.066	5.735	-0.003	.063	.046	3.039	3.888
108.000	572.139	554.878	559.990	5.513	-0.003	.060	.046	3.039	3.845
111.000	572.149	553.889	560.002	5.169	-0.003	.060	.046	3.039	3.849
114.000	572.756	553.065	560.081	4.551	-0.003	.060	.046	3.039	3.754
117.000	572.512	552.051	560.139	4.342	-0.003	.060	.047	3.039	3.482
120.000	572.536	551.136	560.219	3.703	-0.003	.061	.047	3.039	3.339
123.000	572.237	550.397	560.319	3.532	-0.003	.060	.046	3.039	3.284
126.000	571.843	549.732	560.432	3.071	-0.003	.062	.048	3.039	3.412
129.000	571.874	549.128	560.527	2.571	-0.003	.061	.047	3.039	3.537
132.000	571.120	548.328	560.627	2.120	-0.003	.060	.046	3.039	3.543
135.000	571.547	547.455	560.716	1.980	-0.003	.060	.046	3.039	3.556
138.000	571.480	546.772	560.762	1.500	-0.003	.060	.047	3.039	3.430
141.000	570.522	546.122	560.737	.071	-0.003	.059	.045	3.039	3.305
144.000	569.634	545.575	560.722	-0.003	-0.003	.060	.046	3.039	3.275
147.000	569.982	544.763	560.658	-0.003	-0.003	.060	.046	3.039	3.281
150.000	571.355	544.019	560.524	.052	-0.003	.060	.046	3.039	3.287

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Loop 2
Loop 1
Loop 1

RPRINT MONITORED VARIABLES

CHANNEL	CHANNEL 6	CHANNEL 7	CHANNEL 8	CHANNEL 9	CHANNEL 10	CHANNEL 11	CHANNEL 12	CHANNEL 13	CHANNEL 14	CHANNEL 15	CHANNEL 17
153.000	571.090	543.295	560.389	.003	.003	.060	.060	.060	.046	2.506	3.128
156.000	571.976	542.867	560.246	.003	.003	.060	.060	.060	.046	2.478	3.055
159.000	570.756	541.974	560.146	.003	.003	.060	.060	.060	.046	2.475	3.099
162.000	572.042	541.296	560.866	.003	.003	.060	.060	.060	.046	2.400	3.096
165.000	571.767	540.726	559.938	.003	.003	.060	.060	.060	.046	2.435	3.072
168.000	570.699	540.019	559.431	.003	.003	.060	.060	.060	.046	2.374	3.071
171.000	570.046	539.426	559.514	.003	.003	.060	.060	.060	.046	2.377	3.075
174.000	570.449	539.765	558.509	.003	.003	.060	.060	.060	.046	2.353	3.076
177.000	569.501	538.778	557.206	.003	.003	.060	.060	.060	.046	2.377	3.077
180.000	569.466	538.778	555.107	.003	.003	.060	.060	.060	.046	2.292	3.077
183.000	570.104	538.003	555.581	.003	.003	.060	.060	.060	.046	2.292	3.077
186.000	571.929	535.791	551.520	.003	.003	.060	.060	.060	.046	2.277	3.079
189.000	571.024	535.086	551.781	.003	.003	.060	.060	.060	.046	2.277	3.079
192.000	570.513	534.381	547.864	.003	.003	.060	.060	.060	.046	2.277	3.079
195.000	570.653	533.593	545.798	.003	.003	.060	.060	.060	.046	2.260	3.079
198.000	570.925	532.912	545.939	.003	.003	.060	.060	.060	.046	2.260	3.079
201.000	571.472	531.802	542.667	.003	.003	.060	.060	.060	.046	2.260	3.079
204.000	571.471	531.372	541.358	.003	.003	.060	.060	.060	.046	2.402	3.058
207.000	571.476	531.810	541.274	.003	.003	.060	.060	.060	.046	2.116	3.033
210.000	571.629	530.657	539.249	.003	.003	.060	.060	.060	.046	2.310	3.033
213.000	571.169	530.710	537.710	.003	.003	.060	.060	.060	.046	2.310	3.033
216.000	571.621	530.334	536.522	.003	.003	.060	.060	.060	.046	2.308	3.033
219.000	571.802	529.926	535.193	.003	.003	.060	.060	.060	.046	2.308	3.033
222.000	571.041	529.046	534.817	.003	.003	.060	.060	.060	.046	2.350	3.027
225.000	571.874	528.606	534.277	.003	.003	.060	.060	.060	.046	2.350	3.027
228.000	571.810	528.109	533.523	.003	.003	.060	.060	.060	.046	2.521	3.020
231.000	571.665	527.751	533.029	.003	.003	.060	.060	.060	.046	2.521	3.020
234.000	570.937	527.934	531.254	.003	.003	.060	.060	.060	.046	2.475	3.023
237.000	571.727	527.357	531.079	.003	.003	.060	.060	.060	.046	2.475	3.023
240.000	571.221	527.805	530.821	.003	.003	.060	.060	.060	.046	2.311	3.026
243.000	570.406	527.237	529.783	.003	.003	.060	.060	.060	.046	2.311	3.026
246.000	569.866	527.665	529.767	.003	.003	.060	.060	.060	.046	2.320	3.026
249.000	569.634	527.595	529.181	.003	.003	.060	.060	.060	.046	2.320	3.026
252.000	569.744	527.212	528.260	.003	.003	.060	.060	.060	.046	2.320	3.026
255.000	569.724	527.212	527.609	.003	.003	.060	.060	.060	.046	2.320	3.026
258.000	569.820	527.826	527.017	.003	.003	.060	.060	.060	.046	2.320	3.026
261.000	569.822	527.548	527.465	.003	.003	.060	.060	.060	.046	2.320	3.026
264.000	569.069	527.008	527.879	.003	.003	.060	.060	.060	.046	2.320	3.026
267.000	569.209	527.401	527.820	.003	.003	.060	.060	.060	.046	2.320	3.026
270.000	569.594	527.574	527.591	.003	.003	.060	.060	.060	.046	2.320	3.026
273.000	569.468	527.569	527.332	.003	.003	.060	.060	.060	.046	2.320	3.026
276.000	569.500	527.397	527.332	.003	.003	.060	.060	.060	.046	2.320	3.026
279.000	569.330	527.597	527.281	.003	.003	.060	.060	.060	.046	2.320	3.026
282.000	566.139	527.997	527.036	.003	.003	.060	.060	.060	.046	2.320	3.026
285.000	566.029	527.997	527.036	.003	.003	.060	.060	.060	.046	2.320	3.026
288.000	565.584	527.997	527.036	.003	.003	.060	.060	.060	.046	2.320	3.026
291.000	565.584	527.997	527.036	.003	.003	.060	.060	.060	.046	2.320	3.026
294.000	565.373	527.997	527.036	.003	.003	.060	.060	.060	.046	2.320	3.026
297.000	565.373	527.997	527.036	.003	.003	.060	.060	.060	.046	2.320	3.026
300.000	564.247	527.997	527.036	.003	.003	.060	.060	.060	.046	2.320	3.026

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RPRINT MONITORED VARIABLES

Loop 1

CHANNEL 27	CHANNEL 6	CHANNEL 7	CHANNEL 8	CHANNEL 9	CHANNEL 10	CHANNEL 13	CHANNEL 14	CHANNEL 15	CHANNEL 17
303.000	563.597	519.997	519.997	-.003	-.003	.050	.038	14.137	3.342
306.000	563.414	519.997	519.997	-.003	-.003	.051	.038	14.137	4.004
309.000	563.576	519.997	519.997	-.003	-.003	.052	.034	14.100	4.703
312.000	563.640	519.997	519.997	-.003	-.003	.051	.038	14.039	5.341
315.000	563.359	519.997	519.997	-.003	-.003	.052	.035	13.996	6.006
318.000	561.255	519.997	519.997	-.003	-.003	.052	.038	13.969	6.681
321.000	563.314	519.997	519.997	-.003	-.003	.052	.040	13.917	7.334
324.000	563.084	519.997	519.997	-.003	-.003	.052	.038	13.883	7.990
327.000	562.830	519.997	519.997	-.003	-.003	.052	.038	13.841	8.698
330.000	562.424	519.997	519.997	-.003	-.003	.050	.037	13.801	9.131
333.000	562.221	519.997	519.997	-.003	-.003	.051	.037	13.746	9.092
336.000	562.112	519.997	519.997	-.003	-.003	.051	.037	13.734	9.324
339.000	562.834	519.997	519.997	-.003	-.003	.051	.038	13.709	9.608
342.000	561.127	519.997	519.997	-.003	-.003	.051	.038	13.654	9.769
345.000	562.739	519.997	519.997	-.003	-.003	.051	.037	13.624	9.873
348.000	562.327	519.997	519.997	-.003	-.003	.051	.038	13.609	9.888
351.000	562.346	519.997	519.997	-.003	-.003	.051	.038	13.560	9.919
354.000	562.480	519.997	519.997	-.003	-.003	.050	.038	13.545	9.901
357.000	562.556	519.997	519.997	-.003	-.003	.051	.037	13.520	9.949
360.000	562.495	519.997	519.997	-.003	-.003	.052	.037	13.514	9.913
363.000	562.355	519.997	519.997	-.003	-.003	.052	.037	13.441	9.907
366.000	562.282	519.997	519.997	-.003	-.003	.050	.037	13.468	9.876
369.000	562.163	519.997	519.997	-.003	-.003	.051	.037	13.453	9.882
372.000	562.230	519.997	519.997	-.003	-.003	.051	.037	13.429	9.916
375.000	562.221	519.997	519.997	-.003	-.003	.051	.037	13.438	9.839
378.000	562.041	519.997	519.997	-.003	-.003	.051	.037	13.395	9.824
381.000	561.986	519.997	519.997	-.003	-.003	.051	.037	13.401	9.760
384.000	561.983	519.997	519.997	-.003	-.003	.051	.037	13.374	9.769
387.000	561.961	519.997	519.997	-.003	-.003	.051	.037	13.383	9.742
390.000	561.897	519.997	519.997	-.003	-.003	.052	.037	13.371	9.736
393.000	561.744	519.997	519.997	-.003	-.003	.051	.036	13.368	9.656
396.000	561.424	519.997	519.997	-.003	-.003	.052	.037	13.371	9.650
399.000	561.110	519.997	519.997	-.003	-.003	.051	.037	13.340	9.638
402.000	560.920	519.997	519.997	-.003	-.003	.053	.037	13.346	9.611
405.000	560.792	519.997	519.997	-.003	-.003	.051	.037	13.313	9.623
408.000	560.493	519.997	519.997	-.003	-.003	.051	.037	13.306	9.592
411.000	560.573	519.997	519.997	-.003	-.003	.051	.036	13.255	9.574
414.000	560.298	519.997	519.997	-.003	-.003	.051	.037	13.279	9.775
417.000	560.148	519.997	519.997	-.003	-.003	.052	.037	13.267	9.565
420.000	559.069	519.997	519.997	-.003	-.003	.051	.037	13.224	9.540
423.000	559.864	519.997	519.997	-.003	-.003	.051	.037	13.236	9.534
426.000	559.730	519.997	519.997	-.003	-.003	.051	.040	13.245	9.510
429.000	559.431	519.997	519.997	-.003	-.003	.051	.037	13.200	9.495
432.000	559.205	519.997	519.997	-.003	-.003	.051	.037	13.215	9.485
435.000	558.126	519.997	519.997	-.003	-.003	.050	.036	13.218	9.470
438.000	558.979	519.997	519.997	-.003	-.003	.051	.036	13.200	9.452
441.000	558.857	519.997	519.997	-.003	-.003	.050	.037	13.184	9.431
444.000	558.677	519.997	519.997	-.003	-.003	.051	.037	13.172	9.452
447.000	558.564	519.997	519.997	-.003	-.003	.051	.037	13.163	9.427
450.000	558.390	519.997	519.997	-.003	-.003	.051	.037	13.145	9.431

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RPRINT MONITORED VARIABLES

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CHANNEL 27	CHANNEL 6	CHANNEL 7	CHANNEL 8	CHANNEL 9	CHANNEL 10	CHANNEL 13	CHANNEL 14	CHANNEL 15	CHANNEL 17
453.000	558.378	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
456.000	558.482	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
459.000	558.357	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
462.000	558.290	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
465.000	558.308	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
468.000	558.232	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
471.000	558.165	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
474.000	558.073	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
480.000	558.011	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
483.000	558.070	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
486.000	558.036	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
489.000	557.984	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
492.000	558.027	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
495.000	557.807	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
498.000	557.713	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
501.000	557.618	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
504.000	557.504	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
507.000	557.630	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
513.000	557.575	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
516.000	557.630	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
519.000	557.618	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
522.000	557.504	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
528.000	557.435	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
531.000	557.399	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
537.000	557.377	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
540.000	557.322	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
543.000	557.259	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
546.000	557.167	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
549.000	557.102	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
552.000	557.166	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
555.000	557.179	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
561.000	557.160	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
564.000	557.136	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
567.000	557.069	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
570.000	557.041	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
577.000	557.069	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
576.000	557.069	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
579.000	557.154	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
582.000	557.049	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
585.000	556.959	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
588.000	556.977	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
591.000	556.745	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
594.000	556.968	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
597.000	556.907	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997
600.000	556.779	519.997	519.997	519.997	519.997	519.997	519.997	519.997	519.997

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RPRINT MONITORED VARIABLES

CHANNEL 27	CHANNEL 6	CHANNEL 7	CHANNEL 8	CHANNEL 9	CHANNEL 10	CHANNEL 13	CHANNEL 14	CHANNEL 15	CHANNEL 17
603.000	556.288	519.997	525.829	-.003	-.003	.049	.036	12.431	9.199
606.000	551.048	519.997	525.081	-.003	-.003	.044	.025	11.808	8.890
609.000	554.731	519.997	524.230	-.003	-.003	.031	.000	10.819	8.472
612.000	555.982	519.997	526.327	-.003	-.003	.050	.034	12.345	9.174
615.000	556.632	519.997	527.245	-.003	-.003	.050	.035	12.473	9.311
618.000	555.665	519.997	526.559	-.003	-.003	.048	.032	12.247	9.128
621.000	554.237	519.997	525.277	-.003	-.003	.041	.025	11.655	7.654
624.000	553.730	519.997	523.778	-.003	-.003	.038	.021	12.644	8.436
627.000	550.379	519.997	525.344	-.003	-.003	.055	.000	11.178	8.396
630.000	554.817	519.997	524.874	-.003	-.003	.014	.022	11.384	8.359
633.000	555.110	519.997	526.763	-.003	-.003	.054	.031	12.086	9.040
636.000	556.266	519.997	527.764	-.003	-.003	.050	.036	12.373	9.287
639.000	556.282	519.997	528.014	-.003	-.003	.050	.035	12.319	9.305
642.000	554.456	519.997	526.574	-.003	-.003	.045	.030	11.756	8.848
645.000	554.325	519.997	526.861	-.003	-.003	.043	.027	11.500	8.826
648.000	553.373	519.997	525.628	-.003	-.003	.038	.022	11.320	8.466
651.000	554.612	519.997	527.102	-.003	-.003	.045	.030	11.805	9.018
654.000	555.726	519.997	528.121	-.003	-.003	.051	.035	12.238	9.363
657.000	554.560	519.997	527.108	-.003	-.003	.045	.030	11.774	9.061
660.000	553.187	519.997	526.125	-.003	-.003	.037	.023	11.243	8.506
663.000	553.358	519.997	526.491	-.003	-.003	.040	.024	11.298	8.555
666.000	555.775	519.997	528.732	-.003	-.003	.050	.035	12.125	9.388
669.000	555.677	519.997	528.826	-.003	-.003	.049	.035	12.128	9.336
672.000	555.552	519.997	528.890	-.003	-.003	.049	.035	12.077	9.357
675.000	555.464	519.997	529.006	-.003	-.003	.042	.035	12.086	9.351
678.000	555.418	519.997	529.138	-.003	-.003	.050	.035	12.040	9.397
681.000	555.454	519.997	529.290	-.003	-.003	.049	.035	12.022	9.391
684.000	555.418	519.997	529.406	-.003	-.003	.049	.035	12.022	9.360
687.000	551.735	519.997	526.546	-.003	-.003	.033	.000	10.828	8.564
690.000	550.910	519.997	526.553	-.003	-.003	.036	.011	9.342	8.371
693.000	552.756	519.997	529.778	-.003	-.003	.036	.020	10.862	9.498
696.000	552.241	519.997	526.733	-.003	-.003	.036	.021	10.872	8.448
699.000	552.140	519.997	526.742	-.003	-.003	.029	.020	10.865	8.436
702.000	552.157	519.997	527.523	-.003	-.003	.036	.020	11.860	8.448
705.000	552.467	519.997	526.379	-.003	-.003	.037	.022	10.947	8.735
708.000	552.409	519.997	527.053	-.003	-.003	.037	.022	10.874	8.539
711.000	552.419	519.997	527.288	-.003	-.003	.035	.023	10.877	8.573
714.000	550.376	519.997	527.325	-.003	-.003	.035	.021	10.834	8.619
717.000	552.699	519.997	527.053	-.003	-.003	.039	.023	11.008	8.848
720.000	554.916	519.997	529.952	-.003	-.003	.048	.035	11.781	9.458
723.000	554.878	519.997	529.922	-.003	-.003	.048	.035	11.814	9.449
726.000	554.801	519.997	529.739	-.003	-.003	.049	.037	11.750	9.409
729.000	554.829	519.997	529.775	-.003	-.003	.048	.035	11.710	9.488
732.000	554.817	519.997	529.760	-.003	-.003	.049	.035	11.692	9.562
735.000	554.780	519.997	529.955	-.003	-.003	.048	.035	11.686	9.504
738.000	554.673	519.997	530.209	-.003	-.003	.048	.035	11.835	9.498
741.000	553.397	519.997	529.257	-.003	-.003	.044	.031	11.311	9.189
744.000	552.192	519.997	527.581	-.003	-.003	.035	.035	10.486	8.558
747.000	551.655	519.997	527.523	-.003	-.003	.036	.020	10.551	8.588
750.000	551.270	519.997	528.097	-.003	-.003	.031	.027	10.725	8.625

**** NOT CERTIFIED

NOT CERTIFIED

NOT CERTIFIED

NOT CERTIFIED

RPRINT MONITORED VARIABLES

CHANNEL 27	CHANNEL 6	CHANNEL 7	CHANNEL 8	CHANNEL 9	CHANNEL 10	CHANNEL 13	CHANNEL 14	CHANNEL 15	CHANNEL 17
753.000	551.646	519.997	526.327	-.003	-.003	.035	.021	10.499	9.479
756.000	551.591	519.997	527.618	-.003	-.003	.035	.021	10.541	8.573
759.000	554.380	519.997	530.584	-.003	-.003	.047	.035	11.518	9.446
762.000	554.447	519.997	530.749	-.003	-.003	.048	.031	11.494	9.534
765.000	554.109	519.997	530.444	-.003	-.003	.048	.035	11.448	9.568
768.000	554.389	519.997	530.819	-.003	-.003	.048	.035	11.460	9.522
771.000	554.481	519.997	530.996	-.003	-.003	.047	.035	11.442	9.531
774.000	553.516	519.997	530.096	-.003	-.003	.044	.022	11.188	9.321
777.000	552.851	519.997	529.705	-.003	-.003	.041	.028	10.889	9.695
780.000	552.567	519.997	527.981	-.003	-.003	.048	.027	10.804	9.012
783.000	553.184	519.997	530.093	-.003	-.003	.042	.030	11.069	9.278
786.000	554.359	519.997	531.454	-.003	-.003	.046	.035	11.414	9.519
789.000	554.755	519.997	531.445	-.003	-.003	.046	.035	11.399	9.540
792.000	554.359	519.997	531.509	-.003	-.003	.046	.035	11.533	9.637
795.000	552.854	519.997	530.171	-.003	-.003	.041	.035	11.372	9.174
798.000	553.309	519.997	530.828	-.003	-.003	.044	.032	12.153	9.302
801.000	551.505	519.997	532.519	-.003	-.003	.034	.021	12.328	8.579
804.000	554.209	519.997	531.979	-.003	-.003	.046	.035	12.949	9.510
807.000	554.279	519.997	532.275	-.003	-.003	.047	.035	12.672	9.598
810.000	554.084	519.997	532.421	-.003	-.003	.046	.035	12.806	9.403
813.000	554.338	519.997	532.547	-.003	-.003	.046	.034	13.764	9.318
816.000	551.928	519.997	532.626	-.003	-.003	.046	.034	15.077	9.339
819.000	554.011	520.009	532.550	-.003	-.003	.046	.035	16.154	9.861
822.000	551.925	520.653	532.736	-.003	-.003	.047	.034	16.767	10.353
825.000	553.700	521.141	532.401	-.003	-.003	.046	.034	17.356	11.719
828.000	553.663	521.502	533.194	-.003	-.003	.047	.035	17.970	12.775
831.000	553.449	521.598	533.136	-.003	-.003	.048	.034	18.589	13.679
834.000	551.043	521.886	533.273	-.003	-.003	.048	.035	19.791	15.022
837.000	552.500	522.170	533.215	-.003	-.003	.048	.035	18.968	15.415
840.000	551.899	522.570	533.224	-.003	-.003	.048	.035	18.983	15.232
843.000	551.618	522.591	533.404	-.003	-.003	.048	.034	18.974	15.379
846.000	551.411	522.432	533.532	-.003	-.003	.046	.034	19.001	15.257
849.000	551.447	522.013	533.700	-.003	-.003	.045	.035	19.172	15.199
852.000	551.646	521.193	533.657	-.003	-.003	.046	.035	19.166	15.275
855.000	551.042	520.694	533.929	-.003	-.003	.046	.034	19.120	15.345
858.000	552.006	519.997	534.174	-.003	-.003	.046	.034	19.153	15.248
861.000	552.143	519.997	534.292	-.003	-.003	.047	.035	19.166	15.379
864.000	552.253	519.997	534.262	-.003	-.003	.046	.035	19.178	15.470
867.000	552.259	519.997	533.841	-.003	-.003	.046	.035	19.151	15.394
870.000	552.745	519.997	533.610	-.003	-.003	.047	.034	19.282	15.406
873.000	552.515	519.997	533.523	-.003	-.003	.047	.034	19.133	15.241
876.000	552.291	519.997	533.386	-.003	-.003	.046	.035	19.111	15.415
879.000	552.143	519.997	532.721	-.003	-.003	.048	.034	19.142	15.431
882.000	552.143	519.997	532.077	-.003	-.003	.048	.034	19.084	15.415
885.000	551.972	519.997	531.762	-.003	-.003	.048	.034	19.093	15.409
888.000	552.061	519.997	531.329	-.003	-.003	.048	.034	19.081	15.400
891.000	551.942	519.997	530.654	3.697	-.003	.047	.034	19.056	15.409
894.000	551.673	519.997	531.695	18.780	-.003	.048	.034	19.032	15.483
897.000	551.563	519.997	532.765	35.823	-.003	.048	.034	19.017	15.965
900.000	547.669	519.997	527.679	38.026	-.003	.020	.034	17.854	14.710

Handwritten notes:
 Loop 2
 Loop 1
 40%
 50%

Handwritten notes:
 Loop 1
 Loop 2

BLOCK 1

Notes:
 1. Tc Loop 2 is increasing when Tc comes on scale; at Tc ≈ 310 sec 5/6 level begins increasing

RPRINT MONITORED VARIABLES

CHANNEL 27	CHANNEL 6	CHANNEL 7	CHANNEL 8	CHANNEL 9	CHANNEL 10	CHANNEL 13	CHANNEL 14	CHANNEL 15	CHANNEL 17
901.000	549.662	519.997	529.766	37.488	-.003	.035	.019	17.845	14.243
906.000	550.840	519.997	532.717	38.781	-.003	.035	.020	17.857	14.906
909.000	554.475	519.997	537.967	38.383	-.003	.048	.034	19.020	14.872
912.000	559.312	519.997	539.001	38.724	-.003	.048	.034	19.212	14.549
915.000	562.858	521.798	538.888	38.411	-.003	.048	.034	19.420	14.607
918.000	563.756	526.760	538.251	39.044	-.003	.048	.034	19.627	14.546
921.000	563.631	524.474	537.521	39.218	-.003	.048	.034	19.655	14.628
924.000	562.495	525.591	536.944	38.100	-.003	.049	.034	19.691	14.646
927.000	561.735	524.969	536.761	39.394	-.003	.048	.033	19.819	14.683
930.000	558.491	524.087	536.838	38.765	-.003	.048	.034	19.899	14.741
933.000	555.461	523.534	537.240	38.787	-.003	.049	.034	19.868	14.729
936.000	551.530	521.602	537.802	39.051	-.003	.048	.034	19.685	14.726
939.000	546.537	522.798	538.516	38.847	-.003	.049	.035	19.511	14.768
942.000	539.746	521.059	539.221	38.290	-.003	.051	.034	19.433	14.811
945.000	532.199	525.316	539.807	38.567	-.003	.049	.034	19.026	14.869
948.000	526.965	525.591	540.237	38.422	-.003	.049	.034	19.209	14.887
951.000	524.731	527.038	540.524	38.345	-.003	.049	.034	19.224	14.890
954.000	522.564	527.843	540.723	38.641	-.003	.049	.034	19.105	14.906
957.000	520.885	528.649	540.924	38.133	-.003	.048	.034	19.050	14.926

— OTSG Pressure —

RPRINT MONITORED VARIABLES

LOOP 2 LOOP 1

CHANNEL 27	CHANNEL 19	CHANNEL 20
.000	888.445	892.950
3.000	951.671	933.419
6.000	1040.829	1032.192
9.000	1054.935	1052.957
12.000	988.903	1028.017
15.000	990.368	1007.032
18.000	913.190	991.027

— 0756 Pressure —

RPRINT MONITORED VARIABLES

LOOP 2 LOOP 1

CHANNEL 27	CHANNEL 19	CHANNEL 20
1.000	898.445	892.950
3.000	953.671	933.419
6.000	1060.020	1032.192
9.000	1054.935	1052.957
12.000	998.908	1028.017
15.000	930.361	1007.032
18.000	933.199	991.027
21.000	975.682	979.181
24.000	968.394	968.687
27.000	973.082	969.496
30.000	968.541	965.794
33.000	978.246	959.788
36.000	979.894	953.671
39.000	978.090	947.226
42.000	973.558	939.608
45.000	962.608	944.369
48.000	956.272	958.762
51.000	951.436	969.127
54.000	974.600	982.787
57.000	983.570	996.726
60.000	987.475	1004.065
63.000	990.222	1012.012
66.000	998.054	1018.568
69.000	986.230	1024.721
72.000	982.238	1029.655
75.000	978.978	1022.199
78.000	975.609	964.182
81.000	969.420	957.554
84.000	963.303	949.716
87.000	957.004	932.977
90.000	951.144	950.445
93.000	945.504	961.143
96.000	940.194	980.990
99.000	935.067	975.023
102.000	929.830	980.446
105.000	925.691	985.827
108.000	920.967	980.295
111.000	915.682	984.397
114.000	912.763	986.667
117.000	908.625	987.658
120.000	904.853	978.474
123.000	900.641	968.069
126.000	896.502	955.686
129.000	892.291	957.480
132.000	888.116	958.762
135.000	883.281	958.418
138.000	879.436	955.393
141.000	874.638	946.567
144.000	870.170	939.755
147.000	865.556	934.622
150.000	861.088	930.452

RPRINT MONITORED VARIABLES

CHANNEL 27	CHANNEL 19	CHANNEL 20
153.000	856.583	924.922
156.000	852.445	917.195
159.000	846.695	909.101
162.000	844.158	901.227
165.000	840.359	893.902
168.000	836.477	886.504
171.000	832.631	879.253
174.000	828.676	872.661
177.000	825.150	865.739
180.000	820.995	859.257
183.000	817.469	852.628
186.000	813.697	846.475
189.000	810.218	840.432
192.000	806.482	834.243
195.000	803.662	830.251
198.000	799.927	823.952
201.000	796.521	819.008
204.000	793.481	813.880
207.000	790.331	809.376
210.000	787.658	804.541
213.000	784.105	799.487
216.000	780.956	794.543
219.000	777.403	790.551
222.000	775.572	785.937
225.000	772.679	781.615
228.000	770.335	776.634
231.000	767.991	772.972
234.000	765.209	770.409
237.000	761.985	764.595
240.000	760.996	761.472
243.000	758.945	757.653
246.000	755.979	754.441
249.000	754.697	750.925
252.000	752.646	747.299
255.000	750.522	744.113
258.000	748.251	741.073
261.000	746.200	737.704
264.000	749.347	734.701
267.000	755.100	731.588
270.000	765.171	728.292
273.000	770.189	725.147
276.000	774.144	722.432
279.000	779.418	718.949
282.000	785.021	716.426
285.000	789.233	713.789
288.000	791.723	710.602
291.000	794.177	707.526
294.000	796.301	704.962
297.000	798.242	702.069
300.000	735.103	636.330

BLOCK 1

RPRINT MONITORED VARIABLES

CHANNEL 27	CHANNEL 19	CHANNEL 20
303.000	738.143	634.170
306.000	741.659	631.166
309.000	744.259	628.530
312.000	747.189	625.536
315.000	750.335	623.073
318.000	753.964	620.546
321.000	755.613	617.543

RPRINT MONITORED VARIABLES

CHANNEL 27	CHANNEL 19	CHANNEL 20
303.000	738.143	634.170
306.000	741.659	631.166
309.000	744.259	628.530
312.000	747.189	625.536
315.000	750.339	623.073
318.000	753.964	620.546
321.000	755.613	617.543
324.000	758.359	614.686
327.000	760.776	612.415
330.000	763.194	611.756
333.000	765.281	614.649
336.000	767.369	627.065
339.000	769.566	632.595
342.000	771.251	636.477
345.000	772.240	641.001
348.000	772.789	647.391
351.000	775.536	652.984
354.000	775.316	657.316
357.000	777.330	659.879
360.000	779.198	662.553
363.000	778.319	663.798
366.000	778.246	666.471
369.000	777.953	669.108
372.000	777.550	671.672
375.000	777.220	674.931
378.000	777.916	678.227
381.000	776.085	681.194
384.000	775.426	684.956
387.000	774.400	688.116
390.000	774.034	692.304
393.000	773.411	696.393
396.000	773.595	700.311
399.000	772.349	703.534
402.000	771.397	706.903
405.000	771.214	710.676
408.000	770.005	713.752
411.000	769.566	717.095
414.000	768.769	720.088
417.000	768.101	723.238
420.000	767.442	726.241
423.000	766.893	728.914
426.000	766.270	731.075
429.000	765.611	734.591
432.000	765.171	737.118
435.000	764.292	739.535
438.000	763.706	742.025
441.000	763.377	744.652
444.000	760.703	746.860
447.000	761.216	748.874
450.000	761.216	751.950

RPRINT MONITORED VARIABLES

CHANNEL 27	CHANNEL 19	CHANNEL 20
453.000	760.227	754.221
456.000	759.934	756.894
459.000	758.140	758.689
462.000	758.759	761.399
465.000	757.700	763.450
468.000	756.931	765.940
471.000	756.308	768.138
474.000	755.576	770.518
477.000	754.660	772.716
480.000	754.294	775.316
483.000	753.562	777.477
486.000	752.573	780.297
489.000	753.812	783.263
492.000	751.328	784.598
495.000	750.658	786.523
498.000	750.279	789.123
501.000	749.496	789.855
504.000	748.910	792.749
507.000	747.482	795.962
510.000	747.665	798.295
513.000	747.079	800.220
516.000	746.200	802.197
519.000	745.724	804.431
522.000	744.919	805.201
525.000	744.589	808.716
528.000	743.710	810.474
531.000	743.637	812.525
534.000	742.977	814.466
537.000	742.392	816.334
540.000	741.842	818.202
543.000	741.403	819.960
546.000	740.927	821.644
549.000	740.524	823.402
552.000	739.864	825.014
555.000	739.572	826.698
558.000	739.205	828.343
561.000	738.070	829.532
564.000	739.572	831.459
567.000	737.191	832.009
570.000	738.107	833.840
573.000	736.715	835.451
576.000	736.349	837.429
579.000	736.056	837.644
582.000	735.177	838.957
585.000	734.737	840.286
588.000	734.298	841.055
591.000	733.675	842.263
594.000	733.748	843.472
597.000	733.346	844.571
600.000	732.760	843.838

BLOCK 1

RPRINT MONITORED VARIABLES

CHANNEL 27	CHANNEL 19	CHANNEL 20
603.000	731.551	845.010
606.000	727.156	841.014
609.000	721.736	836.184
612.000	723.865	849.222
615.000	711.990	850.320
618.000	728.695	847.684
621.000	720.271	841.458
624.000	719.209	839.187

RPRINT MONITORED VARIABLES

CHANNEL 27	CHANNEL 19	CHANNEL 20
601.000	731.551	845.010
606.000	727.156	841.914
609.000	721.716	836.184
612.000	729.866	849.222
615.000	711.990	850.720
618.000	728.694	847.684
621.000	720.271	841.458
624.000	719.209	839.187
627.000	719.355	840.469
630.000	717.890	839.983
633.000	725.818	850.101
636.000	728.438	855.484
639.000	728.145	855.558
642.000	722.432	848.453
645.000	722.139	849.185
648.000	717.598	844.574
651.000	723.128	856.913
654.000	726.424	857.828
657.000	722.578	852.481
660.000	705.475	846.621
663.000	716.682	843.142
666.000	725.655	860.685
669.000	725.362	861.088
672.000	725.325	861.564
675.000	725.069	862.040
678.000	724.483	862.992
681.000	723.494	863.065
684.000	725.252	863.688
687.000	714.155	851.859
690.000	710.749	850.394
693.000	711.958	850.723
696.000	713.056	849.625
699.000	711.884	865.080
702.000	711.591	852.445
705.000	713.219	855.081
708.000	722.909	855.374
711.000	712.690	870.453
714.000	712.104	856.510
717.000	713.162	858.780
720.000	723.201	870.097
723.000	721.809	870.244
726.000	721.553	870.573
729.000	721.443	871.452
732.000	721.077	871.992
735.000	721.150	872.075
738.000	720.967	872.917
741.000	717.451	869.255
744.000	708.991	859.659
747.000	720.308	860.575
750.000	710.786	863.908

RPRT MONITORED VARIABLES

Loop 2

Loop 2

Loop 2
50 1445

CHANNEL 27	CHANNEL 19	CHANNEL 20
753.000	709.101	862.553
756.000	688.482	850.760
759.000	720.015	877.641
762.000	719.868	877.275
765.000	719.479	877.632
768.000	720.198	878.411
771.000	719.648	879.070
774.000	717.012	876.506
777.000	713.349	874.858
780.000	713.201	872.771
783.000	715.766	879.180
786.000	718.440	882.756
789.000	717.598	882.659
792.000	715.400	883.281
795.000	709.687	877.934
798.000	702.765	880.095
801.000	691.155	870.024
804.000	698.114	880.718
807.000	697.308	877.202
810.000	695.674	865.263
813.000	692.218	852.701
816.000	697.566	841.511
819.000	692.732	831.276
822.000	677.458	820.912
825.000	672.258	810.071
828.000	667.204	800.952
831.000	662.001	792.016
834.000	657.389	783.629
837.000	656.510	778.356
840.000	660.172	783.996
843.000	667.643	786.596
846.000	672.311	789.050
849.000	674.675	790.881
852.000	679.692	794.580
855.000	691.707	796.494
858.000	683.501	798.515
861.000	684.719	799.927
864.000	695.715	801.025
867.000	695.887	801.355
870.000	696.541	802.344
873.000	696.834	802.930
876.000	697.127	802.564
879.000	697.530	804.138
882.000	698.226	804.761
885.000	698.958	806.043
888.000	699.984	805.530
891.000	692.401	805.970
894.000	692.108	809.778
897.000	693.280	827.980
900.000	680.388	850.467

RPRINT MONITORED VARIABLES

CHANNEL 27	CHANNEL 19	CHANNEL 20
903.000	650.696	866.215
906.000	675.664	862.246
909.000	692.998	865.267
912.000	690.571	858.304
915.000	679.582	857.279
918.000	680.132	861.637
921.000	681.063	869.841
924.000	694.234	877.395
927.000	697.017	881.574
930.000	690.350	886.604
933.000	694.159	886.944
936.000	696.281	885.992
939.000	702.545	885.652
942.000	704.743	886.431
945.000	708.112	887.420
948.000	711.555	888.738
951.000	716.792	890.386
954.000	719.575	892.437
957.000	723.677	893.756

RPRINT COMPLETED

E(DTU)

P(BTU/HR)

TIME(SEC)

STEP

1	10000E+00	51058E+09	14242E+05
2	12589E+00	50950E+09	17911E+05
3	19553E+00	50814E+09	22511E+05
4	25119E+00	50644E+09	26330E+05
5	31623E+00	50438E+09	35554E+05
6	39111E+00	50182E+09	44643E+05
7	50119E+00	49940E+09	56020E+05
8	63096E+00	49702E+09	70244E+05
9	79733E+00	49461E+09	88000E+05
10	10000E+01	47700E+09	11012E+06
11	12849E+01	47100E+09	13777E+06
12	16491E+01	46260E+09	17404E+06
13	21353E+01	45333E+09	21404E+06
14	27319E+01	44337E+09	26223E+06
15	34623E+01	43299E+09	33055E+06
16	43411E+01	42252E+09	40968E+06
17	53919E+01	41223E+09	50692E+06
18	66409E+01	40228E+09	62636E+06
19	81333E+01	39257E+09	77309E+06
20	99000E+01	38275E+09	95326E+06
21	12000E+02	37237E+09	11747E+07
22	14549E+02	36099E+09	14462E+07
23	17531E+02	34830E+09	17781E+07
24	21019E+02	33459E+09	21823E+07
25	25119E+02	31992E+09	25729E+07
26	29919E+02	30465E+09	32629E+07
27	35419E+02	28897E+09	39734E+07
28	41996E+02	27282E+09	48619E+07
29	49919E+02	25627E+09	58619E+07
30	59000E+02	23966E+09	70524E+07
31	69549E+02	22246E+09	85270E+07
32	81996E+02	20465E+09	10240E+08
33	96419E+02	18627E+09	12448E+08
34	11319E+02	16627E+09	14948E+08
35	13162E+02	14477E+09	17977E+08
36	15119E+02	12177E+09	21569E+08
37	17119E+02	98017E+09	25804E+08
38	19119E+02	78007E+09	30701E+08
39	21366E+02	56677E+09	36266E+08
40	23933E+02	47002E+09	43507E+08
41	26800E+02	38477E+09	51945E+08
42	29996E+02	30892E+09	61311E+08
43	33419E+02	23555E+09	72913E+08
44	37162E+02	16220E+09	86464E+08
45	41123E+02	9109E+09	10257E+09
46	45123E+02	0E+09	12141E+09

47	.39811E+04	.92107E+08	.14326E+09
48	.56119E+04	.84078E+08	.16843E+09
49	.63096E+04	.76615E+08	.19732E+09
50	.73433E+04	.69984E+08	.23049E+09
51	.10000E+05	.64276E+08	.26873E+09
52	.12589E+05	.59382E+08	.31310E+09
53	.15849E+05	.55025E+08	.36479E+09
54	.19953E+05	.50895E+08	.42508E+09
55	.25119E+05	.46796E+08	.49505E+09
56	.31623E+05	.42676E+08	.57573E+09
57	.39811E+05	.38635E+08	.66799E+09
58	.50119E+05	.34826E+08	.77288E+09
59	.63096E+05	.31376E+08	.89184E+09
60	.79433E+05	.28329E+08	.10269E+10
61	.10000E+06	.25622E+08	.11806E+10
62	.12589E+06	.23118E+08	.13555E+10
63	.15849E+06	.20870E+08	.15533E+10
64	.19953E+06	.18197E+08	.17743E+10
65	.25119E+06	.15708E+08	.20169E+10
66	.31623E+06	.13280E+08	.22778E+10
67	.39811E+06	.11046E+08	.25531E+10
68	.50119E+06	.90810E+07	.28394E+10
69	.63096E+06	.74482E+07	.31352E+10
70	.79433E+06	.61404E+07	.34412E+10
71	.10000E+07	.51013E+07	.37601E+10
72	.12589E+07	.42185E+07	.40943E+10
73	.15849E+07	.35065E+07	.44435E+10
74	.19953E+07	.28292E+07	.48027E+10
75	.25119E+07	.22060E+07	.51615E+10
76	.31623E+07	.16525E+07	.55070E+10
77	.39811E+07	.11953E+07	.58268E+10
78	.50119E+07	.84970E+06	.61150E+10
79	.63096E+07	.61336E+06	.63740E+10
80	.79433E+07	.46410E+06	.66145E+10

**** 7000 SCOPE OPERATION SYSTEM / V2 ****

12/09/77 77343

SYS DEVICES 819/ 4/PF FLS=200K FLL=764K HXS=160K HXL=453K HXD=453D

HH.MM.SS CPU SECOND ORIGIN

14.45.08 0000.004 MFZ. 20PPU G0R73 B+W LYN ECS-2CPUS 08/24/77
 14.45.11 0000.029 USR. -DEHE, F10, CP70, CORADAZZI DA
 14.45.16 0000.050 LOD. CHARGE. 84006A14, CORADAZZI DA, 366, P, DEHE2.
 14.45.17 0000.065 MFZ. -ATTACHP(DEHE, 2)
 14.45.17 0000.070 MFZ. PF646 - PFHACRO - ATTACH - PFLIST - PFLIST
 14.45.17 0000.084 MFZ. PF254 - CYCLE 251 ATTACHED FROM SN=SYSTEM
 14.45.17 0000.089 MFZ. PFE46 - PFHACRO - ATTACH - DEHE - DEHE
 14.45.17 0000.089 LOD. PF254 - CYCLE 1 ATTACHED FROM SN=SYSTEM
 14.45.18 0000.096 USR. -LEHE.
 FORTRAN LIBRARY 217-MODIFIED 03/16/76

**** FULL CERTIFICATION ****

**** FULL CERTIFICATION ****

**** FULL CERTIFICATION ****

**** FULL CERTIFICATION ****

TEFO DECAY HEAT BLK2

STEP	I (SEC)	P (BTU/HR)	F (°C)
1	.10000E+00	.23681E+09)	.66079E+04
2	.12589E+00	.23627E+09	.83092E+04
3	.15849E+00	.23559E+09	.10445E+05
4	.19953E+00	.23475E+09	.13126E+05
5	.25119E+00	.23371E+09	.16487E+05
6	.31623E+00	.23243E+09	.20698E+05
7	.39811E+00	.23086E+09	.25967E+05
8	.50119E+00	.22896E+09	.32549E+05
9	.63096E+00	.22666E+09	.40761E+05
10	.79433E+00	.22393E+09	.50985E+05
11	.10000E+01	.22073E+09	.63685E+05
12	.12589E+01	.21702E+09	.79425E+05
13	.15849E+01	.21282E+09	.98882E+05
14	.19953E+01	.20814E+09	.12287E+06
15	.25119E+01	.20302E+09	.15238E+06
16	.31623E+01	.19801E+09	.18861E+06
17	.39811E+01	.19278E+09	.23302E+06
18	.50119E+01	.18762E+09	.28746E+06
19	.63096E+01	.18266E+09	.35416E+06
20	.79433E+01	.17780E+09	.43590E+06
21	.10000E+02	.17290E+09	.53604E+06
22	.12589E+02	.16771E+09	.65848E+06
23	.15849E+02	.16202E+09	.80770E+06
24	.19953E+02	.15571E+09	.98872E+06
25	.25119E+02	.14882E+09	.12071E+07
26	.31623E+02	.14149E+09	.14691E+07
27	.39811E+02	.13395E+09	.17821E+07
28	.50119E+02	.12651E+09	.21545E+07
29	.63096E+02	.11944E+09	.25972E+07
30	.79433E+02	.11292E+09	.31236E+07
31	.10000E+03	.10696E+09	.37508E+07
32	.12589E+03	.10137E+09	.44991E+07
33	.15849E+03	.95875E+08	.53912E+07
34	.19953E+03	.90193E+08	.64508E+07
35	.25119E+03	.84203E+08	.77008E+07
36	.31623E+03	.77964E+08	.91636E+07
37	.39811E+03	.71683E+08	.10863E+08
38	.50119E+03	.65633E+08	.12824E+08
39	.63096E+03	.60075E+08	.15085E+08
40	.79433E+03	.55171E+08	.17693E+08
41	.10000E+04	.50921E+08	.20716E+08
42	.12589E+04	.47153E+08	.24235E+08
43	.15849E+04	.43595E+08	.28337E+08
44	.19953E+04	.39994E+08	.33095E+08
45	.25119E+04	.36217E+08	.38555E+08
46	.31623E+04	.32279E+08	.44731E+08

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47 39811E+04
48 50119E+04
49 63096E+04
50 79433E+04
51 10000E+05
52 12589E+05
53 15849E+05
54 19533E+05
55 23119E+05
56 26811E+05
57 30119E+05
58 33449E+05
59 36811E+05
60 39433E+06
61 42000E+06
62 44589E+06
63 47195E+06
64 49811E+06
65 52433E+06
66 55000E+06
67 57611E+06
68 60249E+06
69 62811E+06
70 65433E+06
71 68000E+06
72 70611E+06
73 73249E+06
74 75811E+06
75 78433E+06
76 81000E+06
77 83611E+06
78 86249E+06
79 88811E+06
80 91433E+06

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51602E+08
59128E+08
67235E+08
76038E+08
85474E+08
95700E+08
10685E+09
11900E+09
13209E+09
14589E+09
16001E+09
17407E+09
18780E+09
20113E+09
21428E+09
22765E+09
24161E+09
25626E+09
27137E+09
28646E+09
30094E+09
31430E+09
32627E+09
33688E+09
34643E+09
35534E+09
36398E+09
37240E+09
38077E+09
38859E+09
39565E+09
40179E+09
40706E+09
41174E+09

```

7000 SCOPE OPERATION SYSTEM / V2 12/09/77 77343

SYS DEVICES 019/ 4/PF FLS=200K FLL=764K HKS=160K MXL=453K MXB=453B

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HH.HM.SS CPU SECOND ORIGIN
10.15.28 0000.000 31.MFA.
10.15.29 0000.020 04.USR.
10.15.29 0000.050 LOD.
10.15.29 0000.065 HFZ.
10.15.30 0000.070 HFZ.
10.15.31 0000.089 HFZ.
10.15.32 0000.090 LOD.
10.15.32 0000.096 USR.
10.15.32 0000.100 USR.
10.15.32 0000.100 USR.

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20PPU CUR73 0+M LYN ECS-2CPUS 06/24/77
-DEHE 10.CCP70.CORADAZZI DA
-CHARGE.R4006A 14.CORADAZZI DA.366.P.DEME2.
-ATTACH.P10EHE.21
PF646 - PFMACRO - ATTACH - PFLIST - PFLIST
PF224 - CYCLE 250 ATTACHED FROM SN=SYSTEM
PF224 - PFMACRO - ATTACH - DEHE - DEHE
PF224 - CYCLE 1 ATTACHED FROM SN=SYSTEM
-DEHE.
FORTRAN LIBRARY 217-MODIFIED 03/16/76

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STEP TIME(SEC) P(BTU/HR) E(BTU)

1	10000E+00	44747E+09	12485E+05
2	12509E+00	44646E+09	15699E+05
3	15849E+00	44521E+09	19736E+05
4	19953E+00	44365E+09	24802E+05
5	25119E+00	44173E+09	31155E+05
6	31623E+00	43933E+09	39114E+05
7	39119E+00	43646E+09	49074E+05
8	48119E+00	43296E+09	61521E+05
9	59119E+00	42870E+09	77050E+05
10	72433E+00	42364E+09	96388E+05
11	88000E+00	41771E+09	12042E+06
12	10589E+00	41085E+09	15021E+06
13	12644E+00	40309E+09	18706E+06
14	14993E+00	39451E+09	23250E+06
15	17673E+00	38527E+09	28644E+06
16	20713E+00	37570E+09	35715E+06
17	24163E+00	36601E+09	44445E+06
18	28073E+00	35650E+09	54483E+06
19	32493E+00	34729E+09	67161E+06
20	37473E+00	33831E+09	82709E+06
21	43053E+00	32923E+09	10177E+07
22	49293E+00	31963E+09	12509E+07
23	56253E+00	30910E+09	15355E+07
24	64003E+00	29744E+09	18810E+07
25	72613E+00	28469E+09	22985E+07
26	82163E+00	27112E+09	28002E+07
27	92733E+00	25718E+09	34004E+07
28	10443E+00	24341E+09	41162E+07
29	11813E+00	22933E+09	49609E+07
30	13353E+00	21626E+09	59853E+07
31	15063E+00	20472E+09	71991E+07
32	16953E+00	19468E+09	86537E+07
33	18043E+00	18671E+09	10386E+08
34	19353E+00	17619E+09	12452E+08
35	20913E+00	16509E+09	14899E+08
36	22733E+00	15354E+09	17773E+08
37	24813E+00	14191E+09	21128E+08
38	27163E+00	13069E+09	25023E+08
39	29813E+00	12037E+09	29537E+08
40	32763E+00	11127E+09	34780E+08
41	36003E+00	10336E+09	40897E+08
42	39543E+00	96329E+08	48065E+08
43	43393E+00	89927E+08	56474E+08
44	47553E+00	82924E+08	66290E+08
45	52033E+00	75828E+08	77675E+08
46	56833E+00	68407E+08	90602E+08

47	39811E+04	50811E+08	10535E+09
48	50119E+04	53574E+08	12169E+09
49	63096E+04	56821E+08	13972E+09
50	79433E+04	60874E+08	15953E+09
51	10000E+05	65822E+08	18134E+09
52	12589E+05	71570E+08	20574E+09
53	15849E+05	78739E+08	23229E+09
54	19953E+05	86456E+08	26203E+09
55	25119E+05	94891E+08	29465E+09
56	31623E+05	10411E+08	32977E+09
57	39119E+05	11481E+08	36670E+09
58	48119E+05	12057E+08	40501E+09
59	59119E+05	13151E+08	44400E+09

6
11 10

47	3981E+04	6081E+08	1853E+09
48	5811E+04	5376E+08	1217E+09
49	6304E+04	4682E+08	1392E+09
50	7943E+04	4087E+08	1592E+09
51	1000E+05	3562E+08	1813E+09
52	1258E+05	3157E+08	2054E+09
53	1564E+05	2787E+08	2323E+09
54	1995E+05	2445E+08	2621E+09
55	2511E+05	2138E+08	2946E+09
56	3162E+05	1763E+08	3297E+09
57	3981E+05	1401E+08	3667E+09
58	5019E+05	1205E+08	4050E+09
59	6304E+05	9751E+07	4440E+09
60	7943E+05	7947E+07	4838E+09
61	10000E+06	6596E+07	5250E+09
62	12589E+06	5569E+07	5684E+09
63	15749E+06	4720E+07	6148E+09
64	19153E+06	3944E+07	6640E+09
65	23119E+06	3209E+07	7152E+09
66	27623E+06	2502E+07	7662E+09
67	32711E+06	1801E+07	8156E+09
68	38396E+06	1367E+07	8615E+09
69	44633E+06	9779E+06	9031E+09
70	51388E+06	6979E+06	9404E+09
71	58600E+07	5138E+06	9746E+09
72	66299E+07	3928E+06	10066E+10
73	74493E+07	3079E+06	10380E+10
74	83193E+07	2414E+06	10691E+10
75	92493E+07	1845E+06	10994E+10
76	10223E+07	1356E+06	11280E+10
77	11243E+07	9520E+05	11539E+10
78	12319E+07	6510E+05	11764E+10
79	13443E+07	4487E+05	11958E+10
80	14613E+07	3253E+05	12130E+10

11 + 10

95

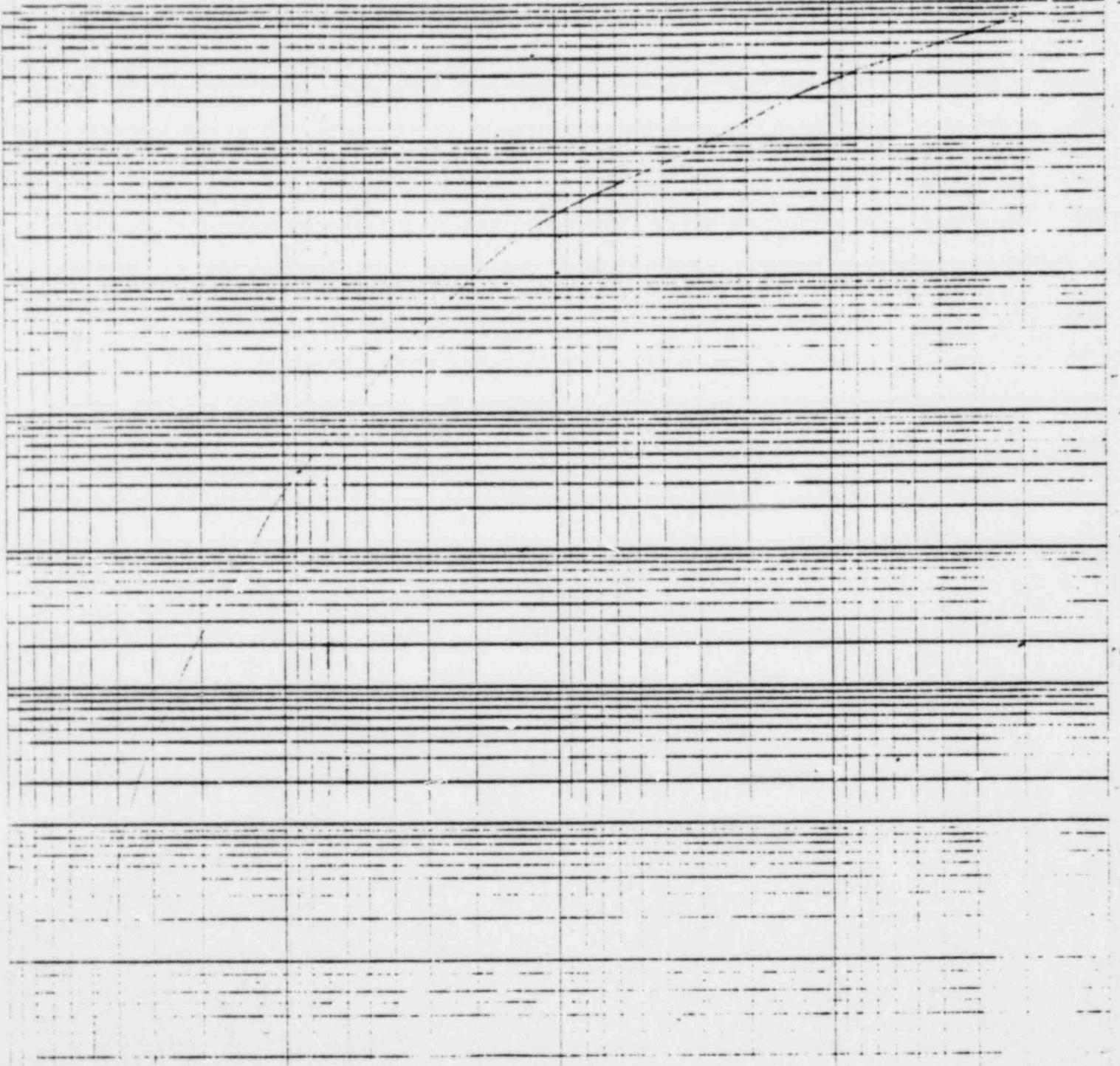
IFCO DECAY HEAT BLKJ

STEP	TIME(SEC)	P (BTU/HQ)	E (BTU)
1	1000E+00	50367E+09	14050E+05
2	1258E+00	50254E+09	17669E+05
3	1544E+00	50122E+09	22211E+05
4	1938E+00	49954E+09	27917E+05
5	2519E+00	49746E+09	35071E+05
6	3162E+00	49497E+09	44035E+05
7	3911E+00	49175E+09	55255E+05
8	5019E+00	48796E+09	69291E+05
9	6709E+00	48378E+09	86797E+05
10	7943E+00	47919E+09	10810E+06
11	1000E+01	47419E+09	13366E+06
12	1258E+01	46884E+09	16399E+06
13	1544E+01	46319E+09	20039E+06
14	1938E+01	45728E+09	25272E+06
15	2519E+01	45114E+09	32572E+06
16	3162E+01	44479E+09	40360E+06
17	3911E+01	43825E+09	49927E+06
18	4709E+01	43154E+09	61678E+06
19	5589E+01	42468E+09	76077E+06
20	6709E+01	41768E+09	93699E+06
21	7943E+01	41056E+09	11555E+07
22	9311E+01	40333E+09	14270E+07
23	1080E+02	39599E+09	17677E+07
24	1258E+02	38856E+09	21892E+07
25	1459E+02	38104E+09	27048E+07
26	1684E+02	37344E+09	33363E+07
27	1938E+02	36576E+09	40971E+07
28	2219E+02	35800E+09	50007E+07
29	2519E+02	35016E+09	60631E+07
30	2943E+02	34226E+09	73982E+07
31	3411E+02	33431E+09	89357E+07
32	3911E+02	32632E+09	10694E+08
33	4449E+02	31829E+09	12694E+08
34	4953E+02	31022E+09	14965E+08
35	5519E+02	30211E+09	17509E+08
36	6138E+02	29396E+09	20461E+08
37	6811E+02	28578E+09	24839E+08
38	7543E+02	27756E+09	29813E+08
39	8336E+02	26931E+09	35544E+08
40	9193E+02	26104E+09	41981E+08
41	1000E+03	25276E+09	49725E+08
42	1258E+03	24448E+09	58992E+08
43	1544E+03	23619E+09	69772E+08
44	1938E+03	22790E+09	82638E+08
45	2519E+03	21961E+09	97753E+08
46	3162E+03	21132E+09	11535E+09

47	3911E+04	85295E+08	13564E+09
48	5019E+04	77237E+08	15804E+09
49	6395E+04	69745E+08	18527E+09
50	7943E+04	63176E+08	21534E+09
51	1000E+05	57497E+08	24971E+09
52	1258E+05	52636E+08	28921E+09
53	1544E+05	48322E+08	33481E+09
54	1938E+05	44243E+08	38797E+09
55	2519E+05	40713E+08	44797E+09
56	3162E+05	36173E+08	51683E+09
57	3911E+05	32234E+08	59442E+09
58	5019E+05	28547E+08	68115E+09

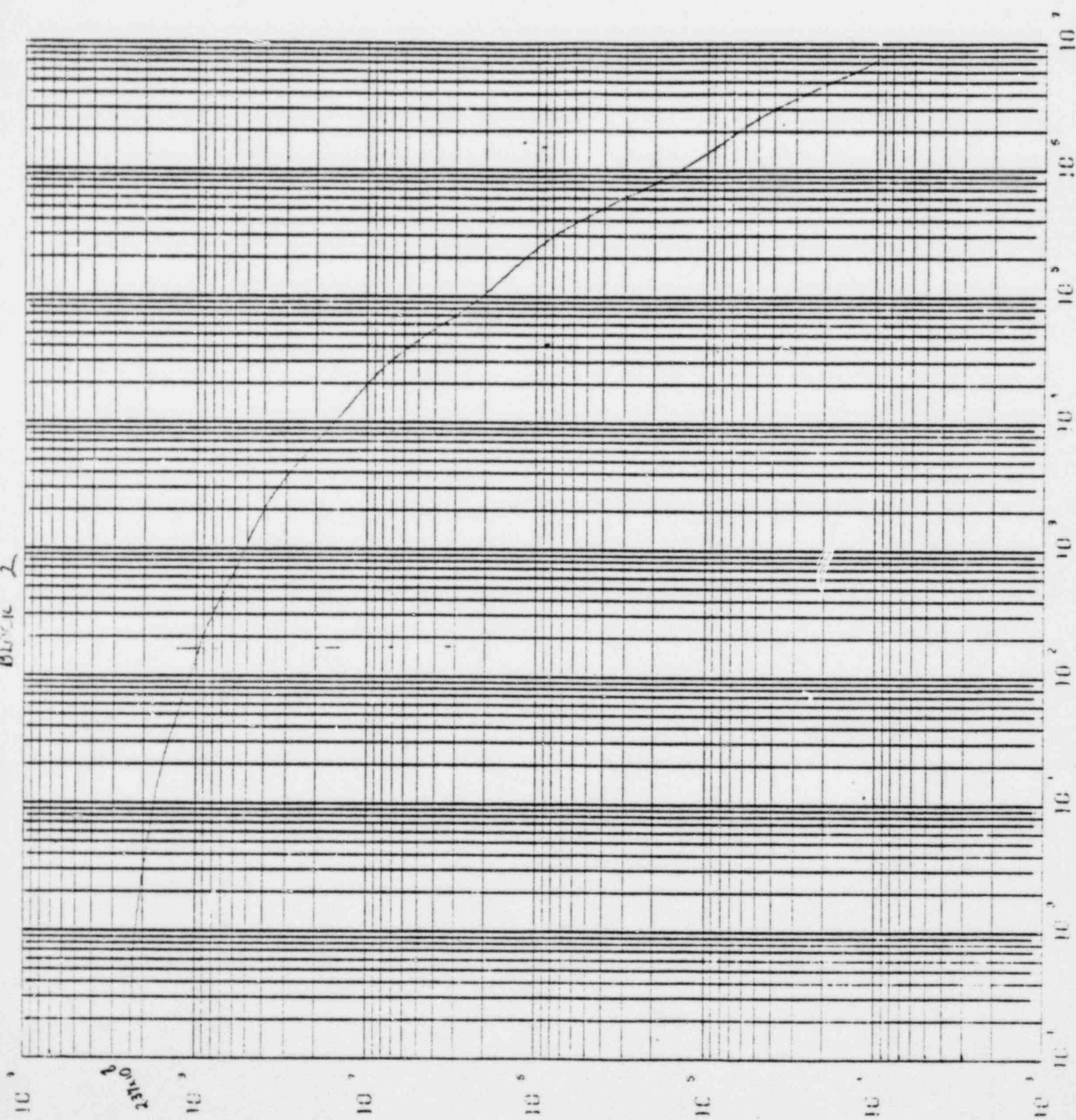
LINE NO	DEF PROGRAM * CALCULATES DECAY HEAT * FULL CERTIFICATION ****	VERSION 2-1 FULL CERTIFICATION ****	MAR..1977 FULL CERTIFICATION ****	12/06/77 16:52:12 PAGE ****
47	..3411E+04	..85245E+04	..13564E+09	
48	..5011E+04	..77237E+04	..15884E+09	
49	..6309E+04	..69785E+04	..14527E+09	
50	..7541E+04	..63176E+04	..12534E+09	
51	..10000E+05	..57497E+04	..24971E+09	
52	..12589E+05	..52636E+04	..28921E+09	
53	..15469E+05	..48322E+04	..33481E+09	
54	..19958E+05	..44249E+04	..38747E+09	
55	..25119E+05	..40213E+04	..44797E+09	
56	..31623E+05	..3675E+04	..51683E+09	
57	..3941E+05	..32234E+04	..59442E+09	
58	..50119E+05	..28547E+04	..68115E+09	
59	..64096E+05	..25243E+04	..77775E+09	
60	..79433E+05	..22371E+04	..89538E+09	
61	..10000E+06	..19471E+04	..10056E+10	
62	..12589E+06	..17606E+04	..11400E+10	
63	..15469E+06	..15431E+04	..12832E+10	
64	..19958E+06	..13252E+04	..14522E+10	
65	..25119E+06	..11106E+04	..16254E+10	
66	..31623E+06	..90365E+03	..18075E+10	
67	..3941E+06	..7157E+03	..19903E+10	
68	..50119E+06	..55569E+03	..21707E+10	
69	..64096E+06	..42824E+03	..23462E+10	
70	..79433E+06	..32527E+03	..25169E+10	
71	..10000E+07	..26292E+03	..26951E+10	
72	..12589E+07	..21148E+03	..28542E+10	
73	..15469E+07	..17043E+03	..30260E+10	
74	..19958E+07	..13600E+03	..31997E+10	
75	..25119E+07	..10488E+03	..33711E+10	
76	..31623E+07	..77578E+02	..35345E+10	
77	..3941E+07	..55102E+02	..36834E+10	
78	..50119E+07	..38230E+02	..38147E+10	
79	..64096E+07	..26422E+02	..39297E+10	
80	..79433E+07	..19778E+02	..40334E+10	

BLOCK 1.



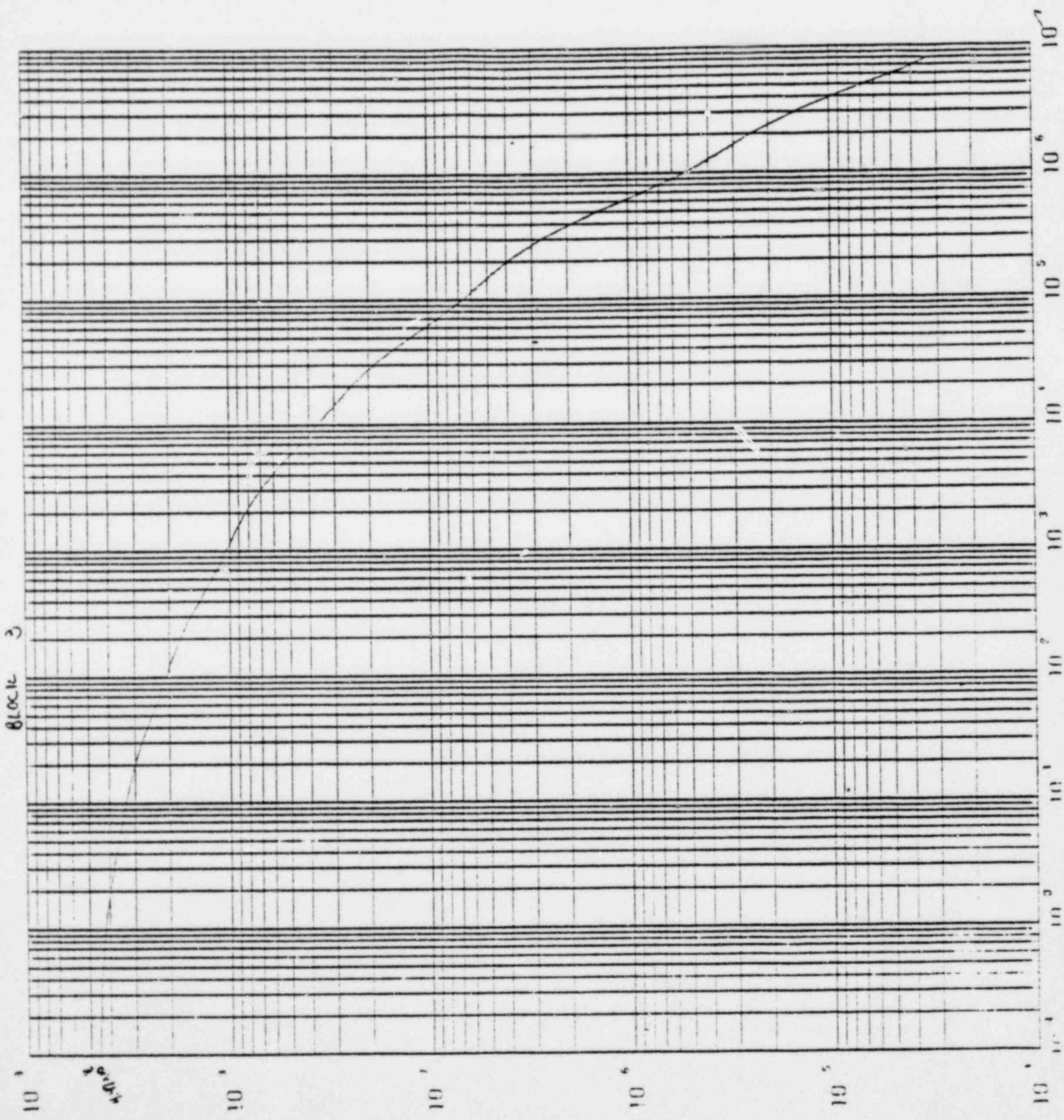
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Block 2



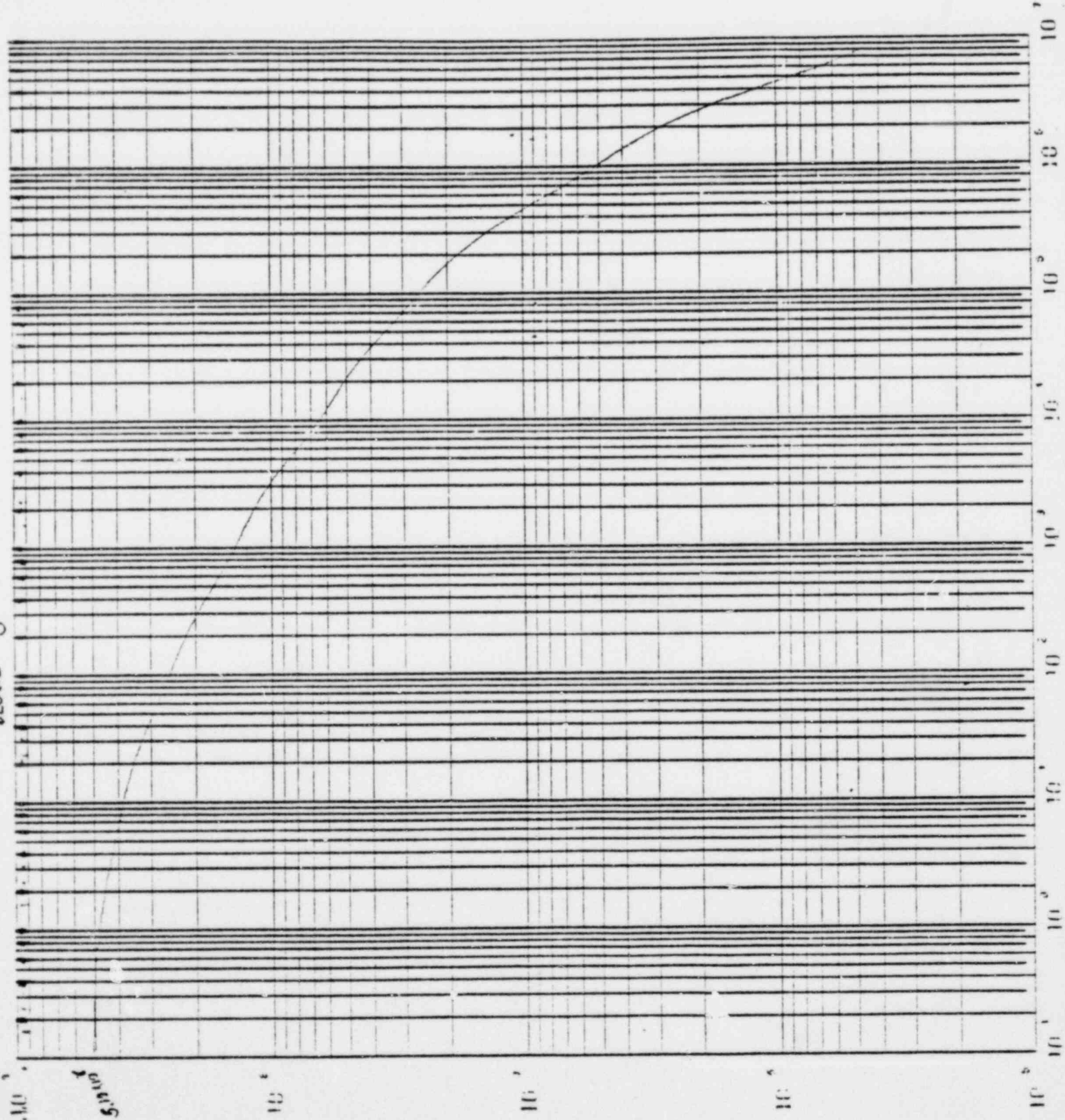
Block 2

FIGURE



BLOC 3

Block 5



BTU/HR

Start

10

101

101

105

A SUPERCEDING CALCULATION OF
ACTUAL MINIMUM PRESSURIZER LEVEL
DURING DAVIS BESSE 1 TRANSIENT
OF NOV 29, 1977

GENERAL CALCULATIONS

Rx Trip on Nov 29, 1977

For the following sets of operating conditions
calculate the minimum pZR level:

Initial Conditions:

$$T_{hot} = 592 \text{ F at } 2138 \text{ psia} \quad v) = .02288$$

$$T_{cold} = 567 \text{ F at } 2138 \text{ psia} \quad v) = .02192$$

$$v) \text{ at saturation @ } 2138 \text{ psia} = v) = .02635$$

$$\text{Initial PZR level} = 192 \text{ inches}$$

$$\text{Final PZR level} = \text{less than 0 inches}$$

Final Conditions:

$$T_{hot} = 562.5 \text{ F at } 1640 \text{ psia} \quad v) = .02195$$

$$T_{cold(avg)} = 508.5 \text{ F at } 1640 \text{ psia} \quad v) = .02042$$

$$v) \text{ at saturation @ } 1640 \text{ psia} \quad v) = .02403$$

$$\text{Initial Volume is } 11226 \text{ ft}^3 + 12" \times 3.2 = 38 \text{ ft}^3 = 11264 \text{ ft}^3$$

$$\frac{5471}{.02288} + \frac{4955}{.02192} + \frac{838}{.02635} = M_0 = 239117$$

$$226049$$

$$31,803$$

$$496,969 \text{ lbs}$$

Assume $M_0 = M_{final}$ at 315 seconds later (too long)

$$\frac{VPZR}{.02403} = \frac{496,969 - 5471 - 4955}{.02195 \quad .02042}$$

$$= 476,969$$

$$- 249,248$$

$$- 242,654$$

$$= 5067$$

$$VPZR = 122 \text{ ft}^3$$

This final volume means the volume change was

$$838 - 122 \text{ ft}^3 \text{ or } 716 \text{ ft}^3$$

$$\text{The } \Delta \text{ PZR level} = \frac{716}{3.2} = 224 \text{ inches}$$

$$\text{"Negative" level indication} = 192 - 224 = -32 \text{ inches (below tap)}$$

EX C.

4)

D-G NO

COMP NO

GROUP NO

DATE

SH-FT NO

BABCOCK & WILCOX
GENERAL CALCULATIONS

Rx Trip on Nov 29, 1977 (4 RC Pumps Tripped)

Time	T hot	T cold	T cold	RC Press	Pr Lvl	T cold Avg	"Calc" Tave
sec (43:25) 0	LP-2 592	LP-1 567	LP-2 567	psig 2123	192	567	579.5
5	590	569	569	2070	188	569	579.5
20	576	568	569	1990	130	568.5	572.3
35	570	563.5	568.5	1950	100	565	567.5
50	570	561	564	1950	89	562.5	566.3
65	567	563	564	1960	89	563.5	565.3
95	570	562	559.5	1985	83	561	565.5
125	572	561	550	1935	75	555.5	563.8
155	572	560	543	1890	63	551.5	561.8
185	572	553	536	1845	44.5	544.5	558.3
215	571.5	539	530.5	1800	24.5	534.5	553
245	570	531	525	1755	4.5	528	549
275	569	523	520	1725	offscale	521.5	545.3
290	566	520	offscale	1650	offscale	—	—
315	562.5	offscale	offscale	1625 (min)	offscale	— (508.5)	— (535.5)

Continuation of listing of Plant Parameters

Time	T cold	Loop 1	Loop 2	"Calc" Tave
sec 43:25 0	LP-2 567	Stm Press 890	Stm Press 890	579.5
5	569	1030	1040	579.5
20	569	980	970	572.3
35	566.5	952	978	567.5
50	564	970	960	566.3
65	564	1020	990	565.3
95	559.5	970	940	565.5
125	550	955	892	563.8
155	543	917	853	561.8
185	536	845	811	558.3
215	530.5	795	780	553
245	525	755	755	549
275	520	723	775	545.3
290	—	708	795	—
(300)			(730) min	
(330)		(612 min)		

DWG NO COMP NO

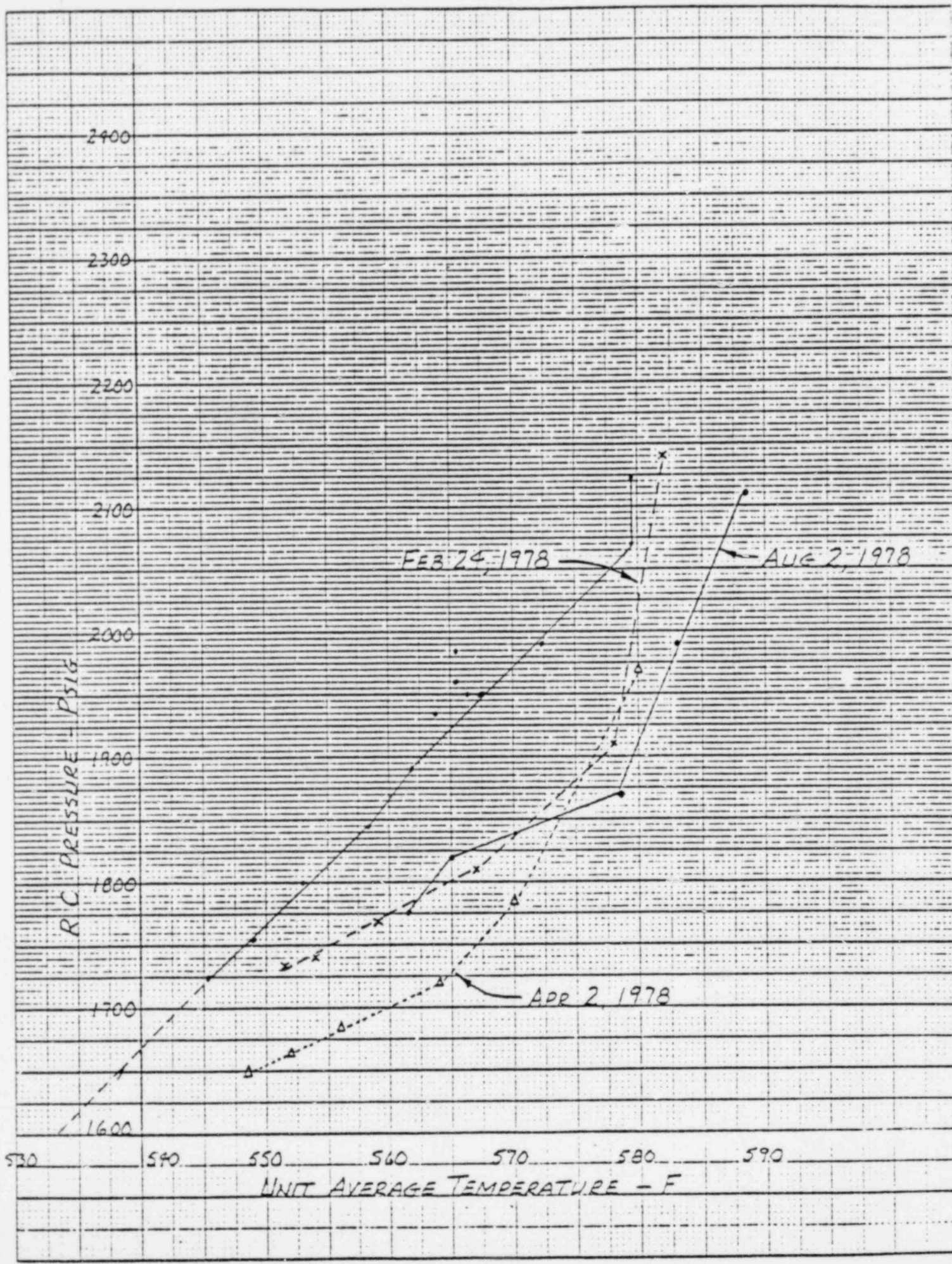
GROUP NO

DATE

SHEET NO

46 1470

K-E
TO A TO 10 1/2 INCHES
REUFFEL & ESSER CO. MADE IN U.S.A.



CALCULATION DATA/TRANSMITTAL SHEETDOCUMENT IDENTIFIERCALC. 32 - 10420 - 00 *

TRANS. 86 - _____ - _____

TYPE: RESEARCH & DEVELOPMENT SAFETY ANALYSIS REPORT NUC. SERV. INPUT DESIGN BOMT. DESIGN VERIF. OTHERTITLE VALIDITY OF THREE INPUTS USED FOR DAVIS
BESSE 1 PRESSURIZER EMPTYING ANALYSISPREPARED BY Robert W. Winks REVIEWED BY M. E. NewlinTITLE Principal Engineer DATE 2/6/79 TITLE Assoc. Engr. DATE 2-12-79PURPOSE:

Prepare a traceable calculational file that shows the validity of the following inputs used by the ECCS Unit in analyzing emptying the pressurizer at Davis Besse 1

- 1) steam pressure \cong 980 psia
- 2) auxiliary feedwater flowrate = 1245 gpm
- 3) volume of water = 711 ft³ when Startup level = 10 feet

SUMMARY OF RESULTS (INCLUDE DOC. ID'S OF PREVIOUS TRANSMITTALS & SOURCE CALCULATIONAL PACKAGES FOR THIS TRANSMITTAL)

Recent Davis Besse 1 reactor trip transient data reveals that only after steam safety relief valves are adjusted properly will steam pressure \cong 980 psia.

The auxiliary feedwater flowrate is dependent on steam generator pressure and at 980 psia, the pump will supply about 950 gpm not 1250 gpm.

The indication of 120 inches of water "level" on the start-up level can be translated into a true height of saturated water of 147 inches, thus the volume of 542 F water is 806 ft³ compared to an assumed 711 ft³.

Reference: Calc File 32-9538-00 for DB-1

DISTRIBUTION

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L. L. Joyner	Helen Vigneau
R. M. Harrington	Robert Winks
N. Shah	